1956

OLDSMOBILE

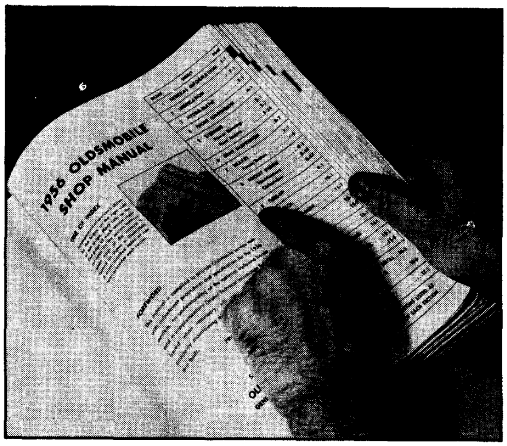
SHOP MANUAL

QUICK REFERENCE INDEX. To use, move either the hand or selection tool directly over the section you desire to reference. Simply click once with the mouse button and the manual will automatically jump to that section.

1956 OLDSMOBILE SHOP MANUAL

USE OF INDEX

Arrangement of sections is shown by the index on the right side of this page. Black tabs on the first page of each section register opposite the section indexes when edge of the manual is turned as shown in illustration. A more detailed table of contents precedes each section.



FOREWORD

This manual is compiled to provide Oldsmobile service men with adjustment procedures and specifications for the 1956 models. An understanding of the material contained herein and in supplementary Dealer Technical Information Bulletins, issued when necessary, will assist service personnel in properly maintaining the quality to which Oldsmobile cars are built.

PRICE: TWO DOLLARS

SERVICE DEPARTMENT
OLDSMOBILE DIVISION
GENERAL MOTORS CORPORATION
LANSING, MICHIGAN

SPECIFICATIONS LISTED AT END OF EACH SECTION

OLDSMOBILE DIVISION
General Motors Corporation
Lansing 21, Michigan

Litho in U.S.A.

GMP—B-45183; 20M; 10-55

GENERAL INFORMATION

CONTENTS OF SECTION 1

1956 MODEL DESIGNATION

Series	Body Style	Olds Code Letters	Fisher Body Style Number
88	2-Door Sedan	K	3611
	Holiday Cp.	HC	3637
	Holiday Sedan	HS	3639
	4-Door Sedan	S	3669
Super 88	2-Door Sedan	DK	3611D
	Holiday Cp.	DHC	3637SD
	Dlx. Holiday Sd.	DHS	3639SD
	Convertible Cp.	DCR	3667DTX
	4-Door Sedan	DS	3669D
98 Series	Dlx. Holiday Cp.	DHC	3037SDX
	Dlx. Holiday Sd.	DHS	3039SDX
	Starfire Cp.	DCR	3067DX
	4-Door Sedan	DS	3069D

ENGINE SERIAL NUMBER

The engine serial number is stamped on a machined pad located on the top left hand cylinder bank of the block. The number can be observed between the front and center exhaust manifold ports. The pad is painted white prior to stamping for better visibility of numbers.

Engine numbers start with V1,000,001. (See Fig. 1-1)

TRANSMISSION SERIAL NUMBER

No serial number is used on the Syncro-Mesh transmission.

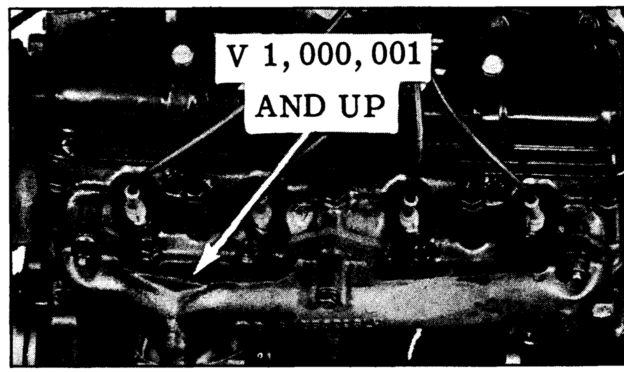


Fig. 1-1 Engine Number Location

The 1956 "88" series will continue to use the 1955 Hydra-Matic transmission. This transmission is identical in every respect, and for service procedures, consult the 1955 Oldsmobile Shop Manual. The transmission serial numbers will continue to use the R 55 prefix used in 1955. (See Fig. 1-2)

The new Jetaway Hydra-Matic transmission is available on the "Super 88" and "98" series only. The serial number for this transmission has a prefix of 056, the first transmission number being 056-1001. (See Fig. 1-3)

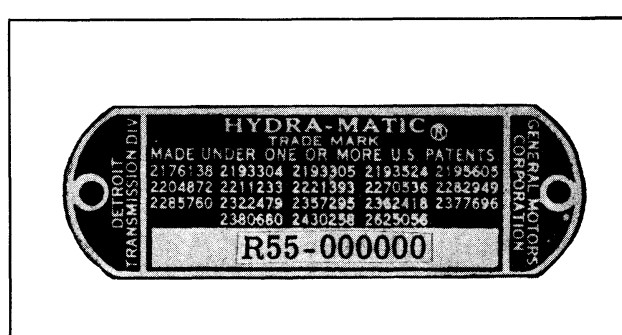


Fig. 1-2 Hydra-Matic Serial Number Plate

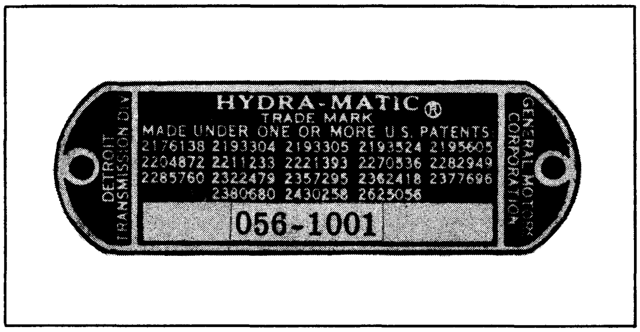


Fig. 1-3 Jetaway Hydra-Matic Serial Number Plate

The Hydra-Matic and Jetaway Hydra-Matic transmissions use the same type of serial number plate and in both cases it is painted orange. On the Hydra-Matic, the serial number plate will be located on the lower left rear corner of the transmission case. The Jetaway Hydra-Matic serial number plate is located on the left side of the case, to the rear of the throttle and manual levers.

IMPORTANT: ALWAYS SHOW HYDRA-MATIC TRANSMISSION NUMBER ON REPORTS.

BODY AND STYLE NUMBER PLATE

The body and style number plate, located under the hood on the front of the cowl adjacent to the left hood hinge, shows:

1. The year and style number of body.
2. Body number.
3. Trim number.
4. Paint number (Color specification number).

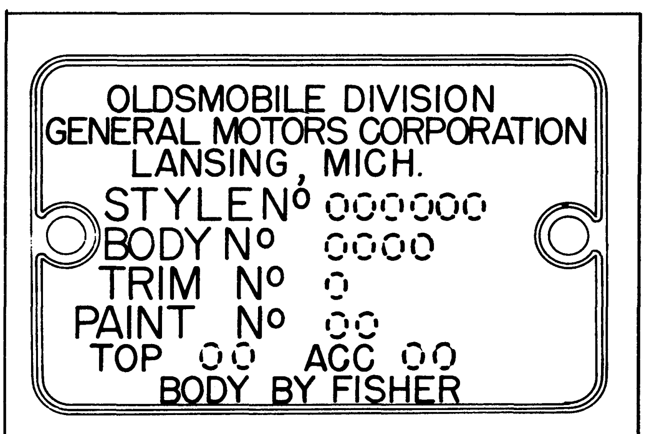


Fig. 1-4 Body and Style Number Plate

The body number is prefixed by letters which indicate, as follows, the plant at which the body was assembled:

L--Lansing	BL--Linden
G--Flint	BC--South Gate
BA--Atlanta	BW--Wilmington
BF--Framingham	CL--Cleveland
FK--Kansas City	BT--Arlington

When ordering body parts or writing shop orders and reports, it is very important that all letters and numbers are included for correct body identification. (See Fig. 1-4)

SERIAL NUMBER PLATE

The 1956 car serial number plate is located on the left hand body pillar post as illustrated in Fig. 1-5.

Each serial number is prefixed by three numbers and a letter; the first two numbers (56) indicate the year 1956. The third prefix number designates the series -

7 -- 88 Series
8 -- Super 88
9 -- 98 Series

The letter used in each prefix identifies the assembly plant at which the car was built, the "M" indicating a Lansing-built car; "A" an Atlanta-built car, etc. (See STARTING SERIAL NUMBERS Chart) ALWAYS SHOW COMPLETE ENGINE AND SERIAL NUMBERS IN REPORTS AND CORRESPONDENCE.

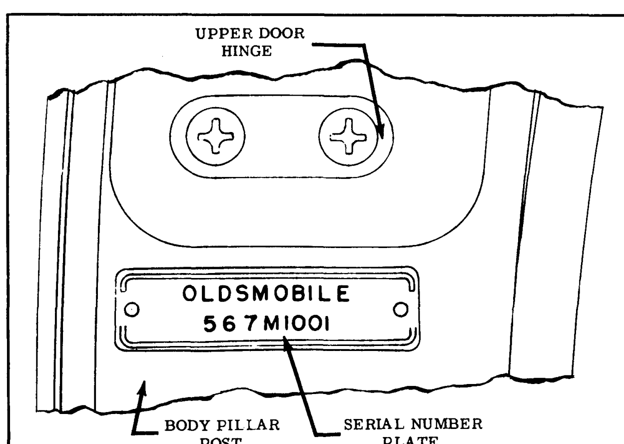


Fig. 1-5 Car Serial Number

STARTING SERIAL NUMBERS FOR 1956

Built At:	88	Super 88	98
Lansing, Michigan	567M1001	568M1001	569M1001
Atlanta, Georgia	567A1001	568A1001	569A1001
Framingham, Massachusetts	567B1001	568B1001	569B1001
Kansas City, Kansas	567K1001	568K1001	569K1001
Linden, New Jersey	567L1001	568L1001	569L1001
South Gate, California	567C1001	568C1001	569C1001
Wilmington, Delaware	567W1001	568W1001	569W1001
Arlington, Texas	567T1001	568T1001	569T1001

GENERAL SPECIFICATIONS

	88	Super 88	98
Wheelbase	122"	122"	126"
Over-all Length	203.29"	203.29"	212.29"
Width	78.62"	78.62"	78.62"
Height*	60.5"	60.5"	60.5"
Tread Width--Front	59"	59"	59"
Rear	58"	58"	58"
Engine	"Rocket"	"Rocket"	"Rocket"
Displacement	324.31 Cu. In.	324.31 Cu. In.	324.31 Cu. In.
Compression Ratio	9.25-1	9.25-1	9.25-1
Carburetion	Dual Downdraft	Quadri-Jet	Quadri-Jet

*With 5 passenger load - 7.60 x 15 Tires

GENERAL SPECIFICATIONS
ALL SERIES

Item	Capacity
Differential	4-3/4 Pints
Engine Crankcase	
Drain and Refill	5 Qts.
Unit Disassembled or Filter Element Changed	6 Qts.
Cooling System	
With Heater	21 Qts.
Without Heater	20-1/2 Qts.
Gasoline Tank	20 Gals.
Syncro-Mesh Transmission	2-1/2 Pints
Hydra-Matic Transmission - Drain and Refill	
"88" Series Hydra-Matic	9-3/4 Qts.
"Super 88" and "98" Jetaway Hydra-Matic	11 Qts.
Power Steering (If completely drained)	1-1/2 Pints

1956 PAINT SERVICE NUMBERS

Comb. No.	Color	Rinshed-Mason No.	DuPont No.
10	Black	L21K400	44
20	Festival Red	L21R046	2274-H
30	Ice Green	L21G081	2269
31	Canyon Green	L22G051	2267
32	Tropical Green	L22G056	2276-H
40	Cirrus Blue	L21B076	2266
41	Artesian Blue	L22B072	2265
42	Nordic Blue	L22B083	2278
50	Sterling Gray	L22A060	2262
51	Juneau Gray	L22A004	1865-H
52	Charcoal	L22A059	2270-H
60	Alcan White	L21W026	2264
61	Citron Cream	L21Y038	2272
62	Terra Cotta	L21N037	2273
63	Shantung Beige	L21N041	2263
64	Citation Bronze	L22N054	2271-H
65	Lime	L21G074	2277
66	Island Coral	L21P024	2275
70	Turquoise	L22B075	2268
*90	Antique White	Not Supplied	2279
*92	Rose Mist	Not Supplied	2281

*Optional Colors. Available only in combinations of Rose Mist and Antique White.

Instrument Panel Colors

Upper Portion			Lower Portion		
Color	Rinshed-Mason No.	DuPont No.	Color	Rinshed-Mason No.	DuPont No.
Medium Gray	L22A046	59398	Light Gray	L39A009	59391
Medium Green	L22G060	59396	Pale Green	L38G010	59389
Medium Blue	L22B079	59397	Pale Blue	L38B003	59390
Red	L21R045	59395	Ivory	L38W001	59392
Turquoise	L22B075	59400	Beige	L39N006	59394
Brown	L22N054	59205	Red	L38R009	59395
Black	L21K400	44			

LUBRICATION

CONTENTS OF SECTION 2

ENGINE LUBRICATION SYSTEM

Oil is delivered by the oil pump to the oil filter, if the engine is so equipped, then to the rear main bearing, and to the main oil galley on the right side. This main galley supplies the valve lifters on the right side, the front four main bearings, the timing chain and sprocket, the fuel pump lever and eccentric, and the left side oil galley. The left galley supplies the valve lifters on the left side and the distributor drive gear. The main bearings supply their respective camshaft bearings No. 2 and No. 4 meter oil to the rocker arm shafts and through these to the rocker arms and push rods. Connecting rod bearings are supplied by the main bearings through drilled passages in the crankshaft. Cylinder wall lubrication is accomplished by means of a spit hole in each connecting rod. (See Fig. 2-1)

CRANKCASE VENTILATION

The crankcase ventilating system aids in preventing harmful dilution of the engine oil. The fan blast causes air to enter the crankcase through the filter element in the oil filter tube breather cap. The vapors are exhausted through the ventilator tube which connects to the rear of the engine. The ventilator tube projects down into the air stream beneath the car causing a low pressure area at this point, which aids in drawing vapors from the crankcase.

ENGINE CRANKCASE OIL

The TYPE of engine oil used will affect operation, wear, and combustion chamber deposits; the oil VISCOSITY will affect oil economy and easy starting. It is, therefore, important that the recommendations made in this section regarding TYPE, VISCOSITY, and OIL CHANGE INTERVAL be followed.

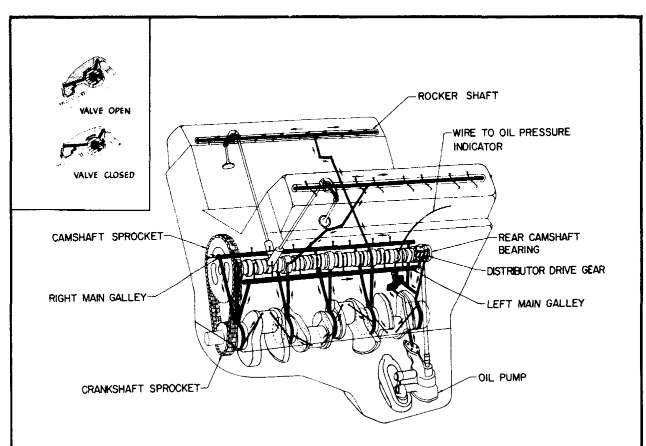
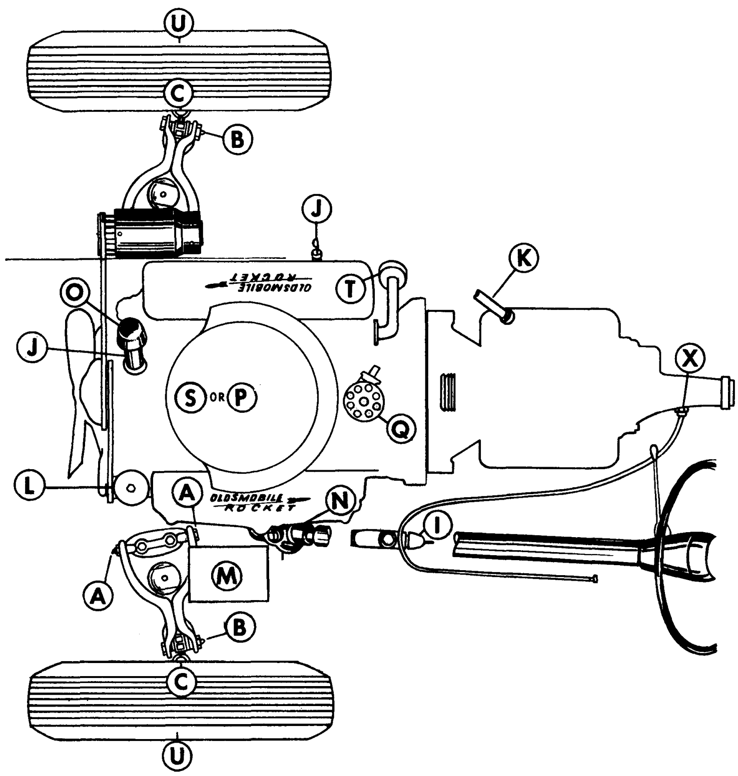


Fig. 2-1 Engine Lubrication System



1956 OLDSMOBILE

EVERY 1,000 MILES

CHASSIS LUBRICANT

A. Upper and lower control arm pivot shafts . . 8 points
B. Upper and lower control arm pivot pins . . . . 4 points
C. Upper and lower king pin bushings . . . . 4 points
D. Inner and outer tie rod ends . . . . 4 points
E. Steering idler arm bushing . . . . 1 point
F. Brake and clutch pedal bushing . . . . . . 1 or 2 points

CHECK FLUID LEVEL—REPLENISH

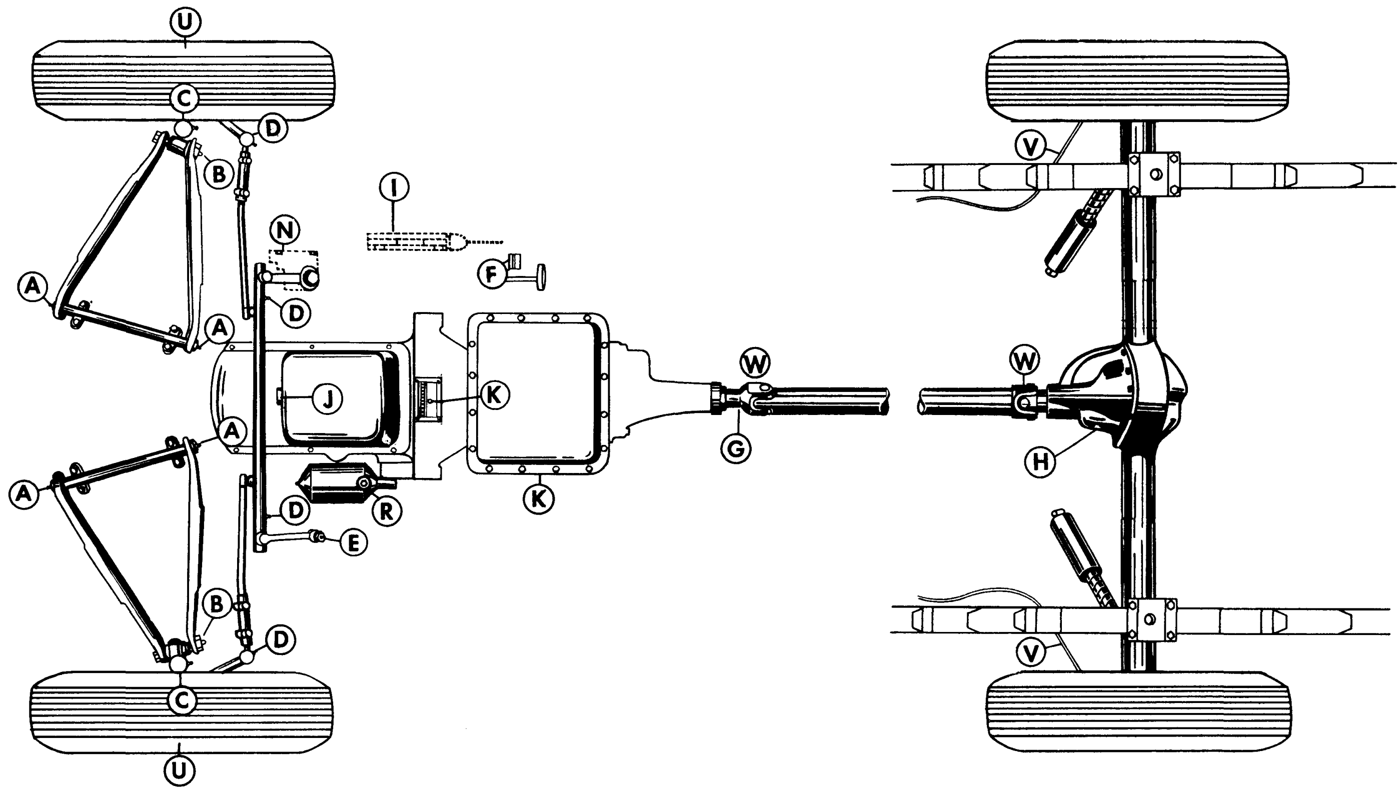
H. Differential . . . . SAE 90 Multi-Purpose Gear Lubricant
I. Master Brake Cylinder . . . . . . G.M. Brake Fluid No. 11
J. Engine Oil . . . . MS or DG oil of proper viscosity
K. Hydra-Matic . . . . G.M. Hydra-Matic Fluid
Syncro-Mesh Transmission . . . SAE 80 Multi-Purpose Gear Lubricant
L. Steering Gear (Power) . . . . . . G.M. Hydra-Matic Fluid
M. Battery . . . . Distilled Water
N. Steering Gear (Standard) . . . . Check and replenish with SAE 80 Multi-Purpose Gear Lubricant
Q. Distributor . . . . Fill Lubrication tube with Engine Oil

ENGINE OIL ON FOLLOWING POINTS

Distributor oil cup
Generator oil cups—front and rear.
Throttle and transmission linkage pivot points.
Parking brake linkage.

BODY LUBRICATION—CHECK—LUBRICATE AS REQUIRED—*(Wipe Off Old Lubricant)*

Door Lock striker teeth—Light coat of stick-type lubricant.
Rotary lock pivot pin—Drop or two of SAE 20 oil.
Rotary lock housing upper surface—Light coat of stick-type lubricant.
Front door hold-open—Thin film of "Lubriplate" on friction surfaces.
Door check shoe (front doors)—Thin film of "Lubriplate" on friction surfaces.
Door hinges—Drop of oil on pivot points.
Hood hinge—Apply SAE 20 oil at pivot points.
Hood latch—Thin film of "Lubriplate" on friction surfaces.
Rear deck lid lock bolt—Apply "Lubriplate" to bolt at striker contact area.
Door and rear deck locks—Lubricate with lock lubricant whenever hard to insert key.
Gas tank filler door hinge—Lubricate with SAE 20 oil.
Door weatherstrip—Dow Corning No. 4 Silicone Grease.



LUBRICATION INSTRUCTIONS

EVERY 3,000 MILES

J. Engine oil.* (See Oil Change Interval)

O. Crankcase inlet breather cap*—Wash in solvent and re-oil with engine oil.

P. Standard air cleaner*—Clean filter and re-oil with engine oil.

EVERY 5,000 MILES

G. Slip Yoke—(Hydra-Matic) Lubricate with Special Lubricant 567196 until lubricant appears at breather groove at end of rear bearing retainer. Install fitting in place of plug to lubricate, then re-install plug. No special lubrication required on Syncro-Mesh.

M. Battery—Clean top of battery and cable terminals. Replace felt washers on battery posts.

Q. Distributor—Apply a film of Delco Remy Cam and Bearing Lubricant to the breaker cam.

R. Oil filter—Replace element.

S. Heavy Duty (oil bath) air cleaner*—Clean and replenish with SAE 40 oil (1 pint).

T. Crankcase ventilating tube breather*—Wash in solvent.

EVERY 7,000 MILES

U. Front wheel bearings—Clean and pack with high melting point wheel bearing grease.

EVERY 10,000 MILES

V. Parking brake cables—Lubricate with brake cable lubricant.

EVERY 20,000 MILES

W. Universal joints—Disassemble, clean, and repack with high melting point fine fibre grease.

EVERY 25,000 MILES

K. Hydra-Matic—Drain and refill with G.M. Hydra-Matic Fluid.

X. Speedometer cable — Lubricate lower ⅔ with AC speedometer grease.

**Severe weather or driving conditions necessitate more frequent attention.*

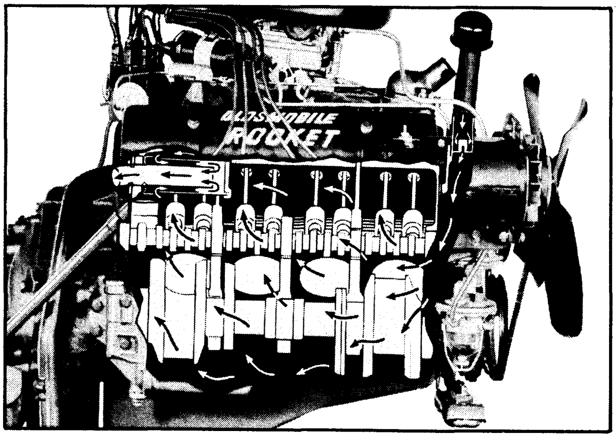


Fig. 2-2 Crankcase Ventilation

Type of Oil

There are four harmful deposits which can form in the crankcase of an engine, namely; sludge, varnish, moisture, and corrosive acids. The formation of these deposits depends on the quality of oil and the additives therein, engine operating temperature, and the type of driving. They form under both low and high speed driving conditions, but generally form more rapidly in cold weather under short run or city driving conditions. Thus, either continued high speed driving or considerable periods of stop and go driving constitutes "severe" driving conditions insofar as motor oil is concerned. Because the Rocket engine is manufactured to very close tolerance for long life and dependability, these deposits, if allowed to form, will cause operating problems.

Formation of these deposits can be substantially reduced by using oils that contain the correct type and quantity of additives. Sludge is reduced by additives having detergent dispersant characteristics. Varnish deposits are reduced by oxidation inhibitors. Bearing corrosion is eliminated by corrosion preventive additives. Only certain types of oil have sufficient of these additives and, therefore, only these types can be recommended for satisfactory service in the Rocket engine.

The following information describes the various types of oil now being marketed and the reasons they should or should not be used in the Rocket engine.

New Designation	Former Designation	
"For Service ML"	"Regular Type"	(Not Recommended)
"For Service MM"	"Premium Type"	(Not Recommended)
"For Service MS"	"Heavy-Duty Type"	(Recommended)
"For Service DG"	"Heavy-Duty Type"	(Recommended)
"For Service DS"	"Series 2"	(Not required)

ML (Comparable to former Regular Type) - Not recommended.
This oil is designed for light service in engines not critically affected by sludge and varnish deposits.

MM (Comparable to former Premium Type) - Not recommended.
This oil has additives to reduce sludge, varnish, and acids, but not in sufficient quantities to be recommended for use in Rocket engines.

MS and DG (Comparable to former Heavy-duty Type) - Recommended.
These oils are recommended for use in Rocket engines as they have sufficient additives to minimize formation of sludge, varnish, and acids under normal driving conditions.

DS (Comparable to former Series 2 Type)
This oil is specially compounded for use in diesel engines under severe operating conditions, and is not generally available at filling stations. It can be used satisfactorily in Rocket engines, but is not required. It contains a larger quantity of additives than the MS or DG oils.

Brands of Oil

In selecting a brand of engine oil, it is advisable to consider the reputation of the refiner and distributor, as they are responsible for the quality of the product and their reputation is the car owner's best indication of quality. To obtain maximum performance and satisfaction from the

Rocket engine, it is important to use only crankcase oils that have been proven, in service, to be satisfactory in minimizing wear as well as sludge, varnish, and acidic deposits.

Even though designated "For Service MS" or "For Service DG", some commercial crankcase oils form the type of combustion chamber deposits that increase the tendency for detonation and pre-ignition; also, some are deficient in anti-wear characteristics and may contribute to rapid wear of engine parts, such as camshaft, valve lifters, rocker arms, and piston rings.

Under adverse operating conditions where a greater concentration of additives is required, a High Detergency Concentrate which has been thoroughly tested and recommended is available under General Motors Part No. 564800.

The use of proprietary compounds, such as "break-in" oils, "tune-up" compounds, "tonics," "friction reducing" compounds, etc., are entirely unnecessary and are not recommended for use in the Rocket engine.

Oil Viscosity

SAE viscosity numbers specify viscosity only and should not be confused with "Type of Oil." The lower viscosity or "thinner" oils, such as SAE 5W, or SAE 10W are designed for use during cold weather to provide fast starting and instant lubrication. The higher viscosity or "thicker" oils, such as SAE 20, or SAE 20W are designed for use during warm or hot weather to provide adequate lubrication and satisfactory oil consumption under higher operating temperatures.

Several oil companies now market multiple viscosity oils, such as SAE 5W-20, SAE 10W-20, SAE 10W-30, etc., which are designed to combine the fast starting and instant lubrication characteristics of the lower SAE number with the warm weather operating characteristics of the higher SAE number.

The proper oil viscosity to use depends upon the range in atmospheric temperature that will be encountered during the period the oil remains in the crankcase. More-than-normal oil consumption will be encountered during warm or hot weather, particularly under high speed driving conditions, if the oil viscosity is too low. The following chart will serve as a guide to the proper oil viscosity to use under various atmospheric temperature conditions. It is not necessary to change oil for the unseasonably cold or warm days encountered during the fall or spring season.

Anticipated Lowest Atmospheric Temperature	Recommended SAE Viscosity Number	Recommended Viscosity Range if Multi-Viscosity Oils are used
+32°F.	SAE 20 or SAE 20W	SAE 10W-30 or SAE 10W-20
0°F.	SAE 10W	SAE 10W-30 or SAE 10W-20
Below 0°F.	SAE 5W	SAE 5W-20

NOTE: The SAE viscosity number should be plainly marked on the oil containers.

SAE 5W oils are not recommended for sustained high speed driving during warm weather. For sustained high speed driving when the prevailing daylight temperature is above 90°F, SAE 30 may be used.

SAE 5W and SAE 5W-20 oils are particularly advantageous during low temperatures because of their easy starting and quick flow characteristics. The easy starting characteristics of these oils greatly reduce the drain on the battery in cold weather.

Oil Change Interval

The crankcase of the Rocket engine was filled at the factory with MS or DG oil. If it is necessary to add oil before the first drain period, use oil of type and viscosity recommended in the preceding paragraphs on "Type of Oil" and "Viscosity". Break-in oils are entirely unnecessary and their use is not recommended.

When changing oil, drain the crankcase after the engine has reached normal operating temperature to insure complete removal of the old oil.

The initial oil change and subsequent changes should be made in accordance with the following recommendations:

500 Mile Change Interval
This period should be used in cold weather when the car is used almost exclusively in the city for house-to-house or store-to-store operating conditions as experienced by doctors and city salesmen.

1,000 Mile Change Interval
This interval should be used under average winter driving conditions when most of the driving is in the city with only occasional highway driving.

2,000 Mile Change Interval
This interval should be used under average summer driving conditions when the car is operated under inter-mixed city and highway driving, such as town driving during the week with a highway trip on week-ends.

3,000 Mile Change Interval
This interval should be used where the car is driven consistently on the highway with occastional city driving.

Oil pan drain plug torque is 35 to 40 ft. lbs.

NOTE: If the car has been driven in a dust or sand storm, the engine oil should be changed as soon as possible. When the car is operated on dirt roads or under dusty conditions, it may be ne^essary to change the oil more frequently than indicated in the above recommended intervals which were predicated on paved road driving conditions.

Crankcase Capacity

Oil change only, 5 qts.
Oil change and filter element change, 6 qts.

Oil Level

The oil gauge rod is marked "Full", "Add 1," and "Add 2". The oil level should be maintained in the safety margin, Figure

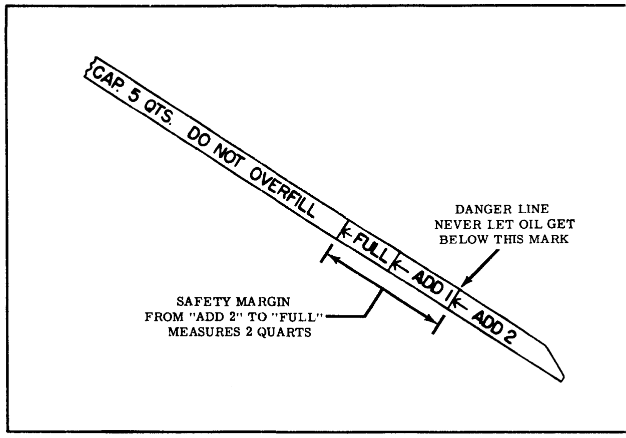


Fig. 2-3 Oil Gauge Rod

2-3, neither going above the "Full" line nor under the "Add 2" line. The oil level should be checked when refueling and oil added to maintain proper level. Do not overfill.

OIL FILTER

A full flow oil filter, provided as optional equipment, filters 100% of the oil delivered by the oil pump. For this reason the interval of change is very important. The oil filter cartridge should be replaced every 5,000 miles.

Changing of Oil Filter Cartridge

Unscrew cartridge container center bolt to remove filter.

Before installing new cartridge, clean out cartridge container, and place new seal in position in oil filter body casting.

NOTE: Oil filter drain plug should be torqued to 20 ft. lbs. and cartridge container center bolt to 40 ft. lbs.

AIR CLEANER

The standard air cleaner should be serviced every 3,000 miles when car is operated on paved roads and every 500 to 1,000 miles when car is operated on dirt roads or under dusty conditions.

The heavy duty oil bath cleaner should be serviced every 5,000 miles when car is operated on paved roads and every 3,000 miles when car is operated on dirt roads under average dust conditions. Under extreme conditions in territories subject to dust storms or where industrial abrasives are prevalent, air cleaners require more frequent service.

The air cleaner should be serviced as follows:

1. Remove filter element.
2. Wash accumulated dirt from the filter element by plunging it up and down several times in clean solvent.
3. On the standard cleaner, the filter element should be oiled with SAE 40 oil and replaced in the silencer unit. Do not wet felt in cover. If felt becomes wet, clean with clear solvent.
4. On the heavy-duty cleaner, the element should be cleaned but not oiled. The reservoir should be cleaned and refilled to the indicated level with one pint of SAE 40 oil (SAE 20 oil for below 32°F. temperatures).

CRANKCASE BREATHER

The crankcase inlet breather cap should be washed in solvent and re-oiled with SAE 20 oil every 3,000 miles or at every lubrication interval if car is used under dusty conditions.

The crankcase ventilating tube breather element is used only on models factory equipped with a heavy-duty oil bath air cleaner. The ventilating tube breather element should be cleaned in solvent and replaced, without oiling, whenever the heavy-duty air cleaner is serviced.

THROTTLE AND TRANSMISSION LINKAGE

At every chassis lubrication interval remove road film from lubrication points, then apply engine oil to all friction and bearing surfaces on transmission control linkage and throttle linkage.

DISTRIBUTOR

The hinge cap oiler tube should be filled with SAE-20 engine oil at each chassis lubrication period. Every 5,000 miles and whenever the contact set assembly is replaced, add a film of Delco-Remy Cam and Ball Bearing Lubricant or equivalent to the breaker cam. No other lubrication is required. The movable breaker plate is lubricated by oil from the upper main shaft bushing.

STARTING MOTOR

No lubrication service is required except at overhaul. When starting motor is disassembled for servicing, 4 or 5 drops of engine oil should be added to bushings in the end frame and pinion housing.

GENERATOR

Hinge cap oilers are provided at both the commutator and drive ends. At each vehicle lubrication period, the oilers should be filled to the cap with SAE 20 oil.

If the oil reserve in the commutator end bearing becomes completely exhausted through failure to lubricate at regular intervals, it will require more than a simple filling to restore the reserve. In such case, the oil cup should be filled three times consecutively, allowing time between fillings for the oil to soak down.

WATER PUMP

The water pump is permanently lubricated and needs no attention.

STEERING GEAR

The necessity for frequent addition of lubricant indicates leakage and the source must be corrected. Use SAE 80 Multi-Purpose Gear Lubricant in standard steering gears. Regular or seasonal changes are unnecessary.

POWER STEERING GEAR AND PUMP

Check at every lubrication period, and maintain oil level at full mark. Use Hydra-Matic Transmission Fluid. Power steering gear lubrication is accomplished by the oil supplied to the gear by the power steering pump.

STEERING LINKAGE AND SUSPENSION

The bushings in the front suspension and the steering linkage should be thoroughly lubricated with chassis lubricant at 1,000 mile intervals.

The rear suspension does not require lubrication. The rear springs are the uncovered type using wax impregnated liners. Rear springs should not be oiled.

RUBBER MOUNTINGS AND BUSHINGS

All load carrying rubber parts (Bushings) are designed to function without slippage. After a very short period of service, they partially bond themselves to adjacent metal parts. This bonding action further reduces slippage.

Lubrication of rubber parts should be avoided, as lubrication defeats the purpose of the design and causes slippage. If a squeak should develop, a soapy water solution can be used. This solution will assist bonding of the rubber to the metal.

SHOCK ABSORBERS

Front and rear shock absorbers are of sealed type construction and do not require periodic checking of fluid level. If a shock absorber leaks or does not operate properly, it should be replaced.

HYDRA-MATIC TRANSMISSION

G.M. Hydra-Matic Fluid

This all-season fluid, designed for year-round operation, is available through authorized dealers.

Fluid for the Hydra-Matic unit is also available through most independent oil companies. Only fluid with the following identification on the container should be used: brand name, including the words "...... Fluid Type A", plus an Armour qualification number embossed on top of can as follows: "AQ-ATF-number."

Checking Hydra-Matic Fluid Level

Fluid level should be checked at every lubrication period. Check must be made with the engine idling, and the selector lever in the park position. Fluid level must be maintained at the full mark. (Transmission warm)

CAUTION: Do not fill above full mark as this will cause foaming and will result in improper operation.

Draining Hydra-Matic Transmission

The Hydra-Matic fluid should be changed every 25,000 miles.

To drain the Jetaway Hydra-Matic transmission oil proceed as follows:

1. Remove flywheel inspection plate.
2. Remove 7/16" "hex head" pipe plug from torus cover and drain fluid from torus cover.
3. Remove drain plug from transmission oil pan permitting fluid to drain.
4. Install pipe plug in torus cover and install oil pan drain plug.
5. Replace flywheel inspection plate.
6. Raise hood.
7. Remove dipstick.
8. First add 11 quarts of H-M fluid to the transmission.
9. Set the parking brake and start engine. With engine running, add fluid to bring level to "FULL" mark on the dipstick.

NOTE: Approximately 11 quarts of oil are required to fill the Jetaway Hydra-Matic transmission after the transmission has been drained. Approximately 11-1/2 quarts will be required to fill the transmission if the oil pan has been removed and drained at the same time that the fluid is changed. After fluid has been added and transmission is warm, level should be checked to make sure that it is at the "FULL" mark on the oil level dipstick. Approximately 13-1/2 quarts are required after an overhaul.

SYNCRO-MESH TRANSMISSION

Remove the filler plug* from the transmission case and fill to the level of the opening with SAE 80 Multi-Purpose Gear Lubricant. The lubricant level should be checked every 1,000 miles and if found low, the transmission should be checked for leaks, and the source of the leak corrected.

*CAUTION: Always clean dirt or foreign material from around plug before removing.

CLUTCH

The clutch throwout bearing is a prepacked ball bearing assembly and normally will not require attention except when the clutch is overhauled. Under abnormal service, the clutch throwout bearing should be lubricated sparingly as required. A lubrication fitting is provided on the throwout bearing retainer and is accessible by removing the access hole cover in the lower center area of the clutch housing.

CAUTION: Extreme care must be exercised to assure that no grease or oil reaches the clutch facings, as this will result in clutch slippage and chatter.

At each lubrication interval, the felt washers at each end of the clutch auxiliary bellcranks should be saturated with SAE 20 oil, and the clutch pedal bushing should be lubricated through the grease fitting provided.

DIFFERENTIAL

The differential must be filled to the filler plug* level with SAE 90 Multi-Purpose Gear Lubricant.

*CAUTION: Always clean dirt or foreign material from around plug before removing.

The lubricant level should be checked at 1,000 mile intervals and, if necessary, add lubricant to proper level. Periodic or seasonal changes of lubricant are not recommended.

NOTE: If it becomes necessary to add lubricant frequently, the differential should be checked for leaks and the leak corrected.

It is extremely important that only Multi-Purpose Gear Lubricants, which have the properties and characteristics necessary for the satisfactory lubrication of hypoid gears, be used.

PROPELLER SHAFT

The needle bearings in the "U" joints of the propeller shaft are prepacked with lubricant at the time of their manufacture; no attention need be given these bearings so far as lubrication is concerned for 20,000 miles.

To lubricate, proceed as follows:

1. Remove universal joint needle bearing assemblies. (See Rear Suspension - Disassemble Universal Joints.)
2. Wash all parts thoroughly.
3. Lubricate each needle bearing assembly and fill the reservoir in each bearing journal of the spiders with high melting point fine fibre grease.
4. Reassemble using new cork washers in each needle bearing assembly and two new lock plates at companion flange.
5. Apply one ounce of special lubricant, Part No. 567196, to the splines in the slip yoke before assembly. Lubricate slip yoke after assembly as covered under "Slip Yoke" in 5,000 mile lubrication.

WHEEL BEARINGS

Front wheel bearings should be lubricated every 7,000 miles with a good quality sodium or sodium and calcium base wheel bearing grease of No. 3 consistency. Long fibrous greases should be avoided because they throw out of bearings.

Pack the ball and separator assemblies full, but do not put grease in hub as excessive grease increases the changes of leakage into the brakes and prevents proper heat dissipation of the hub and drum assembly.

When it is found necessary to remove the front wheel bearings for cleaning, the bearings should be washed in clean gasoline (not light oil). If the bearings are washed in light oil, the grease will not adhere to the bearings and the bearings will run dry.

The adjustment of front wheel bearings should be made as follows:

1. Tighten adjusting nut with torque wrench to approximately 17 ft. lbs. to insure that all parts are properly seated and threads are free.
2. Back off nut and retighten to 4 ft. lbs.
3. If cotter pin hole in spindle and slot in nut line up, insert cotter pin, otherwise, back off adjusting nut to nearest line-up of slot and hole and insert cotter pin.

The rear wheel bearings which are the sealed type, are lubricated for life and need no further lubrication.

BRAKES

The brake (and clutch) pedals have lubrication fittings and should be lubricated every 1,000 miles.

At time of brake overhaul, all rust should be cleaned from brake shoes, the inner surfaces of the brake backing plates, and all metal contact points at the brake shoe assembly, then a film of "Lubriplate" or Bendix Brake Lubricant applied to the surfaces against which the shoes operate or adjacent brake parts contact. Care must be exercised to prevent any lubricant from getting on the braking surfaces of shoes or drums.

The fluid level in the master cylinder should be checked every 1,000 miles. If necessary to add fluid, use G.M. Brake Fluid No. 11. Standard brake fluid level must be maintained at 1/2" below the master cylinder filler cap. Power brake fluid level must be maintained above the "L" mark on the dipstick of the Bendix Unit, or high enough to register on the dipstick of the Moraine Unit.

CAUTION: Extreme care must be exercised to prevent entry of dirt into the master cylinder.

Parking Brake

All the clevis pins, links, and moving parts of the parking brake system should be lubricated with engine oil at each chassis lubrication.

The parking brake cables leading to the rear wheels operate inside metal conduits through a portion of their length. These cables should be lubricated every 10,000 miles by pulling the cables rearward through the metal conduits and applying a liberal amount of brake cable lubricant. Use care not to get any of the lubricant on the brake linings.

SPEEDOMETER CABLE

The speedometer cable is lubricated at the time of assembly and should not require further lubrication, under normal conditions, for 25,000 miles. When a new speedometer cable is installed, it should be lubricated. To lubricate, all old grease must first be removed from the cable casing and then a thin coating of AC speedometer cable grease applied to the lower two-thirds of the cable only. This will properly lubricate the upper one-third of the casing, giving an even coating of lubricant the full length of the flexible cable, without danger of excess grease working up into the speedometer head.

BODY

Door Locks

Before lubricating, remove any dirt or grease from door lock and door lock striker.

Apply stick type lubricant to striker teeth and upper surface of rotary bolt housing. Apply a few drops of SAE 20 oil to rotary bolt bearing surfaces. Clean off excess lubricant.

Door Lock Cylinders

A small quantity of lock lubricant occasionally applied to the door lock cylinders will prevent sticking.

Door Hinge Assemblies

The door hinges should be lubricated with SAE 20 oil at pivot points, and "Lubriplate" applied to front door hold open.

Door Weatherstrip and Door Bumpers

A thin film of silicone grease, DOW CORNING No. 4, should be used to prevent door squeaking.

Front Seat Mechanism

Chassis lubricant should be used twice a year to lubricate the front seat adjusting mechanism.

Hood Latch

Lubricate the lower latch pilot bolt and upper latch locking plate with a thin film of

"Lubriplate". Use a light oil for pivot pins.

NOTE: If undercoating hood, care should be taken to keep latch area clean. The hood panel should not be undercoated aft of the rear hood support. Undercoat in this area will damage the cowl sealing strip.

Hood Hinges

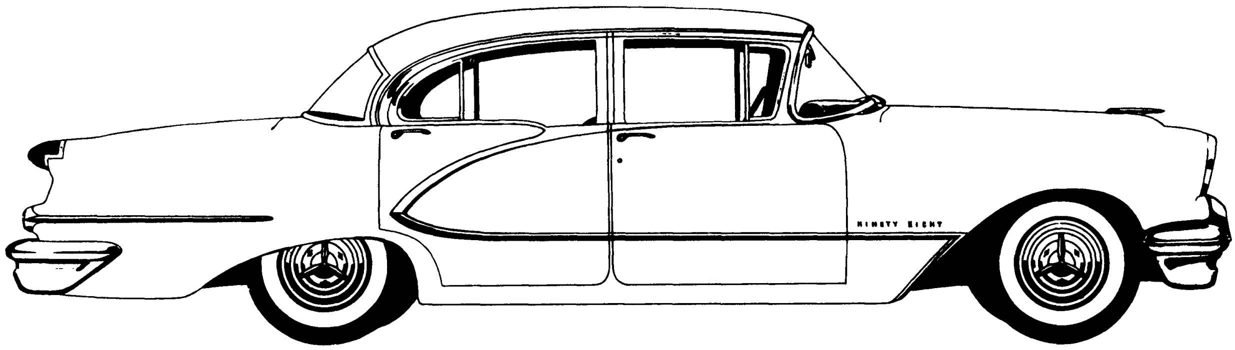
SAE 20 oil should be used to lubricate the hood hinges, care being taken not to allow the oil to drop on fenders or other exposed painted surfaces.

Rear Deck Lid Lock Bolt

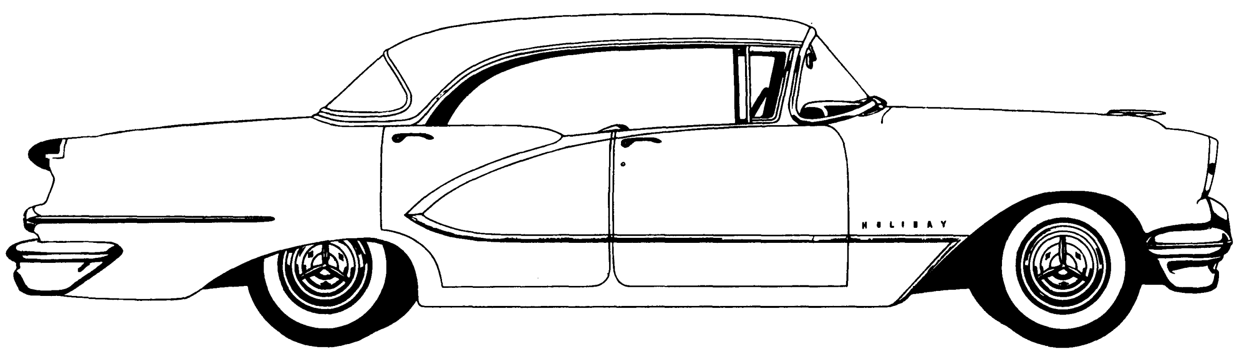
Apply a thin film of "Lubriplate" to the bolt at the striker contact area.

Hydro-Lectric

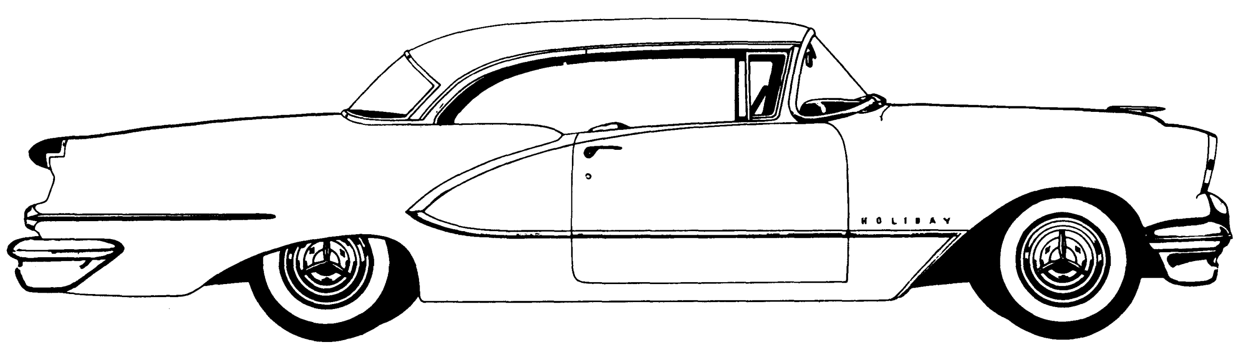
The Hydro-Lectric system is used for operation of convertible tops only. This is a non-vented (sealed) type system which does not require seasonal changing of fluid. It is only necessary to check fluid level if system fails to operate properly. The Hydro-Lectric unit is mounted in the trunk compartment behind the rear seat back.



98 4-DOOR SEDAN (DS)



98 DELUXE HOLIDAY SEDAN (DHS)



98 DELUXE HOLIDAY COUPE (DHC)

HYDRA-MATIC (JETAWAY)

CONTENTS OF SECTION 3

GENERAL INFORMATION

The 1956 Jetaway Hydra-Matic transmission, standard on the Super 88 and 98 Series, is entirely new. The new transmission incorporates a fluid coupling type clutch in the front unit, replacing the multiple disk clutch. Sprag clutches (over running) are used instead of bands (in the front and rear units) which result in smoother shifting. An oil cooler is located in the radiator lower tank which prevents the Hydra-Matic fluid from obtaining excessively high temperatures when "severe" driving conditions are encountered.

The Hydra-Matic indicator has a "Park" position which is desirable for parking and starting the car, to prevent the car from moving, when on an incline. The engine can also be started with the selector lever in the Neutral position.

TRANSMISSION OPERATION

The new transmission offers three selective drive ranges, "DR", "S" and "LO". In "DR" range the transmission starts in first gear and shifts automatically to second, third and fourth gear.

With the selector lever in "S" range the transmission starts in first gear and shifts to second, then to third and remains in third gear until approximately 65-70 M.P.H., regardless of throttle opening. This provides additional acceleration for long hills or traffic driving as well as engine braking power when descending long grades. When car speed reaches approximately 65-70 M.P.H. the transmission automatically shifts to fourth gear. If car speed decreases to approximately 65-70 M.P.H. the transmission will downshift to third gear.

With the selector lever in "LO" range the transmission will shift from first to second and remain in second gear until approximately 45-50 M.P.H. The transmission will then shift to third gear and will shift to fourth gear at approximately 65-70 M.P.H. As car speed decreases the transmission will downshift fourth to third and third to second at approximately the same speed at which the upshifts occurred. "LO" range is designed for engine braking when descending steep grades. It may

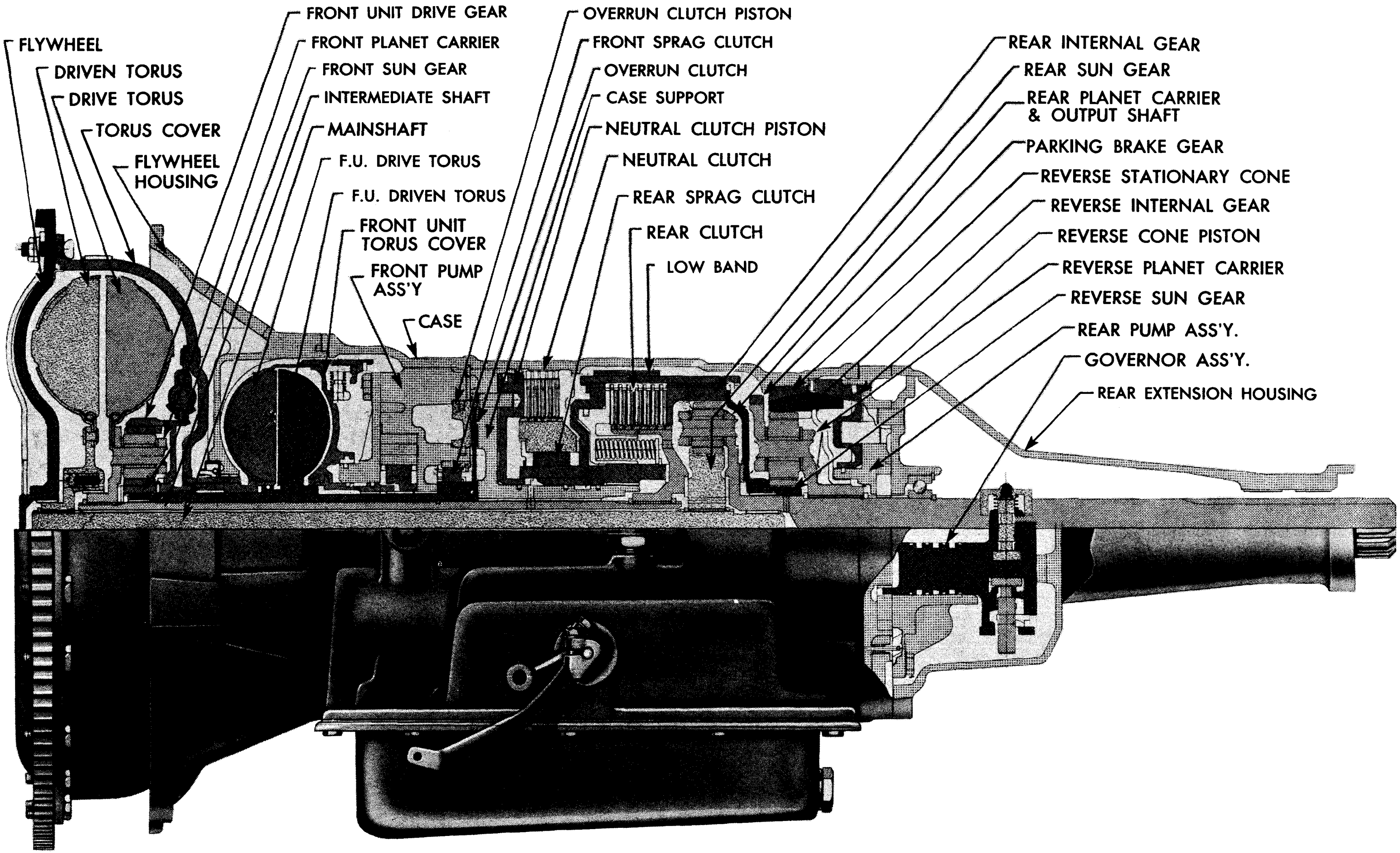


Fig. 3-1 Jetaway Hydra-Matic

also be used to hold the car in second gear for maximum pulling power.

PART THROTTLE DOWNSHIFT
Fourth to Third

A part throttle downshift can be made any time the transmission is in fourth gear and the car speed is below approximately 30 M.P.H. Since this downshift will occur at part throttle opening, the advantage of third gear power is obtained without a wide open throttle. This feature is desirable in traffic conditions where a wide open throttle would be unnecessary.

FORCED DOWNSHIFTS (Detent)

In "DR" range the new transmission can be downshifted fourth to third and third to second within set speed ranges.

In "S" range a third to second forced downshift can be made within a set speed range. A warning "feel" on the accelerator pedal makes it possible for the driver to obtain full throttle performance with or without downshift, as desired.

REVERSE

Reverse is accomplished through use of a friction clutch applied by oil pressure and designed for ease in "rocking" the car. A reverse blocker piston prevents movement of the selector lever to reverse position above 10 M.P.H.

PARKING

With the selector lever in the "Park" position, a parking pawl engages with lugs on the reverse planet carrier and locks the output shaft to the transmission case. A detent in the steering column prevents accidental movement of the selector lever to the "Park" position.

TOWING PRECAUTIONS

Whenever it becomes necessary to tow a Hydra-Matic equipped Oldsmobile, the propeller shaft must be removed or the vehicle towed with the rear wheels off the ground. Damage to the transmission may result unless this practice is followed.

PUSHING CAR TO START ENGINE

To start the engine by pushing the car, move the selector lever to the Neutral position and turn on ignition switch. When the car reaches a speed of 25 M.P.H., move the selector to "DR" or "S" range position.

MAINTENANCE

The fluid level should be checked every 1,000 miles and should be changed at 25,000 mile intervals. The fluid level should be checked with the engine running at idle speed and the car on a level surface. Approximately 11 quarts of oil are required to refill a transmission for an oil change. Use only G.M. Hydra-Matic fluid or fluid identified by brand names and the words "Fluid Type A", plus an Armour Qualification number embossed on top of the can as follows: "AQ-ATF-number".

ADJUSTMENTS

There is one band used in the new Hydra-Matic transmission and it does not require any adjustment. The band is used in first and second speeds low range only. Linkage adjustment is required.

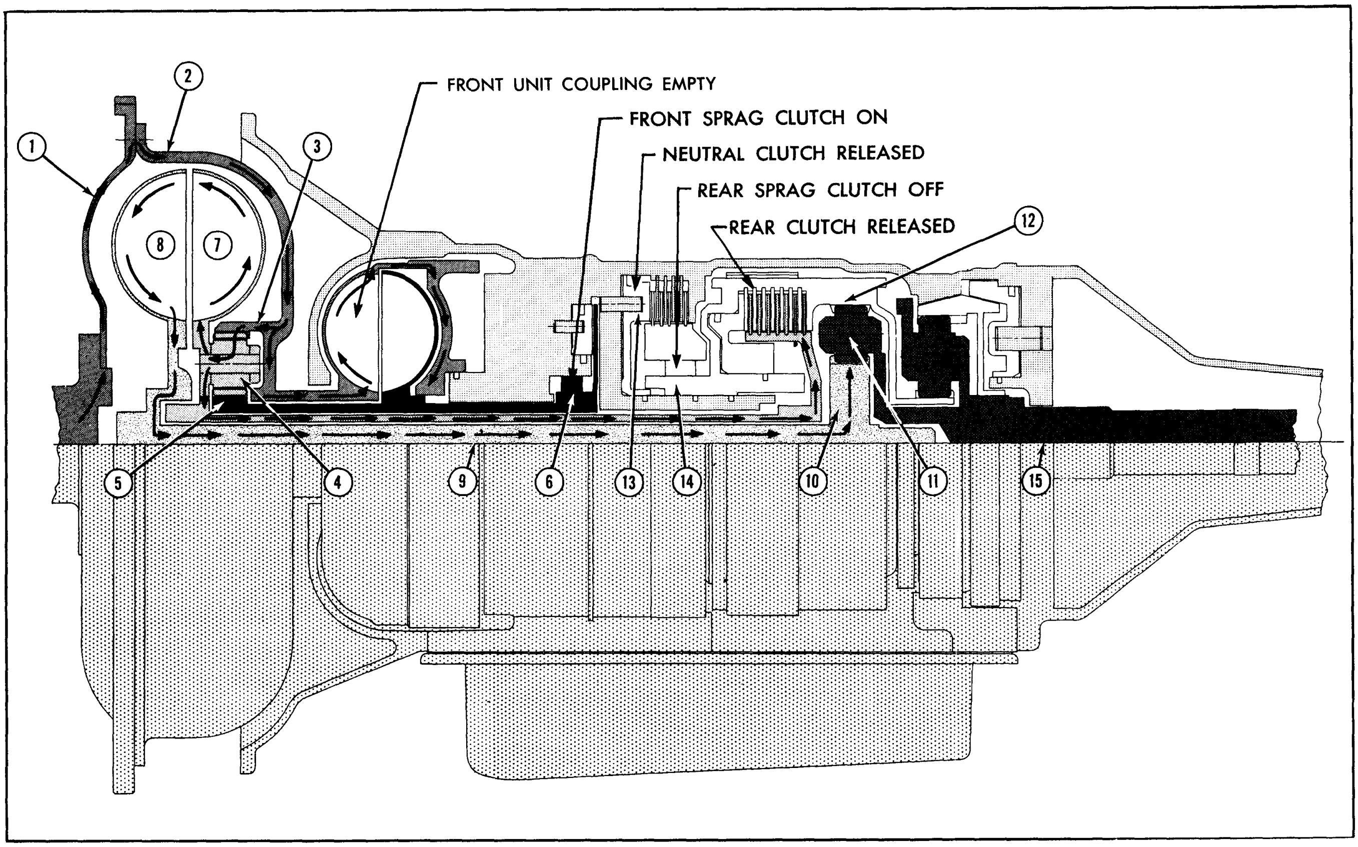


Fig. 3-2 Neutral (Engine Running)

NEUTRAL (ENGINE RUNNING)

FRONT UNIT (IN REDUCTION)		NEUTRAL CLUTCH	REAR UNIT (NEUTRAL)	
Sprag Clutch	**On**	**Released**	**Sprag Clutch**	**Off**
Front Coupling	**Empty**		**Rear Clutch**	**Off**

In neutral, the power flow from the engine is through the flywheel (1) to the torus cover (2) which is bolted to the flywheel. The front unit drive gear (3) is driven by the torus cover, therefore power is transmitted through the cover to the front unit drive gear, through the drive gear to the planet gears (4) causing them to drive around the sun gear (5) which is held stationary by the front sprag clutch (6). Since the planet gears are connected to the drive torus (7) through the planet carrier, the power flow is through the planet gears to the carrier and to the drive torus. The drive torus is turning at less than engine speed due to the reduction of the front unit. The drive torus transmits the power through oil to the driven torus (8) which is splined to the main shaft (9), and through the main shaft to the rear unit sun gear (10) on the main shaft. The rear unit sun gear transmits power to the planet gears (11). The planet gears, turning counter-clockwise, drive the rear unit internal gear (12) counter-clockwise. With the neutral clutch (13) released, the external race of the rear sprag (14), connected to the rear unit internal gear, is allowed to turn with the internal gear, therefore no power can be transmitted to the output shaft (15).

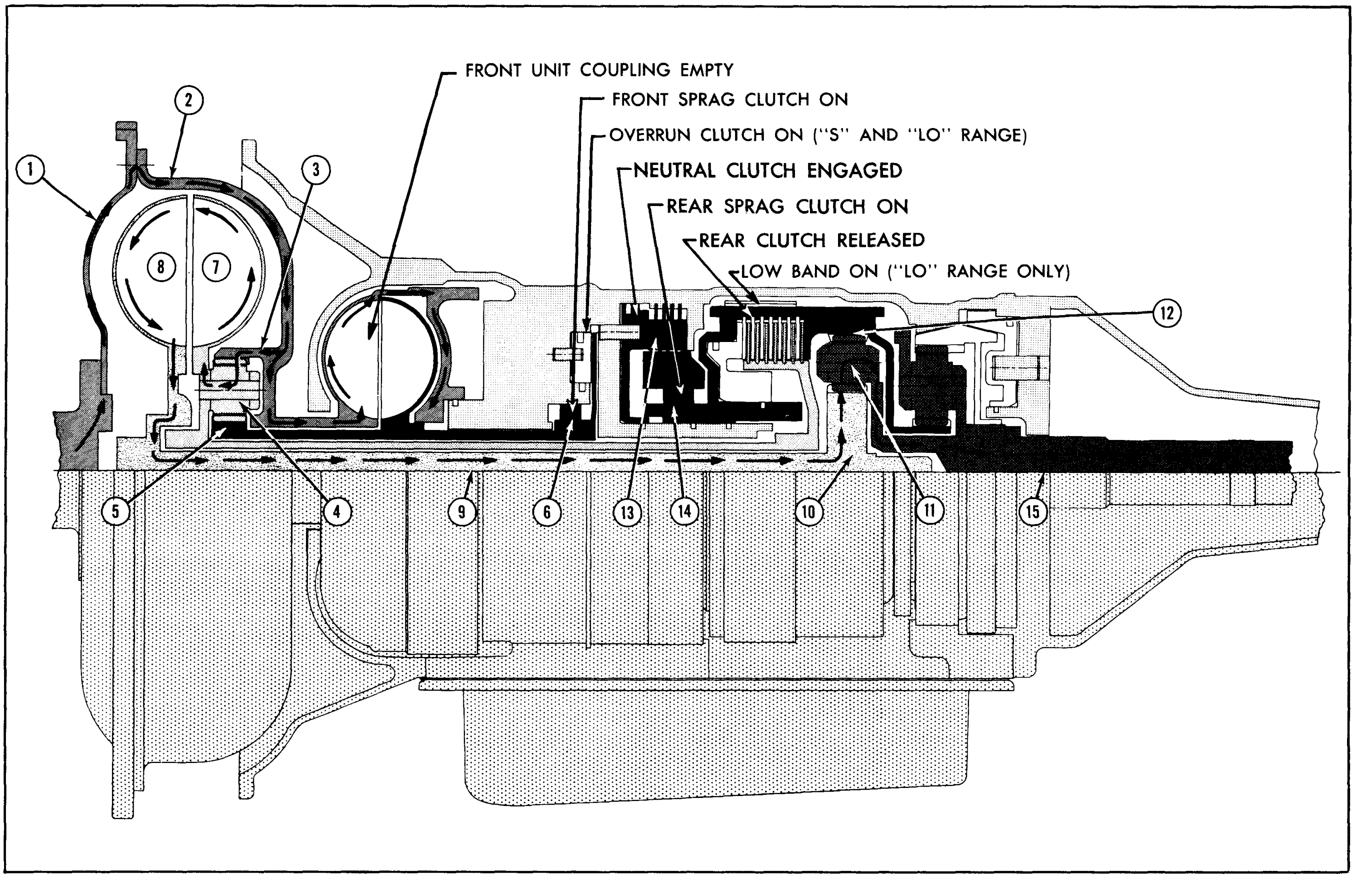


Fig. 3-3 First Speed

FIRST SPEED (3.96 to 1 Ratio)

FRONT UNIT (IN REDUCTION)		NEUTRAL CLUTCH	REAR UNIT (IN REDUCTION)	
Sprag Clutch	On	Applied	Sprag Clutch	On
Front Coupling	Empty		Rear Clutch	Off

In first speed, the front and rear planetary units are in reduction. The power flow is through the flywheel (1) to the torus cover (2). Since the front unit drive gear (3) is driven by the torus cover, power is transmitted through the cover to the front unit drive gear, through the drive gear to the planet gears (4), causing them to drive around the sun gear (5) which is held stationary by the front sprag clutch (6). Since the planet gears are connected to the drive torus (7) through the planet carrier, power flow is through the planet gears to the carrier and to the drive torus. The drive torus is turning at less than engine speed due to the reduction of the front unit. The drive torus transmits power through oil to the driven torus (8), splined to the main shaft (9), and through the main shaft to the rear unit sun gear (10) on the main shaft. The rear unit sun gear transmits power to the planet gears (11) causing them to drive around the rear unit internal gear (12) which is held stationary by the rear sprag clutch (14). The outer race of the rear sprag clutch is held by the neutral clutch (13). The planet gears transmit the power to the planet carrier on the output shaft (15) at reduction.

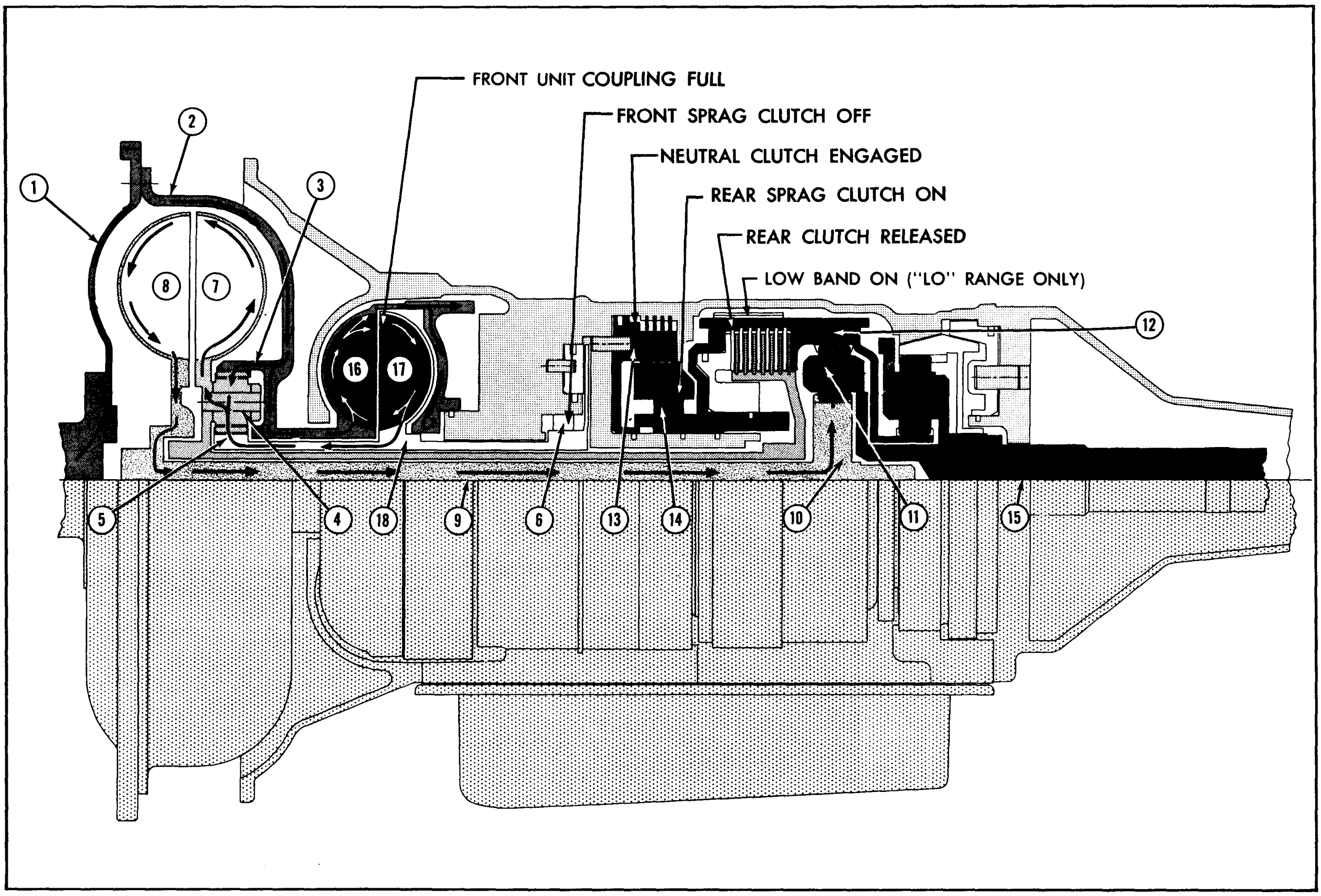


Fig. 3-4 Second Speed

SECOND SPEED (2.55 to 1 Ratio)

FRONT UNIT (DIRECT DRIVE)		NEUTRAL CLUTCH	REAR UNIT (IN REDUCTION)	
Sprag Clutch	**Off**	**Applied**	**Sprag Clutch**	**On**
Coupling	**Full**		**Rear Clutch**	**Off**

In second speed, the front unit is in direct drive and the rear unit is in reduction. The power flow is through the flywheel (1) to the torus cover (2). The torus cover is connected to the front unit drive gear (3) and the drive torus (16) of the front unit coupling, so the power flow divides at the front unit drive gear. Since the front unit coupling is full in second speed, power is transmitted from the drive torus through oil to the driven torus (17) and to the front unit sun gear (5). With the front unit drive gear locked through oil in the front unit coupling to the front unit sun gear the power is transmitted to the planet gears (4) at engine speed. The planet gears transmit power to the carrier attached to the drive torus (7). The drive torus transmits the power through oil to the driven torus (8) splined to the main shaft (9), then through the main shaft to the rear unit sun gear)10) on the main shaft. The rear unit sun gear transmits power to the planet gears (11) causing them to drive around the rear unit internal gear (12), which is held stationary by the rear sprag clutch (14). The outer race of the rear sprag clutch is held by the neutral clutch (13). The planet gears transmit the power to the planet carrier on the output shaft (15) at reduction.

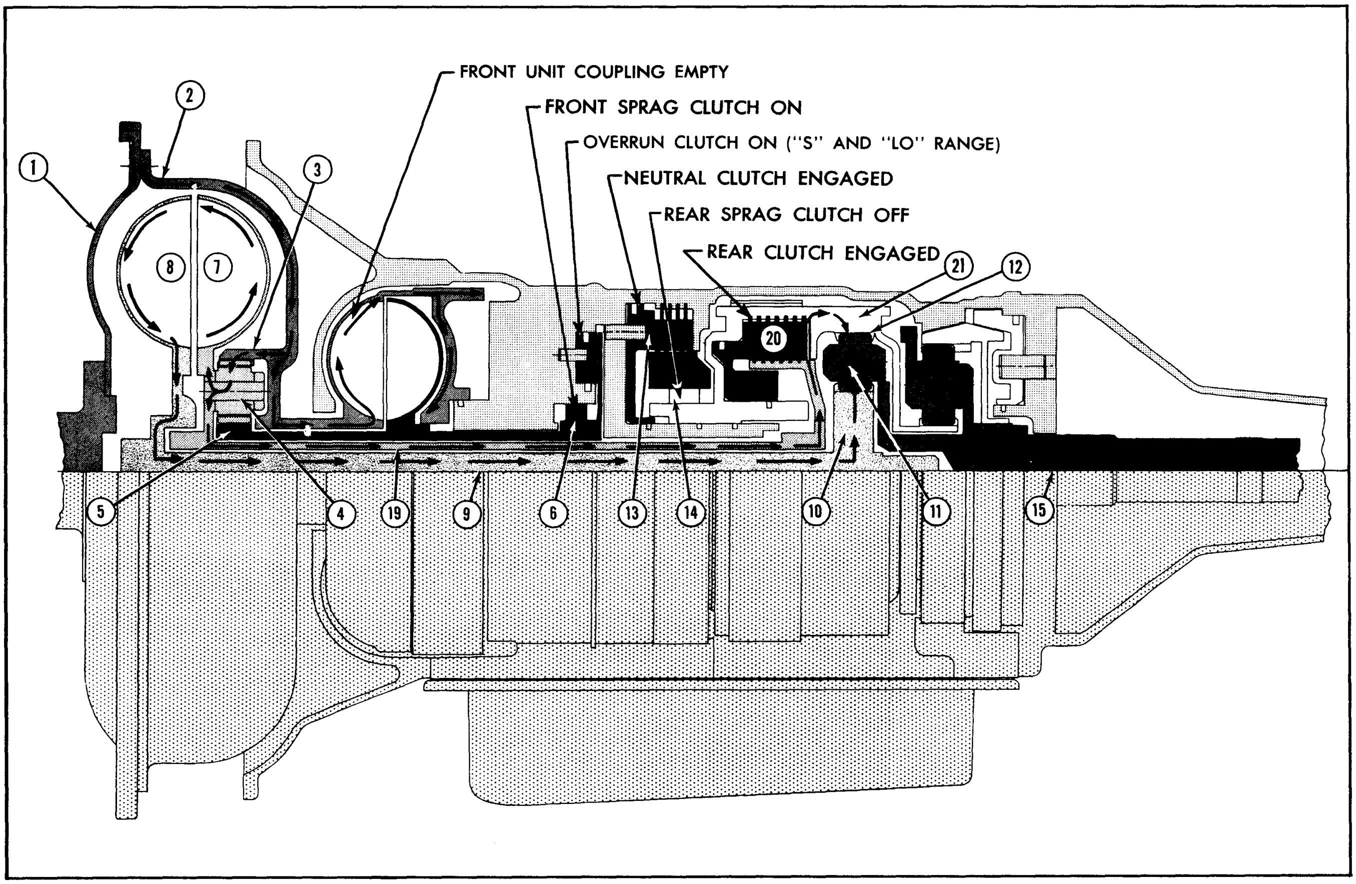


Fig. 3-5 Third Speed

THIRD SPEED (1.55 to 1 Ratio)

FRONT UNIT (IN REDUCTION)		NEUTRAL CLUTCH	REAR UNIT (DIRECT DRIVE)	
Sprag Clutch	**On**	**Applied**	**Sprag Clutch**	**Off**
Front Coupling	**Empty**		**Rear Clutch**	**On**

In third speed, the front unit is in reduction and the rear unit is in direct drive. The power flow is through the flywheel (1) to the torus cover (2). Since the front unit drive gear (3) is driven by the torus cover, power is transmitted through the cover to the front unit drive gear, and through the drive gear to the planet gears (4) causing them to drive around the sun gear (5) which is held stationary by the front sprag clutch (6). Since the planet gears are connected to the drive torus (7) through the planet carrier, the power flow is through the planet gears to the carrier and to the drive torus. The drive torus is turning at less than engine speed due to the reduction of the front unit. Approximately 40% of the torque is transmitted from the drive torus through oil to the driven torus (8) splined to the main shaft (9), then through the main shaft to the rear unit sun gear (10) on the main shaft. The remainder (approximately 60%) of the torque is transmitted from the drive torus to the intermediate shaft (19), then through the rear clutch plate (20) to the rear unit internal gear (12) attached to the rear unit drum (21). This 60% (mechanical) joins the 40% from the fluid coupling at the planet gears and the resultant is transmitted to the planet carrier on the output shaft (15).

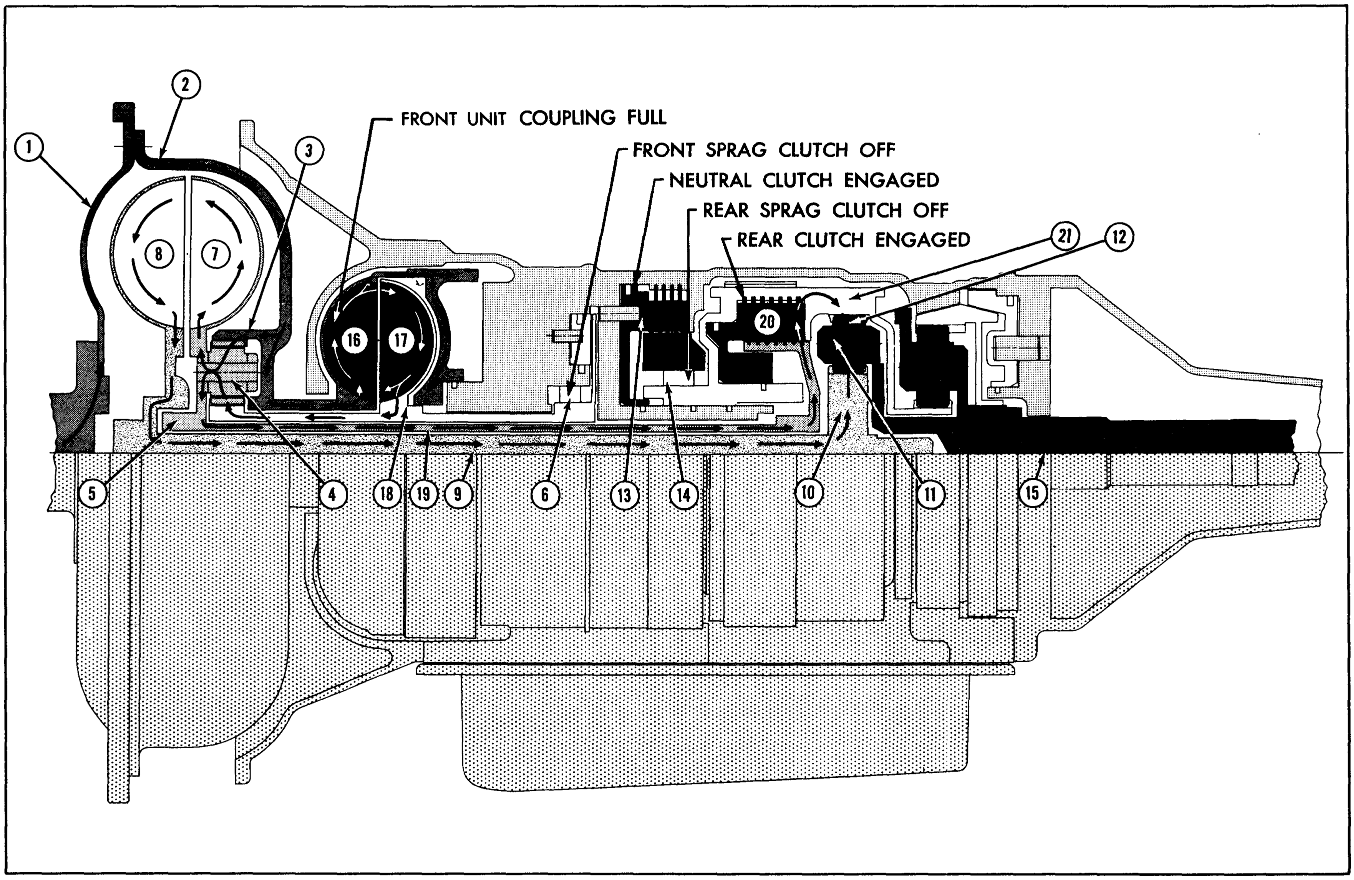


Fig. 3-6 Fourth Speed

FOURTH SPEED (Direct Drive)

FRONT UNIT (DIRECT DRIVE)		NEUTRAL CLUTCH	REAR UNIT (DIRECT DRIVE)	
Sprag Clutch	**Off**	**Applied**	**Sprag Clutch**	**Off**
Front Coupling	**Full**		**Rear Clutch**	**On**

In fourth speed, the front and rear units are in direct drive. The power flow is through the flywheel (1) to the torus cover (2). The torus cover is connected to the front unit drive gear (3) and the drive torus of the front unit coupling (16), so the power flow divides at the front unit drive gear Since the front unit coupling is full in fourth speed, power is transmitted from the front unit coupling drive torus through oil to the driven torus (17) and to the front unit sun gear (5). With the front unit drive gear locked through oil in the front coupling to the front unit sun gear, the power is transmitted to the planet gears (4) at engine speed. The planet gears transmit power to the carrier attached to the drive torus (7). Approximately 40% of the torque is transmitted from the drive torus through oil to the driven torus (8) splined to the main shaft (9) then through the main shaft to the rear unit sun gear (10) on the main shaft. The remainder (approximately 60%) of the torque is transmitted from the drive torus to the intermediate shaft, (19) then through the rear clutch plates (20) to the rear unit internal gear (12) attached to the rear unit drum (21). This 60% (mechanical) joins the 40% from the fluid coupling at the planet gears and the resultant is transmitted to the planet carrier on the output shaft (15).

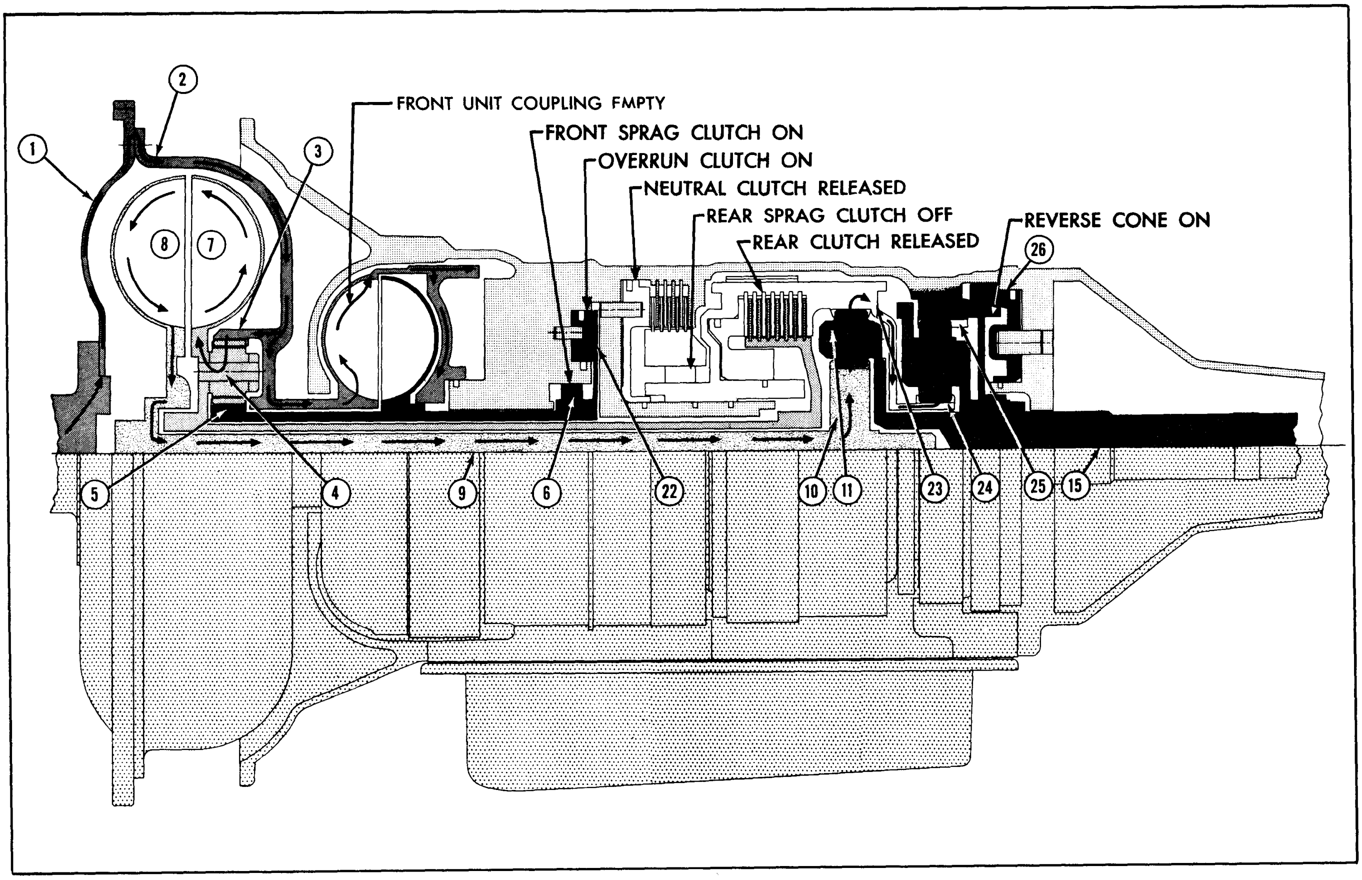


Fig. 3-7 Reverse

REVERSE (4.30 to 1 Ratio)

FRONT UNIT (IN REDUCTION)		NEUTRAL CLUTCH	REAR UNIT (IN REDUCTION)		REVERSE UNIT (IN REDUCTION)	
Sprag Clutch	On	Off	Sprag Clutch	Off	Cone Clutch	On
Overrun Clutch	On					
Coupling	Empty		Rear Clutch	Off		

In reverse, the front unit, rear unit and reverse unit are in reduction. The power flow is through the flywheel (1) to the torus cover (2). Since the front unit drive gear (3) is driven by the torus cover, power is transmitted through the cover to the front unit drive gear, through the drive gear to the planet gears (4) causing them to drive around the sun gear (5) which is held stationary by the front sprag clutch (6). Since the planet gears are connected to the drive torus (7) through the planet carrier, the power flow is through the planet gears to the carrier and to the drive torus. The drive torus is turning at less than engine speed due to the reduction of the front unit. The drive torus transmits the power through oil to the driven torus (8), (splined to the main shaft (9) , and through the main shaft to the rear unit sun gear (10) on the main shaft. The rear unit sun gear transmits power to the planet gears (11). The neutral clutch (13) and rear clutch (20) are off and with the rear planet gears acting as idlers, the rear internal gear (12) and drum (21) turn counter-clockwise. The internal gear, through the reverse drive flange (23), drives the reverse sun gear (24) of the reverse planetary unit. The reverse internal gear (25) is held by the reverse cone clutch (26) and the power is transmitted through the reverse planet carrier to the output shaft (15).

HYDRAULIC OIL CIRCUIT (Fig. 3-8)

VALVES AND THEIR FUNCTION

LIMIT VALVE

The limit valve prevents a sudden drop in line pressure when the front unit coupling fills. It also acts as a pressure relief valve to protect the system from excessive pressure. Pump pressure on the large diameter of the valve will move the valve to the right and open the passage to the coupling valve feed oil passage. The larger spring serves as the pressure relief.

COUPLING VALVE

The coupling valve is in the oil circuit to control the filling and emptying of the front unit coupling. It is held in the closed position in the forward speeds by spring pressure and T.V. pressure and in reverse position by spring pressure, T.V. pressure and reverse oil pressure. The coupling valve opens when G-1 booster pressure builds up high enough to overcome the combined spring pressure and throttle pressure. The valve will not open in reverse. When the valve opens, main line pressure is directed into the signal oil passage to close the 2 exhaust valves in the front unit coupling. Main line pressure thru the limit valve is also directed into the feed passage to fill the front unit coupling. The T.V. passage to the end of the valve is also cut off and the pressure on the plug is allowed to exhaust out the reverse passage. This prevents throttle downshift. "S" range oil is directed through the valve to apply the overrun front clutch in third and first speeds, "S" range and "LO" range. The coupling valve closes the "S" range oil passage to the overrun front clutch in second and fourth, "S" range and "LO" range. When the coupling valve moves to the left, it cuts off main line pressure to the signal oil and feed oil passages. The exhaust valves in the front unit coupling will open and oil will be thrown from the front unit coupling by centrifugal force.

OVERRUN CLUTCH VALVE

The overrun clutch valve is positioned to the right by throttle pressure in "DR" and Reverse. In Drive range the overrun front clutch apply passage is open to exhaust through the reverse passage at the manual valve. In Reverse, oil is directed from the manual valve to the overrun front clutch piston to apply the clutch.

In "S" and "LO" range pump pressure is directed from the manual valve through the coupling valve, in first and third, to the right end of the overrun clutch valve.

Pump pressure moves the overrun clutch valve to the left against throttle pressure and slowly opens the passage to the overrun front clutch to delay application of the clutch. In second and fourth speeds, the coupling valve cuts off the pump pressure to the overrun clutch valve and throtle pressure moves the valve to the right. The overrun clutch apply presure then exhausts through the reverse passage and the overrun clutch is released by spring force. This delay in applying the overrun clutch is to allow the front unit coupling to empty and front sprag clutch to engage, resulting in a smooth downshift 4-3 when moving the selector lever from "DR" to "S" range.

TRANSITION VALVE

The transition valve controls the front unit on the 2-3 upshift. When the 2-3 shift valve opens, 2-3 oil pressure is directed to one end of the transition valve which moves it to the right against combined G-2 pressure and spring force. Movement of the valve cuts off G-1 booster pressure to the coupling valve and exhausts it through the 3-4 valve. The orifice in the 2-3 passage to the transition valve is to aid in timing the front unit with the rear unit during the 2-3 shift.

DETENT VALVE

Main line pressure from the manual valve is directed through the detent valve to the 3-4 governor valve. This pressure has no action on the detent valve, and the passage to the 3-4 governor valve is closed when the detent valve has been pushed to the left. "S" range oil is directed through the detent valve to the 3-4 shift valve to hold the transmission in third speed. The detent valve is mechanically opened by linkage. It is returned to the closed position by spring force on the end of the valve. The valve is in the circuit to make the 4-3 and 3-2 detent downshifts. When the accelerator pedal has been depressed all the way, the valve will be positioned to the left. T.V. pressure at the detent valve will then be directed to the 2-3 and 3-4 shift valves. At car speeds below 65 M.P.H. the 4-3 shift valve will close for a 4-3 downshift, and at speeds below 20 M.P.H. the 2-3 shift valve will close for a 3-2 downshift.

PUMP PRESSURE

The first requirement of a hydraulic control system is a source of oil pressure. Oil pressure for the Hydra-Matic transmission is supplied by two oil pumps. One is at the front of the transmission driven by the engine, the other at the rear, driven by the transmission output shaft. The front pump operates whenever the engine is running; the rear pump operates whenever the car is in forward motion.

The front pump is of the vane type and consists of 7 vanes rotated within a movable slide by a rotor. Variable output is achieved through the movable slide. A priming spring holds the slide up to deliver maximum output to quickly attain regulated pressure in the control system when the engine is started. The pressure regulator will then adjust the position of the slide so that only the amount of oil needed is pumped. Main line pressure operates on the end of the pressure regulator and tends to move it downward. When the pressure regulator is in the upward position, oil is directed to hold the slide up for maximum output. Oil is directed to the opposite side of the slide when the pressure regulator is forced down and the volume output of the pump will be decreased to the amount required to maintain regulated pressure.

The torus feed valve controls the flow of oil to the fluid coupling, the valve is held against the slide by the spring. The valve closes the oil passage to the fluid coupling until oil pressure moves the slide toward the priming springs. The valve follows the slide and opens to direct oil through the oil cooler in the radiator lower tank, through the fluid coupling and lubrication system. A ball check is provided to by-pass the cooler in the event the cooler becomes plugged. The limit valve in the front clutch valve body protects the system against excessive pressures. Both oil pumps deliver oil at regulated pressure (controlled by front pump) when the car is driven forward.

THROTTLE PRESSURE

Throttle valve pressure originates at the throttle valve and varies according to carburetor throttle opening by means of linkage from the accelerator pedal. As the accelerator pedal is depressed, linkage to a lever on the side of the transmission moves the throttle valve plunger. Plunger movement opens the throttle valve through spring force, and oil from the pump then flows through an opening at the throttle valve. This oil under pressure acts on the end of the throttle valve to oppose the throttle valve spring force which opened the valve. In this manner the throttle valve becomes a balanced valve; balanced between spring force and throttle pressure. As a result of this action throttle pressure varies with accelerator pedal position from zero pressure at closed throttle to full line pressure at full throttle. Throttle pressure is directed to a land on the throttle valve plunger to assist in moving the plunger which gives a lighter feel to the accelerator pedal. This pressure cannot move the plunger without assistance from the accelerator linkage.

Throttle valve pressure is directed to the 2-3 and 3-4 regulator valves where it is modulated. Throttle valve pressure acts against the end of these valves, and due to their design the pressure of the oil passing the valves is reduced. It is therefore called modulated throttle valve pressure.

This pressure assists the 2-3 and 3-4 shift valve springs in opposing governor pressures.

Throttle valve pressure is directed to one end of the overrun clutch valve to position it to the right and to the coupling valve plug to assist the coupling valve spring in opposing G-1 booster pressure.

Throttle valve pressure is directed to the transition valve when in detent position for a 3-2 downshift to prevent a 3-1-2 downshift by properly timing the front and rear unit change.

Throttle pressure is directed to the accumulator to absorb the shock of the rear clutch apply oil pressure.

GOVERNOR PRESSURE

A centrifugal governor driven by the rear pump supplies two governor pressures. G-1 is supplied from the governor valve having the large weight. G-2 is supplied from the governor valve having no weight. These two pressures vary with car speed, however, G-1 increases at a faster rate than G-2 pressure because of the large weight. The G-1 valve also has a spring to assist in opening the valve to give an initial G-1 pressure when the engine is running. This is to provide a higher G-1 pressure at low car speeds. The G-1 valve is a balanced valve, balanced between G-1 pressure and centrifugal force assisted by spring force. The G-2 valve is a balanced valve, balanced between G-2 pressure and centrifugal force. Pump pressure is the supply for G-1 pressure and G-1 pressure is the supply for G-2 pressure. G-1 pressure is used to open the G-1 booster valve, and is also used to assist G-2 pressure in opening the 2-3 and 3-4 shift valves. G-2 pressure is used on the transition valve to help control the 2-3 shift.

G-1 BOOSTER VALVE PRESSURE

G-1 booster pressure originates at the G-1 booster valve. G-1 pressure working on the larger diameter end of the valve moves it to the right allowing main line pressure to feed into the center area of the valve. As G-1 booster pressure builds up in the center of the valve it moves the valve back to the closed position cutting off the main line pressure. Since the G-1 booster pressure must force the valve closed against G-1 pressure, and it has less area of the valve to work on, booster pressure will be higher than G-1. The G-1 booster valve is a balanced valve, balanced between G-1 and G-1 booster pressure. G-1 booster pressure increases with car speed until it reaches main line pressure. As car speed decreases, G-1 booster pressure forces the valve further to the left against G-1 pressure and allows G-1 booster pressure to enter the G-1 passage where it is regulated at the G-1 valve.

G-1 booster pressure is directed through the transition valve to one end of the coupling valve. When G-1 booster pressure on the end of the coupling valve becomes high enough, depending on car speed, to overcome the spring force and T.V. pressure on the other end of the coupling valve it will move the valve for the 1-2 upshift.

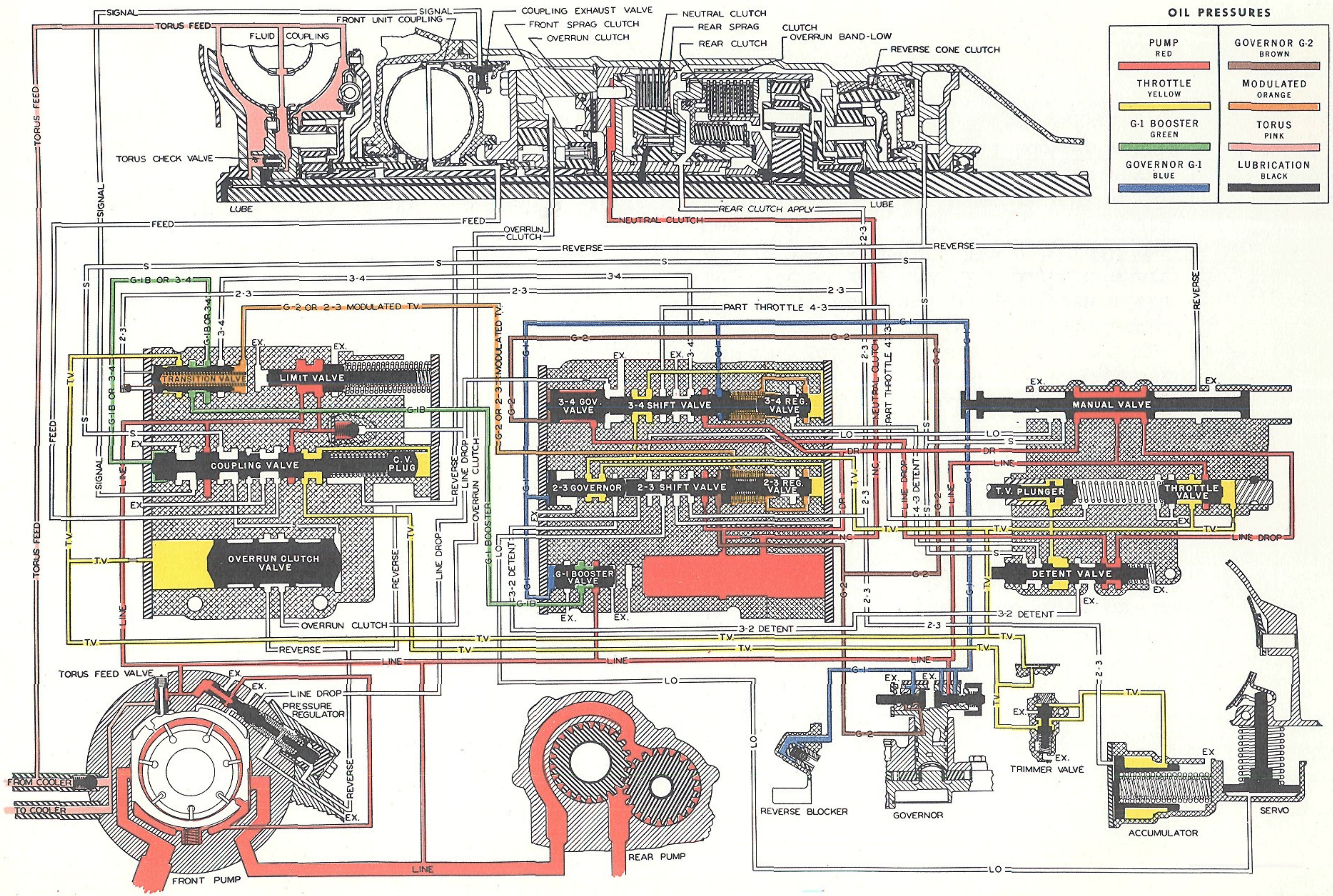


Fig. 3-8 Oil Pressures

NEUTRAL—ENGINE NOT RUNNING—Car Standing

With both pumps inoperative there is no oil pressure and the front unit coupling is empty. The front and rear sprag clutches are off, the overrun clutch, the neutral clutch, the rear clutch, reverse clutch, and the low band are off. If the selector lever is moved to the "P" position, the parking pawl will engage the parking gear and lock the output shaft for parking.

NEUTRAL—ENGINE RUNNING

The Front Unit Will Be In Reduction, The Neutral Clutch Will Be Off And No Drive Can Be Transmitted To The Output Shaft.

Oil pressure is not required in order to satisfy the condition for neutral.

When the engine is started the front pump builds up pressure to the: manual valve, throttle valve, G-1 governor valve, G-1 booster valve, limit valve, rear oil pump, front unit coupling valve, and the pressure regulator valve. As the pressure builds up, the front pump slide moves toward center to regulate the pressure. Movement of the slide allows the torus feed valve to open, and oil pressure is directed through the cooler to fill the fluid coupling.

As soon as pump pressure builds up to approximately 55 p.s.i. the limit valve will move to the right and allow pump pressure to be directed to the coupling valve for the feed oil supply.

Since the G-1 valve is spring loaded it will be open and pump pressure will be directed into the G-1 passage where it will be regulated. The valve will become balanced between G-1 pressure and spring force. G-1 pressure will be directed to the G-2 valve and is the supply for the G-2 valve and G-1 booster valve.

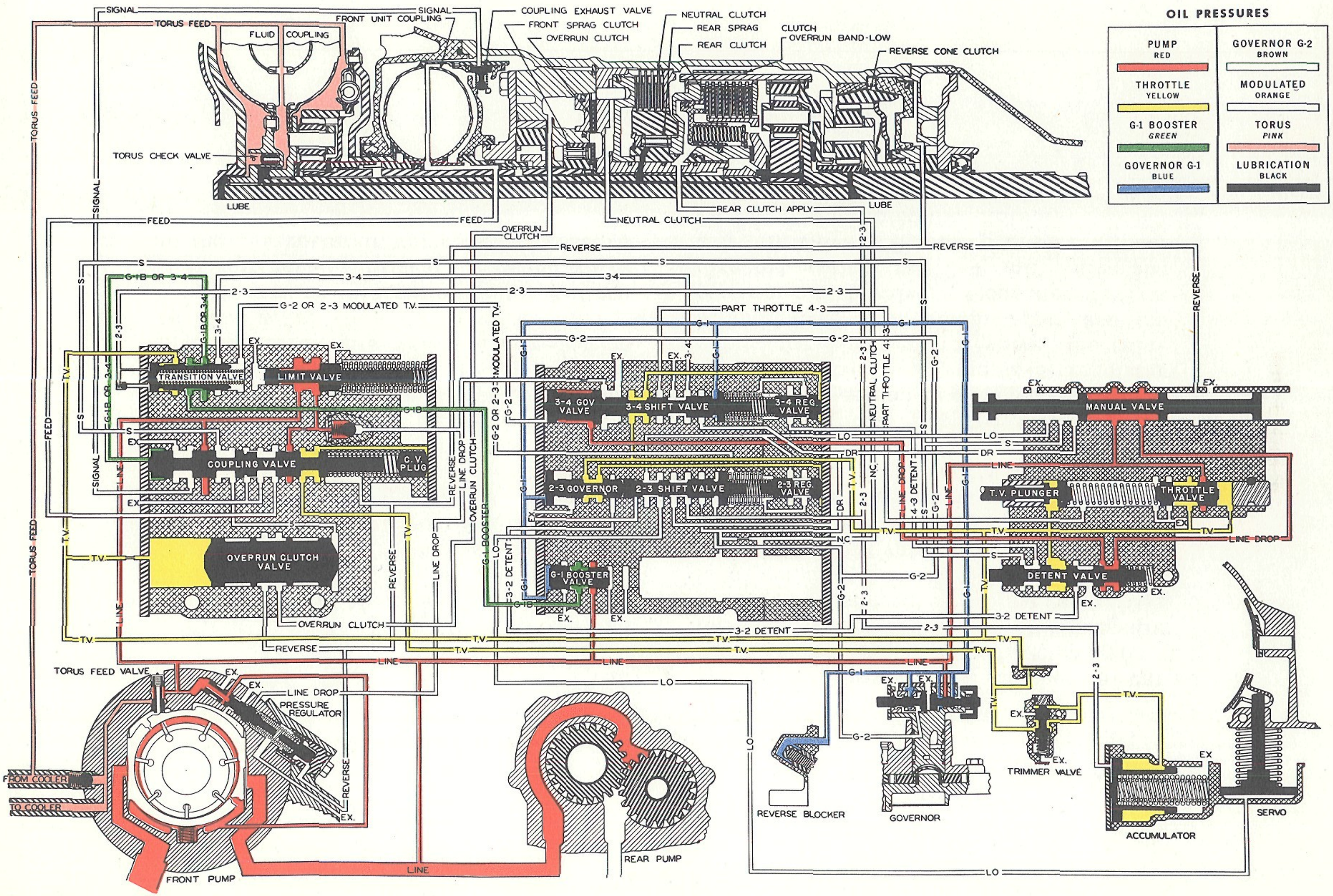


Fig. 3-9 Neutral (Engine Running)

FIRST GEAR—DR.

Front And Rear Sprag Clutches And The Neutral Clutch Must Be On. With The Front Unit Coupling Empty And The Rear Clutch Released The Transmission Will Be In First Gear. (Front Overrun Clutch And Lo Band is Released In DR. Range)

The manual valve in the "DR" position directs oil to apply the neutral clutch. With the neutral clutch applied by oil pressure, the front and rear sprag clutches applied, both units will be in reduction for first gear.

Oil pressure is directed to the 2-3 and 3-4 shift valves, through the detent valve to the 3-4 governor valve. This pressure has no function at this time.

Governor pressures increase as car speed increases. G-1 is directed against the G-1 booster and G-1 booster pressure is directed against the coupling valve. G-1 is directed against the 2-3 governor valve and the 3-4 shift valve. G-1 is also directed against the reverse blocker piston to prevent reverse engagement above 10 M.P.H. G-2 is directed against the 2-3 shift valve and the 3-4 governor valve.

As the throttle is opened, throttle pressure increases and is directed against the coupling valve plug, the 2-3 regulator valve, the 3-4 regulator valve, the transition valve, rear clutch apply and the overrun clutch valve. Modulated T.V. is directed against the 3-4 shift valve and 2-3 shift valve. Throttle pressure will act as a factor in timing the shifts.

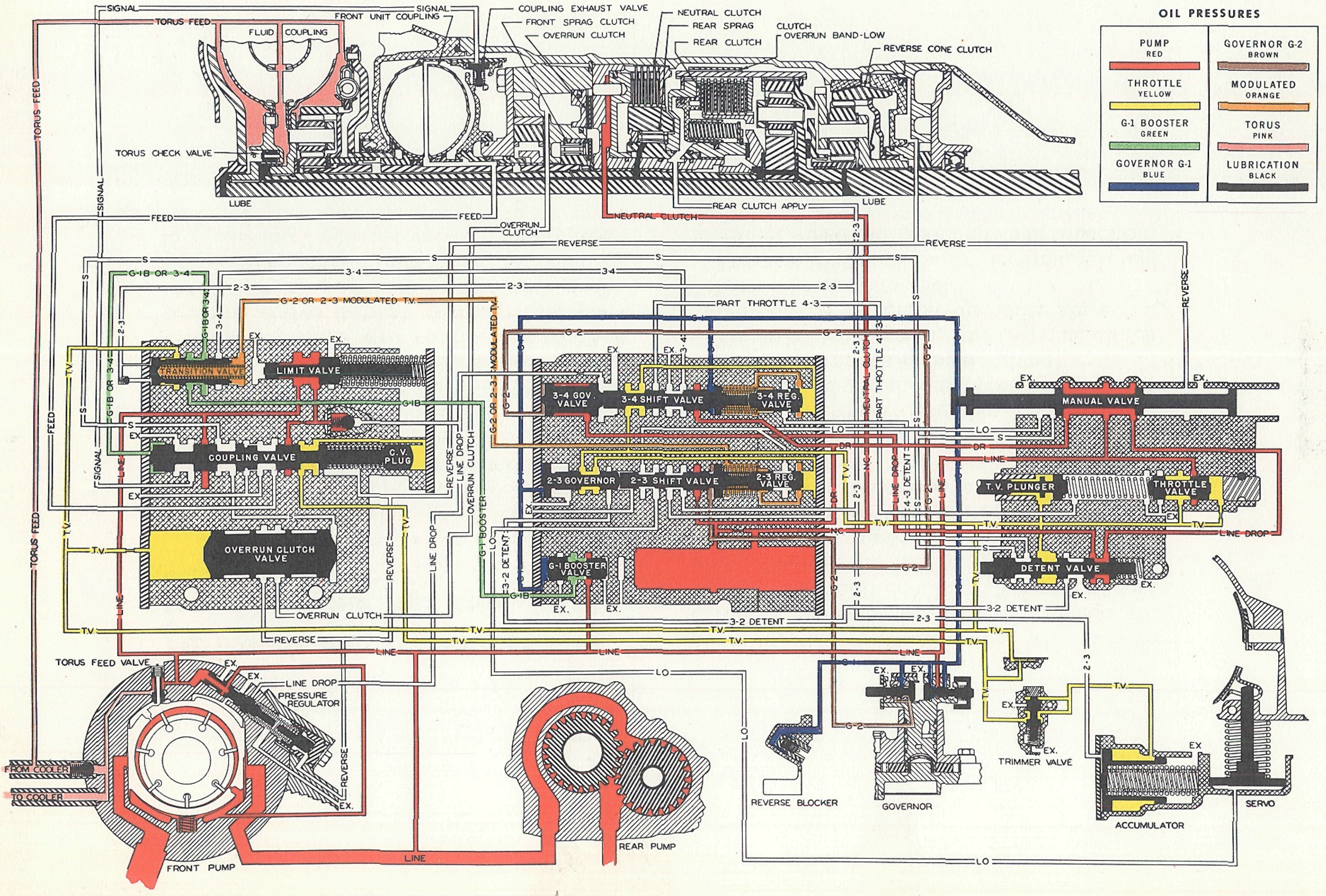


Fig. 3-10 First Gear "Dr."

1-2 UPSHIFT AND SECOND GEAR—DR.

FRONT COUPLING FULL AND REAR SPRAG ON

As the speed of the car increases in first gear, so will governor pressure. As G-1 increases in pressure on the G-1 booster valve, G-1 booster pressure will increase on the coupling valve. When G-1 booster pressure exceeds the spring force plus the throttle pressure, the coupling valve will open and cause the following action:

Pump pressure will be directed past the coupling valve through two separate passages. Pump pressure will go through the signal oil passage to the front unit coupling to close the 2 exhaust valves. Pump pressure through the limit valve will also be directed through the feed oil passage to fill the front unit coupling. While the front unit coupling is filling, the front sprag clutch automatically releases and the front unit will be in direct drive. With the rear unit in reduction and the front unit in direct drive, the transmission is in second gear.

Throttle pressure on the coupling valve plug is exhausted through the reverse passage and out at the manual valve.

Throttle pressure on the overrun clutch valve had no effect on the shift since the selector lever is in "DR".

Throttle pressure on the accumulator had no effect since the rear unit is in reduction.

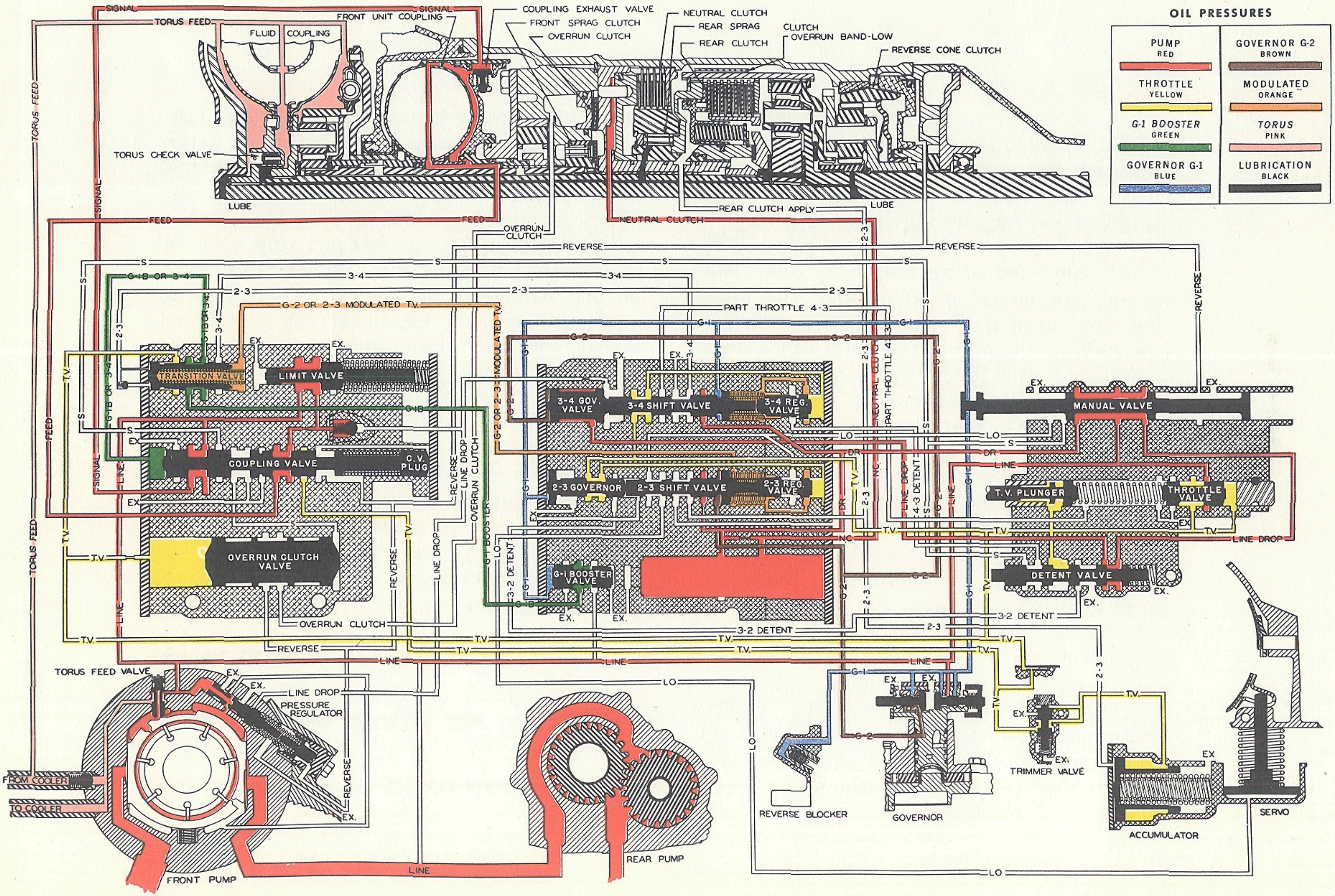


Fig. 3-11 Second Gear "Dr."

2-3 UPSHIFT AND THIRD GEAR— DR.

FRONT SPRAG CLUTCH ON

REAR CLUTCH APPLIED

When the car speed is such that the increasing governor pressures G-1 on the 2-3 governor valve, and G-2 on the 2-3 shift valve overcomes the spring force and modulated pressure on the 2-3 shift valve, the 2-3 shift valve opens and directs oil to the rear unit where it applies the clutch. Applying the clutch automatically releases the rear sprag clutch. During the 2-3 shift, rear clutch apply oil is directed to the accumulator and must move the piston against spring force and throttle pressure. The rise of pressure due to rear clutch apply oil working against the accumulator and rear clutch is gradual and a harsh apply of the rear clutch is avoided. As the accumulator piston moves against spring force and throttle pressure, a check valve is lifted off its seat to eliminate restriction of TV oil returning to the throttle valve. Also oil from the 2-3 shift valve is directed to the transition valve moving it to the right which closes the G-1 booster passage to the coupling valve and opens it to exhaust through the 3-4 shift valve. When G-1 booster pressure is cut off, the coupling valve spring moves the valve to the left, which closes the main line passage to the signal oil and signal oil is opened to exhaust at the valve. This allows the 2 exhaust valves in the front unit coupling to open. Movement of the coupling valve also closes the main line passage to the feed oil and opens the feed oil passage to an air vent which allows the front unit coupling oil to exhaust at the 2 exhaust valves. When the front unit coupling is empty the front sprag clutch automatically engages and the front unit is in reduction. With the front unit in reduction and the rear unit in direct drive the transmission is in third gear.

Throttle pressure on the 2-3 regulator valve is exhausted at the detent valve.

The trimmer valve will limit the maximum amount of throttle pressure applied to the accumulator.

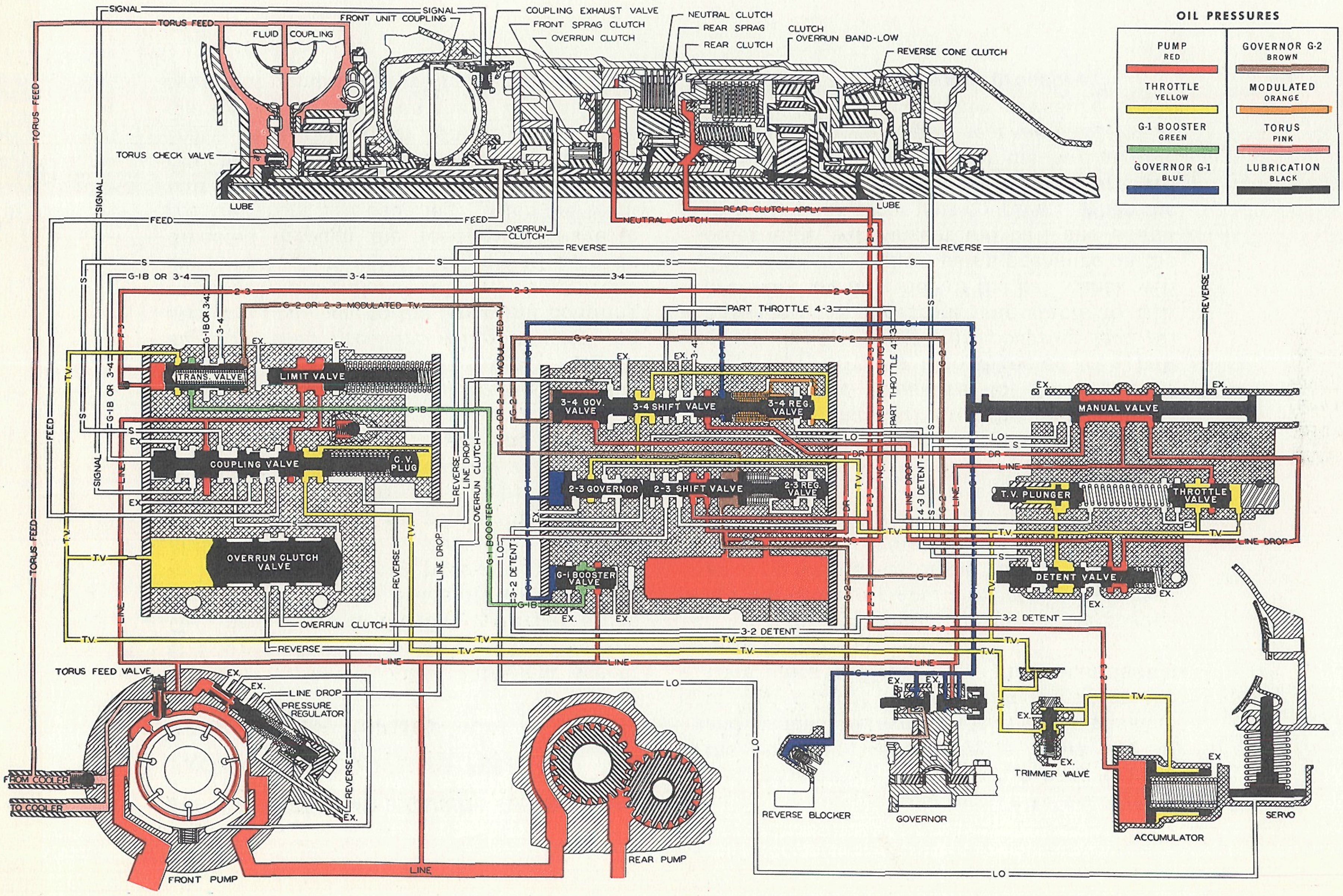


Fig. 3-12 Third Gear "Dr."

3-4 UPSHIFT AND FOURTH GEAR— DR. FRONT UNIT COUPLING FULL REAR CLUTCH APPLIED

When the car reaches sufficient speed, G-1 pressure on the 3-4 shift valve and G-2 pressure on the 3-4 governor valve will overcome the 3-4 shift valve spring and modulated throttle pressure on the 3-4 shift valve. The 3-4 shift valve will open and direct pump pressure through the transition valve to the coupling valve. Pump pressure on the coupling valve moves it to the right and causes the following action:

Pump pressure will be directed past the coupling valve through two separate passages. Pump pressure will go through the signal oil passage to the front unit coupling to close the 2 exhaust valves. Pump pressure through the limit valve will also be directed through the feed oil passage to fill the front unit coupling. When the front unit coupling has filled, the front sprag clutch is automatically released and the front unit will be in direct drive. The change is the same as the 1-2 upshift except that pump pressure from the 3-4 shift valve opens the coupling valve instead of G-1 booster valve. Throttle pressure on the coupling valve plug is again cut off and exhausted through the reverse passage to the manual valve. With the front and rear units in direct drive the transmission is in fourth gear.

When G-2 pressure moved the 3-4 governor valve to the right, it directed pump pressure on the center of the valve to a land on the pressure regulator valve to lower pump pressure in fourth gear (line drop). The transmission will operate on less pressure in fourth gear which will lower horse power requirements. To prevent pressure from dropping until after the front unit has changed, the pressure to the pressure regulator valve is also directed to a ball check in the front unit coupling feed oil passage. As the front unit starts to fill, pressure on this side of the ball check will drop and the higher pump pressure on the other side will unseat the ball and assist in filling the front unit coupling. When the front unit coupling has filled, pressure will be equal on both sides of the ball and the spring force will again seat the ball. Pressure will then act on the pressure regulator valve to lower pump pressure.

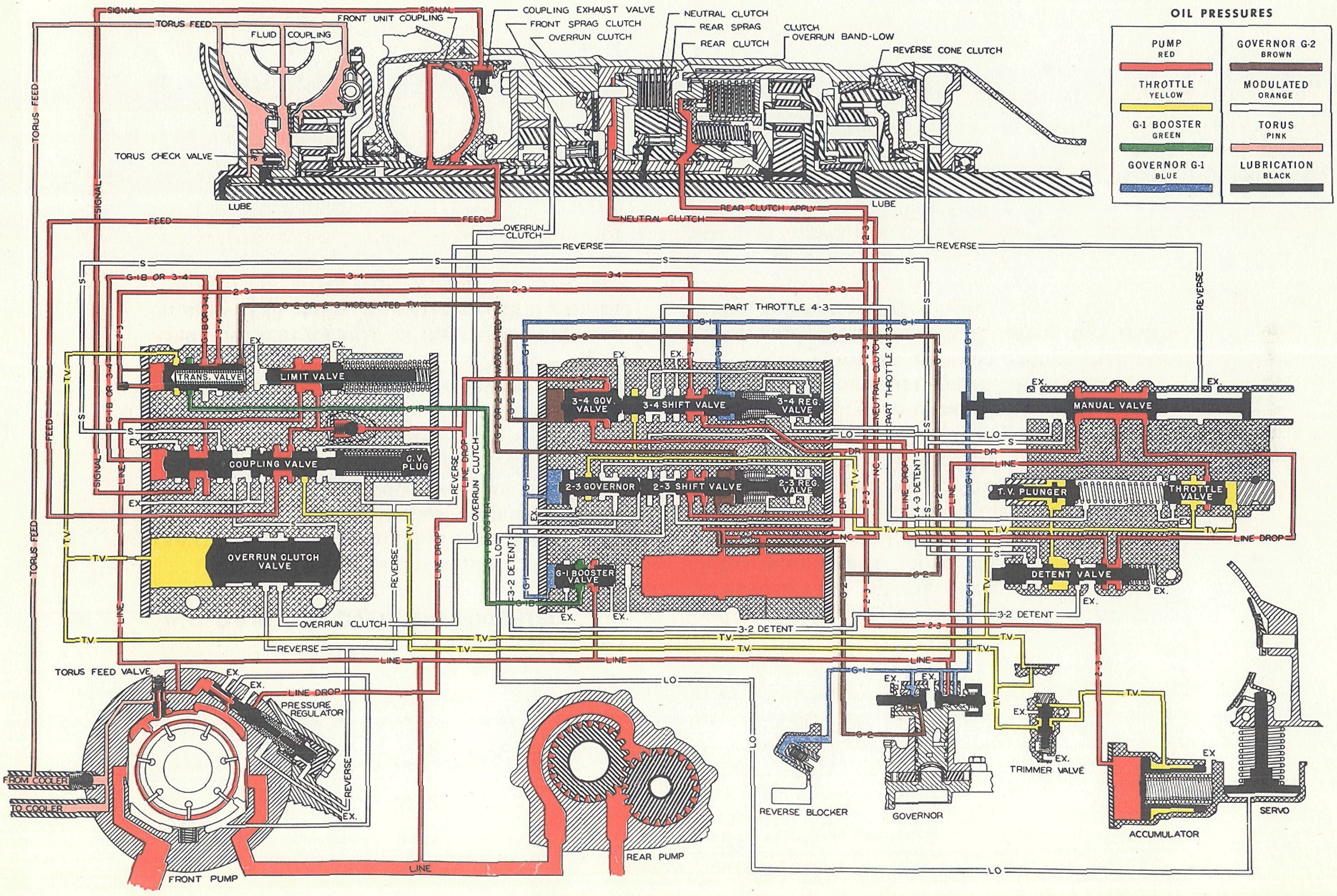


Fig. 3-13 Fourth Gear "Dr."

4-3 PART THROTTLE DOWNSHIFT

A 4-3 part throttle downshift can be made any time the transmission is in fourth gear and the car speed is below approximately 30 M.P.H. This is desirable in traffic because the transmission can be downshifted to third gear for faster pickup without a wide open throttle. The part throttle downshift is obtained in the following manner:

When the transmission is in fourth gear and the accelerator is depressed approximately 1/3 down, throttle pressure on the plunger is directed through the 3-4 shift valve to the regulator valve. Throttle pressure and spring force on the regulator valve will close the valve and the transmission will be in third gear. When the shift valve closes, throttle pressure from the plunger will be cut off and throttle pressure from the throttle valve will hold the shift valve closed until governor pressures can increase enough to open the shift valve again for fourth gear. If pressure on the accelerator is relaxed enough then the governor pressures will open the shift valve immediately.

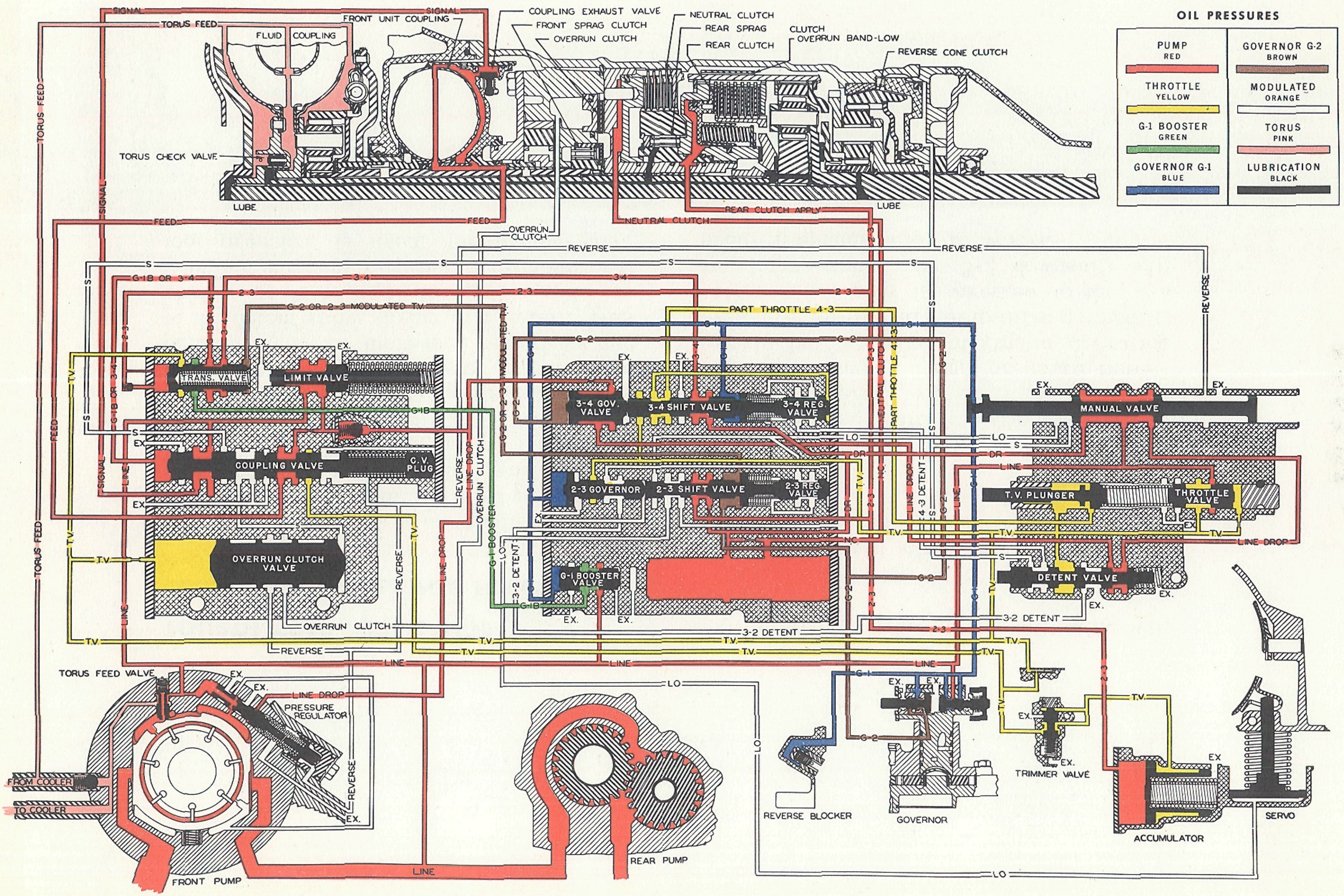


Fig. 3-14 4-3 Part Throttle Downshift

FOURTH GEAR—DR. RANGE

DETENT POSITIONED FOR FORCED 4-3 DOWNSHIFT

It may be desirable to downshift the transmission from fourth to third at a speed higher than the part throttle downshift would occur. This downshift can be made up to speeds of approximately 65-70 M.P.H. by pressing the accelerator pedal all the way down. As the throttle lever contacts the detent valve, the increased resistance due to the detent valve spring will be felt. This resistance is to warn the driver and prevents an accidental downshift. If additional foot pressure is used, the detent valve moves to the right and the following will occur:

Detent oil is directed to the 3-4 shift valve which will close the valve against governor pressures and the transmission will downshift from fourth to third gear.

When the detent valve moves to the right it cuts off the main line passage through the 3-4 governor valve to the pressure regulator valve. Pump pressure immediately builds up to maximum operating pressure for the fourth to third downshift.

Detent oil also is directed to the 2-3 regulator valve and 3-2 downshift will occur at speeds below 20 M.P.H.

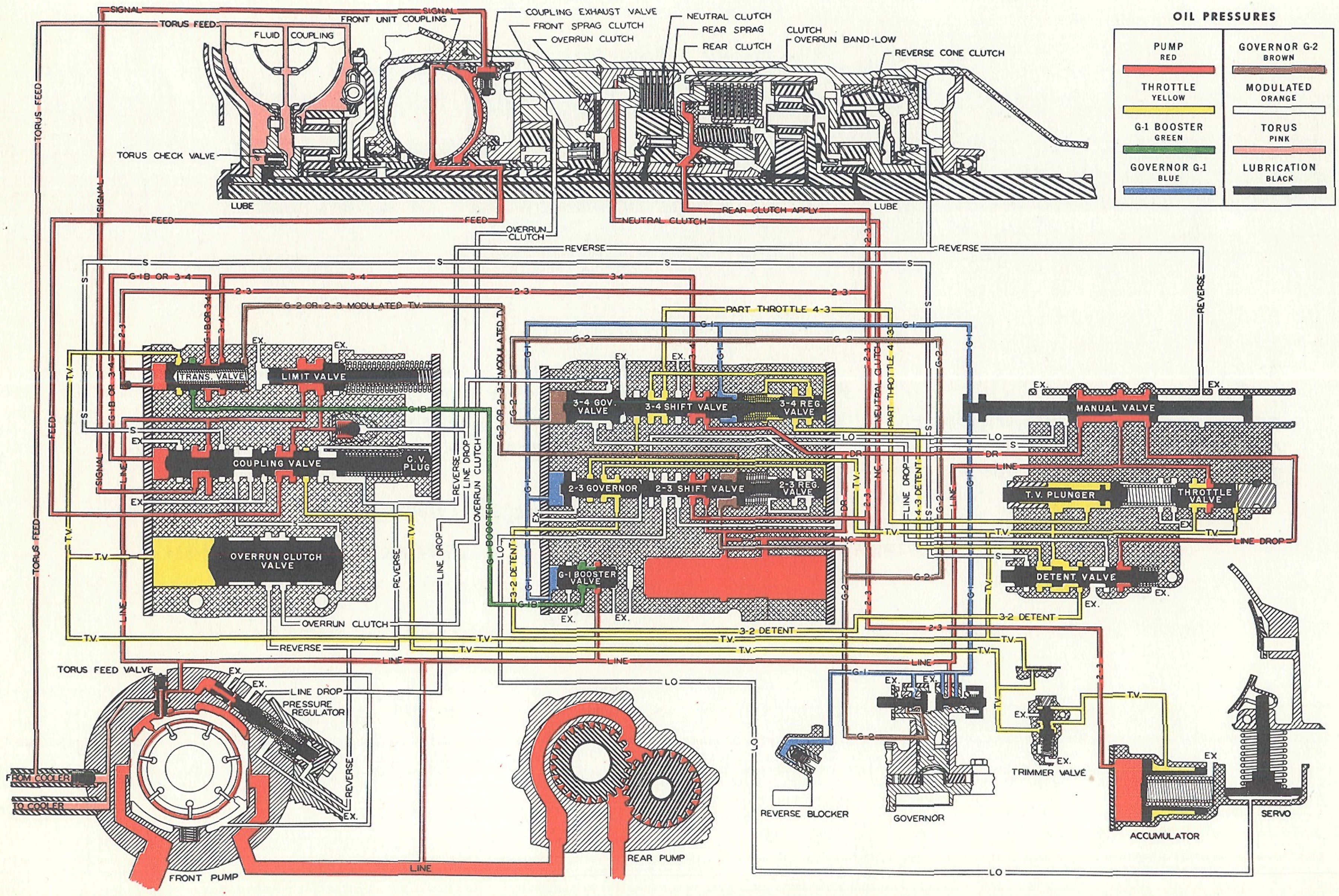


Fig. 3-15 Fourth Gear "Dr." (Forced 4-3 Downshift Detent Position)

THIRD GEAR—DR. RANGE

FORCED 3-2 DOWNSHIFT DETENT POSITION

Below 20 M.P.H. a forced downshift to second gear may be obtained. Pressing the accelerator pedal to the floor will move the detent valve to the left and the following will occur:

Throttle pressure will be directed from the throttle valve through the detent valve to the 2-3 regulator valve.

Detent oil assisted by spring force will overcome the governor pressures and the valve will close placing the transmission in second gear.

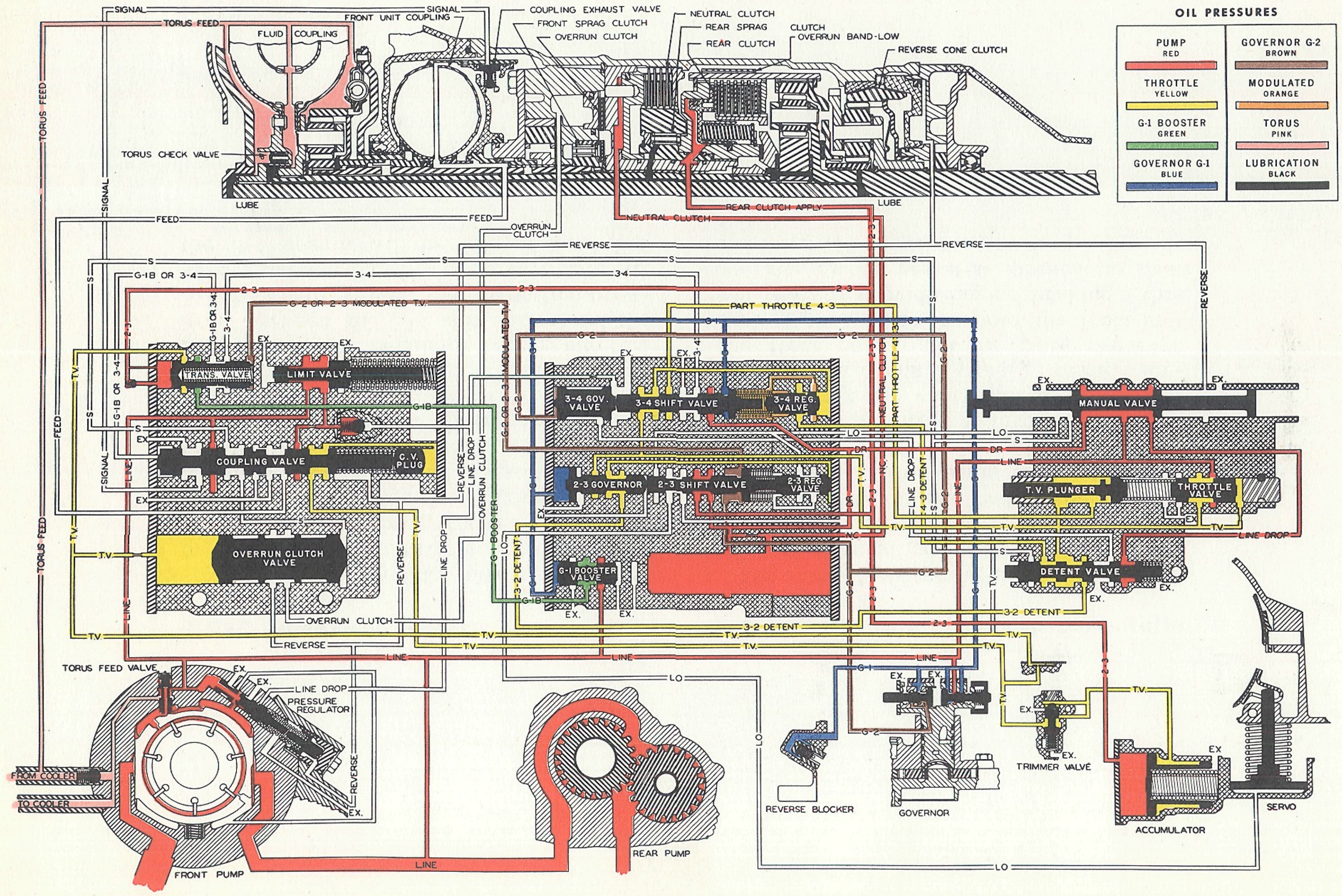


Fig. 3-16 Third Gear "Dr." (Forced 3-2 Downshift Detent Position)

THIRD GEAR—"S" RANGE

"S" range is provided in order to keep the car operating in third gear over a large portion of the driving range. This is of particular advantage for engine braking, for hilly driving, or acceleration in heavy traffic with part throttle. Placing the selector lever in "S" range causes the following operations to occur:

The manual valve directs line pressure around the 3-4 regulator valve into the area between the 3-4 shift valve and the 3-4 regulator valve. With main line pressure assisting the 3-4 shift valve spring, the 3-4 upshift will be delayed until G-1 and G-2 has built up enough pressure to overcome them.

Since the front sprag clutch will overrun while coasting, pump pressure from the manual valve is directed through the coupling valve to one end of the overrun clutch valve. This pump pressure moves the overrun clutch valve (with delayed action) to the left against throttle pressure. Movement of the valve closes the reverse passage and opens a passage to the overrun front clutch and the pump pressure applies the clutch to hold the front unit sun gear to provide engine braking. This overrun clutch assist is present in first and third "S" range.

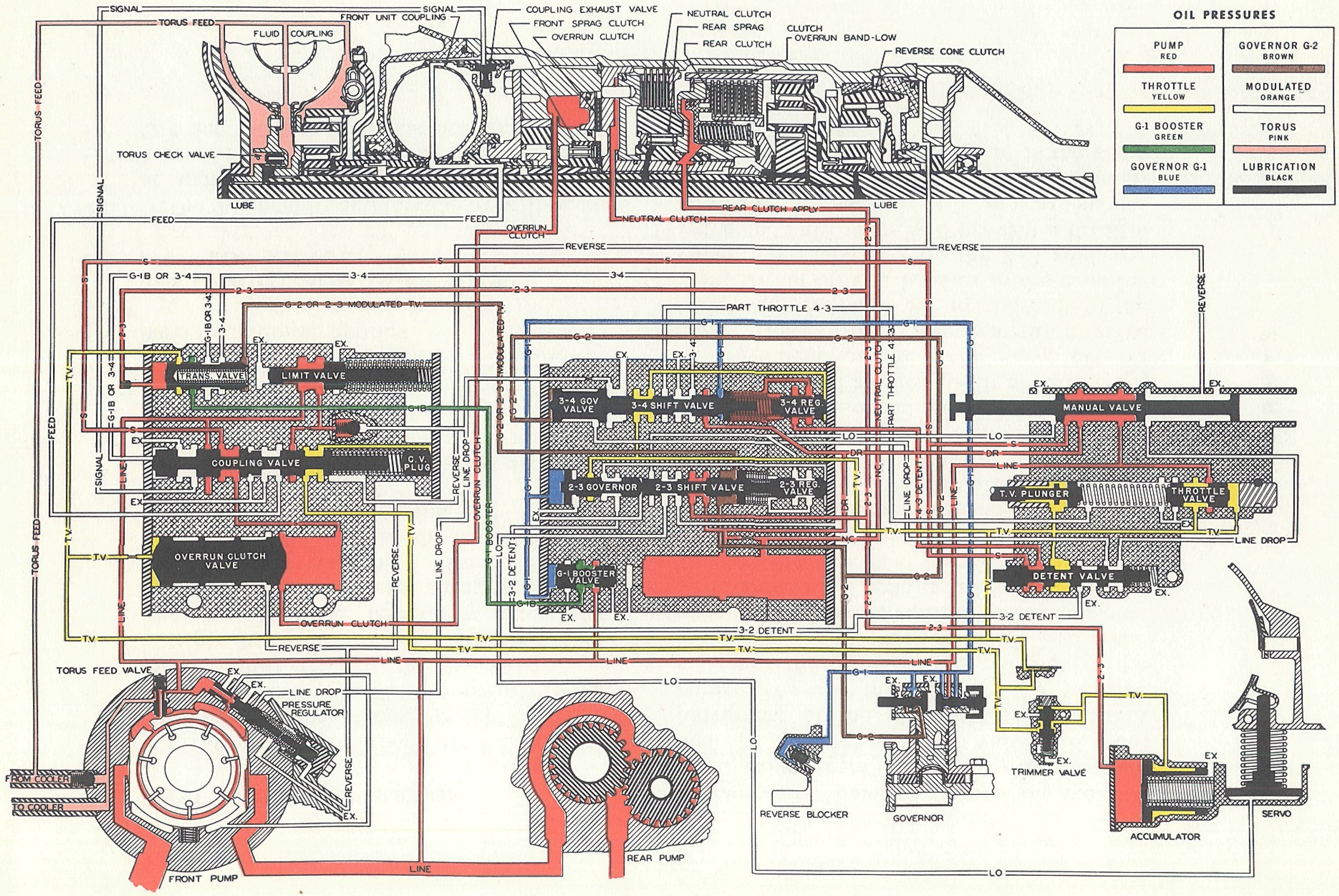


Fig. 3-17 Third Gear "S" Range

FIRST GEAR—"LO" RANGE

First gear "LO" range is the same as first gear drive range except that the manual valve directs "LO" range oil through the 2-3 shift valve to the low band servo to apply the band for first and second gear. The low band is necessary for engine braking since the rear sprag is not effective when coasting. The "S" range passage is also open so the overrun clutch is applied for engine braking.

1-2 UPSHIFT AND SECOND GEAR—"LO" RANGE

The 1-2 upshift and second gear is the same as in "S" range except that the low band will remain applied.

2-3 UPSHIFT AND THIRD GEAR—"LO" RANGE

The 2-3 upshift and third gear will occur at approximately 45-50 M.P.H. and is accomplished in the following manner. When G-1 and G-2 pressure has increased enough to overcome pump pressure on the 2-3 shift valve from the low range passage and spring force, the shift valve will open. Movement of the shift valve will direct pump pressure through the 2-3 passage to apply the rear clutch and also to the transition valve to cut off G-1 booster pressure to the coupling valve the same as it does in 2-3 upshift "DR" range. Pressure to the low band servo is also cut off and the band is released by spring force, oil from the servo is exhausted at the 2-3 shift valve*. "LO" range oil pressure remains on the 2-3 shift valve so that if car speed decreases the transmission will downshift to second gear approximately the same speed as the upshift occured.

*Movement of the shift valve cut off "LO" range oil to the transition valve which allowed 2-3 oil to move it to the right to cut off G-1 booster to the coupling valve. G-1 and G-2 on the 2-3 governor valve and shift valve will prevent a throttle downshift to second gear at car speeds above 45-50 M.P.H.

3-4 upshift and fourth gear is the same as for "S" range.

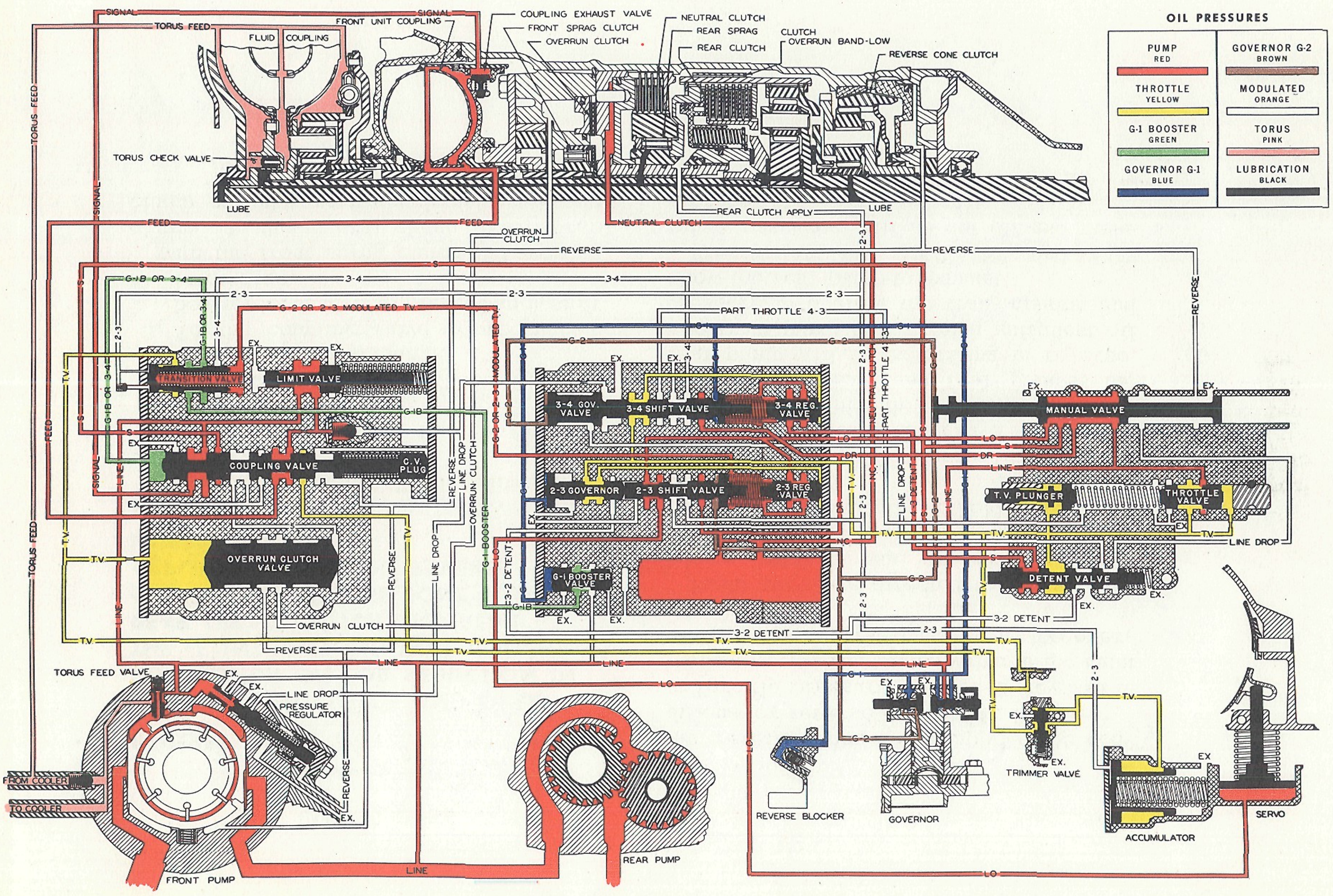


Fig. 3-18 Second Gear "Lo" Range

REVERSE

FRONT SPRAG CLUTCH AND OVER-RUN CLUTCH ON FOR REDUCTION IN THE FRONT UNIT. NEUTRAL CLUTCH, REAR SPRAG CLUTCH AND REAR CLUTCH OFF. REVERSE CONE CLUTCH APPLIED TO HOLD THE REVERSE INTERNAL GEAR.

When the selector lever is moved to the "R" position the manual valve directs oil to the following:

1. To the reverse cone clutch to hold the reverse internal gear.
2. Through the overrun clutch valve to apply the overrun clutch.
3. To the coupling valve to oppose G-1 booster pressure to prevent an upshift in reverse.

With the front sprag clutch and overrun clutch on, the neutral clutch, rear sprag clutch and the rear clutch released, and the reverse cone clutch applied the conditions for reverse are satisfied.

Throttle pressure is used in reverse to move the overrun clutch valve to the right to open the reverse passage to the overrun clutch.

Pump pressure directed to the reverse booster plug in the pressure regulator increases pump pressure. Increase in pressure is necessary to hold the reverse cone clutch.

Although G-1, G-2, and G-1 booster are present in reverse they have no function to perform. Since there is no check valve between the front and rear pumps, the rear pump will be exhausting in reverse. The front pump will furnish sufficient oil pressure to operate the transmission and allow the rear pump to exhaust.

Pressure to the "DR", "S", and "LO" range passages will be cut off and these passages are open to exhaust.

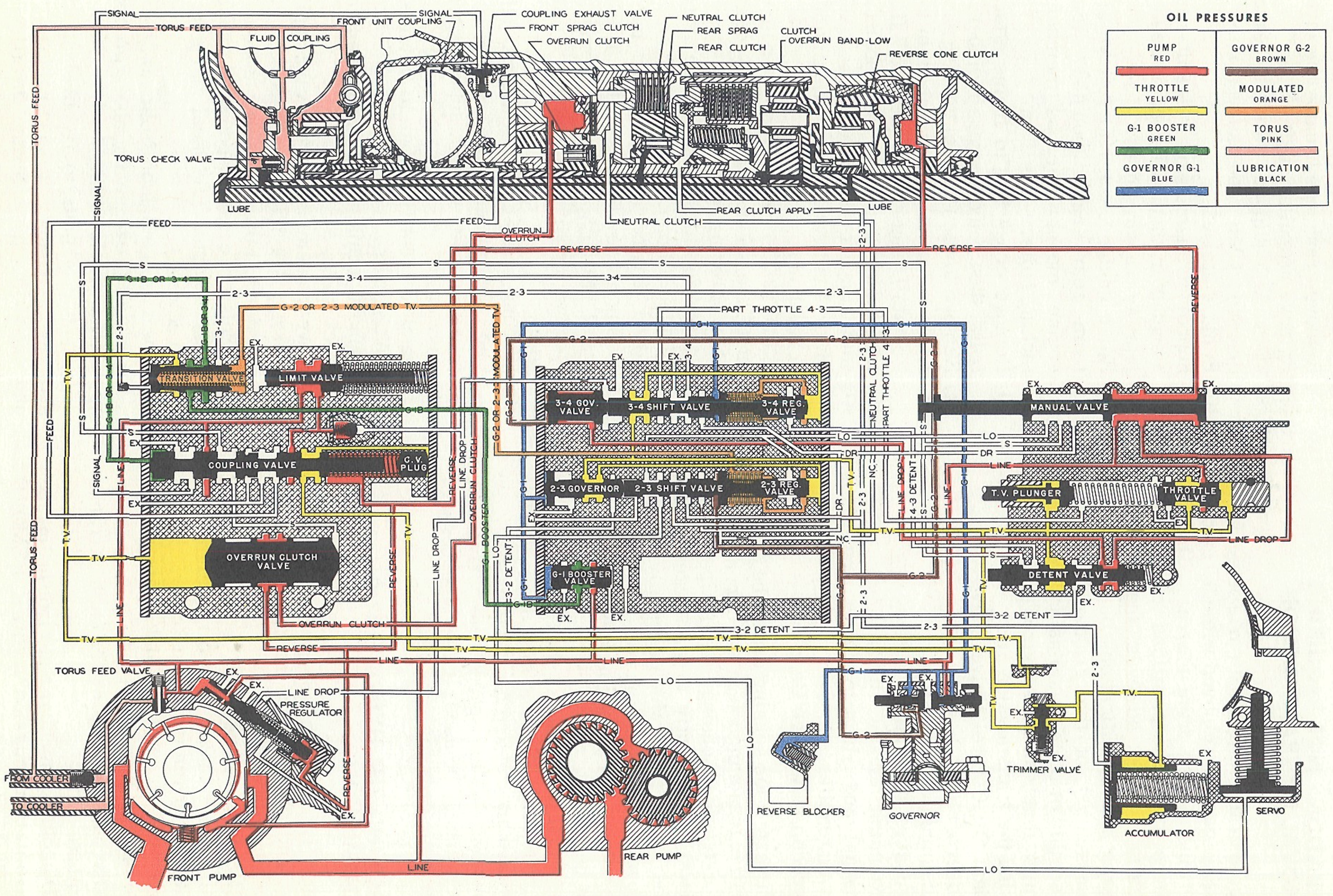


Fig. 3-19 Reverse

OPERATIONS NOT REQUIRING REMOVAL OF TRANSMISSION

Some of the component parts of the transmission can be removed without removing the transmission from the car. The procedures for such operations are not specifically outlined; however, the basic procedures and specifications outlined under "Disassembly of the Transmission" and "Assembly of the Transmission" will apply.

Units that can be serviced without removing the transmission are:

Main Oil Control Valve Body
Governor
Accumulator and Servo
Pressure Regulator Valve
Extension Housing Oil Seal
Manual and Throttle Lever and Shaft Assemblies
Speedometer Drive Gear

The extension housing cannot be removed with the transmission in the car, however, the extension housing can be positioned rearward sufficiently to gain accessibility to the above parts which normally require removal of the extension housing. Exercise care to prevent damaging the gasket, as it must be reused.

In order to remove the parking pawl bolt, the rear oil pump must be positioned rearward and rotated for clearance.

Inasmuch as the speedometer drive gear puller cannot be used, it will be necessary to split the gear for removal.

REMOVING THE HYDRA-MATIC TRANSMISSION

The Hydra-Matic transmission, torus cover and flywheel are removed from the car as an assembly.

1. Disconnect battery.
2. Remove transmission oil filler tube.
3. Raise car (on twin-post hoist).
4. Remove drain plug and drain transmission. Reinstall plug.
5. Disconnect speedometer cable at transmission.
6. Disconnect manual and throttle linkage from transmission levers. REMOVE THROTTLE LEVER.
7. Remove crankcase breather outlet tube.
8. Remove propeller shaft.
9. On cars equipped with dual exhaust, disconnect left hand exhaust pipe.
10. Remove starter.
11. Support transmission with unit-lift and an adapter that will accommodate the Jetaway transmission.
12. Raise engine enough to relieve weight from rear engine mounts. Remove engine mount to cross member attaching bolts.
13. Remove cross bar to frame attaching bolts, then remove cross member.
14. Remove lower flywheel housing.
15. Remove torus oil plug and drain torus. Reinstall plug and torque 6 to 7 ft. lbs.
16. Install engine support bar (Tool BT-28), with support screw pilots seated into lower flywheel housing front attaching screw holes.

    NOTE: Locate support bar forward on frame so that it will not interfere when lowering transmission.
17. Lower unit-lift until it is free of transmission oil pan.
18. Lower engine (using support bar adjusting screws), NOT TO EXCEED 1 1/2 INCHES, to permit removal of the two upper bell housing to block bolts.
19. Disconnect oil cooler hoses from lines. Cap lines immediately.
20. Raise unit-lift until it supports transmission.
21. Remove the 4 flex plate to flywheel attaching nuts.
22. Remove remaining flywheel housing to block bolts.
23. Move transmission rearward approximately 3/4" to clear dowels (3/8" standard thread holes adjacent to dowels are provided for installing bolts to push flywheel housing off the dowels.)
24. Lower transmission from car.

To install, reverse the above procedure and include the following:

Torque flex plate to flywheel attaching nuts 20-25 ft. lbs. Torque oil pan drain plug 35-45 ft. lbs. Torque throttle lever 10-12 ft. lbs.

After transmission is installed, add 11 quarts of Hydra-Matic fluid. Set parking brake, start engine and allow oil to reach operating temperature, then add enough fluid to bring level to the "Full" mark on the dipstick.

NOTE: Transmission capacity: 11 1/2 quarts approx. (for oil change, pan removed). 13 1/2 quarts approx. (after complete overhaul). Adjust throttle and manual control linkage.

GENERAL SERVICE PRECAUTIONS

To aid the mechanic when servicing the transmission, it is recommended that upon disassembly of a unit, all parts should be cleaned and inspected as outlined under CLEANING AND INSPECTION, then the unit should be reassembled before disassembly of other units to avoid confusion and interchanging of parts.

1. Before disassembly of the unit, thoroughly clean the exterior of the unit.
2. Disassembly and reassembly of the unit and the sub-assemblies must be made on a clean work bench. As in repairing any hydraulically operated unit, cleanliness is of the utmost importance; therefore, the bench, tools, and parts must be kept clean at all times.
3. Seal protecting tools must be used when assembling the units. The slightest flaw in the sealing surface can cause an oil leak.
4. The aluminum castings and the valve parts are very susceptible to nicks, burrs, etc., and care should be exercised while handling them.
5. The internal snap rings should be expanded and the external snap rings compressed if they are to be reused. This will insure proper seating when installed. DO NOT REUSE TRU-ARC SNAP RINGS.
6. Replace all "O" rings when servicing unit.
7. Sealing compound should not be used on seals with neoprene coated outside diameters.
8. During assembly of each unit, all internal parts must be lubricated with Hydra-Matic oil.
9. The steel clutch plates must be installed with the single offset notches (on lugs) positioned directly above each other.
10. Gears that may be installed either way should be installed the same as they were removed. If gears are not installed the same, the tooth contact would change which could result in noisy gears.

CLEANING AND INSPECTION OF PARTS

After complete disassembly of a unit, all metal parts should be washed in a clean solvent and dried with compressed air. All oil passages should be blown out and checked to make sure that they are not obstructed; the small passages, such as in the front pump slide, should be checked with tag wire. All parts should be inspected to determine which parts are to be replaced.

The various inspections of parts are as follows:

1. Inspect linkage and pivot points for excessive wear.
2. Bearing and thrust surfaces of all parts should be checked for excessive wear and scoring.
3. Check for broken seal rings, damaged ring lands and damaged threads.
4. Check the neutral clutch outer oil ring gap. Tolerance should be .002" to .007".
5. Mating surfaces of castings and end plates should be checked for burrs and irregularities. If a good seal is not apparent, burrs and irregularities may be removed by lapping the surface with crocus cloth. The crocus cloth should be held on a flat surface, such as a piece of glass.
6. Castings should be checked for cracks and sand holes.
7. Gear teeth should be checked for chipping, scoring, and excessive wear.
8. A wear pattern may be apparent on the drive and driven lugs; however, this is to be considered normal and the amount of clearance between the drive

and driven lugs will not affect operation of the units.

9. Valves should be free of burrs and the shoulders of the valves must be square. Any burrs or irregularities may be removed by honing. Valves should be free to slide in their respective bores.
10. Inspect composition clutch plates for damaged surfaces and loose facings. If flakes of facing material can be removed with the thumbnail, the plates should be replaced; however, composition plate discoloration is not an indication of failure.
11. Inspect steel clutch plates for scored surfaces and damaged lugs. The 6 equally spaced waves must be .008" to .012" and can be checked by placing the plates on a flat surface.
12. Inspect springs for distortion or collapsed coils. Slight wear (bright spot) on the sides of the springs is permissable.

DISASSEMBLY OF THE TRANSMISSION

FLYWHEEL, TORUS MEMBERS AND FLYWHEEL HOUSING REMOVAL

1. Remove the 20 flywheel attaching nuts and remove the flywheel.

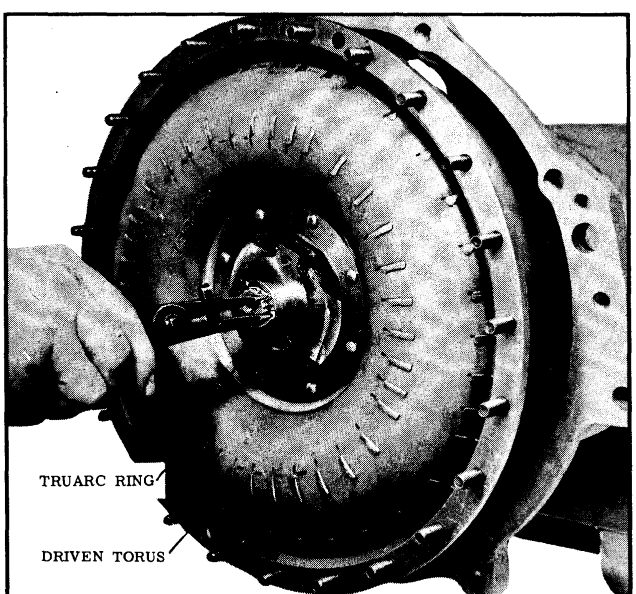


Fig. 3-20 Removing Driven Torus

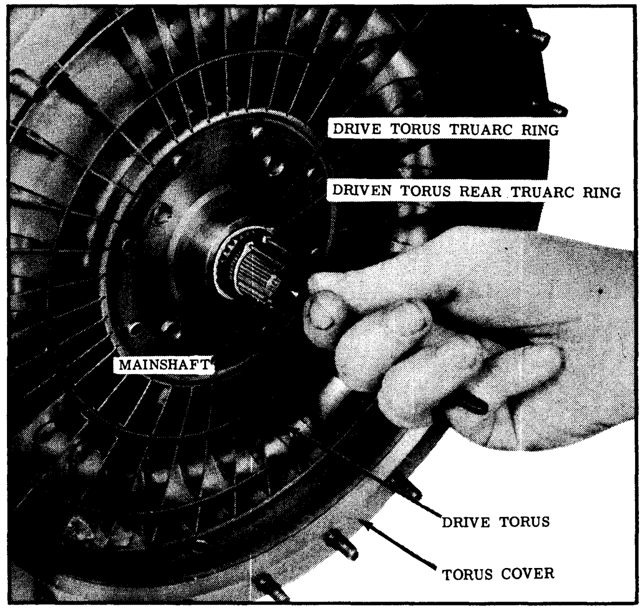


Fig. 3-21 Removing Snap Ring

2. Remove the "O" ring from the flywheel and discard.
3. Remove the Tru-arc ring and the driven torus from the mainshaft. (See Fig. 3-20)
4. Remove the driven torus rear Tru-arc ring from the mainshaft. (See Fig. 3-21)
5. Remove the Tru-arc ring and drive torus from the intermediate shaft.

CAUTION: Do not attempt to remove drive torus and torus cover together.

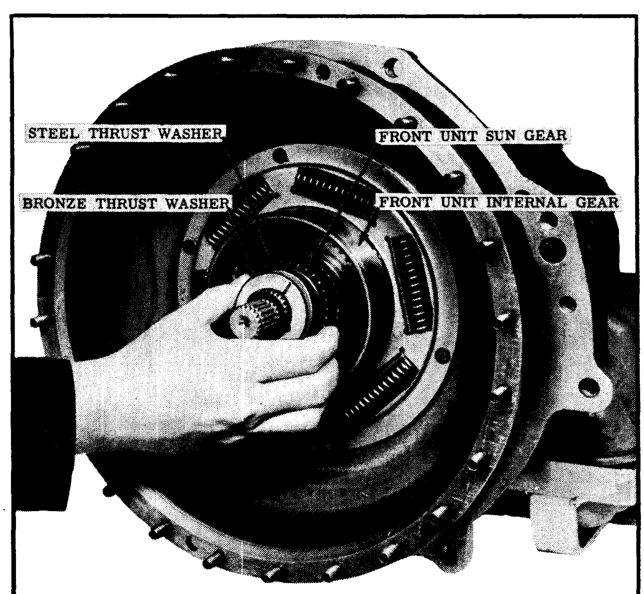


Fig. 3-22 Removing Thrust Washers

6. Remove the bronze and steel thrust washers from the intermediate shaft. (See Fig. 3-22)
7. Remove the front unit sun gear and the steel washer.
   NOTE: Sun gear can be installed with either side out, but to prevent possible gear noise, should be reinstalled the way it was removed.
8. Slide the internal gear and the bronze thrust washer from the torus cover, then remove thrust washer from the internal gear.
9. Remove the torus cover assembly.
10. Remove the selective steel spacer from the hub of the front unit coupling driven torus. (See Fig. 3-23)
    NOTE: Spacer may have remained in the internal gear.

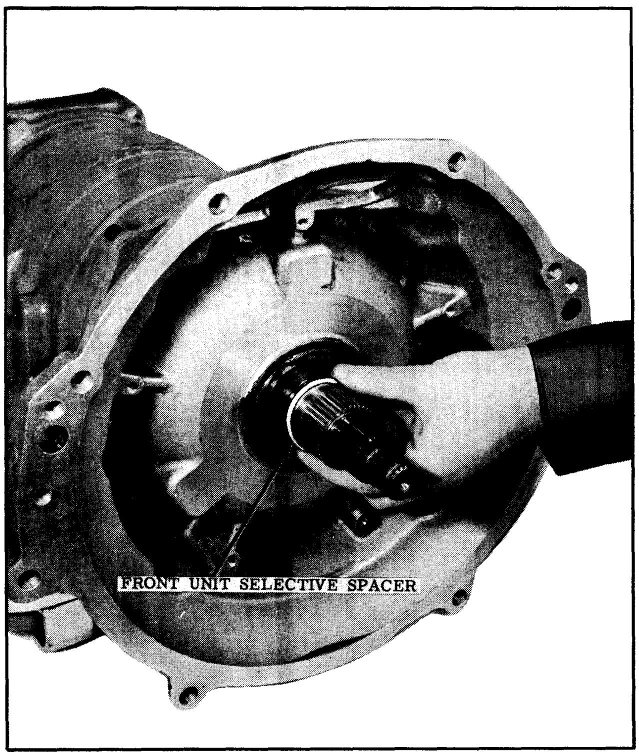


Fig. 3-23 Removing Selective Spacer

11. Install seal and bushing protector Tool J-6119 over the shafts. (See Fig. 3-24)
12. Remove the 6 flywheel housing attaching bolts and washers, then remove the housing. Remove the tool from the housing.
13. Remove the large "O" ring from the housing and discard.

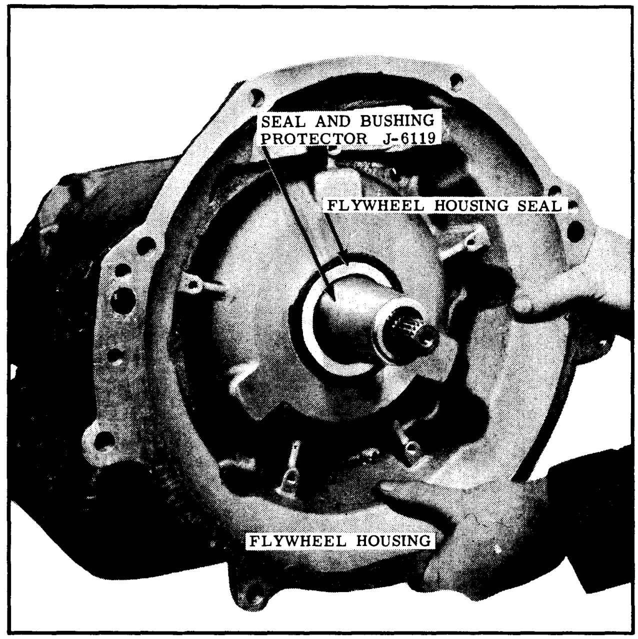


Fig. 3-24 Seal and Bushing Tool

FRONT UNIT COUPLING, MAIN OIL CONTROL BODY AND FRONT PUMP REMOVAL

1. Remove oil cooler adapter attaching bolts, copper washers, adapter and gasket from the side of the transmission.
2. Remove the 2 oil cooler sleeves from the side of the transmission with snap ring pliers.

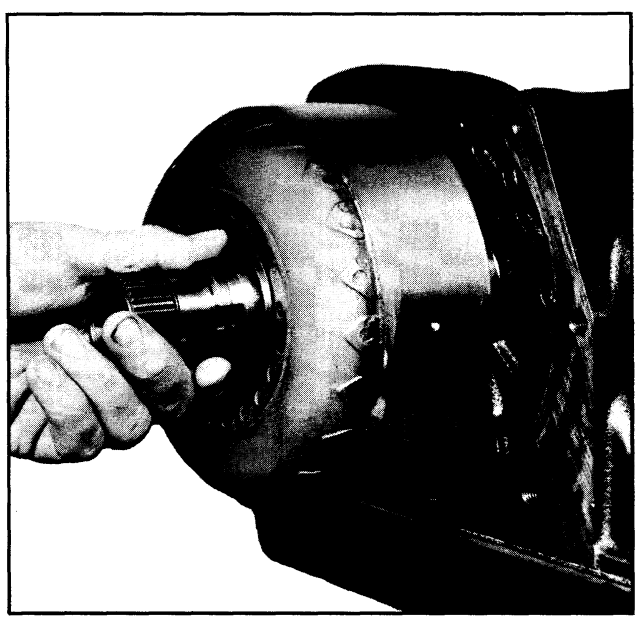


Fig. 3-25 Front Unit Coupling Removal

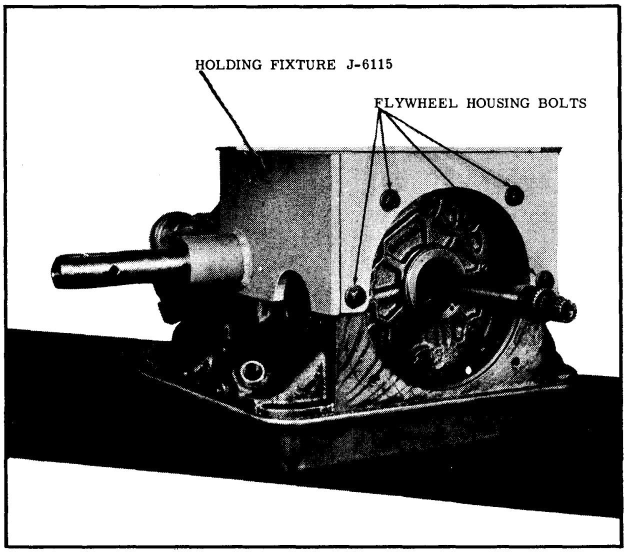


Fig. 3-26 Transmission Holding Fixture

3. Slide the front unit coupling from the transmission. (See Fig. 3-25)
4. Bolt holding fixture J-6115 to front of transmission with 4 flywheel housing bolts. (See Fig. 3-26)
5. Place in holding fixture on the bench with oil pan up.
6. Remove the oil pan bolts, then remove the oil pan and gasket.
7. To avoid damage to screen, carefully pull rear pump intake pipe (small) from rear pump, then remove screen and pipe as an assembly.

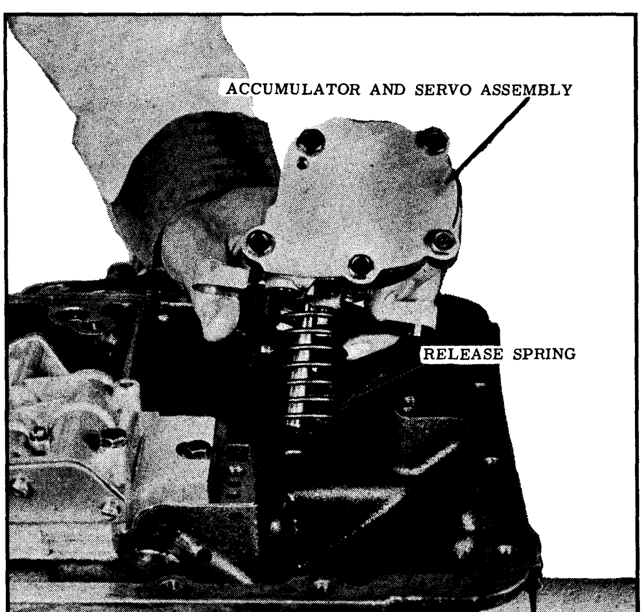


Fig. 3-27 Accumulator & Servo Removal

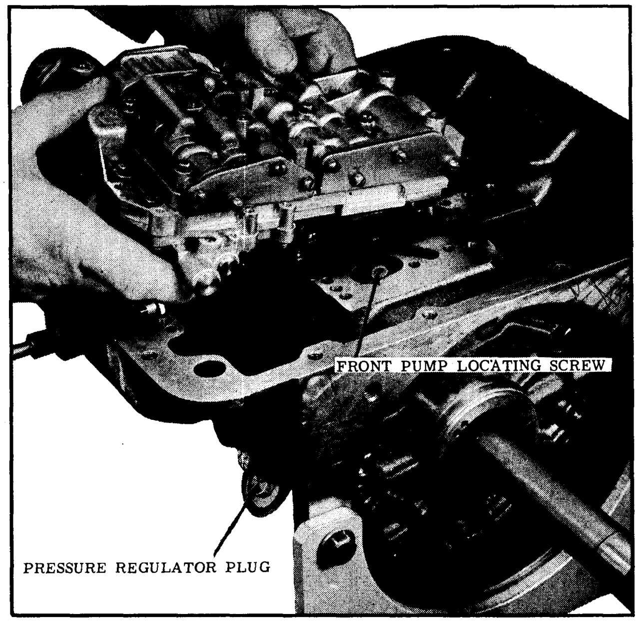


Fig. 3-28 Oil Control Valve Body Removal

8. Remove the rear pump intake pipe "O" ring from the case.
9. Remove the front pump intake pipe clamp, then pull the pipe from the front pump and remove the "O" ring from the pump.
10. Remove the accumulator and servo assembly, which is under spring tension, by removing the 3 attaching bolts. (See Fig. 3-27) Remove the release spring.
11. Remove the 5 remaining oil control valve body attaching bolts, then remove

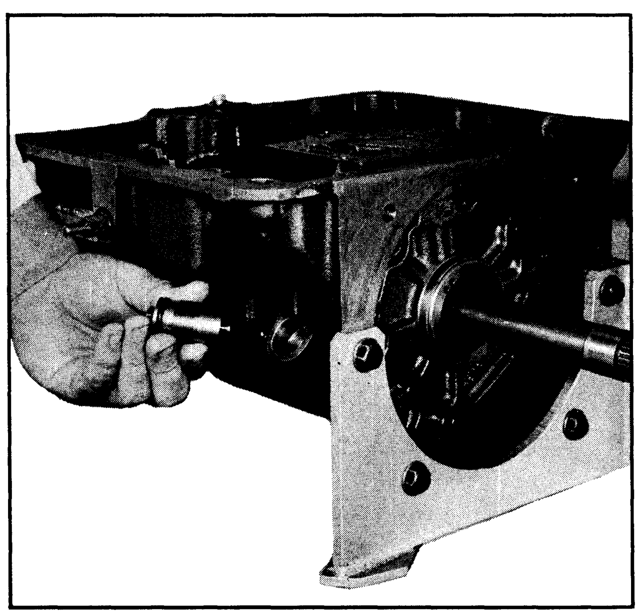


Fig. 3-29 Pressure Regulator Plug Removal

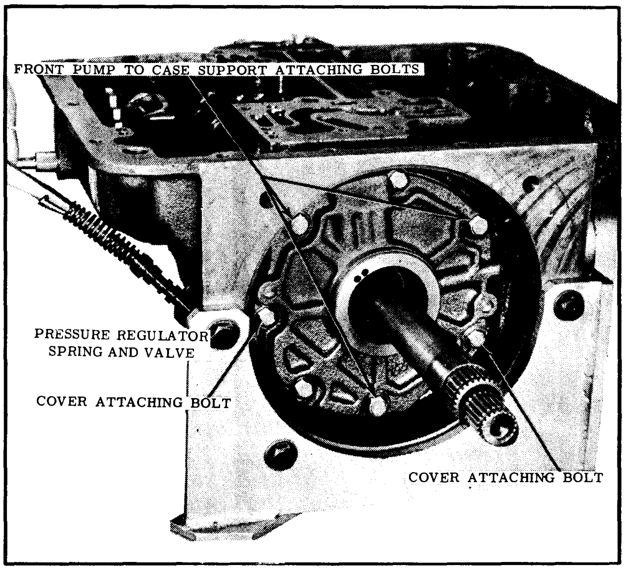


Fig. 3-30 Spring & Valve Removal

the oil control valve assembly. (See Fig. 3-28)

12. Remove the front pump locating screw and lock washer from recess in the case. (See Fig. 3-28)
13. Remove the pressure regulator plug assembly. (See Fig. 3-29)
14. Remove the pressure regulator spring and valve. (See Fig. 3-30)
15. To remove the front pump, remove the 2 cover attaching bolts adjacent to the dowels and install slide hammer Tools J-6125, then remove the 3 large front pump attaching bolts. (See Figs. 3-30 and 3-31)

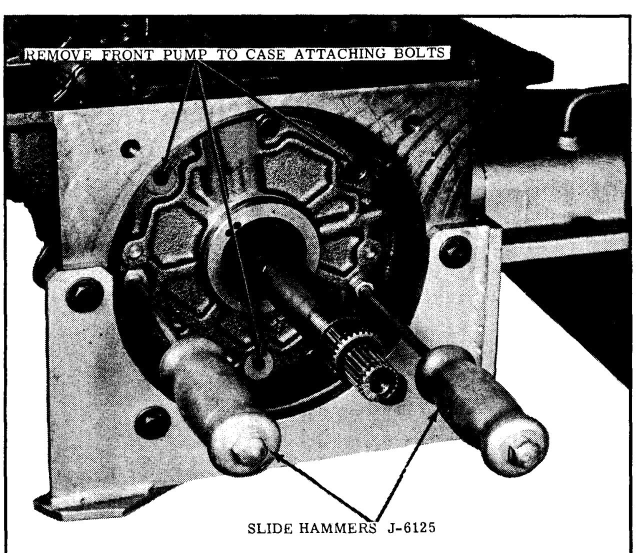


Fig. 3-31 Removing Front Pump

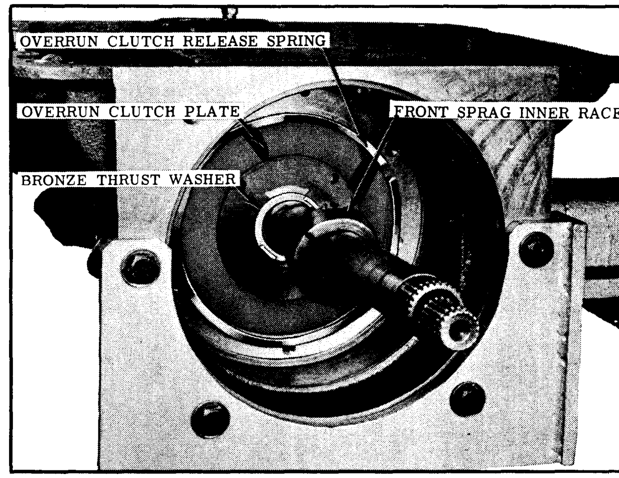


Fig. 3-32 Removing Front Sprag and Overrun Clutch

16. Pull pump from the case then remove tools from the pump.

    NOTE: Remove front sprag inner race if it remained on the intermediate shaft. (See Fig. 3-32)
17. Remove overrun clutch release spring and the overrun clutch plate from the case support. Spring may have remained in the front pump.
18. Remove bronze thrust washer from the intermediate shaft.
19. Install Tool J-6135 over the intermediate shaft and against the case support, then tighten the locking bolt. (See Fig. 3-33)

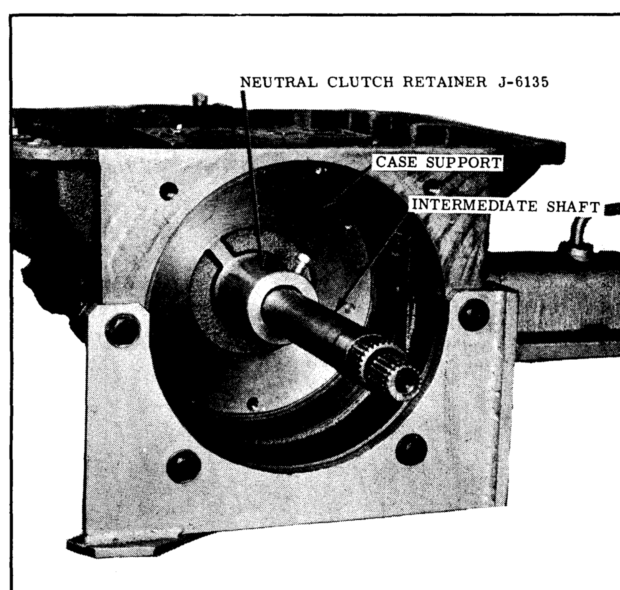


Fig. 3-33 Neutral Clutch Retainer Tool

Fig. 3-34 Mainshaft End Play Checking Tool

CHECK MAINSHAFT END PLAY

1. Remove collar from Tool J-6127 and install on mainshaft. (See Fig. 3-34)
2. Install Tru-arc ring on mainshaft, then install body of Tool J-6127 and tighten.
3. Install Tool J-6126 on front of transmission and install dial indicator. (See Fig. 3-35)
4. Move mainshaft in and out, end play should be .004" to .018". Be sure to get free mainshaft end play, forcing mainshaft will give inaccurate reading.
5. Record amount of end play so proper selective washer can be installed when transmission is reassembled.

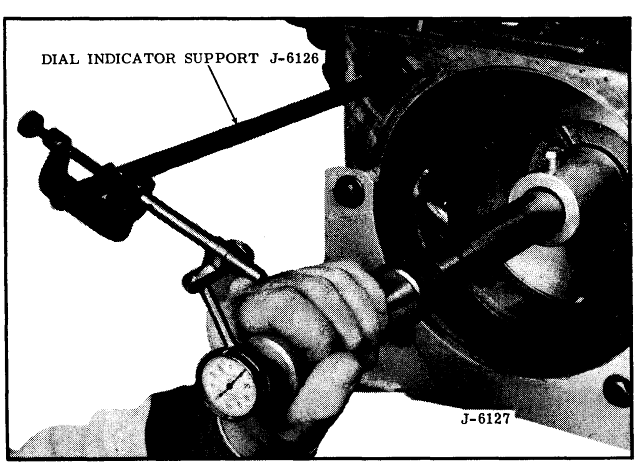


Fig. 3-35 Checking Mainshaft End Play

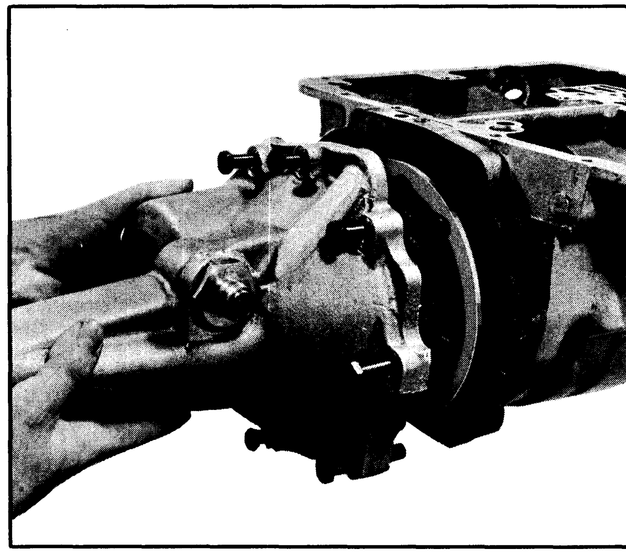


Fig. 3-36 Removing Extension Housing

Nine mainshaft selective washers are available and are marked 0 through 8.

8616570	8616575
8616571	8616576
8616572	8616577
8616573	8616578
8616574	

The selective washer is located on the output shaft between the reverse drive flange and the rear planet carrier.

6. Remove tools from the transmission.

REAR OIL PUMP AND REVERSE UNIT REMOVAL

1. Remove the rear oil seal with a blunt chisel.

   NOTE: If speedometer driven gear is to be replaced, remove at this time.
2. Remove the 8 rear extension housing attaching bolts, then remove the housing and gasket. (See Fig. 3-36)
3. Remove the "O" ring from the output shaft.
4. Turn output shaft so that governor weight (G-1) is down, then pull the governor from the rear oil pump.
5. Pull speedometer drive gear from the output shaft with Tool J-6123. (See Fig. 3-37)
6. Remove the rear bearing snap ring from the output shaft with snap ring

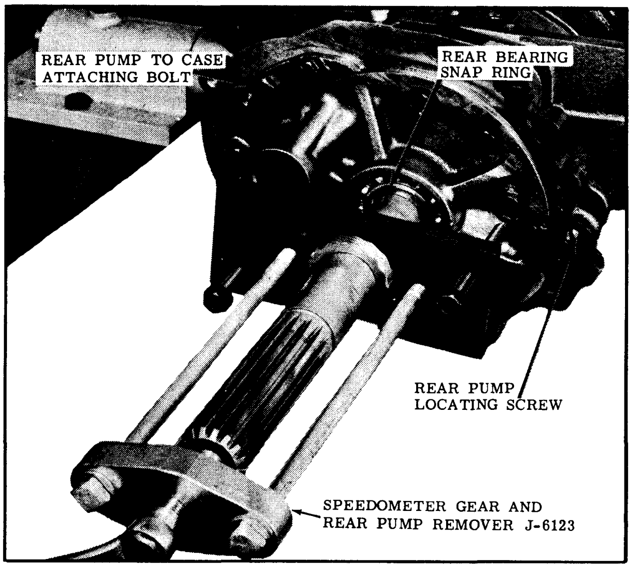


Fig. 3-37 Removing Speedometer-Drive Gear

pliers. Remove breather pipe clamp screw and pry pipe from rear pump.

7. Turn transmission to a vertical position with output shaft up and remove 2 opposite rear pump cover attaching bolts. (See Fig. 3-38) Install Tool J-6123, then remove rear pump locating screw and the 1 pump to case attaching bolt.
8. Tighten tool bolt to pull rear oil pump and rear bearing from the output shaft.
9. Remove the tool from the rear pump.
10. Remove the oil pump to case gasket.

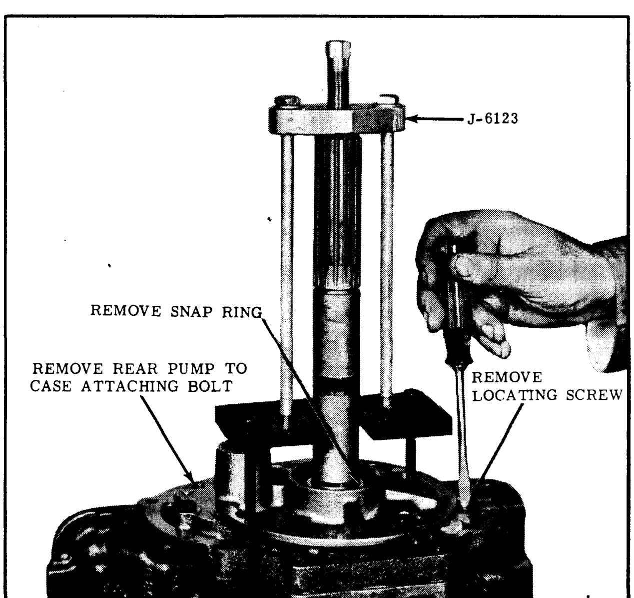


Fig. 3-38 Removing Rear Pump

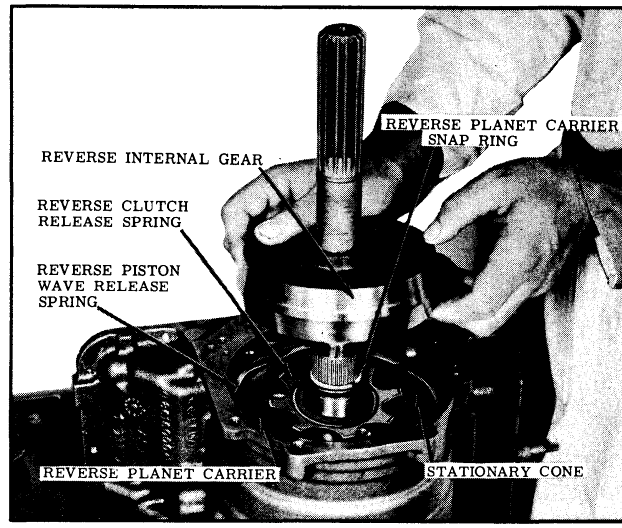


Fig. 3-39 Removing Reverse Internal Gear

11. Lift the reverse internal gear from the output shaft (See Fig. 3-39), then remove thrust washer from internal gear.
12. Remove the reverse clutch release spring. (See Fig. 3-39)
13. Remove the reverse piston release spring. (See Fig. 3-39)
14. Remove the reverse planet carrier snap ring from the output shaft.
15. Lift the reverse planet carrier and stationary cone from the case.
16. Remove the stationary cone lock from the case. (See Fig. 3-40)

CASE SUPPORT, NEUTRAL CLUTCH, , AND REAR UNIT REMOVAL

1. Turn transmission to a horizontal position and remove the case support

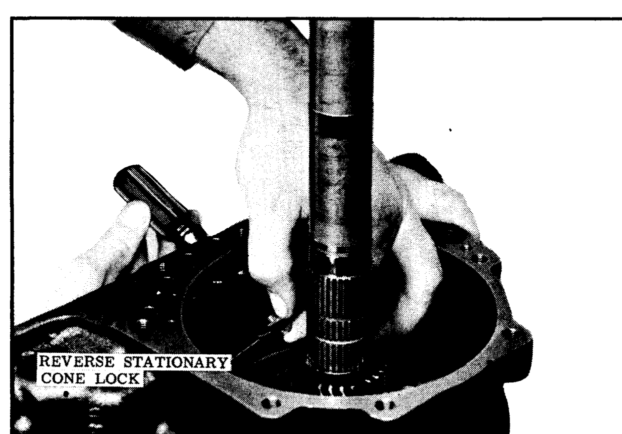


Fig. 3-40 Removing Reverse Stationary Cone Lock

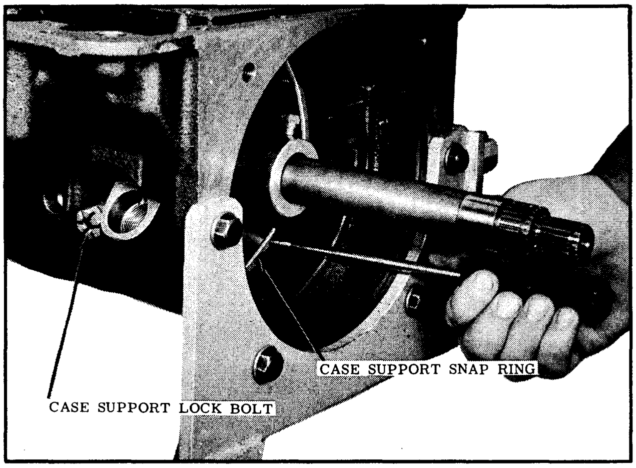


Fig. 3-41 Removing Case Support Snap Ring

snap ring from the front of the case. (See Fig. 3-41)

2. Remove the case support lock bolt from the side of the transmission. (See Fig. 3-41)
3. Remove the case support, neutral clutch and rear unit as an assembly by sliding toward front of case while rocking the assembly to prevent the case support from binding. (See Fig. 3-42)
4. Place assembly in holding fixture J-6116, output shaft down. (See Fig. 3-43)

   NOTE: If the assembly is a tight fit in the case then install slide hammers J-6125 and adapters J-6134-1 into the case support and use to free case support from the case. (See Fig. 3-44)

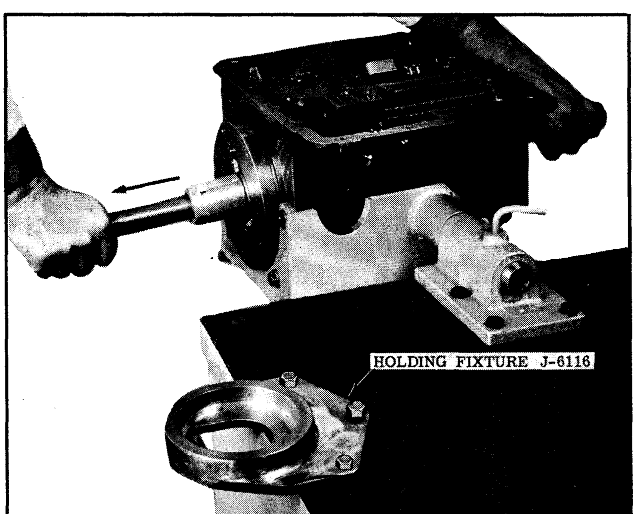


Fig. 3-42 Removing Case Support, Neutral Clutch & Rear Unit

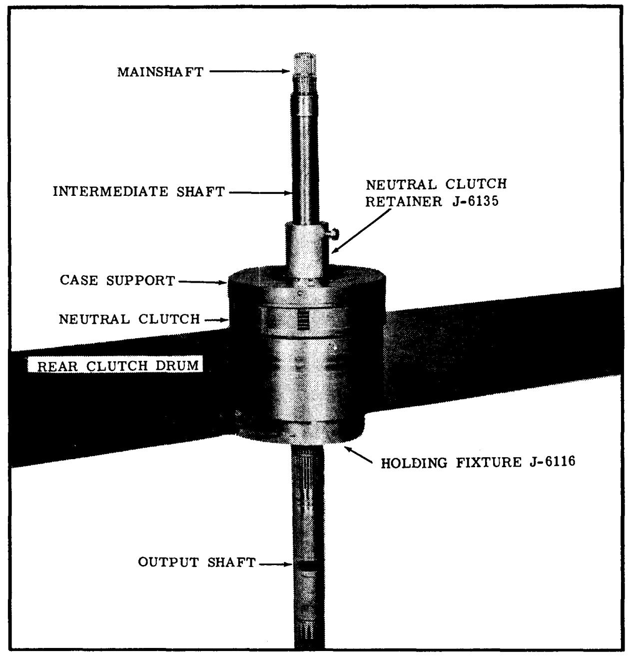


Fig. 3-43 Assembly in Holding Fixture

5. Remove the neutral clutch drum lock from the case. (See Fig. 3-45)
6. Remove low band from case by disengaging from case anchor, rotate band to a horizontal position and turn it so that the ends are facing rear of case, then pull band from front of case.

THROTTLE AND MANUAL LEVER SHAFTS AND PARKING PAWL REMOVAL

1. Remove the retaining ring from the manual lever shaft. (See Fig. 3-46)

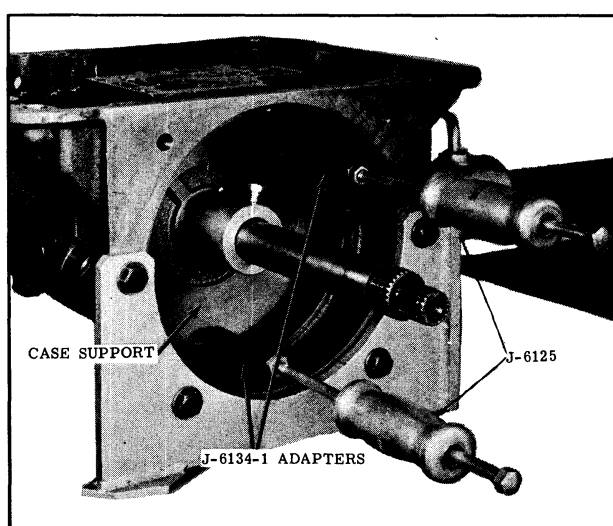


Fig. 3-44 Case Support Removal

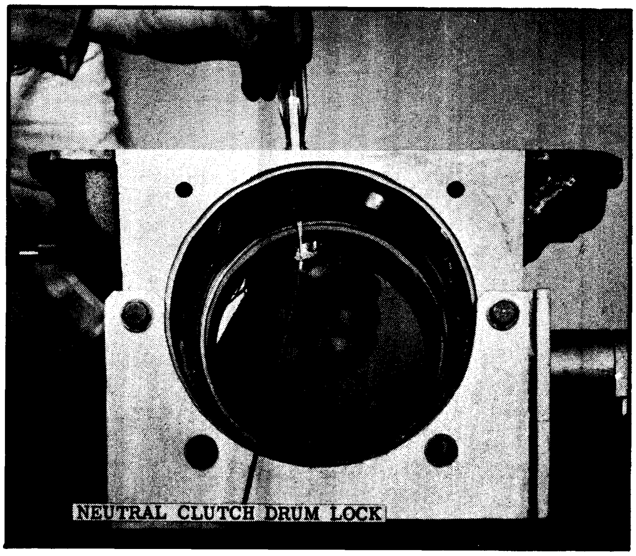


Fig. 3-45 Removing Lock From Case

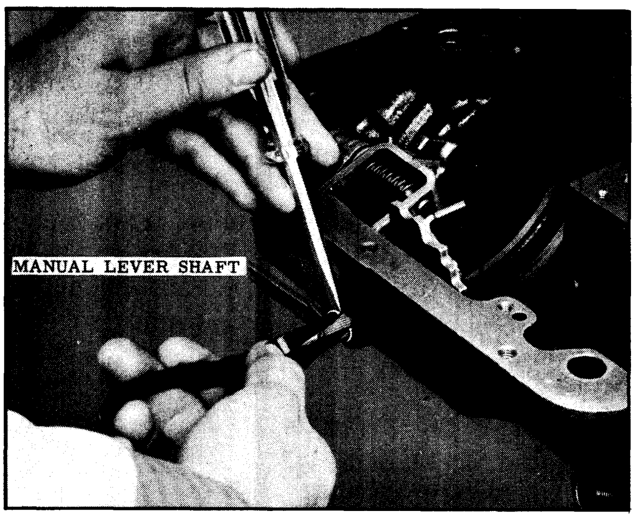


Fig. 3-46 Removing Retaining Ring

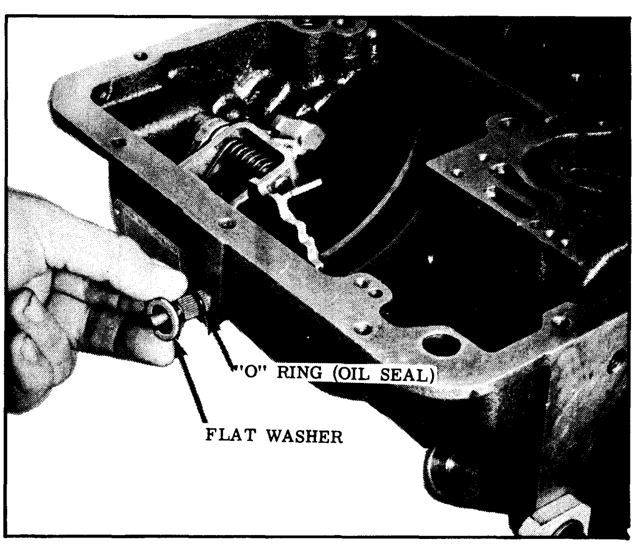


Fig. 3-47 Removing Flat Washer and "O" Ring

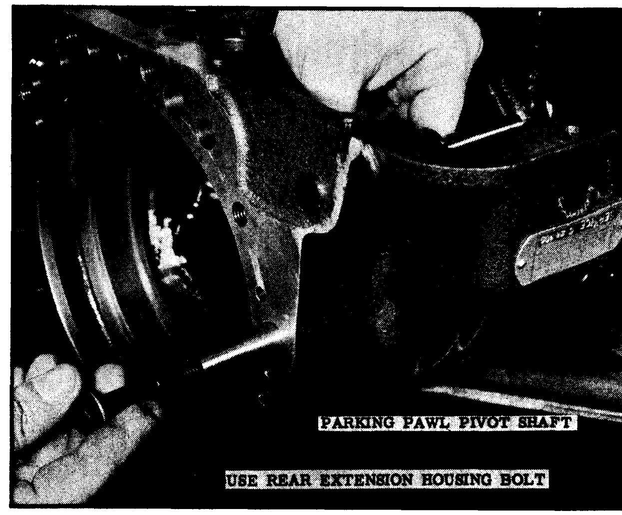


Fig. 3-48 Removing Pivot Shaft

2. Push the shaft assembly part way into the case, then back into position and remove the flat washer and "O" ring. (See Fig. 3-47) Remove the shaft assembly and spacer washer from the case.
3. Install a rear extension housing bolt into the parking pawl pivot shaft, then slide the pivot shaft from the case while turning the shaft. (See Fig. 3-48) Remove the bolt from pivot shaft.
4. Lift the parking pawl and remove spacer from recess in pivot shaft boss in the case.
5. Rotate the pawl upward and slide the

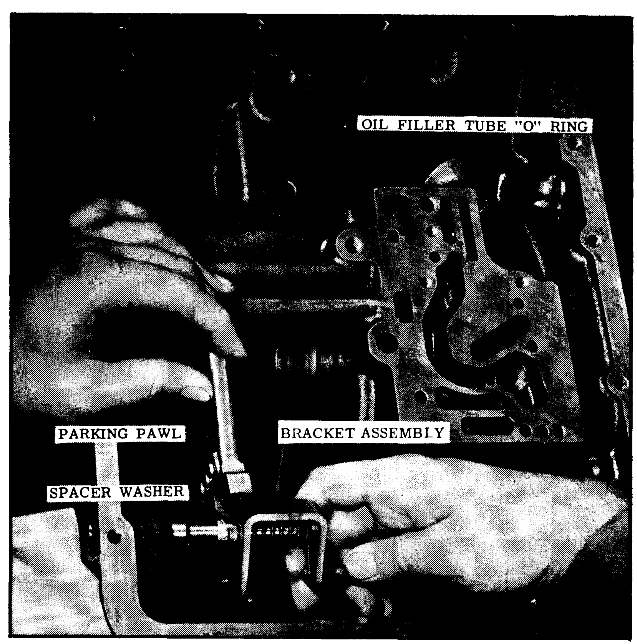


Fig. 3-49 Pawl & Bracket Removal

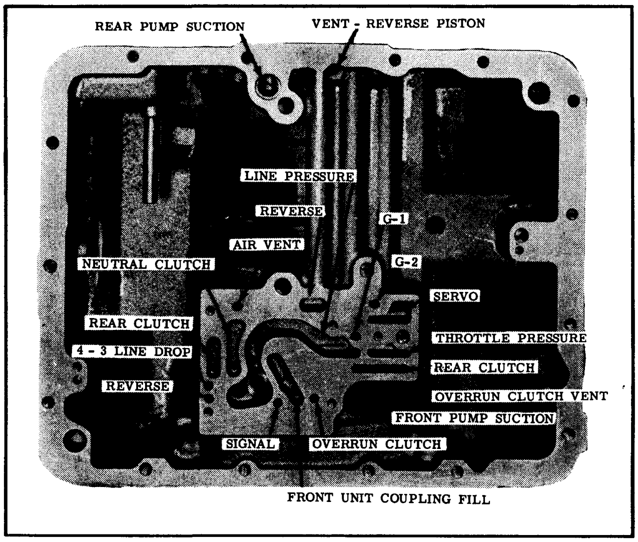


Fig. 3-50 Oil Passages (Bottom of Case)

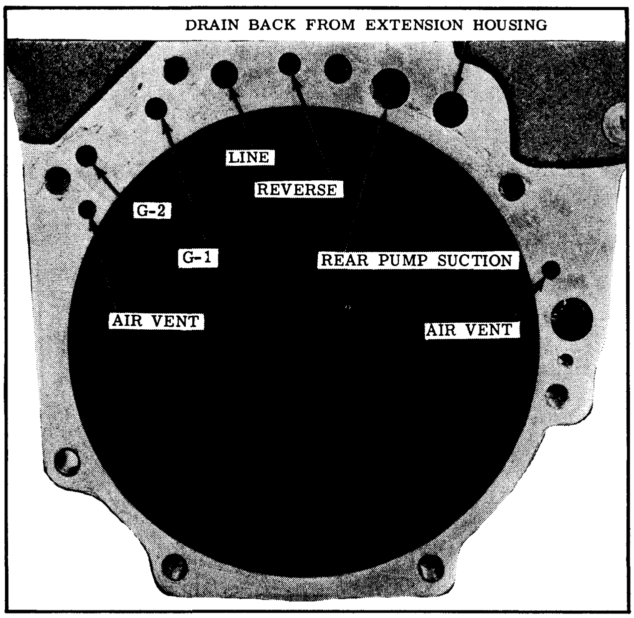


Fig. 3-51 Oil Passage (Rear of Case)

pawl and bracket lever assembly from the shaft being careful not to drop the spacer washer. (See Fig. 3-49)

6. Remove the "O" ring from the oil filler tube boss in the case and discard, then clean and inspect the transmission case. (See Fig. 3-50 and 3-51)

DISASSEMBLY AND ASSEMBLY OF INDIVIDUAL UNITS

DISASSEMBLY OF THROTTLE AND MANUAL LEVERS (FIG. 3-52)

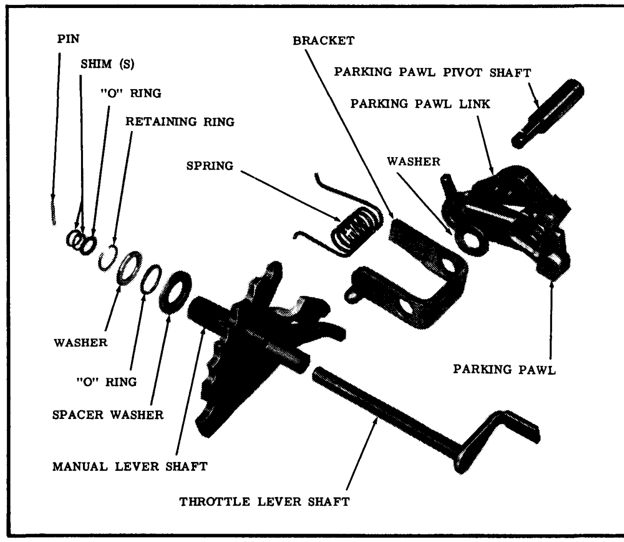


Fig. 3-52 Manual & Throttle Lever Shafts

1. Remove spacer washer from manual lever shaft.
2. Pull the pin from the throttle lever shaft and remove the shim or shims.
   NOTE: Shims are used to keep end play to a minimum.
3. Remove throttle lever shaft from manual lever shaft.
4. Remove the "O" ring from manual lever shaft.
5. Clean and inspect parts.

ASSEMBLY OF THROTTLE AND MANUAL LEVERS

1. Install throttle shaft into manual lever shaft.
2. Install "O" ring into counter bore in manual lever shaft, use Hydra-Matic oil on "O" ring.
3. Install sufficient number of shims to remove end play, then install retaining pin.
4. Install spacer washer on manual lever shaft.

PARKING PAWL, THROTTLE AND MANUAL LEVER INSTALLATION

1. Install a new "O" ring in oil filler tube boss in the case.
2. Install parking pawl pivot shaft spacer in recess in the case. (See Fig. 3-53)
3. Slide parking pawl link over shaft and

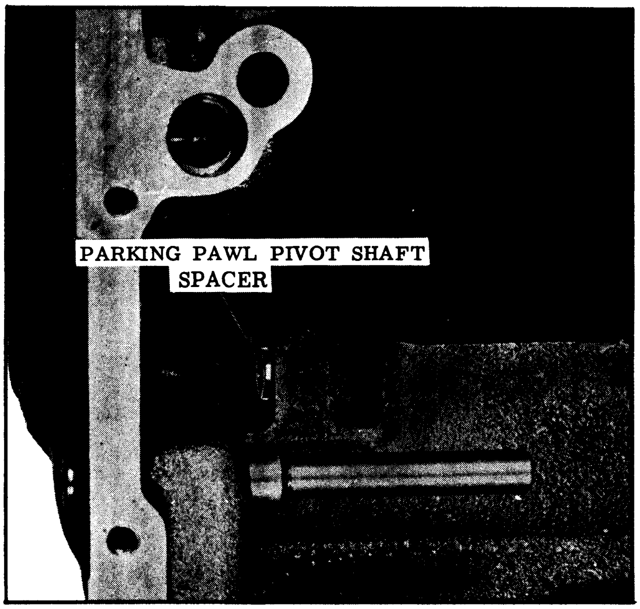


Fig. 3-53 Installing Pivot Shaft Spacer

position parking pawl between bosses in the case.

4. Align hole in parking pawl with holes in the case and install parking pawl pivot shaft from rear of the case.
5. Place spacer washer on the link shaft.
6. Install bracket and spring on the shaft. (See Fig. 3-54)
7. Turn bracket to contact top side of the link.
8. With short end of spring against bracket pin, hook long end under the link.
9. Install throttle and manual lever shaft

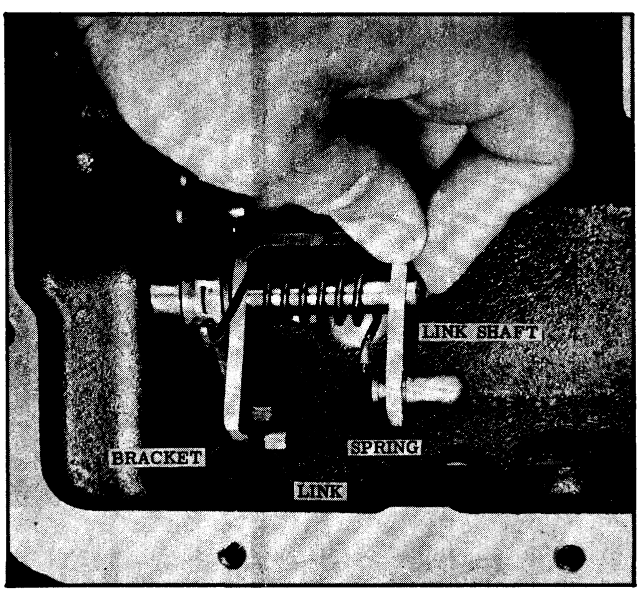


Fig. 3-54 Installing Bracket & Spring

assembly into the case and rotate so that pin engages with manual lever.

10. Install "O" ring on manual lever shaft and seat it into the recess in the case. Use Hydra-Matic oil on "O" ring.
11. Install flat washer and retaining ring on manual lever shaft.

DISASSEMBLY OF THE CASE SUPPORT, NEUTRAL CLUTCH AND REAR UNIT

1. Remove Tool J-6135 from the intermediate shaft.
2. Unhook the lock type oil ring, then remove the ring from the intermediate shaft. (See Fig. 3-55)

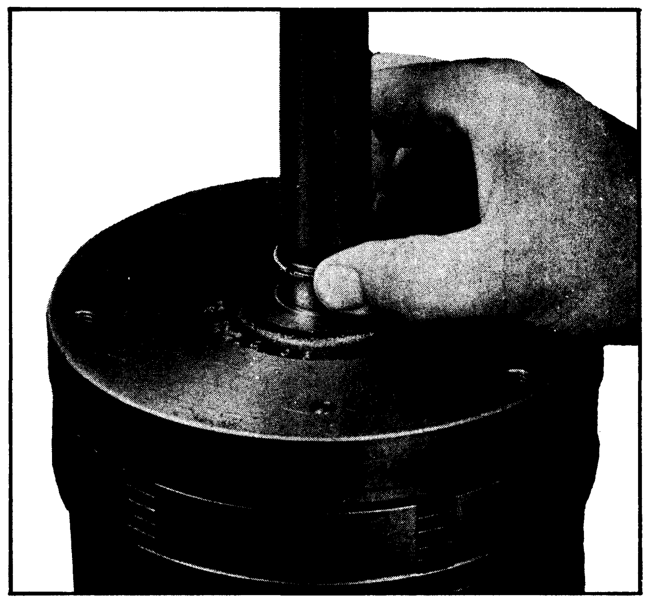


Fig. 3-55 Lock Type Oil Ring Removal

3. Lift the case support with neutral clutch piston from the intermediate shaft. (See Fig. 3-56)
4. Remove the 2 oil rings from the case support hub.
5. Remove neutral clutch piston from case support by bumping the hub on a wood block. (See Fig. 3-57)
6. Inspect oil rings on the neutral clutch piston and hub, remove rings if replacement is necessary. (Outer ring gap must be .002" to .007" when installed in the case support)
7. Lift the neutral clutch drum assembly

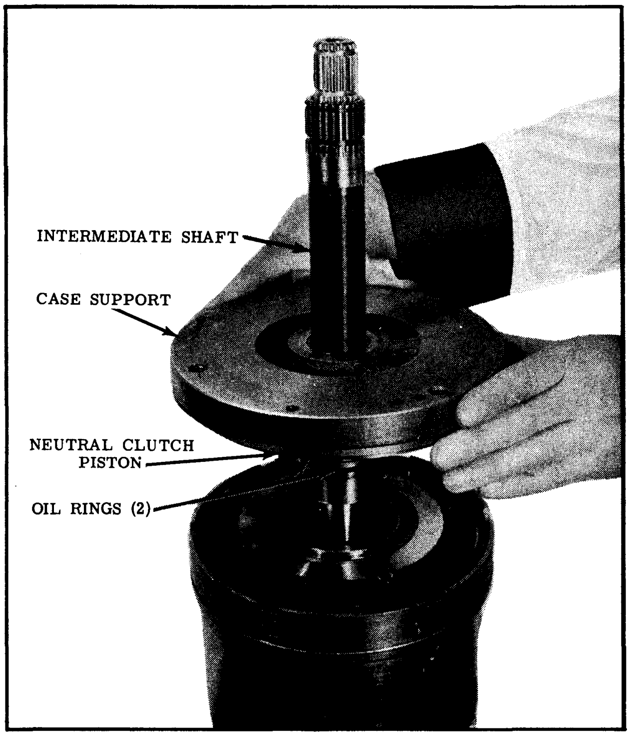


Fig. 3-56 Removing Case Support

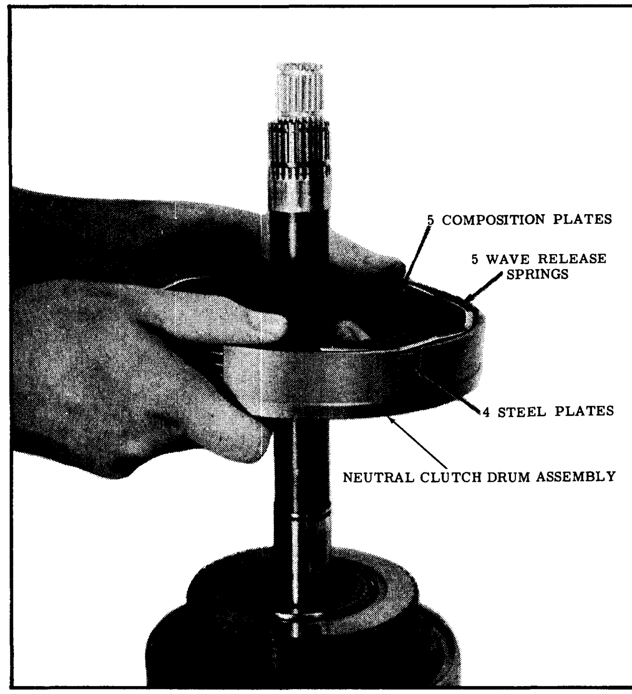


Fig. 3-58 Neutral Clutch Drum Removal

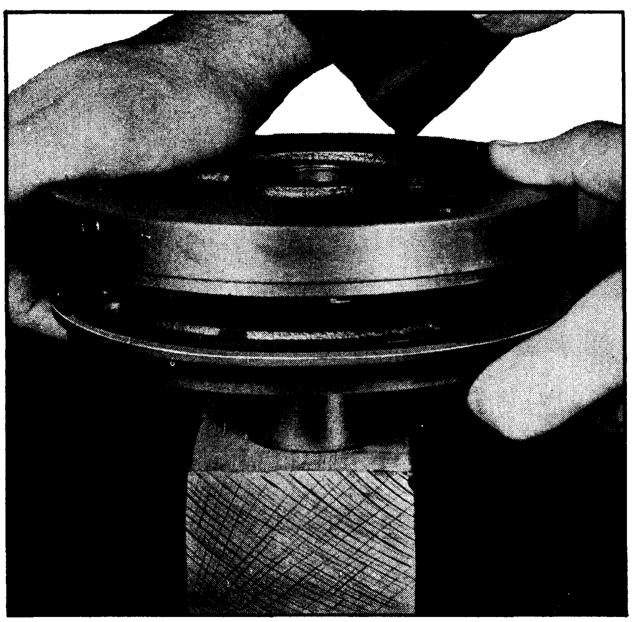


Fig. 3-57 Neutral Clutch Piston Removal

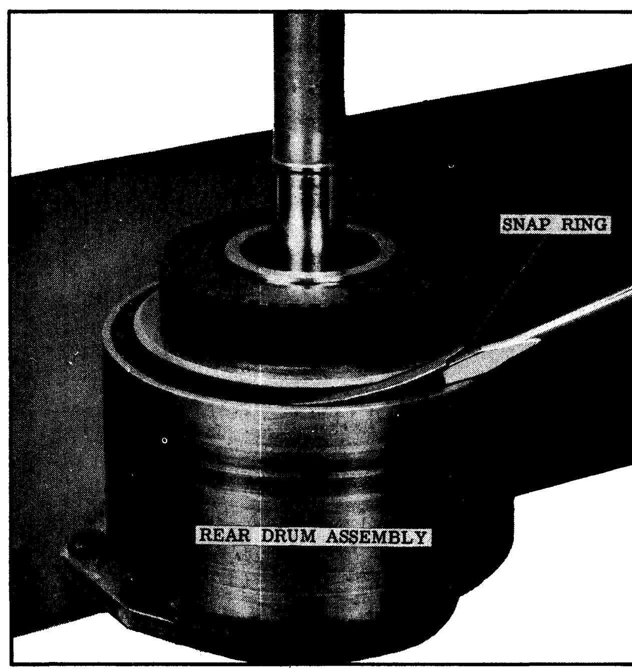


Fig. 3-59 Snap Ring Removal

from the intermediate shaft. (See Fig. 3-58)

8. Remove the clutch plates and wave release springs from the neutral clutch drum. (5 composition, 4 steel and 5 wave release springs)
9. Remove the large snap ring from the rear drum. (See Fig. 3-59)
10. Lift the intermediate shaft and rear clutch assembly from the drum. (See Fig. 3-60)
11. Lift the rear sprag and clutch assembly from the intermediate shaft. (See Fig. 3-61)
12. Remove thrust washers from both sides of the clutch hub.

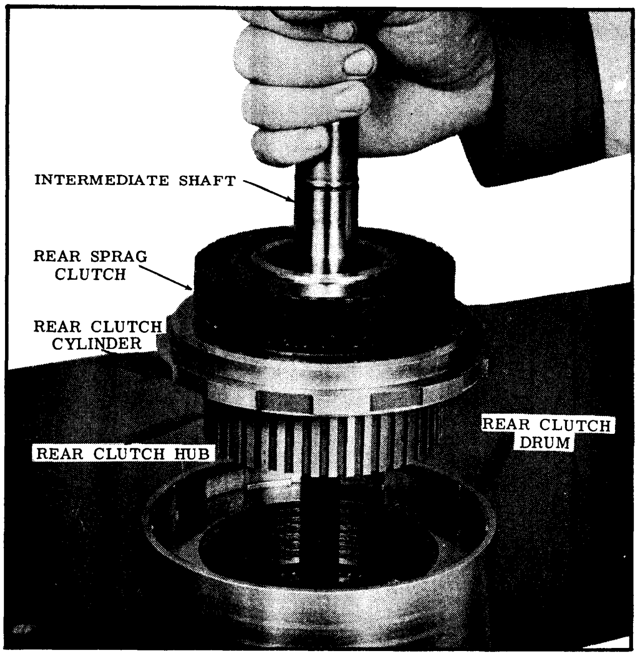


Fig. 3-60 Intermediate Shaft & Rear Clutch Removal

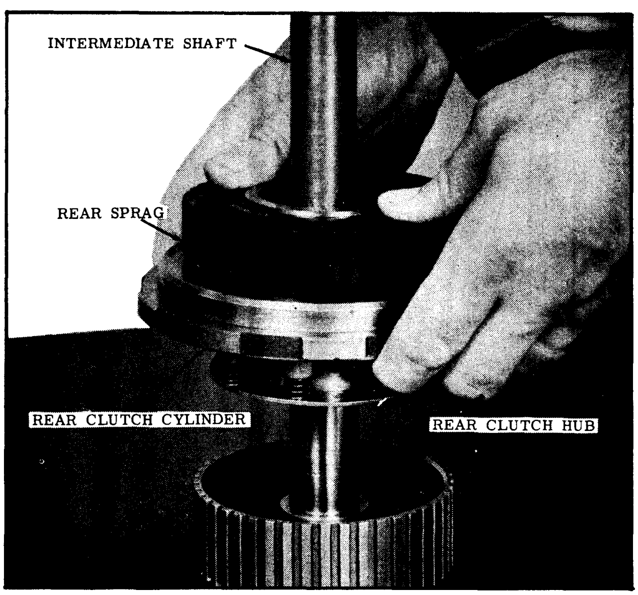


Fig. 3-61 Rear Sprag & Clutch Removal

NOTE: One thrust washer may remain on the mainshaft sun gear.

13. Remove the Spirolox ring from the rear sprag inner race. (See Fig. 3-62)
14. Remove sprag outer race and retainer by rotating outer race counterclockwise and pulling upward.
15. Slide the sprag assembly and retainer from the outer race.

NOTE: Do not disassemble the sprag.

16. Place rear clutch cylinder assembly

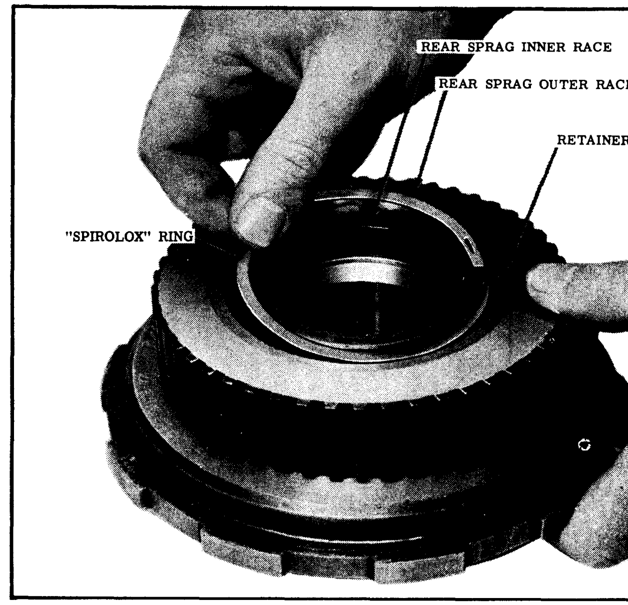


Fig. 3-62 Spirolax Ring Removal

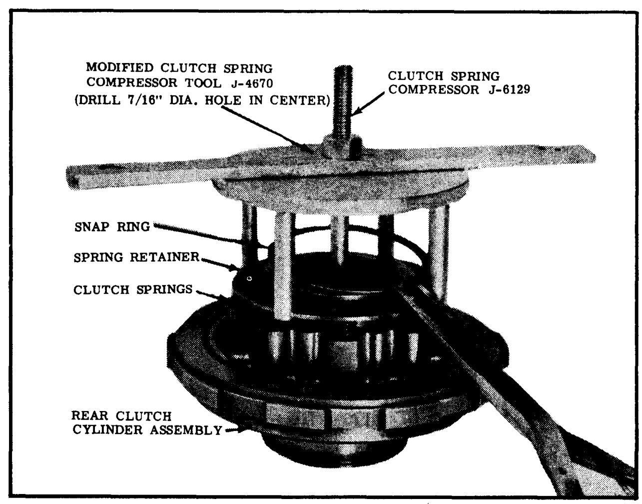


Fig. 3-63 Snap Ring Removal

over Tool J-6129 and install modified Tool J-4670-B. (See Fig. 3-63)

17. Tighten tool nut to compress clutch release springs, then disengage the snap ring.
18. Remove the tools from the rear clutch and remove the snap ring and spring retainer.
19. Remove the eight clutch release springs.
20. Remove the clutch piston from the rear clutch cylinder. (See Fig. 3-64)
21. Remove the oil seal from the piston and cylinder.
22. Remove mainshaft assembly and thrust washer from the rear unit.

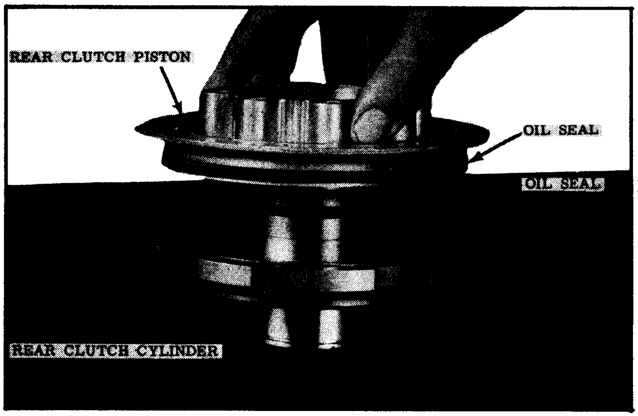


Fig. 3-64 Clutch Piston Removal

NOTE: Thrust washer may remain in counter bore in output shaft.

23. Remove the 7 composition plates and 7 steel plates from the rear unit.
24. Invert the output shaft and drum assembly on the bench.
25. Remove the reverse drive flange snap ring from the rear drum.
26. Lift the output shaft and reverse drive flange from the drum.
27. Remove reverse drive flange snap ring from the output shaft, then lift the flange from output shaft.
28. Remove the selective thrust washer from the reverse drive flange.

NOTE: Thrust washer may remain on the output shaft.

Fig. 3-65 Internal Gear & Clutch Backing Plate Removal

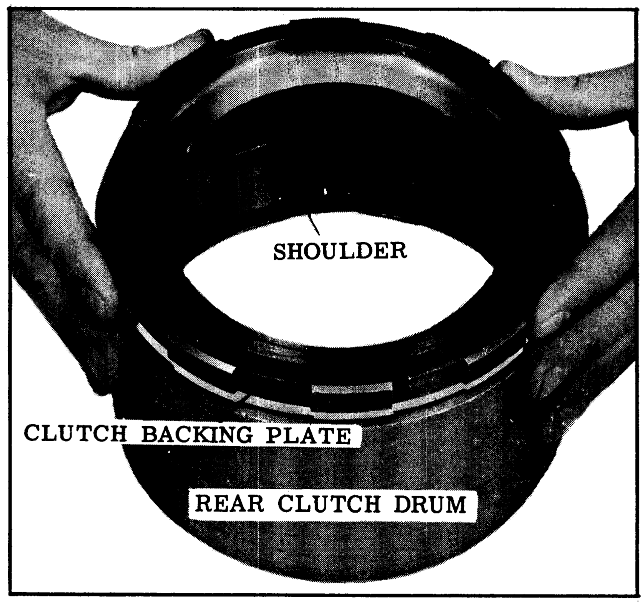


Fig. 3-66 Clutch Backing Plate Installation

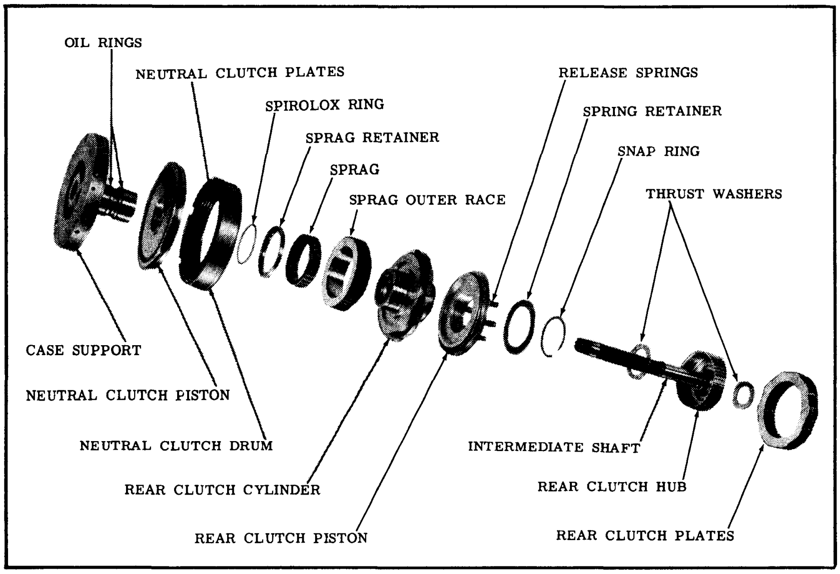
29. Slide the internal gear and the rear clutch backing plate from the rear drum. (See Fig. 3-65)
30. Clean and inspect all parts.

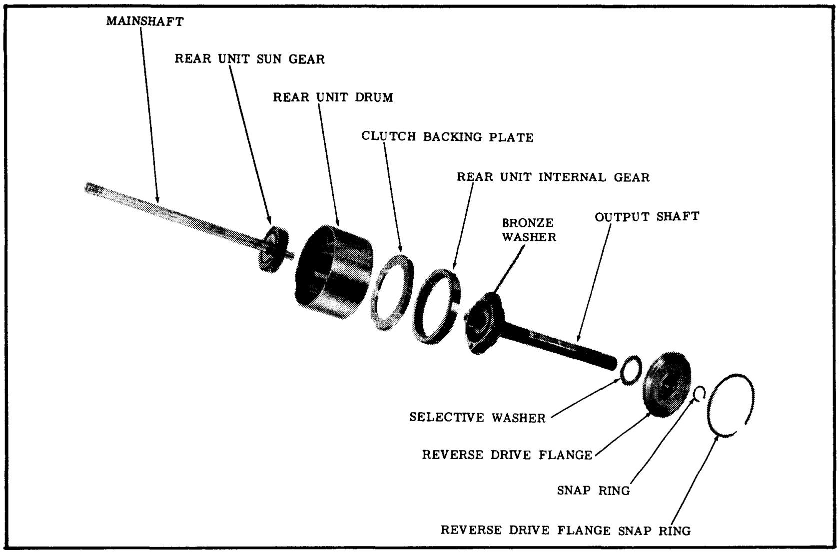
NOTE: Internal gear must be reinstalled with same side toward backing plate to prevent possible gear noise.

ASSEMBLY OF THE REAR UNIT (FIG. 3-68)

1. Install the clutch backing plate against

Fig. 3-67 Rear Unit Internal Gear Installation





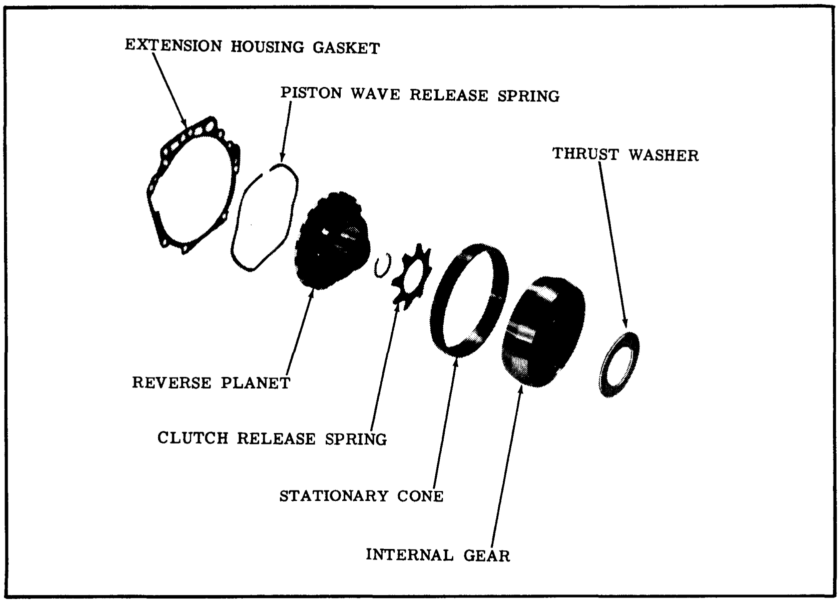


Fig. 3-68 Rear Unit Assemblies

the shoulder in the rear drum. (See Fig. 3-66)

2. Place the rear unit internal gear on the backing plate. (See Fig. 3-67)
   NOTE: Make sure gear is reinstalled with same side toward clutch backing plate to prevent possible gear noise.
3. Position selective washer in recess of the reverse drive flange.
4. Install output shaft into the reverse drive flange (See Fig. 3-69), then invert the assembly on the bench while holding the flange against the planet carrier to prevent the washer from dropping out of place.
5. Install snap ring on output shaft adjacent to the reverse sun gear.

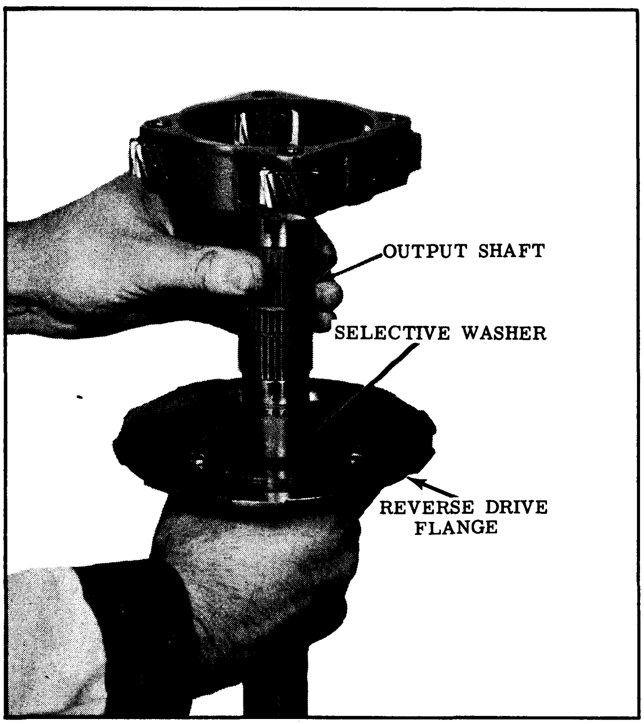


Fig. 3-69 Installing Reverse Drive Flange

6. Install reverse drive flange retainer J-6120 on output shaft between sun gear and snap ring. (See Fig. 3-70)
   NOTE: This is to prevent the selective thrust washer from dropping out of place when installing output shaft into rear unit drum.
7. Install output shaft assembly into rear unit drum, then install snap ring into the drum. (See Fig. 3-71)
8. Place the assembly, with output shaft

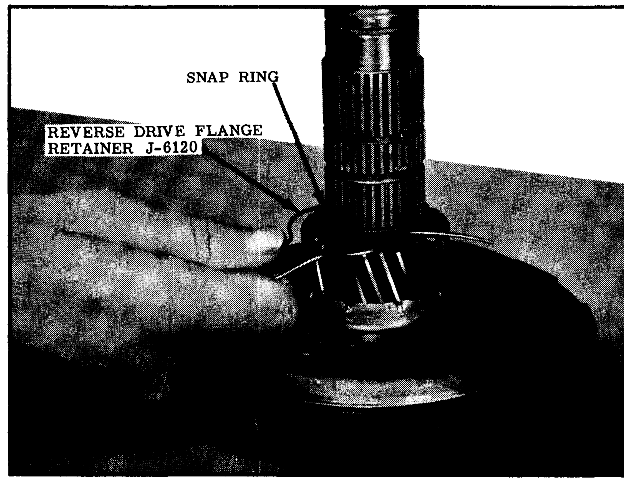


Fig. 3-70 Installing Retainer Tool

down, part way into holding fixture J-6116, then hold the rear drum and remove reverse drive flange retaining tool as shown in Fig. 3-72. Lower the drum until reverse drive flange rests on holding fixture.

9. Install thrust washer in counter bore of output shaft.
10. Lubricate composition plates with Hydra-Matic oil as they are installed. Place a composition plate on the backing plate and install a steel plate. Alternate until 7 composition plates and 7 steel plates have been installed. (See Fig. 3-73)
    NOTE: The steel clutch plates must be installed with the single offset notches (on lugs) positioned directly above each other.

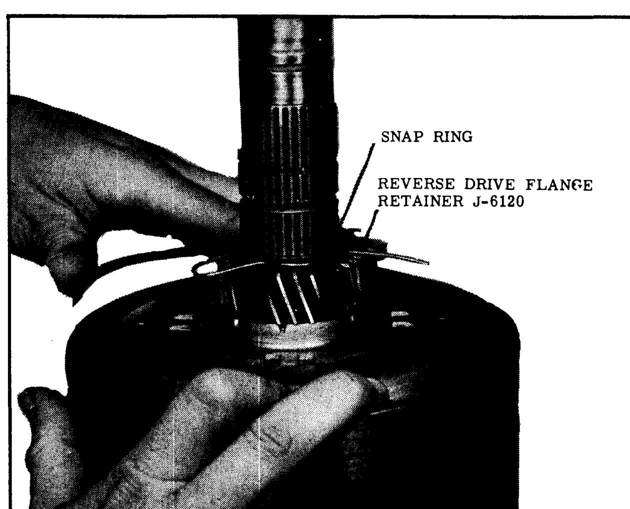


Fig. 3-71 Installing Snap Ring

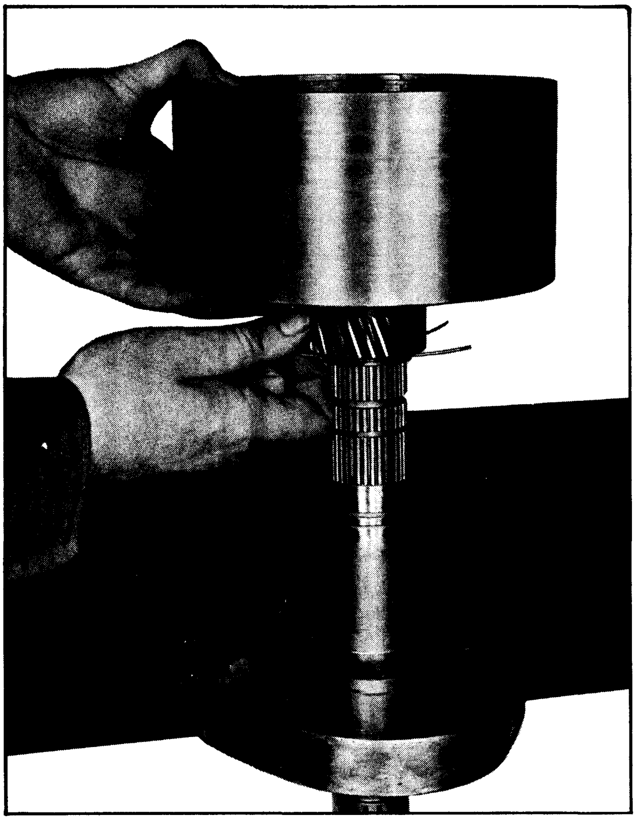


Fig. 3-72 Removing Retainer Tool

11. Install mainshaft by engaging the sun gear with the rear planet pinions.
12. Install thrust washer in rear clutch hub on side opposite the intermediate

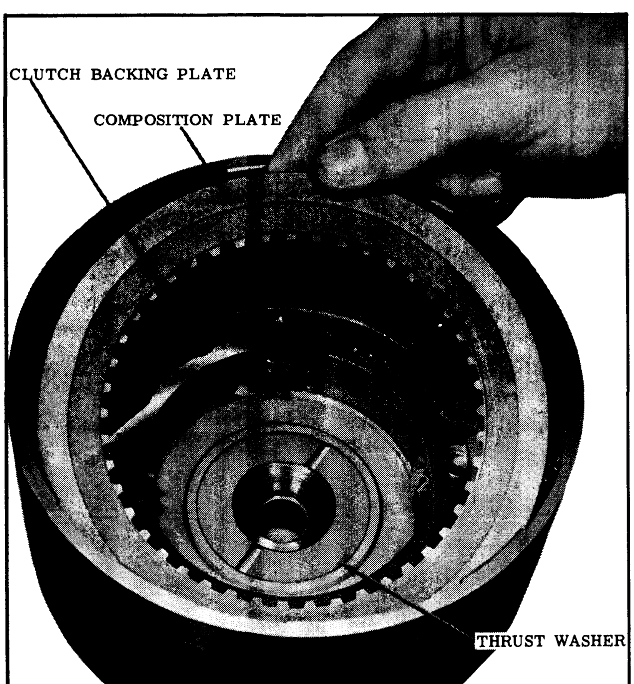


Fig. 3-73 Installing Clutch Plates

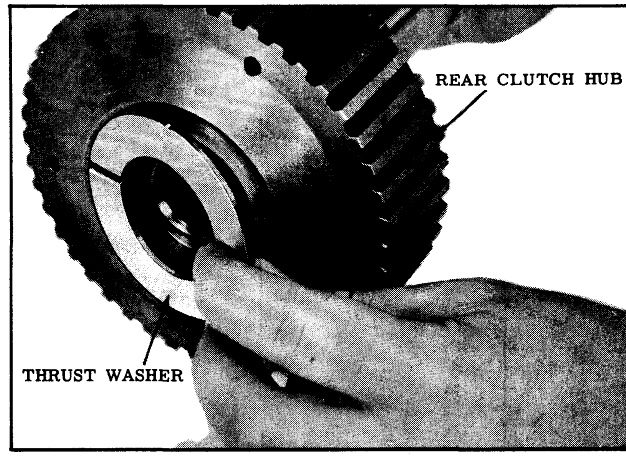


Fig. 3-74 Installing Thrust Washer

shaft and retain with petrolatum. (See Fig. 3-74)

13. Install intermediate shaft and clutch hub assembly into the rear unit so that top of clutch hub is flush with steel

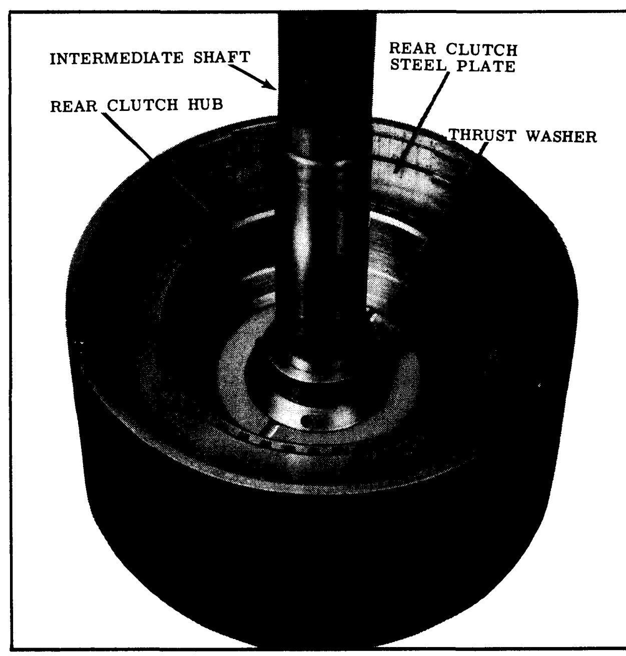


Fig. 3-75 Installing Intermediate Shaft

plate. (See Fig. 3-75)

14. Install the thrust washer over intermediate shaft and onto the clutch hub.
15. Install new oil seals on the rear clutch piston and cylinder. (See Fig. 3-76) Lubricate seals with Hydra-Matic oil.
16. Place the clutch piston on the clutch cylinder so that it rests on the lip of the seal. While applying light pressure

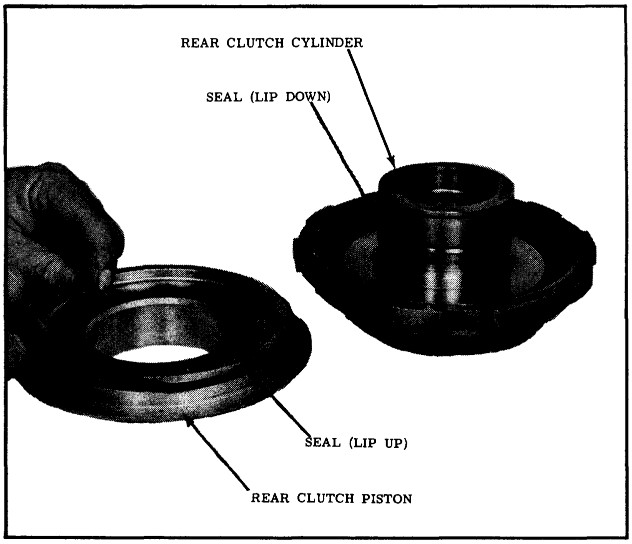


Fig. 3-76 Installing Oil Seal

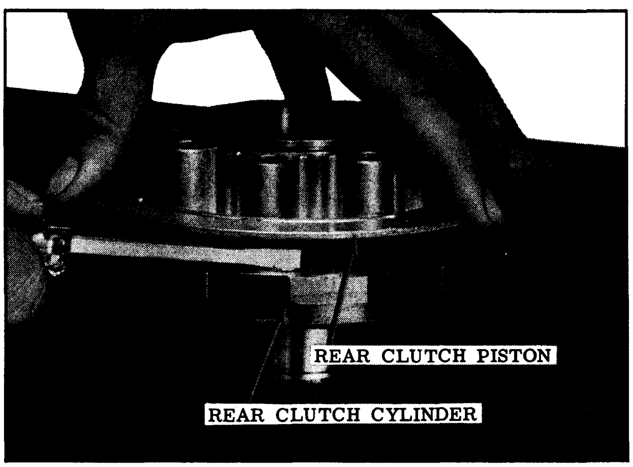


Fig. 3-77 Installing Rear Clutch Piston

on the piston, work the seal lip into the clutch cylinder. (See Fig. 3-77)

17. Install the 8 clutch release springs into the piston.
18. Place the rear clutch assembly over Tool J-6129 and place the spring retainer on the release springs with the tangs facing up.
19. Lay snap ring on the retainer and install modified Tool J-4670-B.
20. Compress the springs with the tool and install snap ring.
21. Remove the tools from the rear clutch assembly and check to see that the snap ring is not on any of the tangs.
22. With the recessed side of the rear sprag outer race facing up and with the shoulder of the sprag up, install it

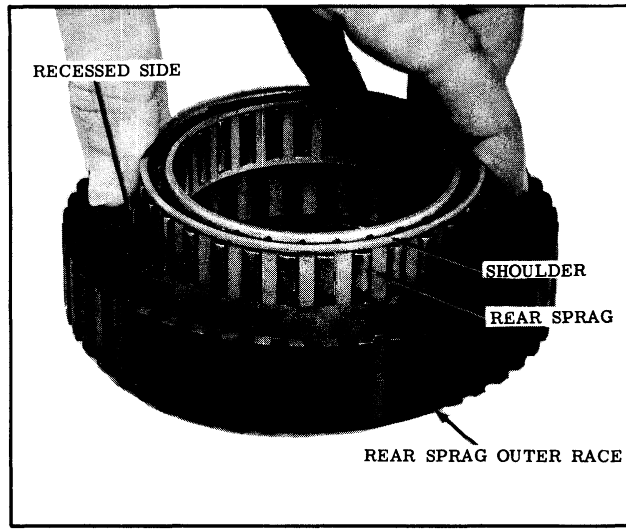


Fig. 3-78 Installing Rear Sprag

into the outer race by turning the sprag counterclockwise. (See Fig. 3-78)

23. Install sprag assembly on clutch cylinder with the beveled side of outer race toward the hub by turning sprag counterclockwise. (See Fig. 3-79)

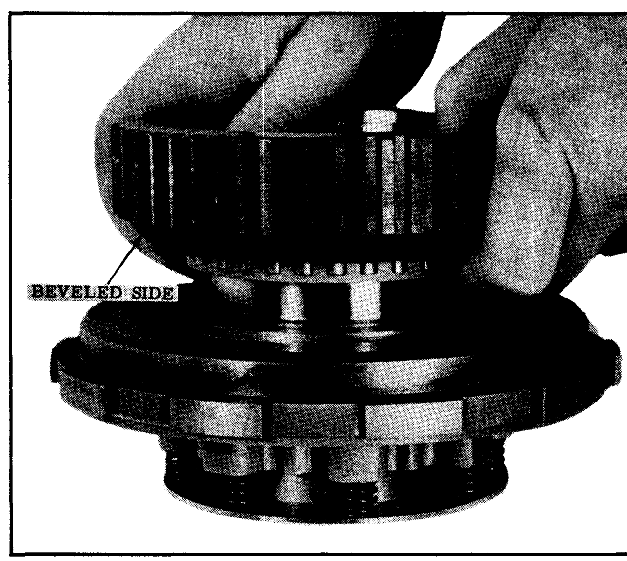


Fig. 3-79 Installing Sprag Assembly

24. Place sprag retainer on sprag and outer race, then install Spirolox ring. (See Fig. 3-80)
25. Install rear clutch assembly into rear unit drum, then install the large snap ring. (See Fig. 3-81)

NOTE: It may be necessary to lift up on the drum to allow snap ring to enter the groove.

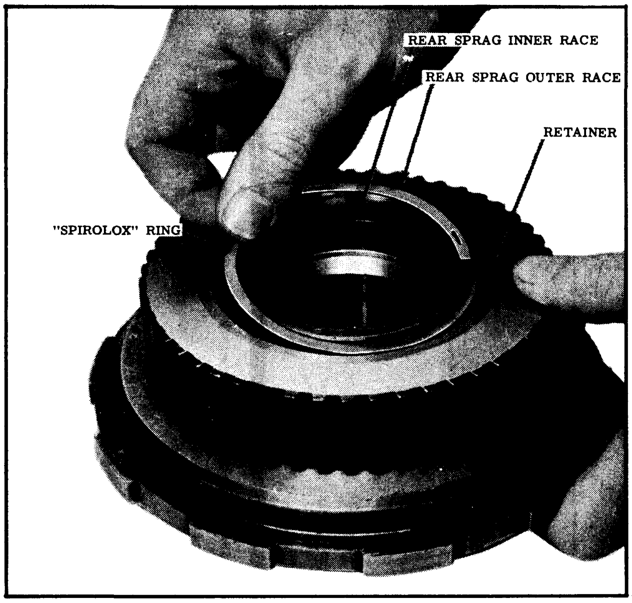


Fig. 3-80 Installing Spirolox Ring

26. Place the neutral clutch drum on rear unit with clutch plate surface up. (See 3-82)
27. Lubricate composition plates with Hydra-Matic oil. Install a wave release spring in the clutch drum, then place a composition plate over sprag outer race and install a steel plate. Alternate until 5 composition plates,

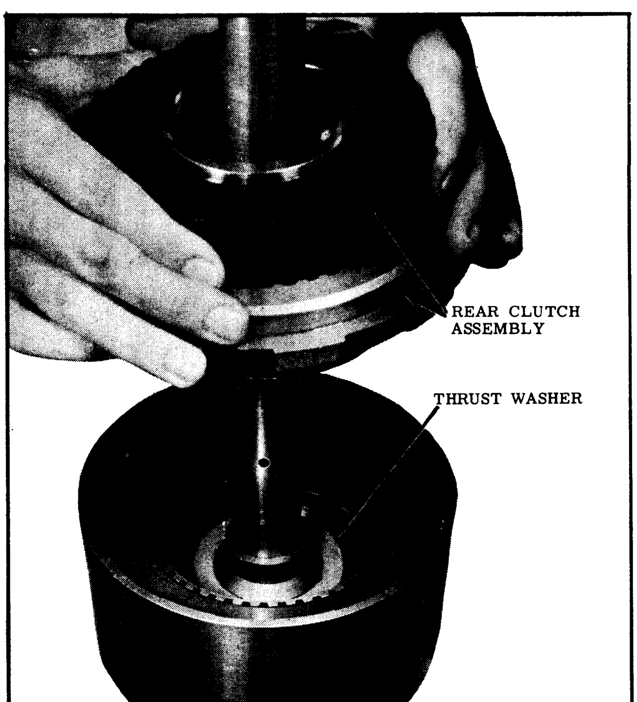


Fig. 3-81 Installing Rear Clutch Assembly

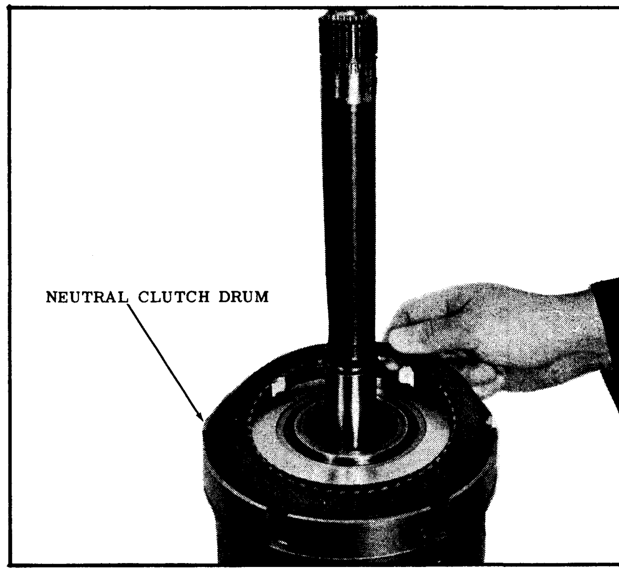


Fig. 3-82 Installing Neutral Clutch Assembly

4 steel plates and 5 wave release springs have been installed.

28. Install the neutral clutch piston in the case support with the dowel pins aligned with the holes, then compress oil ring to allow piston to enter the drum. (See Fig. 3-83)
29. Install the 2 oil rings on hub of the case support; lubricate the rings with Hydra-Matic oil.
30. Install case support assembly, hub down, over the intermediate shaft, being careful not to damage the bushing while passing over the sharp shoulders on the shaft. (See Fig. 3-84)

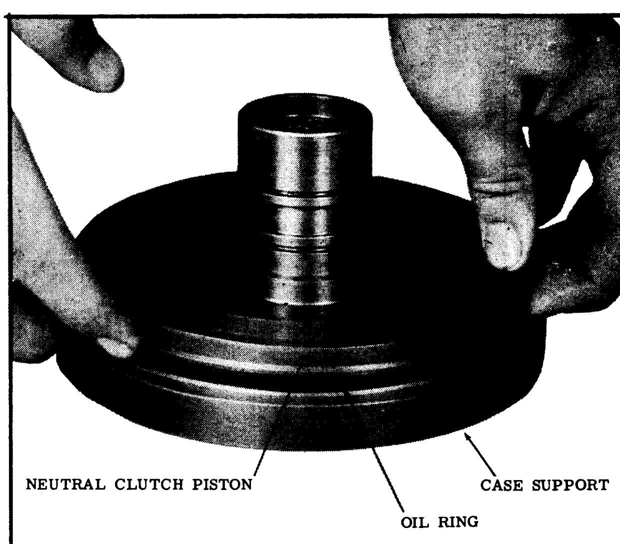


Fig. 3-83 Installing Neutral Clutch Piston

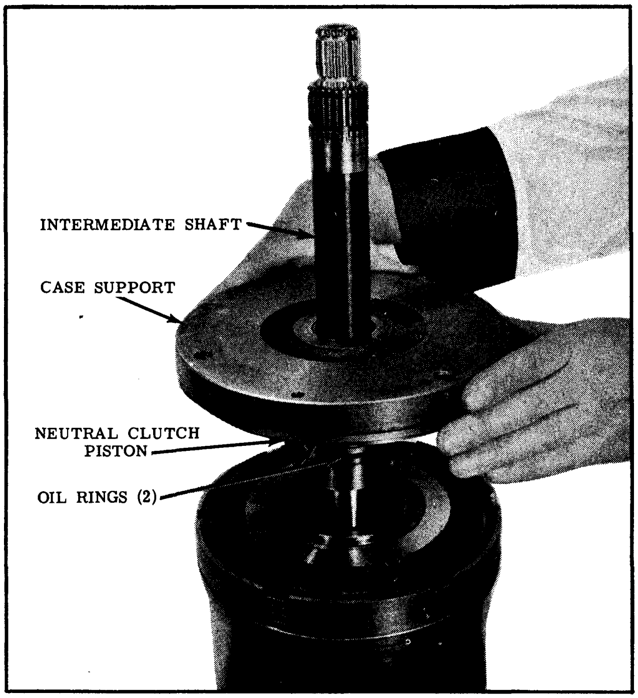


Fig. 3-84 Installing Case Support

31. Install lock type oil ring on the intermediate shaft. (See Fig. 3-85)
32. Install Tool J-6135 over the intermediate shaft and push down on case support to compress clutch release springs, then tighten lock bolt. (See Fig. 3-86)

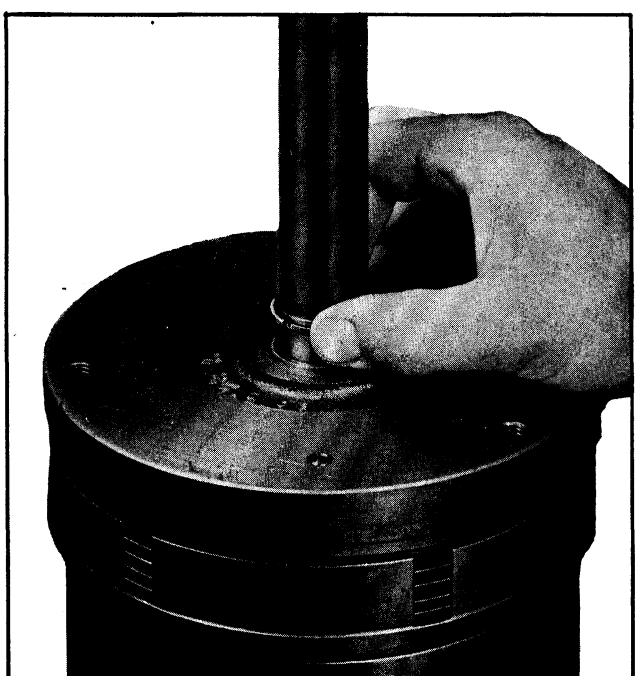


Fig. 3-85 Installing Lock Type Oil Ring

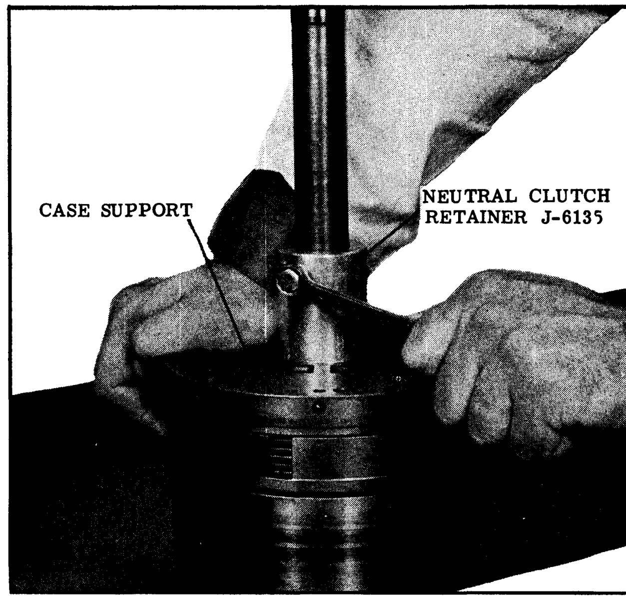


Fig. 3-86 Installing Neutral Clutch Retainer

INSTALLATION OF THE REAR UNIT INTO THE CASE

LOW BAND

1. Slide band into front of the case with band ends to rear of the case. (See Fig. 3-87)
2. When the band is half way in the case, rotate it so that the end of the band will hook onto the case anchor.
3. Hook band end on case anchor.

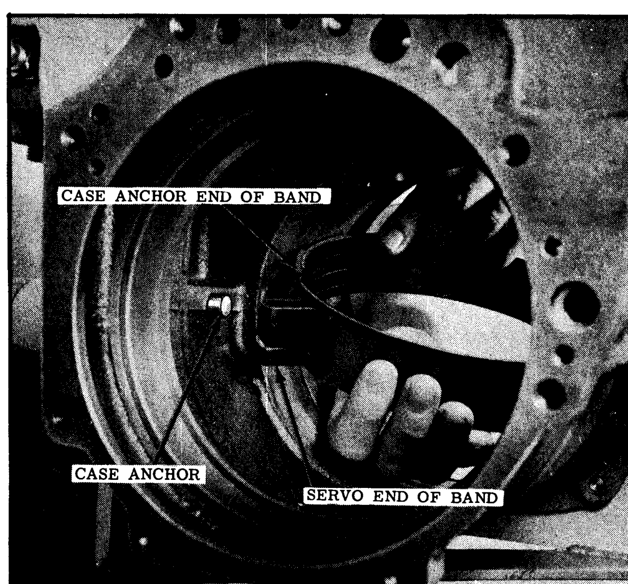


Fig. 3-87 Installing Low Band

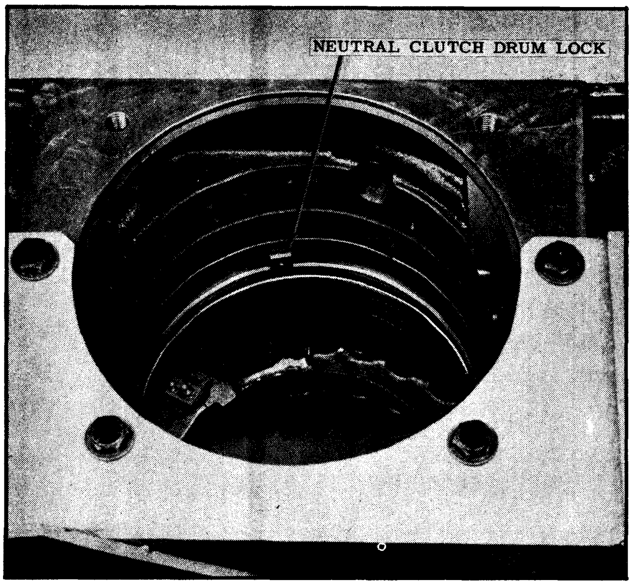


Fig. 3-88 Lock Installation

CASE SUPPORT, NEUTRAL CLUTCH AND REAR UNIT

1. Install neutral clutch drum lock into the case and retain with petrolatum. (See Fig. 3-88)
2. Hold neutral clutch drum and turn case support to align case support lock bolt hole with center of clutch plate drive lugs as shown in Fig. 3-89. Mark rear drum with a pencil as shown.

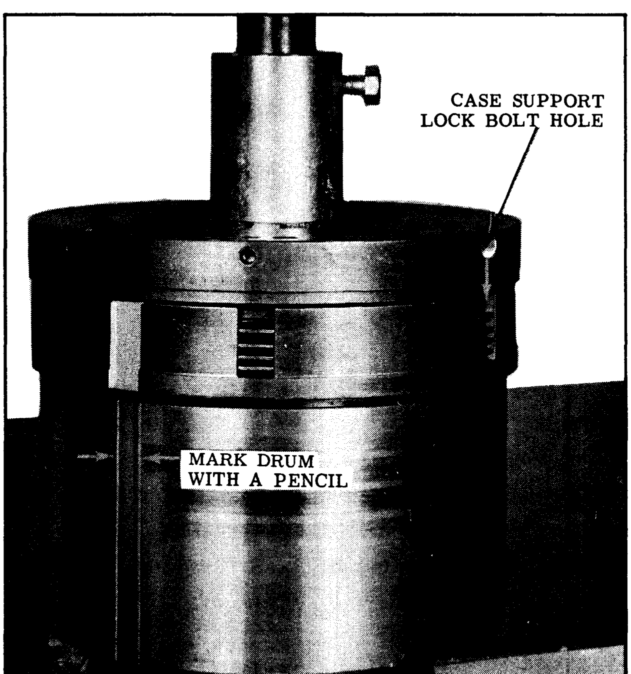


Fig. 3-89 Correct Alignment

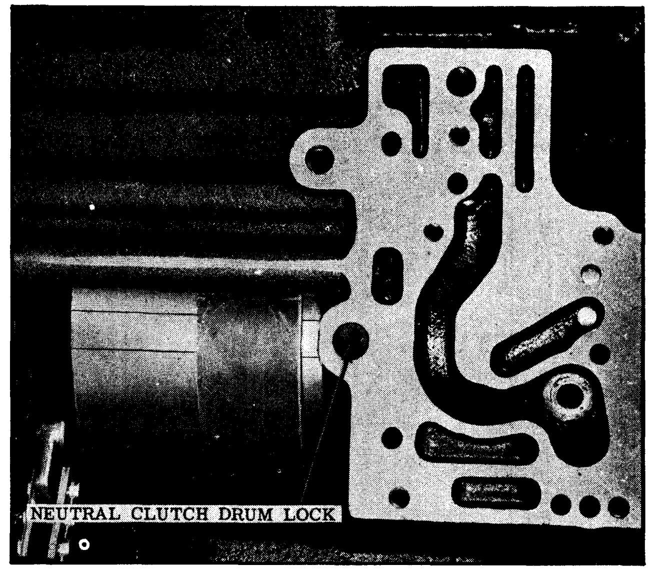


Fig. 3-90 Installing Neutral Clutch, Case Support & Rear Unit

3. Install case support, neutral clutch and rear unit assembly into transmission with pencil marks on rear drum aligned with neutral clutch drum lock. (See Fig. 3-90)

   CAUTION: Do not knock low band off case anchor when installing assembly. Check position of band end before assembly is pushed into place.
4. Make sure hole in the case support and hole in the case are aligned, then install case support snap ring into the case.

   NOTE: It may be necessary to install slide hammers, Tool J-6125 with adapters J-6134-1, in the case support to seat the support so that the snap ring will enter the groove.
5. Install the case support lock bolt and torque 25 to 30 ft. lbs.

DISASSEMBLY OF THE FRONT UNIT COUPLING

1. Scribe a mark on the front unit coupling and cover, then remove snap ring.
2. Install Tools J-6122-1 to retain the two exhaust valves, then install Tool J-6121 to front unit coupling. (See Fig. 3-91)
3. Place the assembly in holding fixture J-6116, then tighten the center nut.

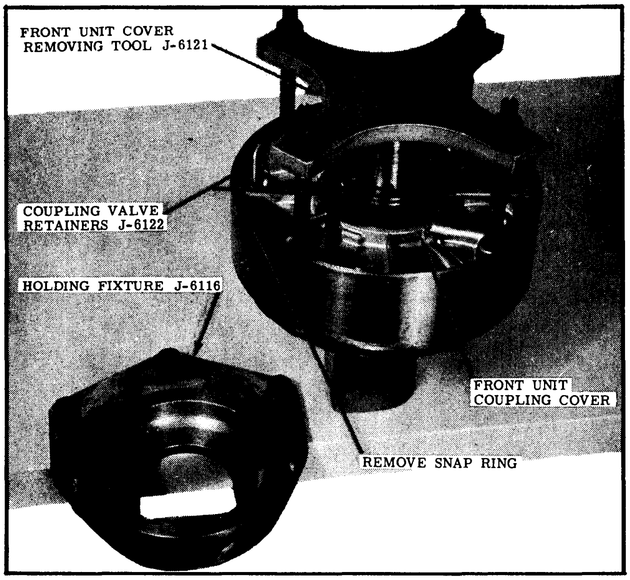


Fig. 3-91 Cover Removing Tools

Make sure the 4 studs are tight in the cover.

4. Tighten the 4 nuts alternately to prevent cocking the cover while removing. There are 2 square "O" rings that will hang up in the snap ring groove and a greater effort will be required to shear the rings when they drop into the snap ring groove. (See Fig. 3-92)
5. When the cover is free of the coupling remove the exhaust valve retaining tools, exhaust valves and springs.

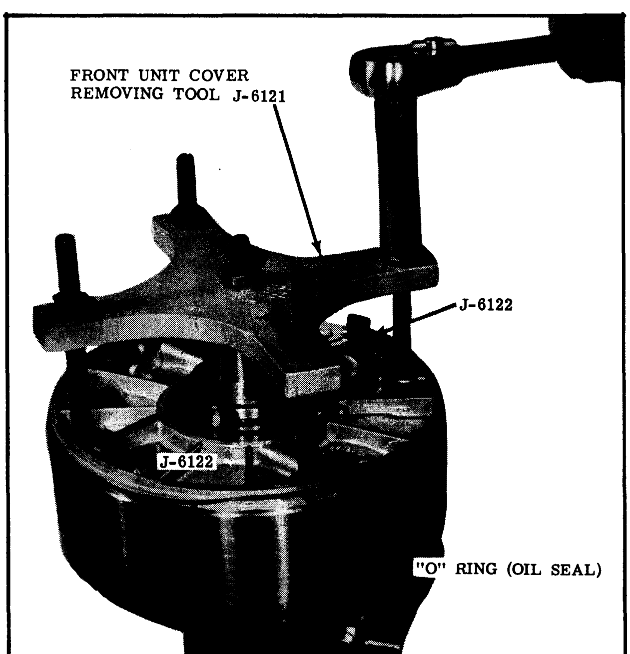


Fig. 3-92 Removing Front Unit Coupling Cover

6. Remove the tools from the front unit coupling.
7. Lift the cover and the driven torus from the coupling.
8. Remove spacer and bronze thrust washer from driven torus shaft.
9. Clean and inspect all parts.

ASSEMBLY OF THE FRONT UNIT COUPLING (FIG. 3-93)

1. Place drive torus in holding fixture and install the steel spacer in counter

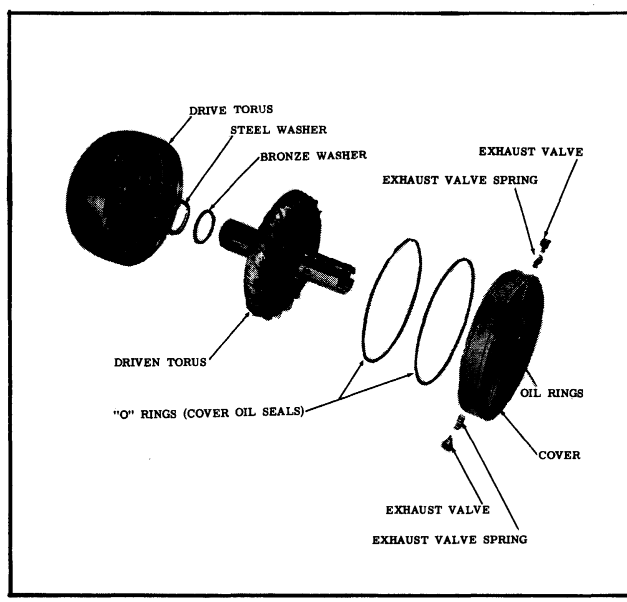


Fig. 3-93 Front Unit Coupling

bore on vane side of drive torus, then install bronze thrust washer.

2. Install driven torus into the drive torus.
3. Install New "O" rings on the front unit coupling cover, making sure the "O" rings are not twisted in the groove.
4. Lubricate the "O" rings and the snap ring groove in drive torus with petrolatum.
5. Install springs and exhaust valves in cover and retain with Tool J-6122.
6. Place cover on drive torus with marks aligned. Mark cover and drive torus with a pencil to indicate the notch and locating pin. (See Fig. 3-94)
7. With the cover resting on the bottom "O" ring push the cover as far

Fig. 3-94 Coupling Cover Alignment

as possible into the coupling. (See Fig. 3-95)

8. Make sure pencil marks are still aligned, then tap cover into place with a composition hammer until snap ring can be installed.

   NOTE: Tap on alternate sides of cover on puller bolt hole bosses to prevent binding the cover.

9. Inspect snap ring groove. If part of "O" ring is visible the cover will need to be removed and new "O" rings installed.

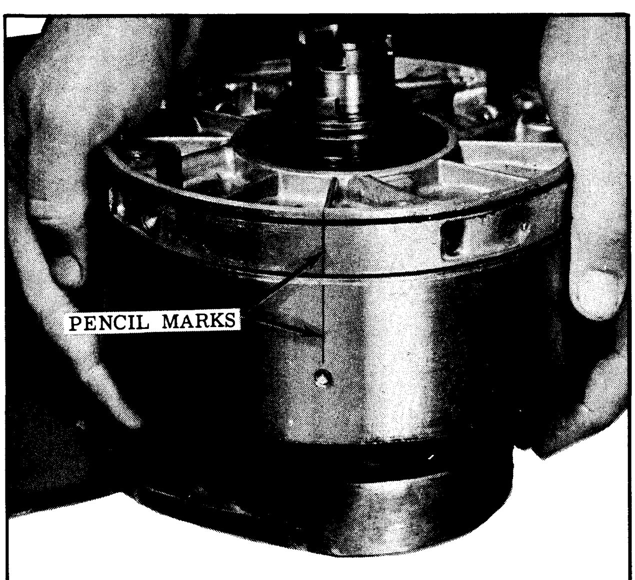


Fig. 3-95 Installing Coupling Cover

Fig. 3-96 Rotor Removal

10. Install snap ring.

DISASSEMBLY OF THE FRONT OIL PUMP

1. Remove the 2 remaining bolts from the pump cover, then lift the cover from the pump body.
2. Remove the top vane ring and the rotor. (See Fig. 3-96)

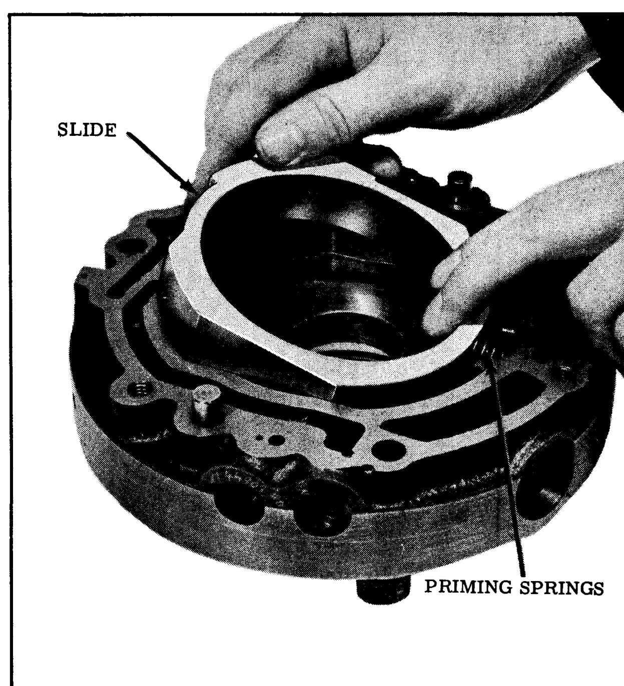


Fig. 3-97 Removing Front Pump Slide

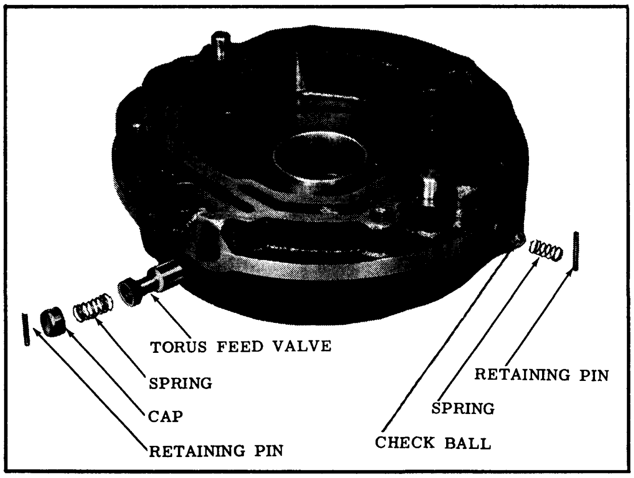


Fig. 3-98 Front Oil Pump Valves

3. Remove the 7 vanes and the lower vane ring.
4. Remove the slide by pushing toward the priming springs, then lift out of the body from the opposite side. (See Fig. 3-97)
5. Remove the inner and outer priming springs.
6. Remove the torus feed valve retaining pin, cap, spring and valve. (See Fig. 3-98)
7. Remove the check ball retaining pin and spring, then remove the check ball.
8. Remove the front sprag inner race if it remained in the pump during disassembly, then remove the Spirolox retaining ring from the outer race. (See Fig. 3-99)

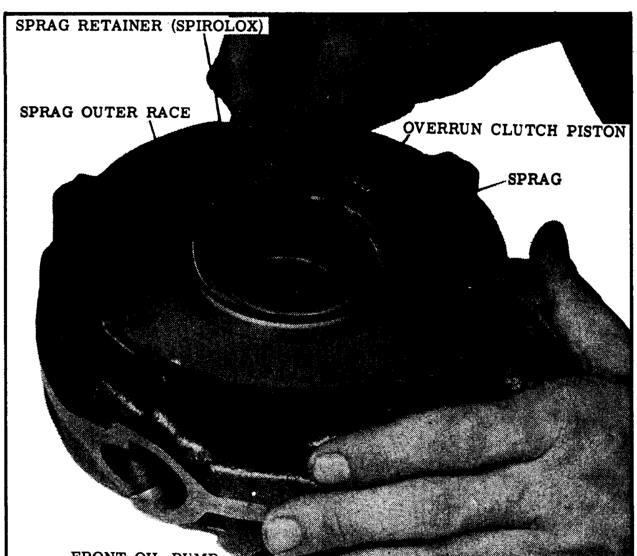


Fig. 3-99 Removing Spirolox Ring

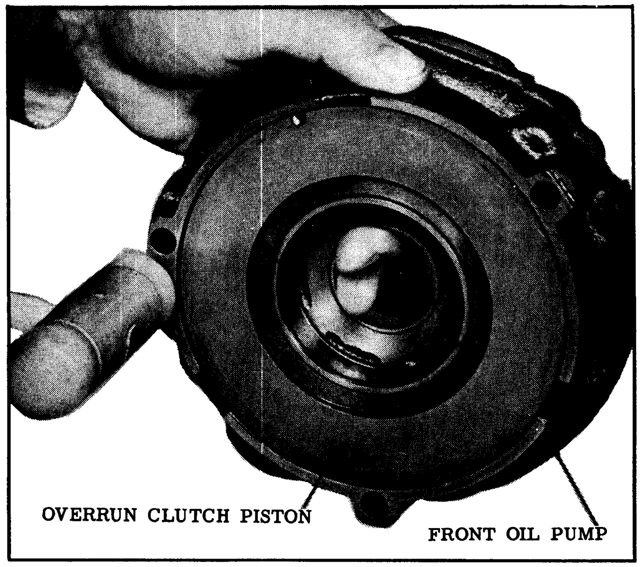


Fig. 3-100 Removing Overrun Clutch Piston

9. Remove sprag assembly from the front pump. Do not remove outer race.
10. Remove overrun clutch piston from the pump by tapping on rear of pump with a composition hammer. (See Fig. 3-100)

ASSEMBLY OF THE FRONT OIL PUMP (FIG. 3-102)

1. Install the overrun clutch piston into the pump body. Dowels must be aligned with dowel holes. (See Fig. 3-101)
2. Install the sprag assembly, with shoulder up, into the sprag outer race. (See Fig. 3-103)

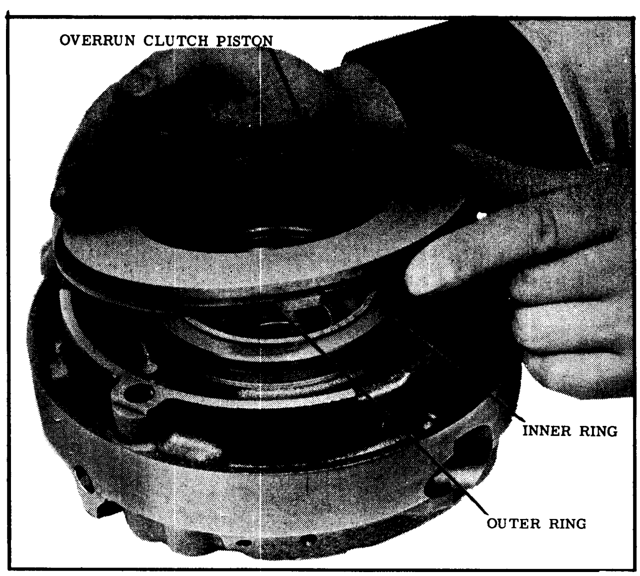


Fig. 3-101 Installing Overrun Clutch Piston

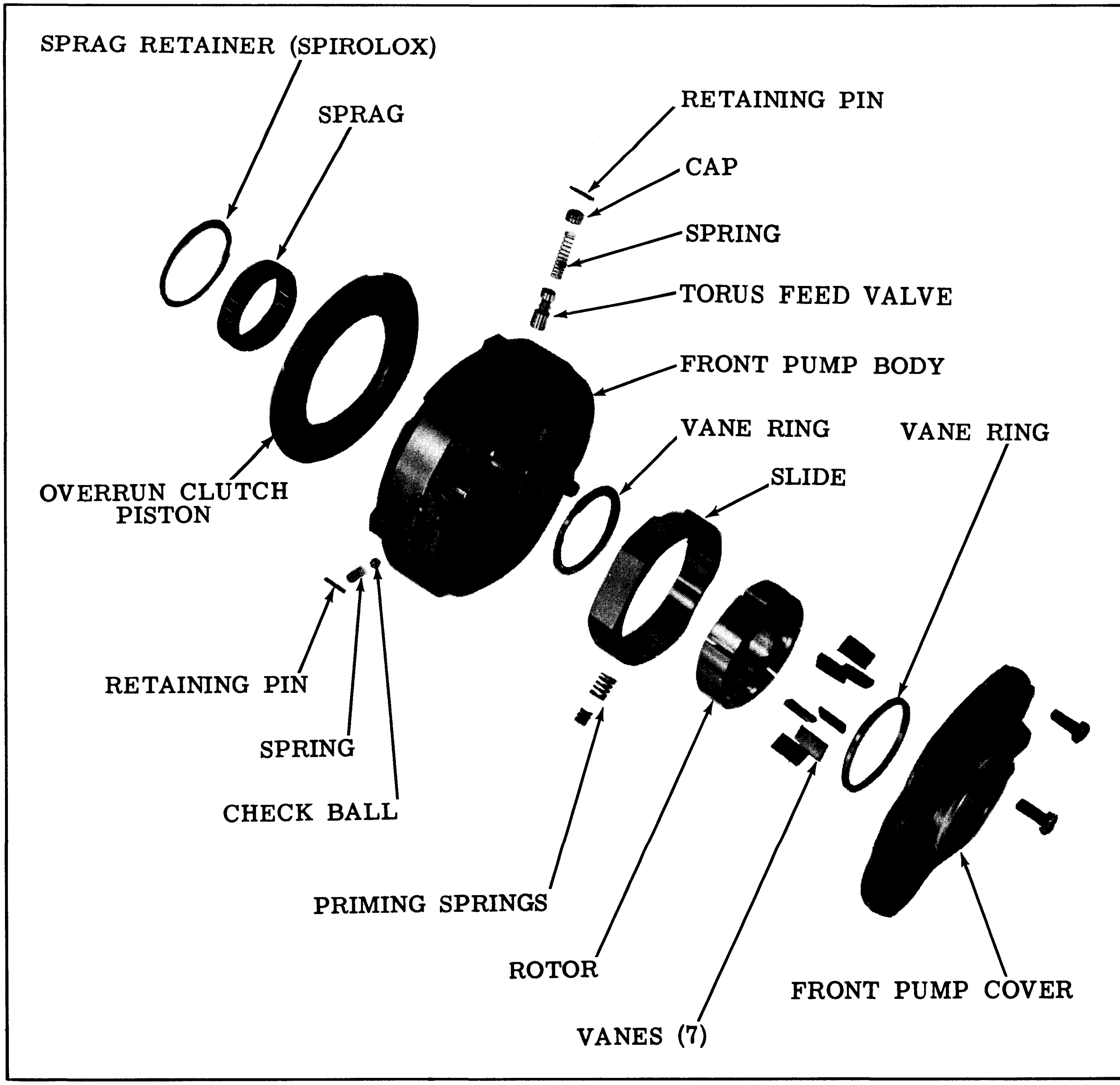


Fig. 3-102 Front Oil Pump

3. Install inner race of sprag with drive lugs up and check rotation. With sprag properly installed the inner race will be free to turn counter-clockwise and will lock up if turned clockwise.
4. Install Spirolox ring in the outer race of the sprag.
5. Install inner and outer priming springs in the recess of the pump body.
6. Compress priming springs with the slide and allow slide to drop into the pump body. (See Fig. 3-104)
7. Position vane ring in the pump cavity and locate in the center of the slide.
8. Install the rotor into the pump with the drive slots facing up. (See Fig. 3-105)
9. Install the 7 vanes in the rotor with the full wear pattern against the slide.
10. Install the top vane ring.
11. Install torus feed valve, spring, cap and retaining pin. (See Fig. 3-105)
12. Install ball check, spring and retaining pin.

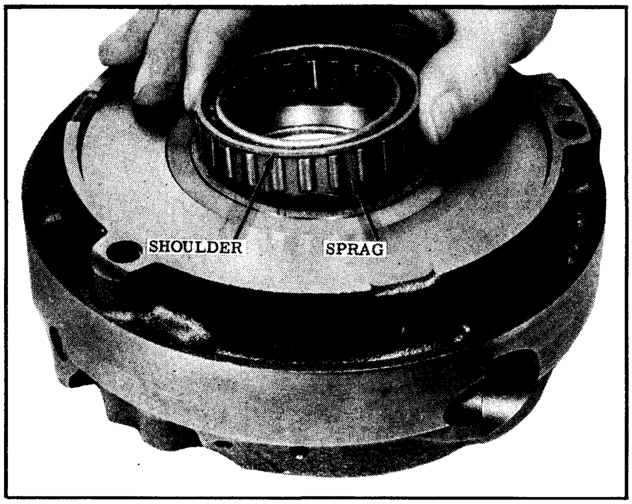


Fig. 3-103 Installing Sprag Assembly

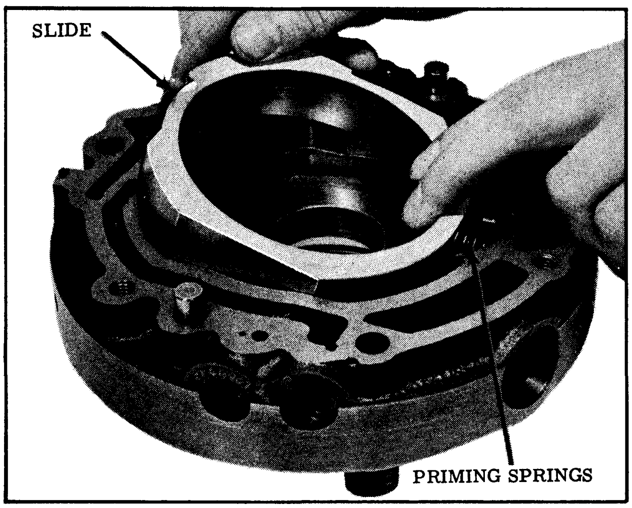


Fig. 3-104 Installing Front Pump Slide

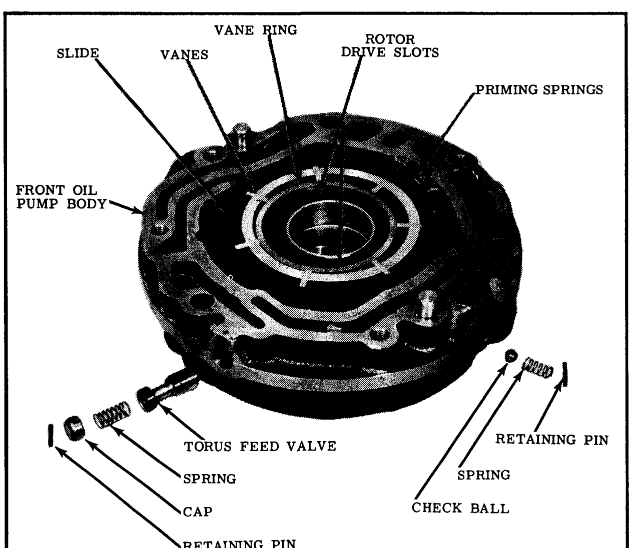


Fig. 3-105 Front Oil Pump

13. Place the cover on front pump body and install 2 cover bolts midway between the 2 dowels.

    NOTE: Short cover bolt must be installed above exhaust passage.

DISASSEMBLY OF THE PRESSURE REGULATOR (FIG. 3-106)

1. Remove the reverse booster plug and the pressure regulator valve stop pin from the pressure regulator plug.
2. Remove the "O" ring from the pressure regulator plug and discard.
3. Clean and inspect parts.

ASSEMBLY OF THE PRESSURE REGULATOR VALVE

1. Install a new "O" ring on the pressure regulator plug.
2. Apply petrolatum on the reverse booster plug, then install it into the pressure regulator plug.
3. Install stop pin in the booster plug and retain with petrolatum.

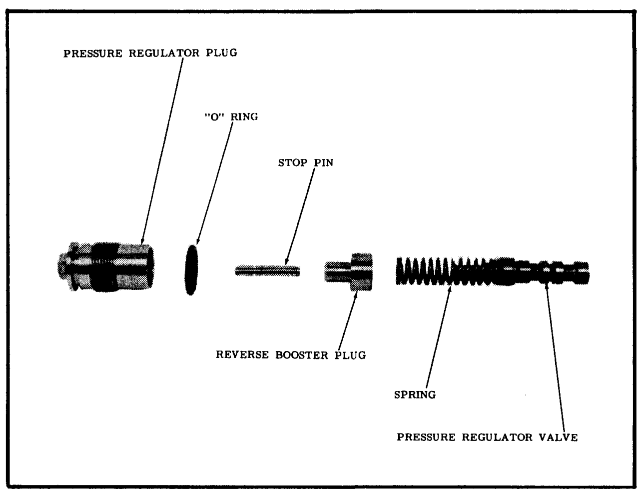


Fig. 3-106 Pressure Regulator Assembly

DISASSEMBLY OF THE REAR OIL PUMP

1. Lift the reverse piston from the front of the pump assembly. (See Fig. 3-107)
2. Remove the 6 rear pump cover attaching bolts, then separate the rear pump cover from the body by holding the cover and tapping on the body with a composition hammer.

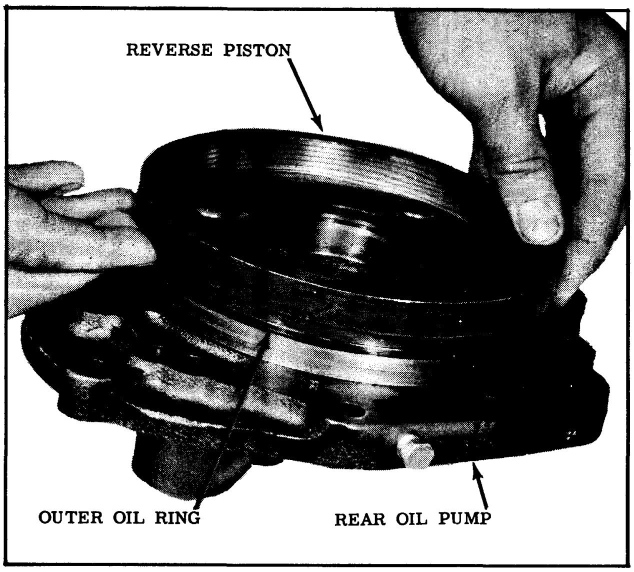


Fig. 3-107 Reverse Piston Removal

3. Remove governor drive key from driven gear. (See Fig. 3-108)
4. Remove drive and driven gears and note which side of gears is up for assembly purposes.
5. Remove the pump gasket.

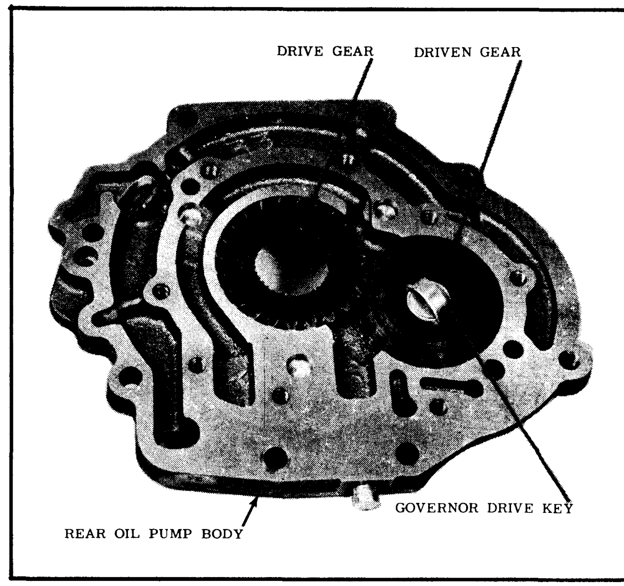


Fig. 3-108 Rear Oil Pump Gears

6. Remove the snap ring from the cover, then remove the bearing.
7. Clean and inspect parts.

ASSEMBLY OF THE REAR OIL PUMP (FIG. 3-109)

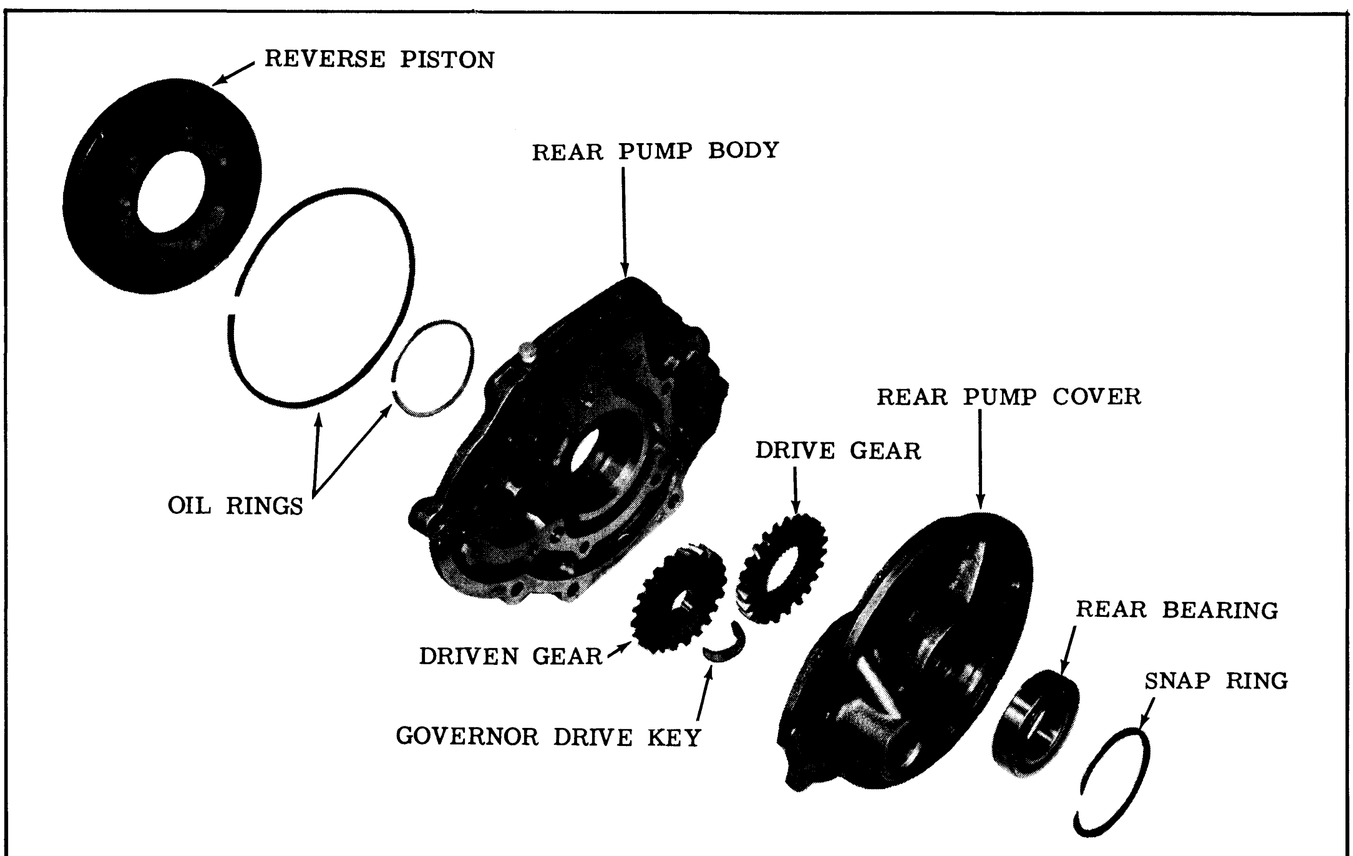


Fig. 3-109 Rear Oil Pump

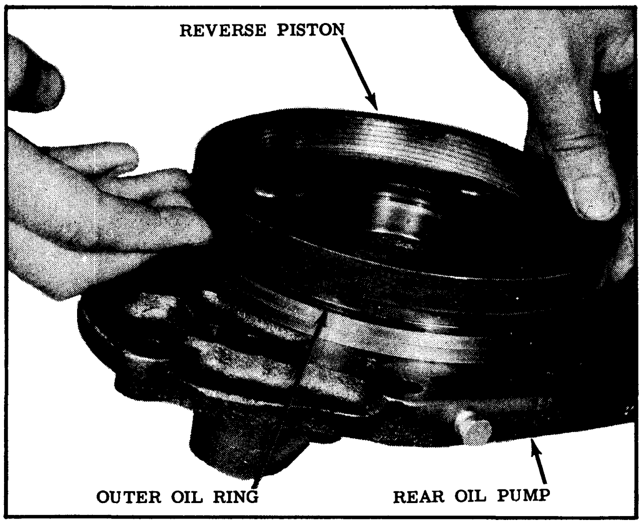


Fig. 3-110 Installing Reverse Piston

1. Install drive and driven gears. Gears should be reinstalled with same side up.
2. Install governor drive key into driven gear.
3. Install rear pump cover and install the 8 cover bolts. Torque 15 to 18 ft. lbs.
4. Position the reverse piston over the dowels in rear pump and compress the large oil ring to allow the piston to enter the pump cavity. (See Fig. 3-110)

   NOTE: Rear bearing will be installed after pump is installed on the transmission.

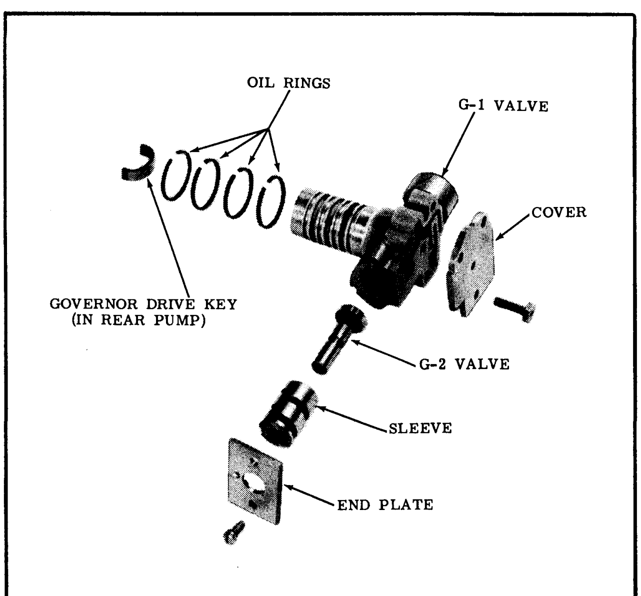


Fig. 3-111 Governor Assembly

DISASSEMBLY OF THE GOVERNOR (FIG. 3-111)

1. Remove the 3 cover attaching bolts, then remove the cover.
2. Remove the two G-2 valve end plate screws, then remove the end plate, sleeve and G-2 valve.
3. Remove the G-2 valve from the sleeve.
4. Clean and inspect parts.

ASSEMBLY OF GOVERNOR

1. Install G-2 governor valve into the sleeve, then install the assembly into the governor with locating notches aligned. (See Fig. 3-112)
2. Install end plate with the 2 attaching screws.
3. Install cover and the 3 cover attaching bolts and lockwashers.

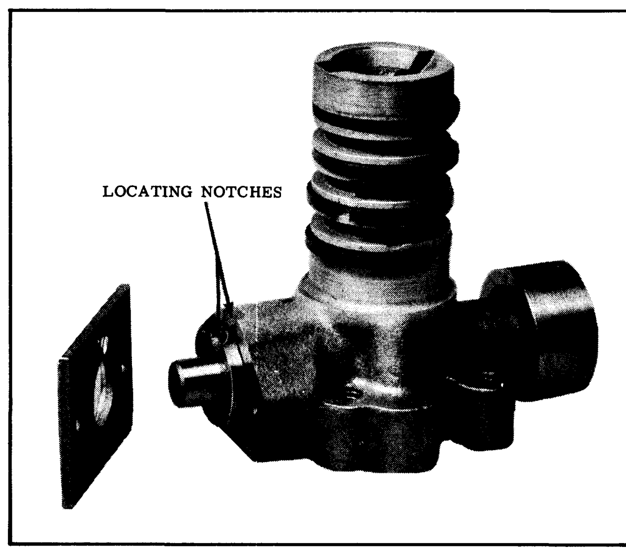


Fig. 3-112 G-2 Valve Installation

DISASSEMBLY OF ACCUMULATOR AND SERVO

1. Pull the servo piston from the servo body.
2. Remove 2 opposite accumulator cover screws and install Tool J-6124. (See Fig. 3-113)
3. Tighten tool bolt against cover to hold cover in place.
4. Remove the 3 remaining cover bolts.
5. Loosen the tool bolt to relieve the

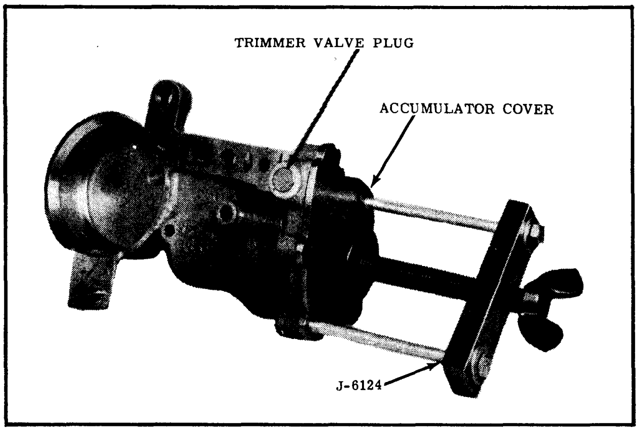


Fig. 3-113 Tool Installation

spring tension. Then remove tool, cover, gasket, accumulator piston and the accumulator springs.

6. Push on the trimmer valve plug to relieve the spring tension. Then remove the spring tension. (See Fig. 3-114)
7. Remove the plug, trimmer valve, and spring from the accumulator body.
8. Clean and inspect parts.

ASSEMBLY OF ACCUMULATOR AND SERVO

1. Install trimmer valve spring on the trimmer valve.
2. Install trimmer valve and spring into the accumulator body, spring first.
3. Install trimmer valve plug. Then compress the spring and install the retaining pin.
4. Install the accumulator springs into the accumulator body.
5. Install accumulator piston into the accumulator body over the springs.
6. Install the accumulator cover and gasket on Tool J-6124.

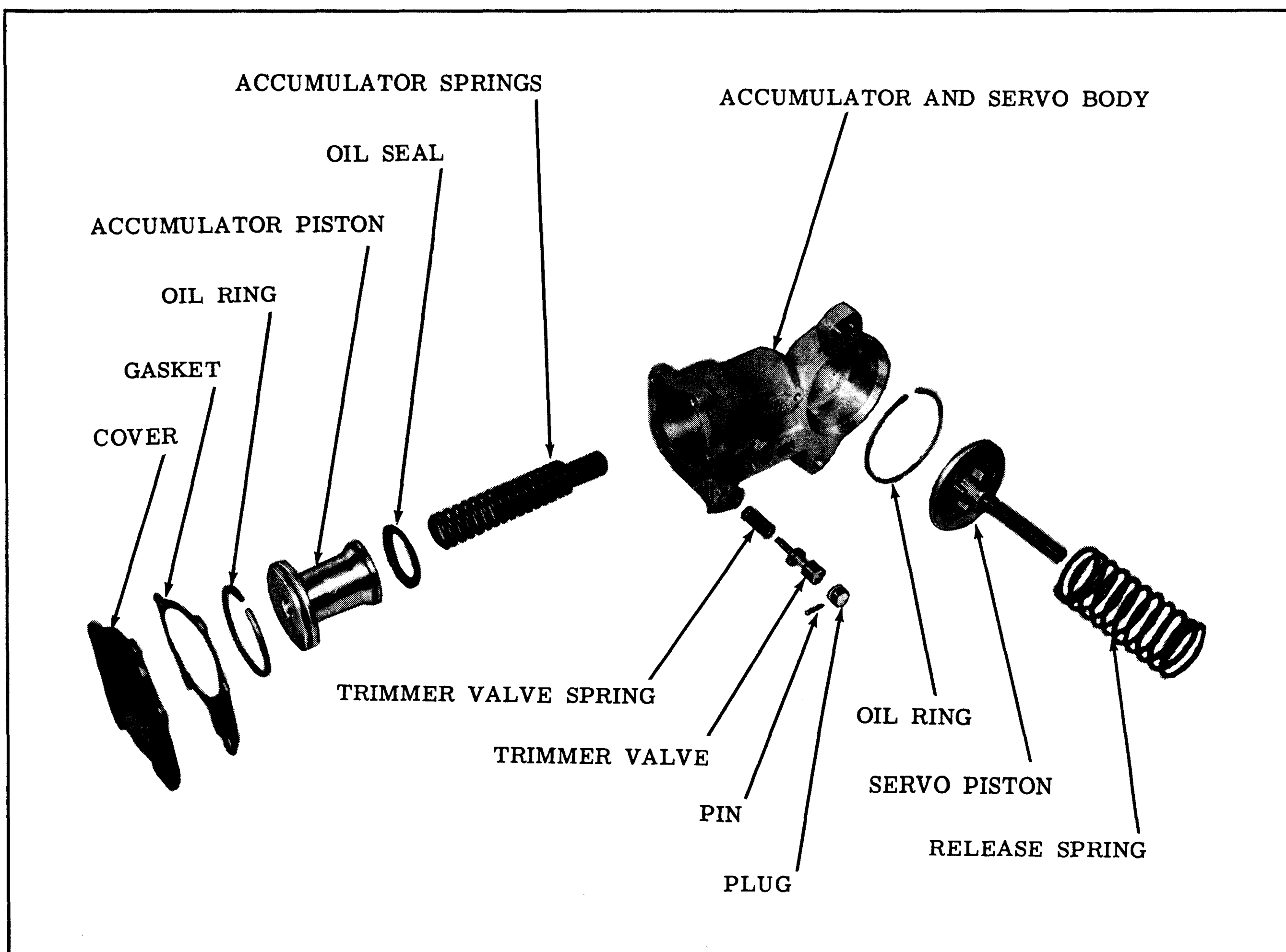


Fig. 3-114 Accumulator and Servo

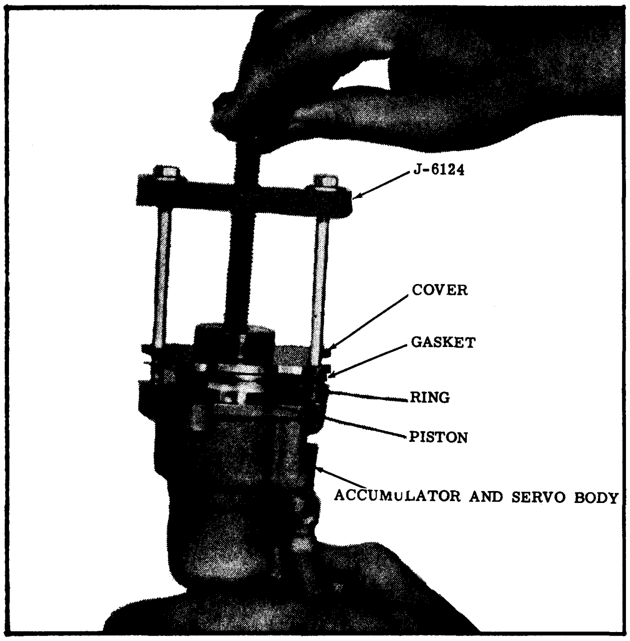


Fig. 3-115 Installing Accumulator Piston

7. Install tool with cover and gasket on the accumulator body. (See Fig. 3-115)
8. Tighten tool bolt slowly while guiding piston and ring into the accumulator.
   CAUTION: Do not force piston into accumulator. If ring binds it can be centered with a small screwdriver.
9. Install the 3 cover bolts and lock-washers.
10. Remove the tool and install the 2 remaining bolts and lockwashers. Torque bolts 12 to 15 ft. lbs.
11. Install servo piston into the servo body.

DISASSEMBLY OF THE CONTROL VALVE

The control valve assembly consists of 4 individual assemblies bolted to the channel body. In the disassembly and

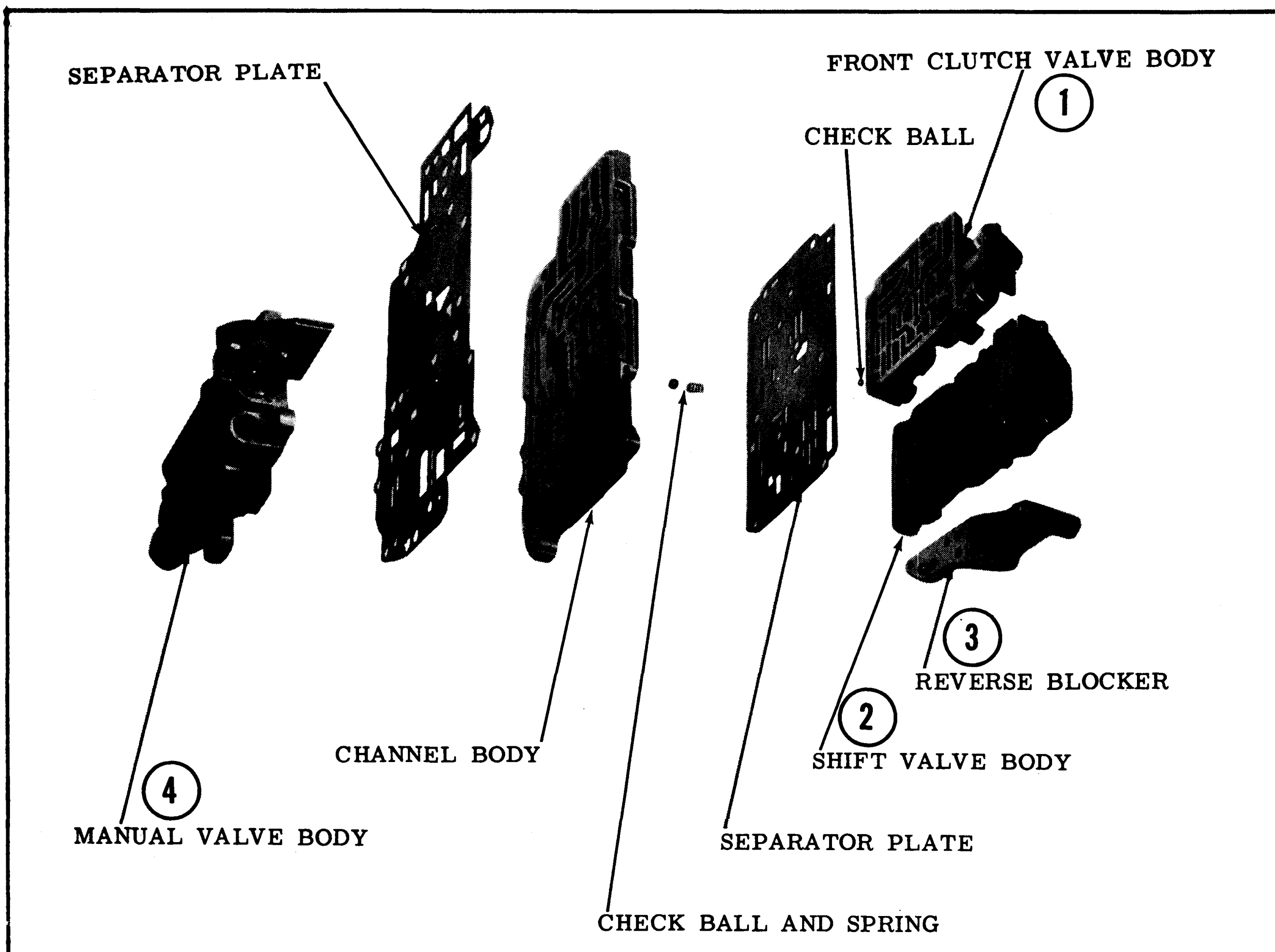


Fig. 3-116 Main Oil Control Valve Bodies

assembly procedure each valve body will be serviced individually.

The names of these individual assemblies and the order in which they will be serviced are: (See Fig. 3-116)

1. Front clutch valve body
2. Shift valve body
3. Reverse blocker
4. Manual valve body

DISASSEMBLY OF THE FRONT CLUTCH VALVE BODY (FIG. 3-117)

1. Remove the 2 front clutch valve body attaching screws, then remove the valve body from the channel body.
   CAUTION: Do not lose the ball check when removing the valve body from the channel body.
2. Remove the 2 coupling valve plate screws while holding the plate to keep the springs compressed. Then remove the plate.
3. Remove the inner and outer limit valve springs.
4. Remove the limit valve.
5. Remove the coupling valve plug and spring.
6. Remove the 4 screws and cover plate from the opposite end of the body.
7. Remove the transition valve and spring.
8. Remove the coupling valve from the center bore.
9. Remove the overrun clutch valve.
10. Clean and inspect parts.

ASSEMBLY OF THE FRONT CLUTCH VALVE BODY (FIG. 3-117)

1. Install the overrun clutch valve into the large bore in the body.
2. Install the coupling valve into the center bore.
3. Install the transition valve spring into the transition valve.
4. Install transition valve and spring into the valve body, spring first.
5. Install the cover plate on the body with 4 screws.
6. On the opposite end of the body install

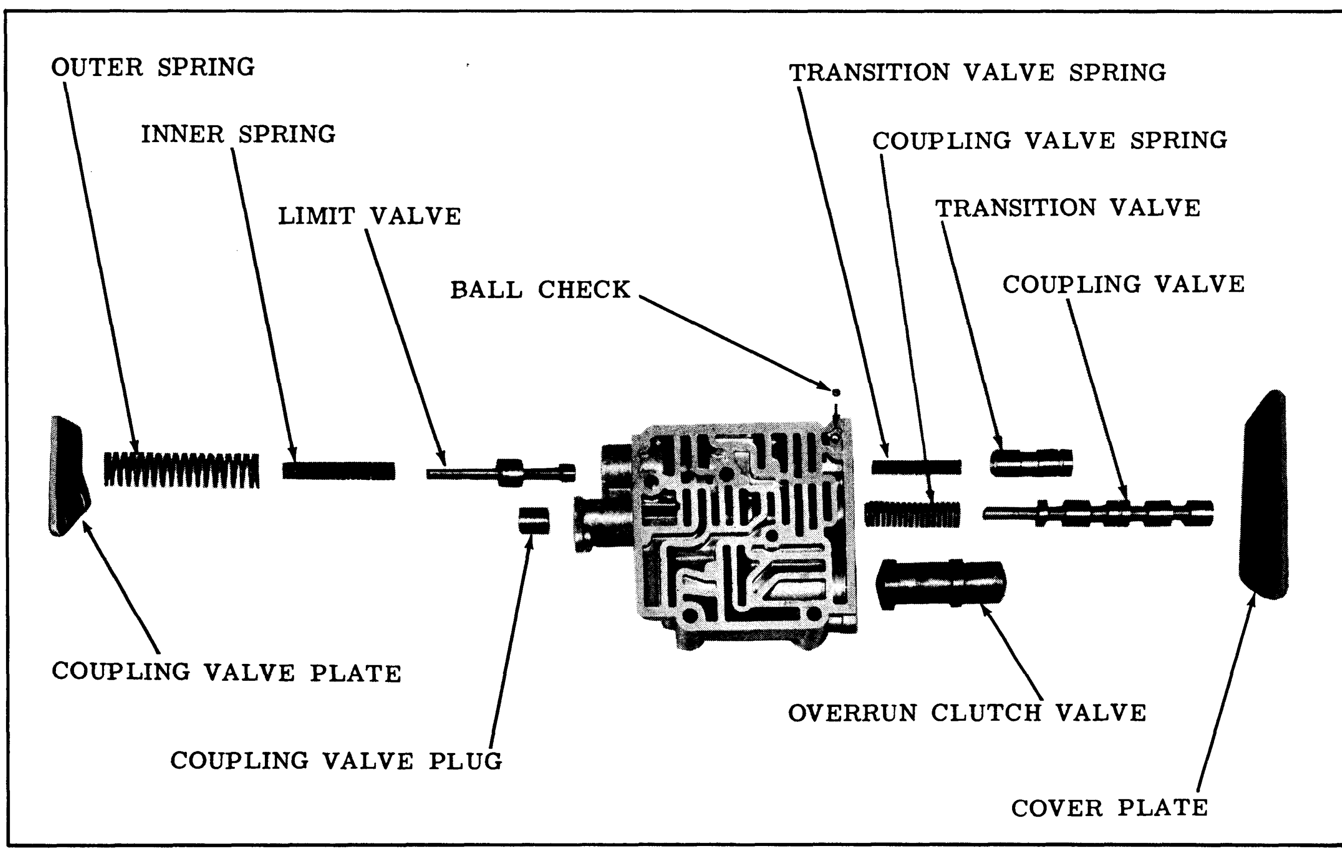


Fig. 3-117 Front Clutch Valve Body

the limit valve with the stem facing out.

7. Install the inner and outer limit valve springs.
8. Install the coupling valve spring.
9. Install the coupling valve plug.
10. Install the coupling valve plate with 2 screws while holding the plate to compress the limit valve springs.
11. Make sure outer spring is seated squarely on the plate.
12. Install ball check and retain with petrolatum.

DISASSEMBLY OF THE SHIFT VALVE BODY

1. Remove the 4 shift valve body attaching screws, then remove the shift valve body from the channel body. (See Fig. 3-118)
2. Remove the separator plate from the channel body.
3. Remove the spring and ball check from the channel body.
4. Remove the 4 governor valve end plate attaching screws, then remove the plate. (See Fig. 3-119)
5. Remove the 3-4 governor valve. (See Fig. 3-119)

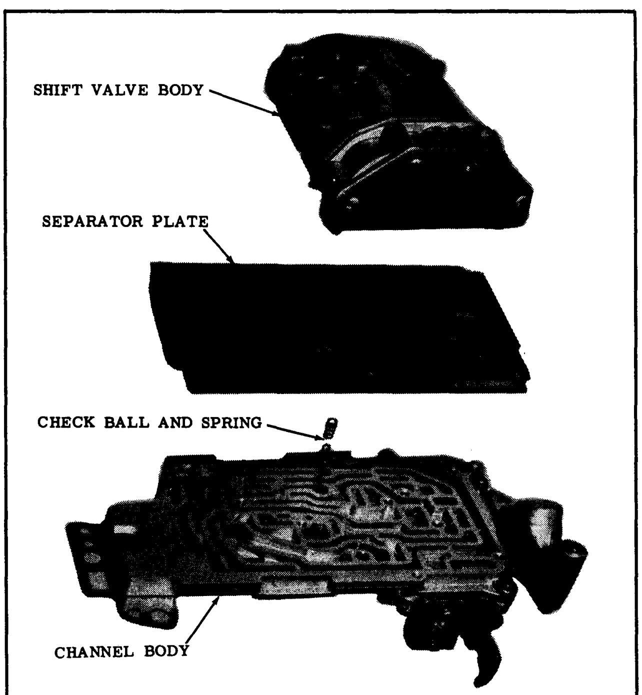


Fig. 3-118 Shift Valve Body Removal

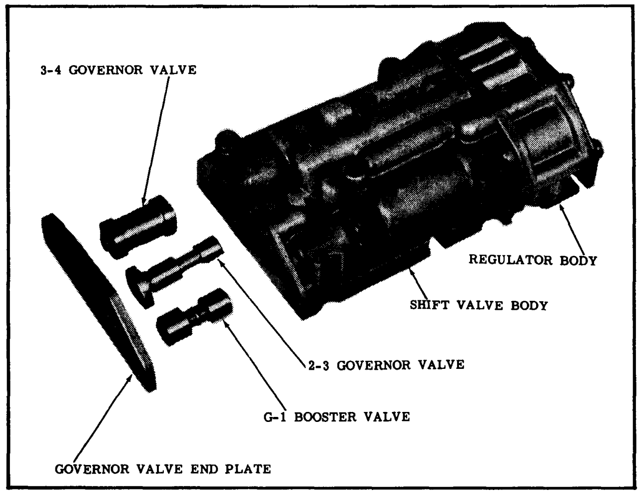


Fig. 3-119 End Plate & Valve Removal

6. Remove the 2-3 governor valve from the center bore.
7. Remove the G-1 booster valve.
8. Lay the valve body on a flat surface, and while holding the regulator body, remove the 4 attaching screws. (See Fig. 3-120)
9. Remove the regulator body from the valve body.
10. Remove the regulator body end plate.
11. Remove the 3-4 regulator valve from the regulator body.
12. Remove the 2-3 regulator valve from the regulator body center bore.
13. Remove the 3-4 shift valve spring (outer) and the 3-4 regulator spring (inner) from the shift valve body.
14. Remove the 2-3 shift valve spring

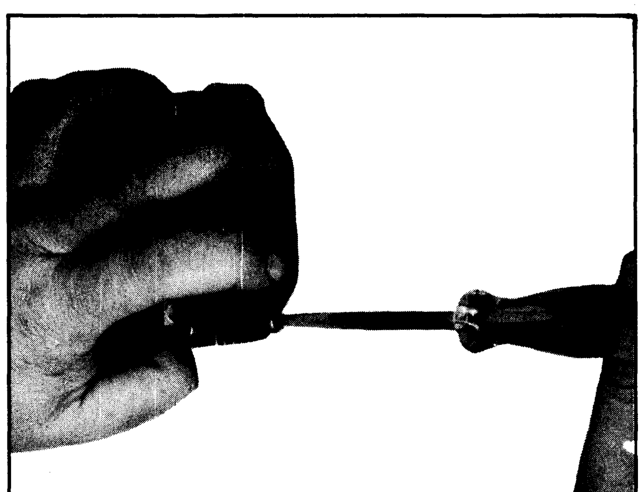


Fig. 3-120 Regulator Body Removal

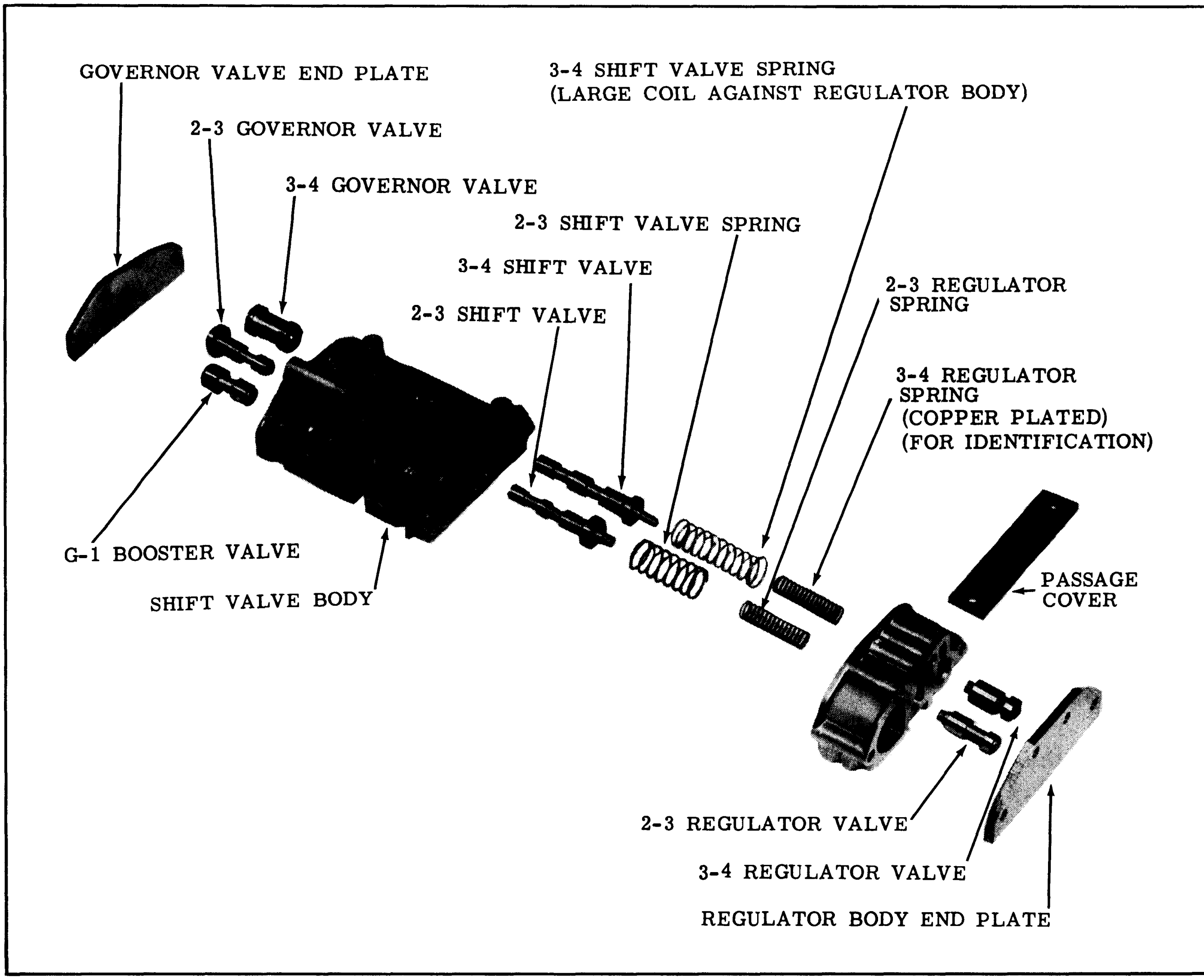


Fig. 3-121 Shift Valve Body

(outer) and the 2-3 regulator spring (inner) from the shift valve body.

15. Remove the 3-4 shift valve from the shift valve body.
16. Remove the 2-3 shift valve from the shift valve body.
17. Clean and inspect parts.

ASSEMBLY OF THE SHIFT VALVE BODY (FIG. 3-121)

1. Install the 2-3 shift valve into the center bore of the shift valve body.
2. Install the 3-4 shift valve into the shift valve body.
3. Install the 2-3 regulator valve spring (inner) and shift valve spring (outer) on the 2-3 shift valve.
4. Install the 3-4 regulator valve spring (inner-copper plated) and shift valve spring (outer) on the 3-4 shift valve.
5. Install the neutral clutch spring into the shift valve body.
6. Install the 3-4 regulator valve into the regulator body.
7. Install the 2-3 regulator valve into the regulator body center bore.
8. Position the regulator body end plate on the regulator body and insert 2 screws to hold the cover in alignment.
9. Install the neutral clutch valve in the regulator body.
10. Place valve body and regulator body on a flat surface and slide together while guiding springs into place. Then turn both screws in two turns.

Fig. 3-122 Installing Regulator Body

11. Hold valve body in a vertical position to make sure regulator springs are in place on regulator valves, and shift valve springs are seated on regulator body. (See Fig. 3-122)
12. Push the regulator body against the shift valve body and turn the 2 screws in to hold the assembly.
13. Install the 2 remaining screws and tighten all 4 evenly.
14. Install the 3-4 governor valve (large).
15. Install the 2-3 governor valve into the center bore.
16. Install the G-1 booster valve.
17. Install the governor valve end plate with 4 attaching screws.

DISASSEMBLY OF THE REVERSE BLOCKER (FIG. 3-123)

1. Remove the 2 reverse blocker body attaching screws. Then remove the reverse blocker assembly.
2. Depress the detent plunger. Then remove the retaining clip.
3. Remove the detent plunger and spring from the body.
4. Remove the spring from the detent plunger.
5. Remove the reverse blocker retaining pin.

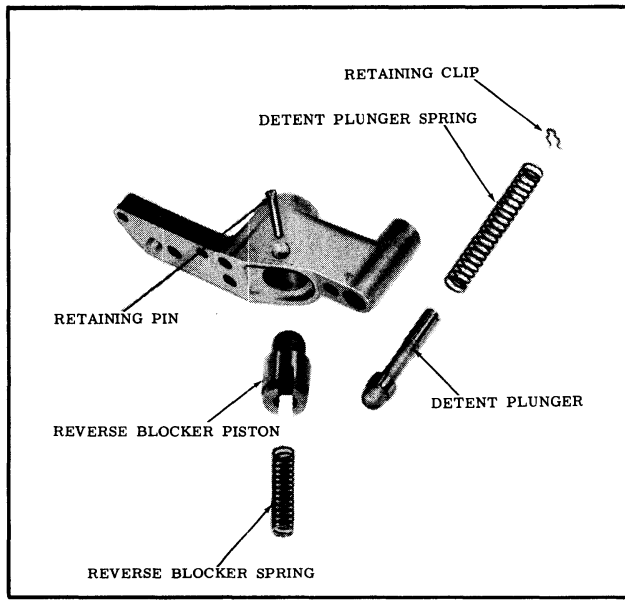


Fig. 3-123 Reverse Blocker

6. Remove the reverse blocker spring. Then remove the reverse blocker piston.
7. Clean and inspect parts.

ASSEMBLY OF THE REVERSE BLOCKER

1. Install the reverse blocker piston into the body with the spring bore out.
2. Install the reverse blocker spring into the piston.
3. Compress the spring with a screwdriver and install the retaining pin from the counterbored side of the body.
4. Install the detent plunger spring on the detent plunger.
5. Install the spring and detent plunger into the body.
6. Depress the detent plunger and install the retaining clip.

DISASSEMBLY OF THE MANUAL VALVE BODY (FIG. 3-124)

1. Remove the manual valve from the manual valve body.
2. Remove the 6 manual valve body attaching screws and remove the manual valve body from the channel body.

   CAUTION: Do not loosen T.V. lever stop pin locking screw. This is calibrated at the factory and NO attempt

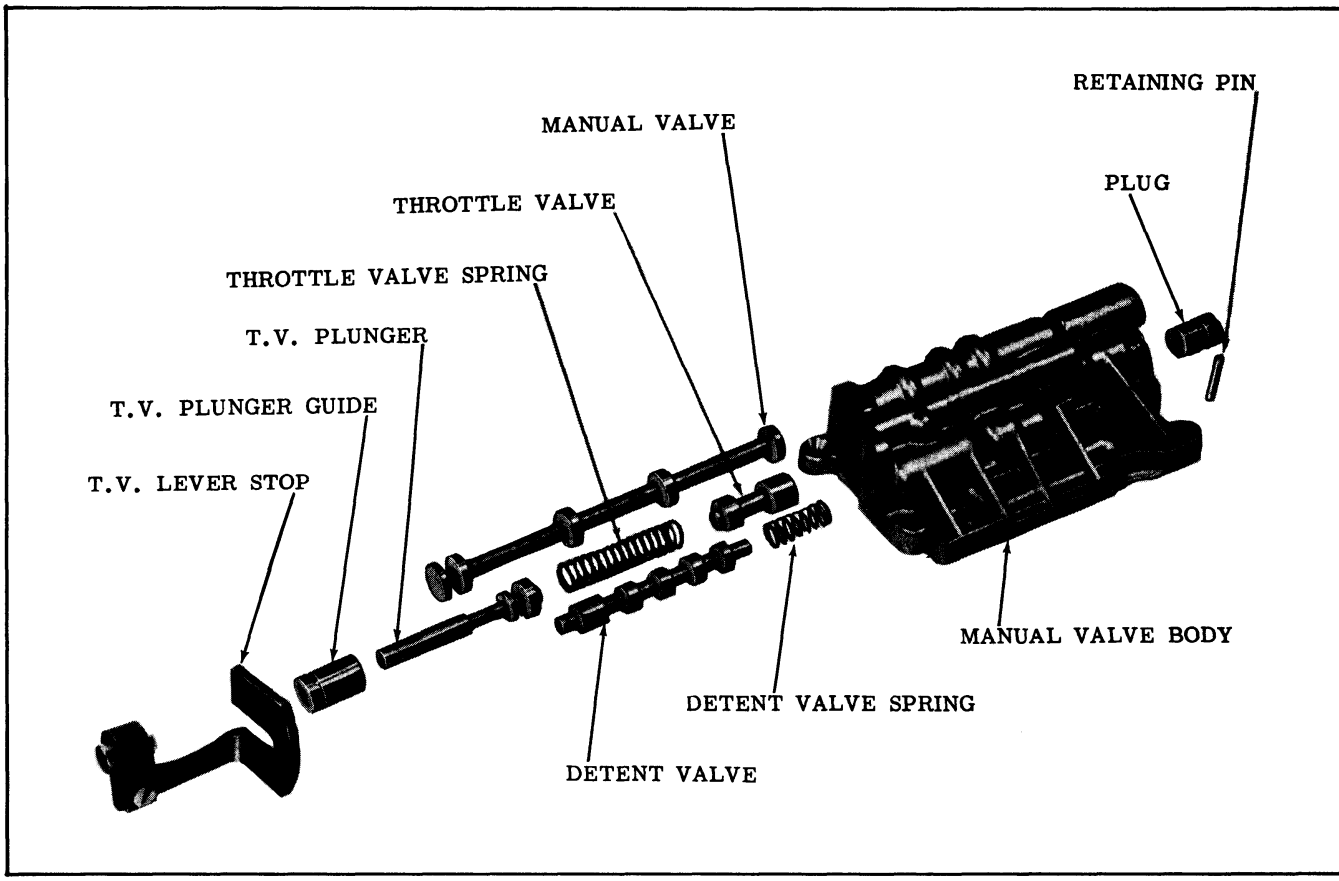


Fig. 3-124 Manual Valve Body

should be made to change the adjustment.

3. Remove the T.V. lever stop.
4. Remove the detent valve and spring from the body.
5. Remove the T.V. plunger and guide.
6. Remove the T.V. plunger from the guide.
7. Remove the T.V. spring.
8. Remove the throttle valve.
9. Remove the throttle valve plug retaining pin.
10. Remove the throttle valve plug.
11. Remove the separator plate from the channel body.

ASSEMBLY OF THE MANUAL VALVE BODY

1. Install the T.V. plug and retaining pin.
2. Install throttle valve with spring stem out. Make sure valve is seated on the plug.
3. Install the T.V. spring.
4. Install the T.V. plunger guide on the plunger.
5. Install the T.V. plunger and guide into valve body.
6. Install detent valve spring and detent valve with wide land out.
7. Push detent valve into valve body and install T.V. lever stop with the 2 attaching screws.

ASSEMBLY OF INDIVIDUAL VALVE BODIES TO THE CHANNEL BODY

1. Position the long separator plate on the check valve side of the channel body. (See Fig. 3-125)
2. Position the manual valve body on the separator plate and install the 6 attaching screws finger tight.
3. Turn the channel body over and position the reverse blocker body on the manual body end of the separator plate. Install the 2 attaching screws finger tight.

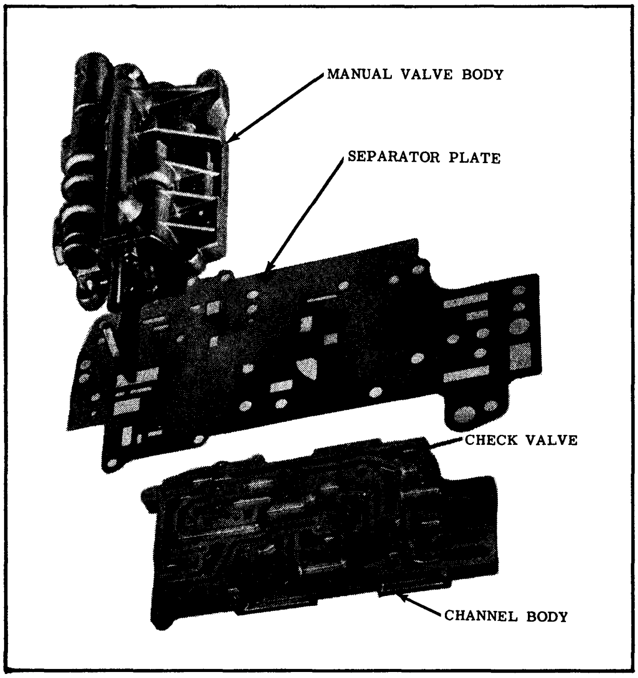


Fig. 3-125 Manual Valve Body Installation

4. Install the check ball and spring into the ball seat in the channel body. (See Fig. 3-126)
5. Position separator plate on the channel body.
6. Position the shift valve body on the separator plate and install the 4 attaching screws finger tight.

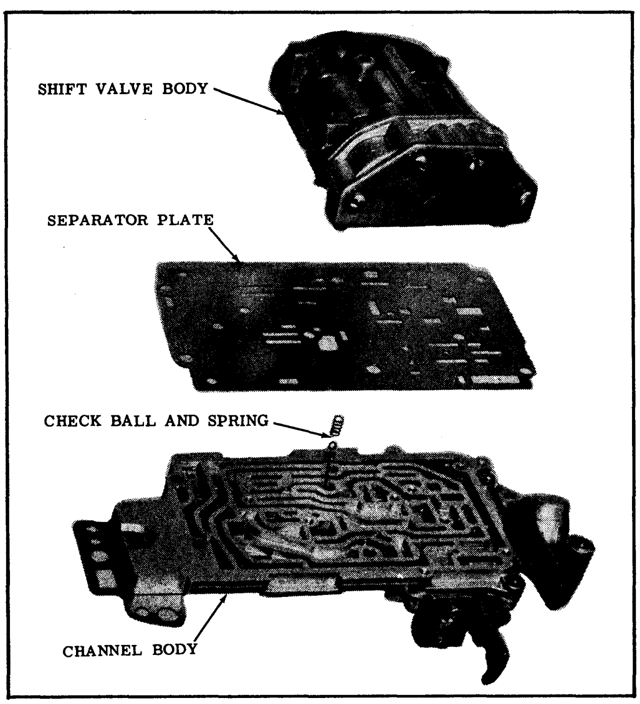


Fig. 3-126 Shift Valve Body Installation

7. Make sure the small check ball seats in the front clutch valve body.
8. Position the front clutch valve body on the separator plate and install the 2 attaching screws finger tight.
9. Use 4 valve body to case attaching bolts to align channel body, separator plates and valve bodies.
10. Tighten all valve body attaching screws. (Total 14)
11. Install manual valve in the shift valve body.

DRIVEN TORUS DISASSEMBLY

1. Remove the cotter pin from hub of the driven torus.
2. Remove the torus check valve and spring. (See Fig. 3-127)
3. Clean and inspect parts.

ASSEMBLY OF THE DRIVEN TORUS

1. Apply petrolatum on the spring, then install the spring into the check valve.
2. Install valve into the driven torus, spring first.
3. Install cotter pin to retain the valve.

DRIVE TORUS

The drive torus requires no service other than replacement when damaged.

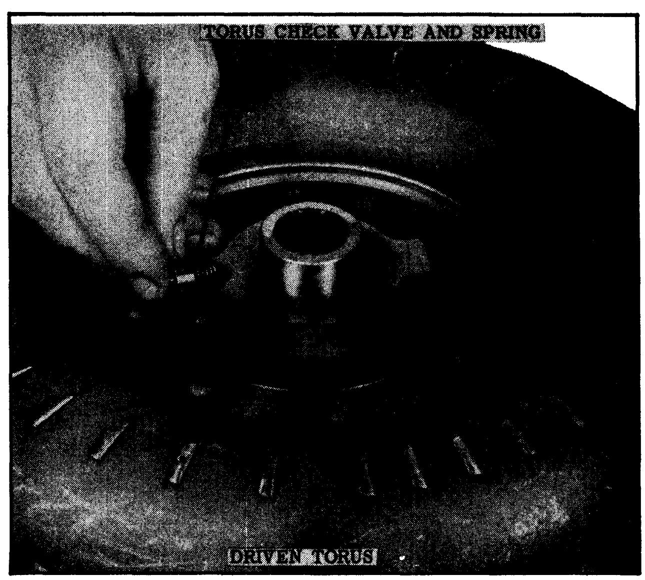


Fig. 3-127 Driven Torus Check Valve

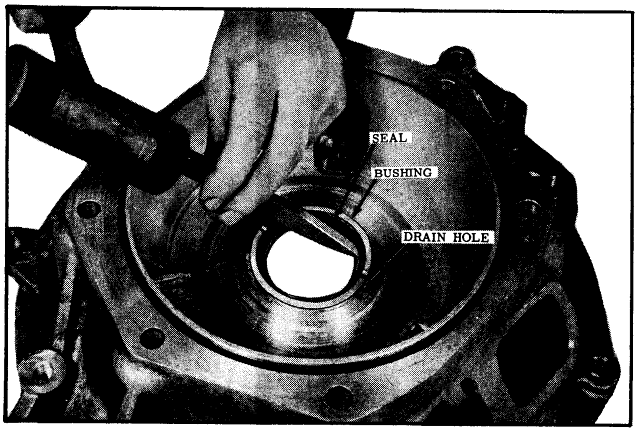


Fig. 3-128 Flywheel Housing Seal Removal

FLYWHEEL HOUSING

Flywheel Housing Seal Removal (FIG. 3-128)

1. Place a blunt chisel behind the lip of the seal and drive the seal out of the housing.

CAUTION: Do not damage the bushing in the housing.

Flywheel Housing Seal Installation

1. Place a new seal (lip down) on housing.
   NOTE: Sealer is not required since the seal material covers the edge of the seal and will contact the housing when driven into place.
2. Inspect seal installing Tool J-6118 for nicks or sharp edges that might damage the lip of the seal. A hone can be used to clean up any sharp edges on the tool.
3. Place seal installing Tool J-6118 into seal and drive seal into place. (See Fig. 3-129). Remove tool from seal.
4. Support the center of the flywheel housing on a wood block (approximately 4" x 4" x 4") and stake seal into place with a center punch. (See Fig. 3-130)
   NOTE: 4 evenly spaced punch marks will be sufficient.

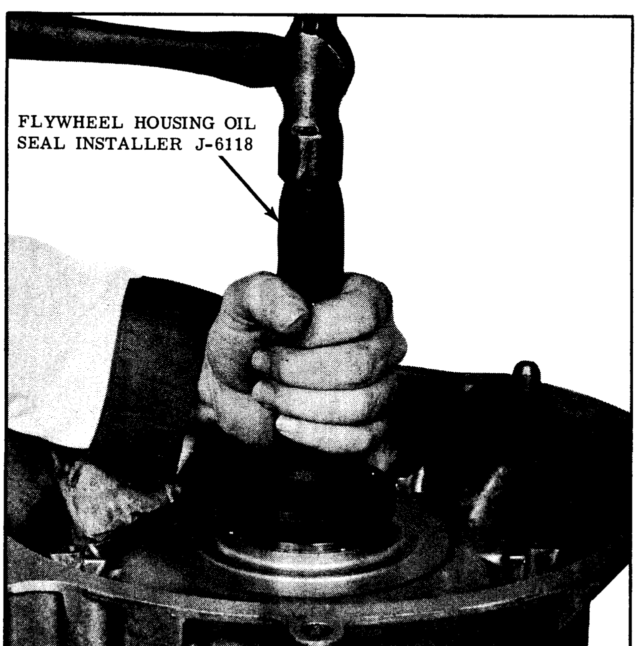


Fig. 3-129 Seal Installation

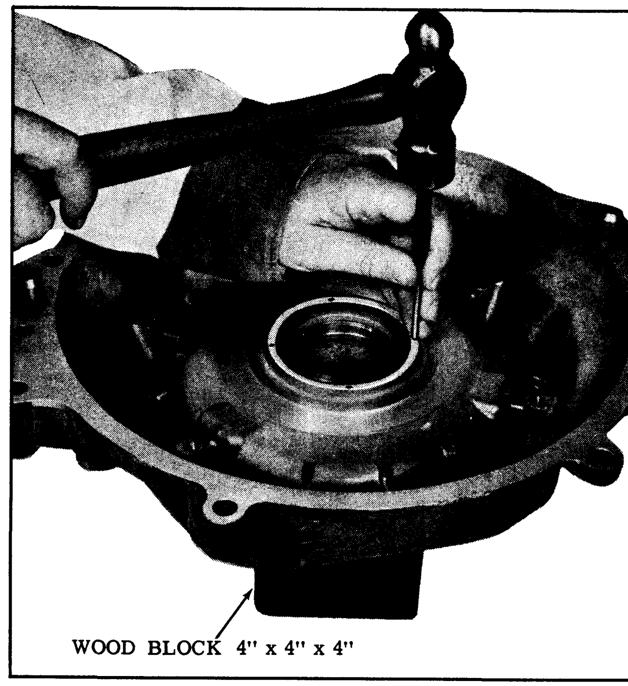


Fig. 3-130 Staking Housing to Retain Seal

FLYWHEEL

The flywheel requires no service other than replacement when necessary.

ASSEMBLY OF THE TRANSMISSION

REVERSE UNIT AND REAR OIL PUMP

1. Install reverse planet carrier on the output shaft. Lifting up on the output

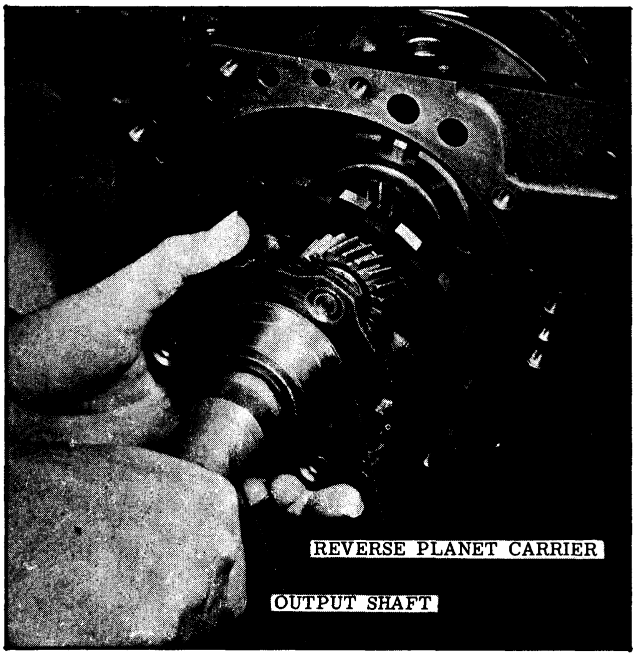


Fig. 3-131 Installing Reverse Planet Carrier

shaft will allow planet pinions to engage with the reverse sun gear. (See Fig. 3-131)

2. Install reverse carrier snap ring on the output shaft.
3. Install reverse stationary cone lock in the transmission case and retain with petrolatum. (See Fig. 3-132)
4. Install reverse stationary cone in the case. Make sure cone seats on the shoulder in the case.
5. Install reverse clutch release spring

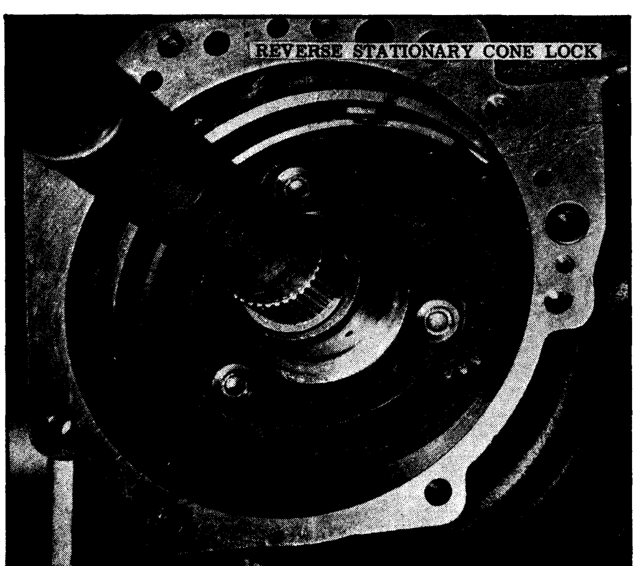


Fig. 3-132 Reverse Stationary Cone Lock

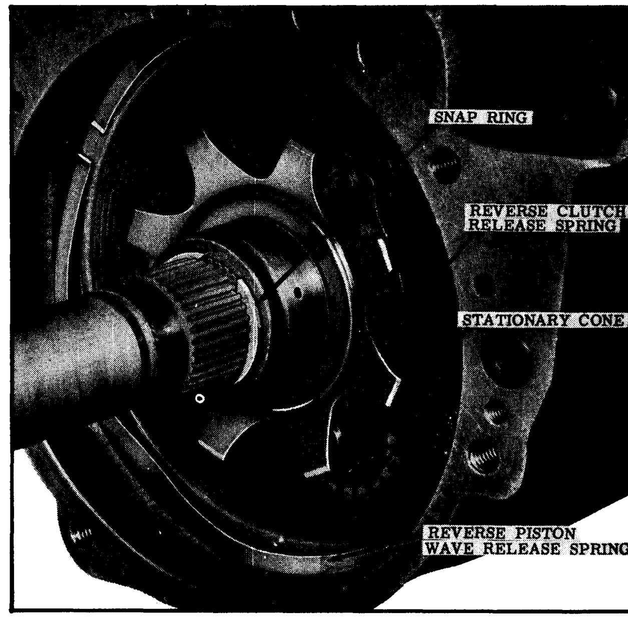


Fig. 3-133 Reverse Release Springs

over the output shaft and against reverse carrier with fingers out. (See Fig. 3-133)

6. Install reverse piston wave release spring.
7. Install the reverse internal gear by turning to engage planet pinions. (See Fig. 3-134)
8. Install thrust washer on reverse internal gear.
9. Install gasket on rear pump and retain with petrolatum.
10. Install rear pump assembly on transmission case. Install locating screw and attaching bolt. (See Fig. 3-135)

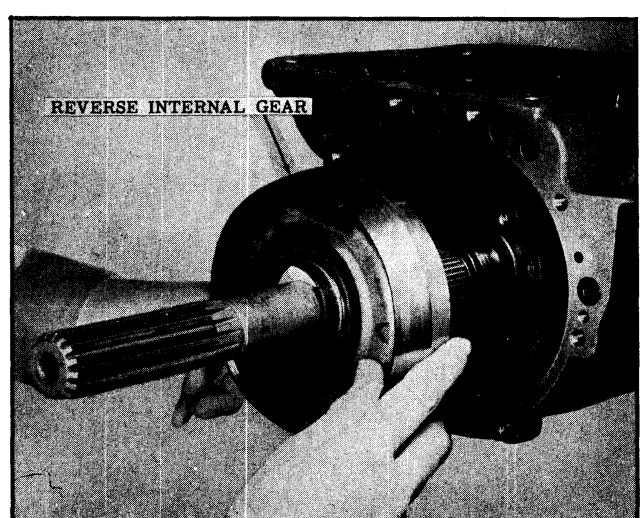


Fig. 3-134 Installing Reverse Internal Gear.

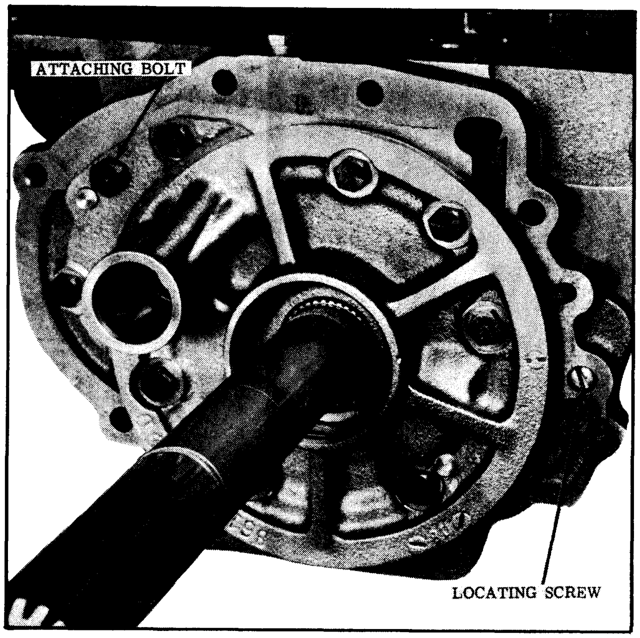


Fig. 3-135 Rear Oil Pump

NOTE: Pump should be held against the case until locating screw and attaching bolt are tightened.

11. Loosen Tool J-6135, then install rear bearing on output shaft with rear bearing installing Tool J-6133. (See Fig. 3-136)
12. Install rear bearing retaining ring into the rear pump. (See Fig. 3-137)
13. Install rear bearing snap ring on the output shaft. (See Fig. 3-137)
14. Install breather pipe in rear pump. Then install clamp screw.

Fig. 3-136 Installing Rear Bearing

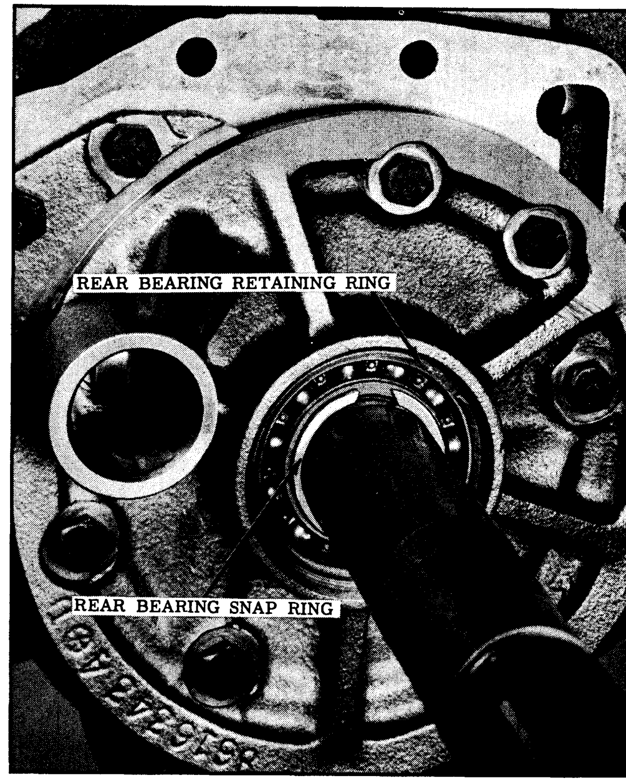


Fig. 3-137 Snap Rings Installed

CHECK MAIN SHAFT END PLAY

1. Remove collar from Tool J-6127 and install on mainshaft. (See Fig. 3-138)
2. Install Tru-arc ring on mainshaft then install body of Tool J-6127 and tighten.
3. Install Tool J-6126 on front of transmission and install dial indicator. (See Fig. 3-139)

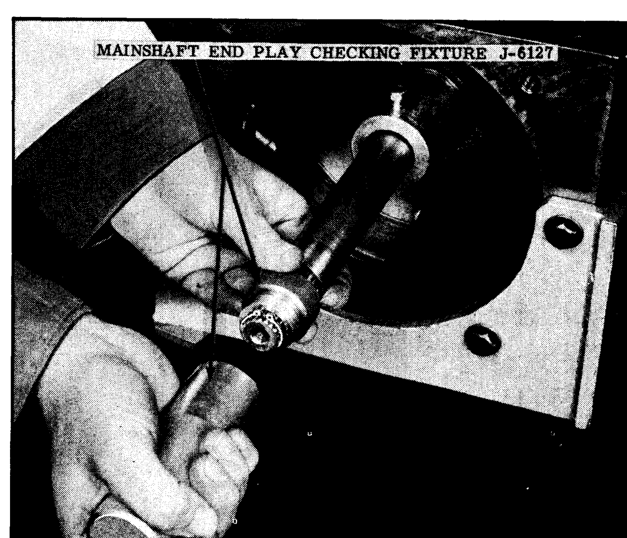


Fig. 3-138 Mainshaft End Play Tools

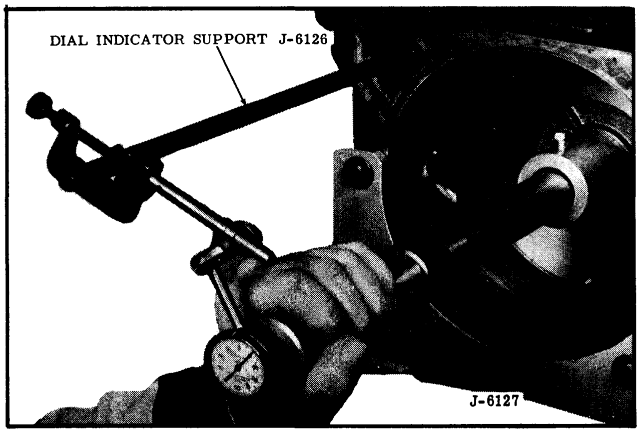


Fig. 3-139 Checking Mainshaft End Play

4. Check mainshaft end play. If not within .004" to .018" the selective washer in the reverse drive flange is incorrect and will need to be changed.
5. Remove tools from the transmission.

REVERSE UNIT AND REAR OIL PUMP

1. Install the speedometer drive gear on the output shaft with Tool J-6133 and use gauge J-6133-4 to locate gear on the shaft. (See Fig. 3-140)
2. Install governor into rear pump with the ring gaps on top, and lubricate rings with Hydra-Matic oil.
3. Turn output shaft to make sure governor and drive key are engaged.

Fig. 3-140 Installing Speedometer Drive Gear

4. Install a new "O" ring on the output shaft.
5. Install a new rear extension housing gasket on the rear oil pump and retain with petrolatum.
6. Install the extension housing and the 8 attaching bolts. Torque 25 to 30 ft. lbs.
7. Apply seal lubricant Pt. No. 563598 to the sealing lip of a new rear seal.
8. Apply a light coat of Gasoila or Aviation Form-A-Gasket Cement to the outer diameter of the seal.
9. Install seal into the extension housing using rear seal installing Tool J-5154. (See Fig. 3-141)
10. Install breather tube into rear pump and install attaching screw into transmission case.

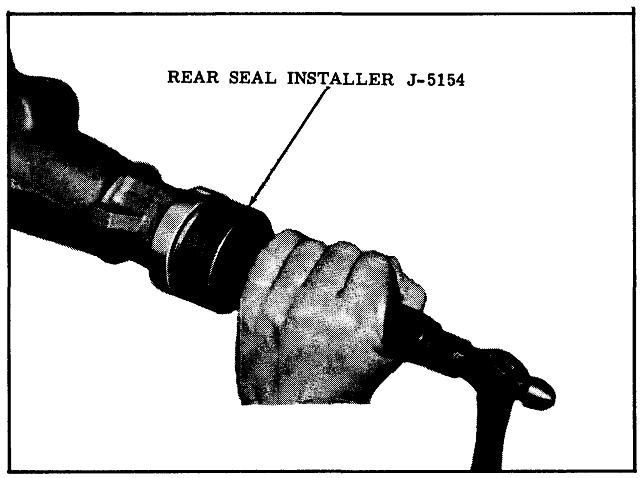


Fig. 3-141 Installing Seal

OVERRUN CLUTCH AND FRONT PUMP

1. Turn transmission so that the intermediate shaft is up.
2. Remove Tool J-6135 from the intermediate shaft.
3. Install the overrun clutch plate and the bronze washer, with lugs up, over the intermediate shaft. Align lugs on washer with lugs on plate. (See Fig. 3-142)
4. Remove the front sprag inner race from the front pump.
5. Install the front sprag inner race so that the drive lugs engage with the overrun clutch lugs and the bronze

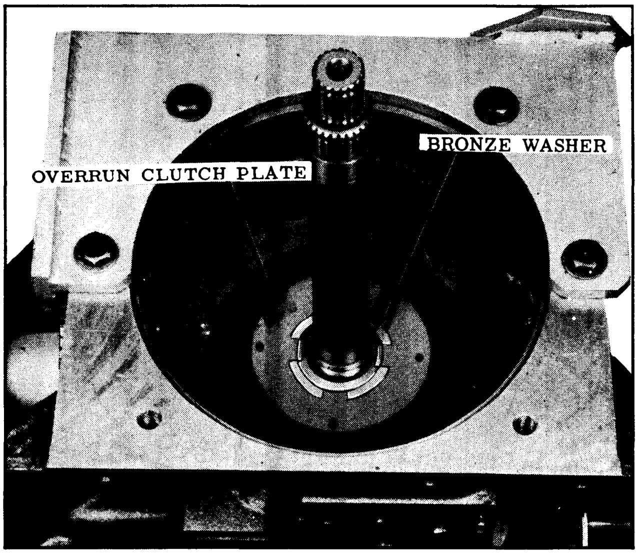


Fig. 3-142 Clutch Plate & Bronze Washer Installation

washer. Center the race around the intermediate shaft. (See Fig. 3-143)

6. Install the overrun clutch wave release spring. (See Fig. 3-143)
7. Lubricate locktype oil ring on intermediate shaft with Hydra-Matic oil.
8. Install Tools J-6125 into front pump and install pump into case with intake pipe hole aligned with hole in the case. (See Fig. 3-144)

   NOTE: If the sprags will not go down over the sprag inner race a slight turn of the pump counterclockwise will permit the pump to drop into place.

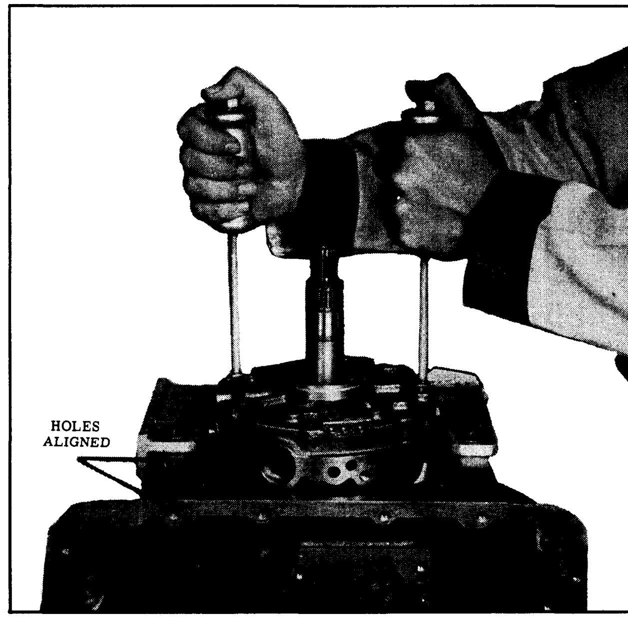


Fig. 3-144 Installing Front Pump

9. Install the 3 front pump to case support attaching bolts and tighten. Then back off approximately 1/4 turn. Do not torque tighten until after locating screw has been installed and tightened. Remove slide hammers.
10. Install the 2 front pump cover attaching bolts.
11. Torque the 4 front pump cover attaching bolts 15 to 18 ft. lbs.
12. Install the 2 oil cooler sleeves with "O" rings facing into the pump.

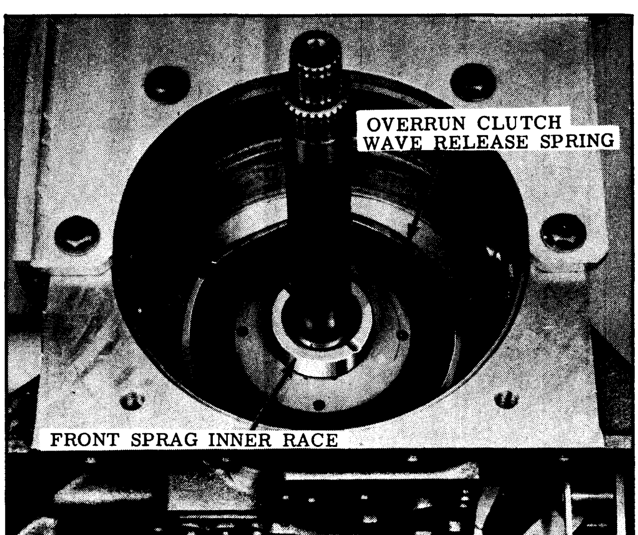


Fig. 3-143 Front Sprag Inner Race

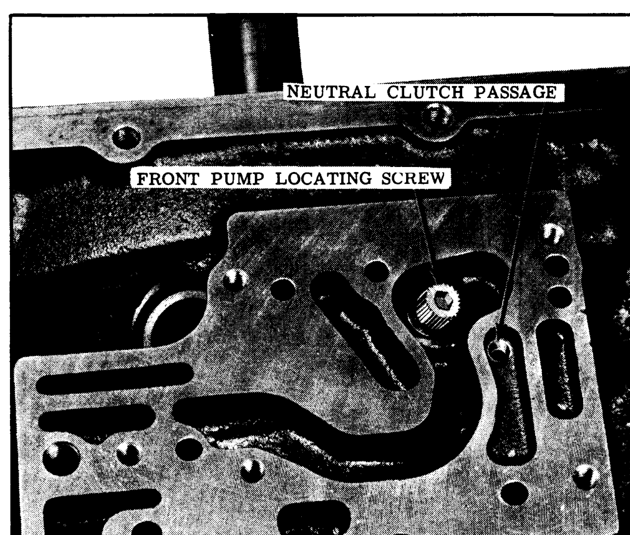


Fig. 3-145 Front Pump Locating Screw

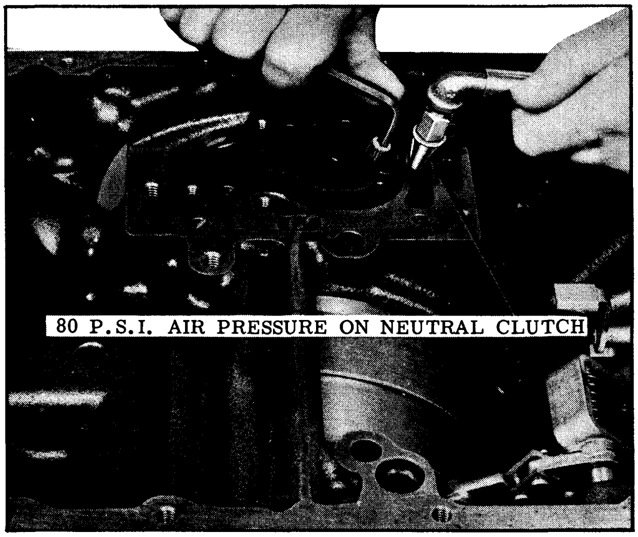


Fig. 3-146 Tightening Front Pump Locating Screw

13. Install adapter gasket and adapter with the 2 bolts and copper washers. Torque 15 to 18 ft. lbs.
14. Turn transmission to a horizontal position.
15. Install front pump locating screw and lock washer finger tight. (See Fig. 3-145)
16. While applying approximately 80 P.S.I. air pressure to the neutral clutch passage, tighten front pump locating screw. (See Fig. 3-146). Torque 10 to 13 ft. lbs.

    NOTE: Air pressure on the neutral clutch will properly position front pump and neutral clutch with oil passages in the case. This is necessary to prevent an internal oil leak at this point. The pump mounting bolts were left loose so that the locating screw would draw the pump toward the case.
17. Torque the 3 front pump to case support attaching bolts 20 to 25 ft. lbs.
18. Install front pump pressure regulator valve and spring.
19. Install the pressure regulator plug into the case. Torque 3 to 6 ft. lbs.

MAIN OIL CONTROL VALVE ASSEMBLY, SERVO AND ACCUMULATOR

1. Position the oil control valve body on the case with the throttle lever between the T.V. plunger and the stop, and the shift lever pin engaged with the manual valve. (See Fig. 3-147)

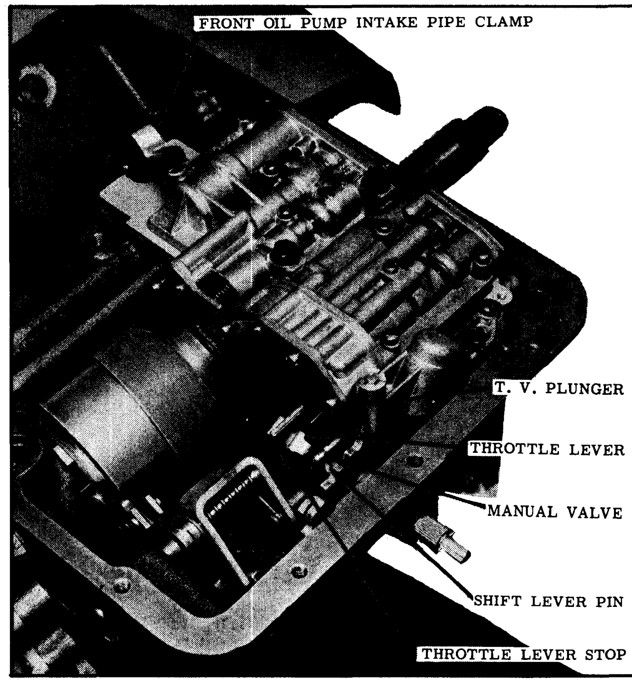


Fig. 3-147 Main Oil Control Valve Body Installation

2. Install the 6 attaching bolts finger tight.
3. Position the low band release spring on the servo piston. Then install the servo and accumulator assembly with 3 attaching bolts. (See Fig. 3-148) Torque bolts 23 to 28 ft. lbs.

   NOTE: Make sure release spring is centered around servo piston stem.

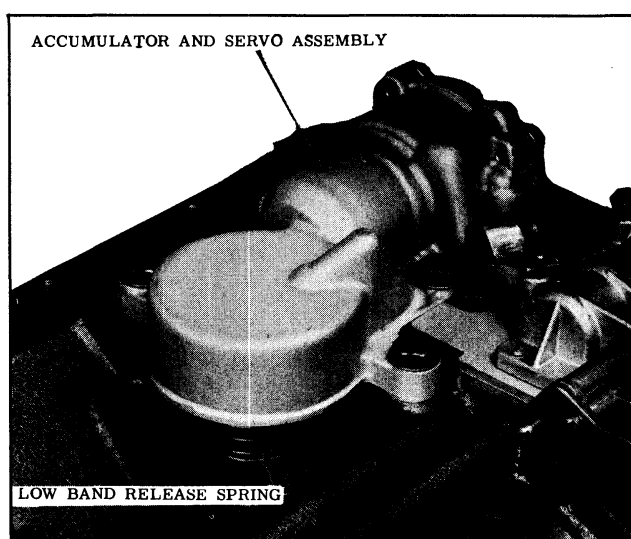


Fig. 3-148 Accumulator & Servo Installation

4. Torque main oil control valve body attaching bolts 6 to 8 ft. lbs., except the one with the front pump pipe clamp.
5. Install a new front pump intake pipe "O" ring into the front pump and lubricate with Hydra-Matic oil.
6. Install the front pump intake pipe into the front pump and under the clamp. Torque clamp bolt 6 to 8 ft. lbs.
7. Install a new rear pump intake pipe "O" ring into the case and lubricate with Hydra-Matic oil.
8. Install rear pump intake pipe into the screen. Then install the screen on the front pump intake pipe and push rear pump intake pipe into the case.
9. Install oil pan gasket, oil pan and attaching bolts.

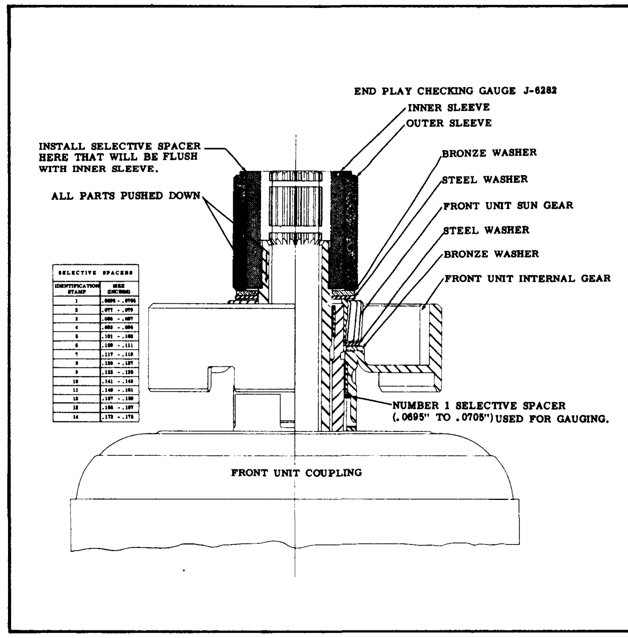


Fig. 3-149 Front Unit End Play

FRONT UNIT END PLAY

To control end play of the front unit a selective spacer is used on the front unit coupling driven shaft. The spacer is between the front unit coupling drive torus hub and the front unit internal gear.

The following method is used to determine the proper selective spacer to use.

1. Turn transmission so that the intermediate shaft is up.
2. Install front unit coupling with drive lugs down. Turn driven torus shaft counter-clockwise until lugs engage with front sprag inner race. When lugs are engaged the shaft cannot be turned counter-clockwise.
3. Turn front unit coupling until lugs on cover hub engage with front pump rotor.
4. Place a No. 1 selective spacer (.0695" to .0705") on driven torus shaft. (See Fig. 3-149) This will be used as a gauge spacer.
5. Install front unit internal gear and bronze thrust washer (with 2 lugs).
6. Install steel spacer (splined to shaft) against bronze thrust washer in internal gear.
7. Install front unit sun gear.
8. Install steel washer, then the bronze washer.
9. Push on intermediate shaft and front unit sun gear bronze washer to make sure all parts are down as far as possible.
10. Install front unit end play checking gauge J-6282, splined end down.
11. Push down on inner and outer sleeves of gauge to make sure gauge is seated.

There are 14 selective spacers available and are marked 1 through 14. There is a variation in thickness of .002" in spacers with the same number, and a variation of .006" to .010" in spacers of consecutive numbers.

12. Select a spacer that will be flush with inner sleeve of gauge when installed on outer sleeve.

The number 1 selective spacer used to properly position the parts for gauging will be replaced by the spacer determined by the gauge when assembling the transmission.

13. Remove selective spacer from top of gauge and save to be used when assembling the transmission.
14. Remove the gauge, bronze washer, steel washer, sun gear, steel washer, internal gear and bronze washer from the transmission.
15. Remove the No. 1 selective spacer used for gauging.
16. Lift the front unit coupling from the transmission.

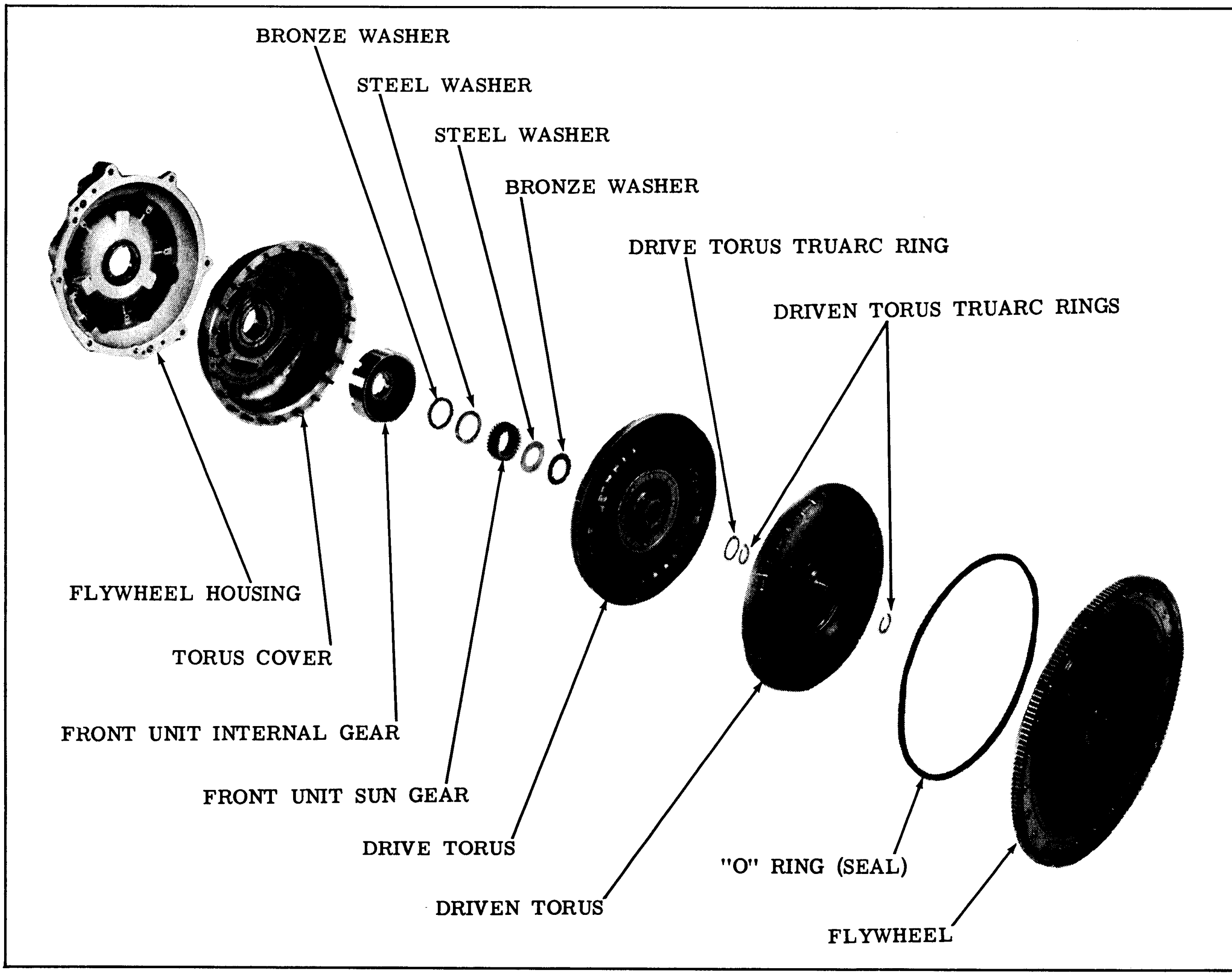


Fig. 3-150 Torus Assembly

FLYWHEEL HOUSING TORUS COVER, TORUS MEMBERS AND FLYWHEEL (FIG. 3-150)

1. Remove the transmission and holding fixture from the mounting fixture and place the assembly on the bench.
2. Remove the holding fixture from the transmission.
3. Install front unit coupling by turning driven torus shaft counter-clockwise to engage drive lugs in front sprag. Turn front unit coupling to engage lugs with the pump rotor.
4. Install seal and bushing protector Tool J-6119 over the shafts on the front of the transmission.
5. Install a new flywheel housing "O" ring on the housing. Make sure "O" ring is seated in the groove. (See Fig. 3-151)
6. Install flywheel housing with the 6

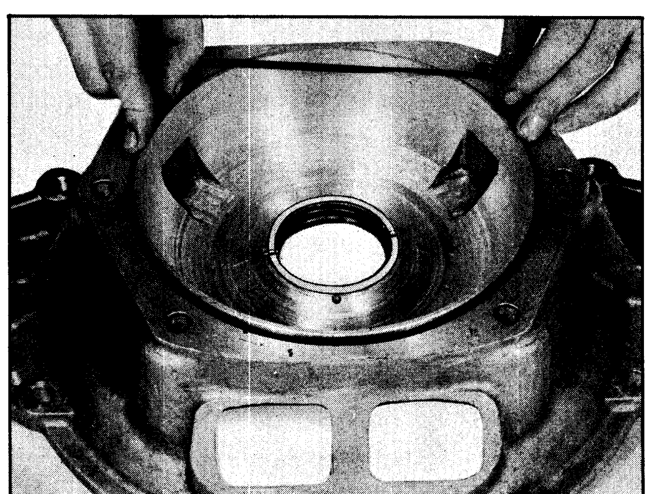


Fig. 3-151 Installing "O" Ring

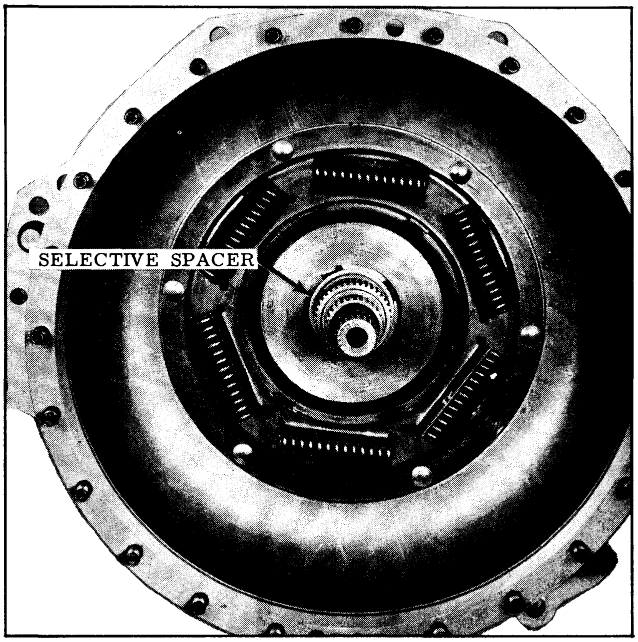


Fig. 3-152 Selective Spacer

attaching bolts and washers. Tighten evenly and torque 40 to 50 ft. lbs.

7. Remove the seal and bushing protector Tool J-6119.
8. Lubricate hub of torus cover with seal lubricant 567196. Then install the cover using care to prevent damage to the seal.
9. Install the selective spacer, determined by the gauge, on the front unit coupling shaft. (See Fig. 3-152)
10. Install internal gear into the torus cover, indexing with the drive lugs. (See Fig. 3-153)
11. Install bronze washer in internal gear, and install steel washer (splined to shaft) and front unit sun gear.
12. Install steel washer against the sun gear. Then install the bronze washer.
13. Install drive torus on the intermediate shaft, and turn to engage planet pinions.
14. Install Tru-arc ring on the intermediate shaft.
15. Install Tru-arc ring in second groove on the mainshaft.
16. Install driven torus on mainshaft, lifting up to prevent damage to the bushing in the torus member.
17. Install Tru-arc ring on the mainshaft.
18. Install a new "O" ring on the flywheel on outside of retainer. Make sure "O" ring is not twisted.
19. Install flywheel on torus cover with 20 attaching nuts. Tighten evenly, then torque 20 to 25 ft. lbs.

   NOTE: 4 flywheel bolts evenly spaced are for mounting flywheel to flexplate on back of the crankshaft.

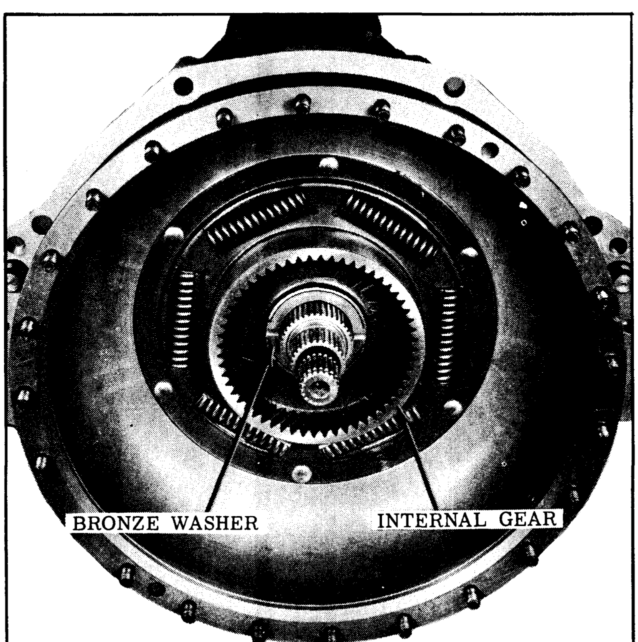


Fig. 3-153 Internal Gear & Bronze Washer Installation

SERVICING THE OIL COOLER

In the event of a major transmission failure, where particles of metal have been carried with the oil throughout the units of the transmission, it will be necessary to flush out the oil cooler and connecting tubes. The oil cooler is located in the radiator lower tank. (See Fig. 3-154) It is a sealed container providing a passage for oil to flow from the inlet to the outlet. Carbon tetrachloride or clean solvent can be flushed through the cooler with air pressure. (An engine de-sludge gun may be used). The cooler should be back-flushed first through the return tube to remove all foreign material possible. Then flush through the inlet tube and finish by flushing through the return tube. Clean remaining solvent from cooler with compressed air applied to the return hose and flush with Hydra-Matic oil.

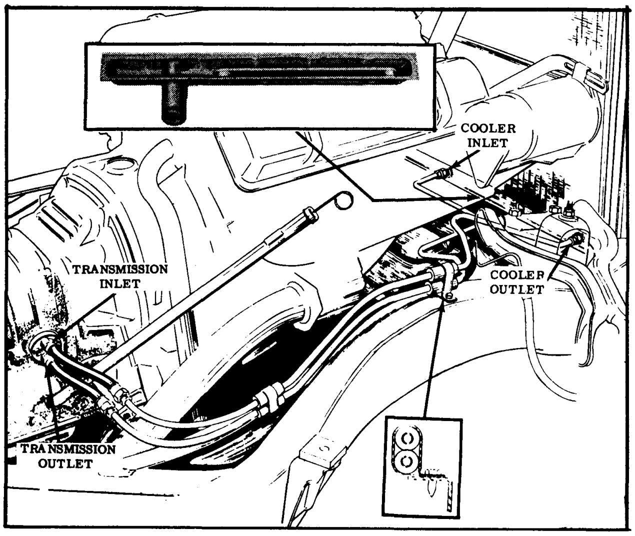


Fig. 3-154 Oil Cooler Details

MINOR SERVICE ADJUSTMENTS

THROTTLE CONTROL ADJUSTMENT (FIG. 3-155)

NOTE: Because of the split throttle lever design of the 1956 carburetors, changing the slow idle speed setting will not affect the adjustment of the throttle linkage, however it will affect the adjustment of the throttle return check.

ADJUST THROTTLE RETURN CHECK

1. With transmission in neutral and engine at normal operating temperature, set carburetor on fast idle and adjust to 1500 R.P.M.

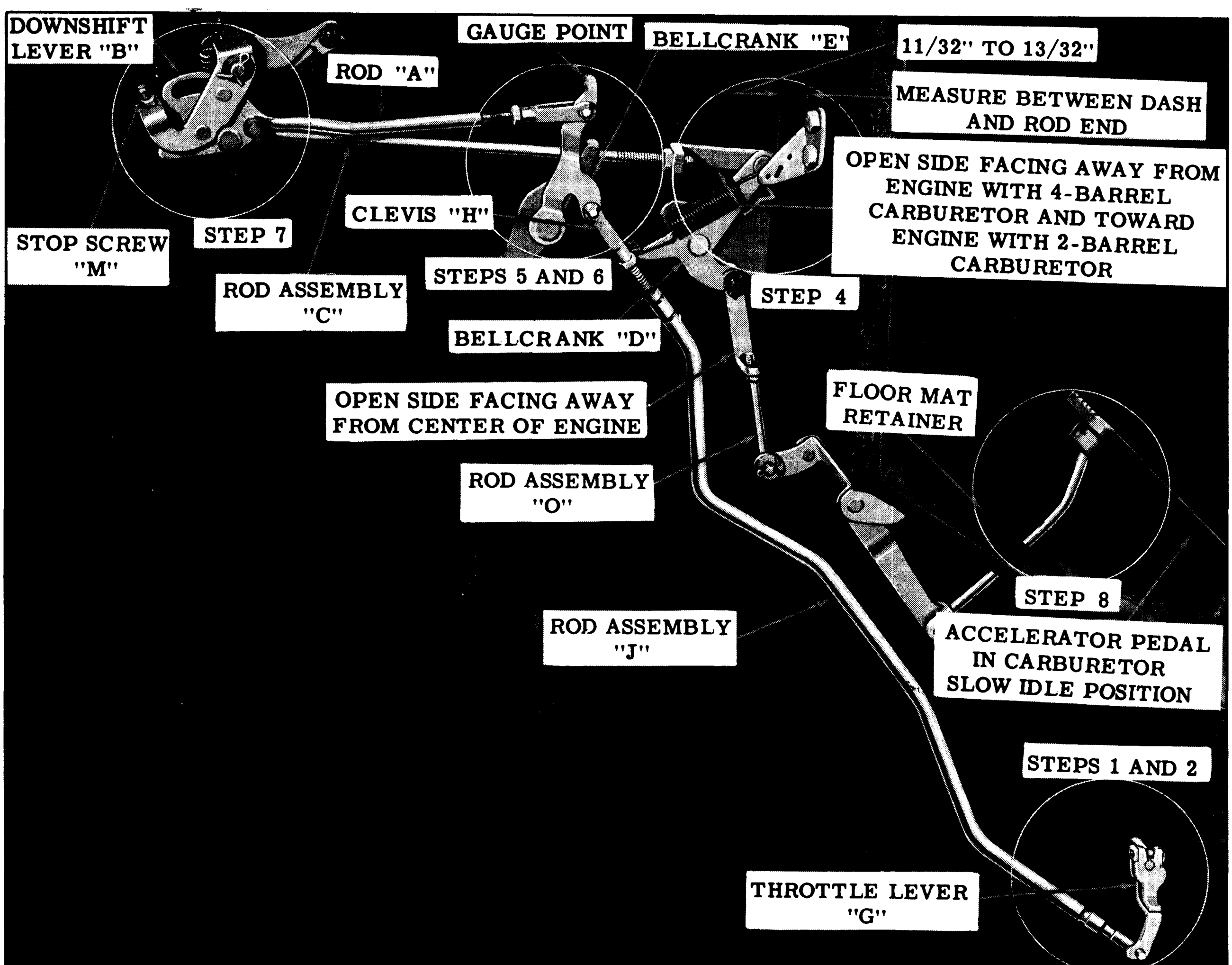


Fig. 3-155 Throttle Linkage Adjustments

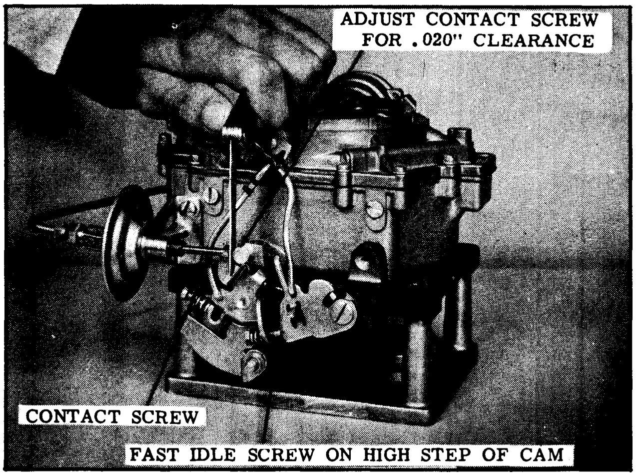


Fig. 3-156 Adjusting Throttle Return Check

2. Flash throttle and allow to return to slow idle. Then turn off ignition switch.
3. Set carburetor on fast idle and check clearance between throttle return check plunger and throttle lever. (See Fig. 3-156) Adjust to .020" using two wrenches so that diaphragm is not permitted to turn.
4. Set carburetor on slow idle and install throttle return check holding Tool J-6342 to hold plunger away from throttle lever. (See Fig. 3-157)

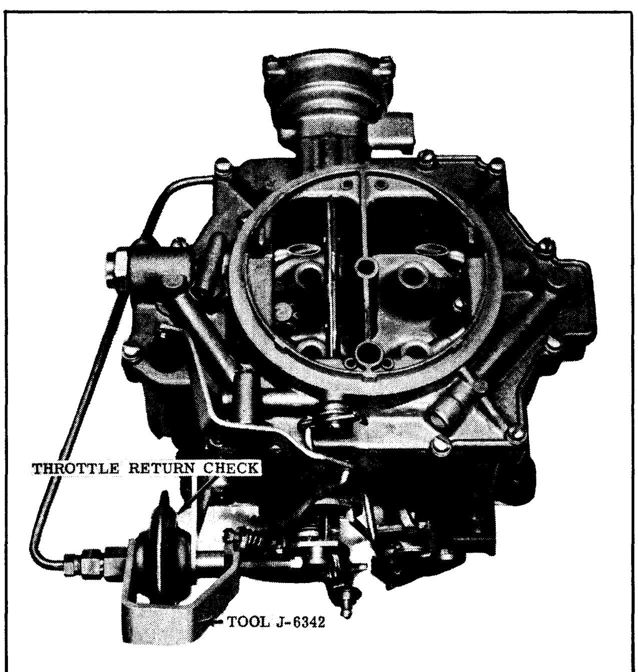


Fig. 3-157 Throttle Return Check Holding Tool

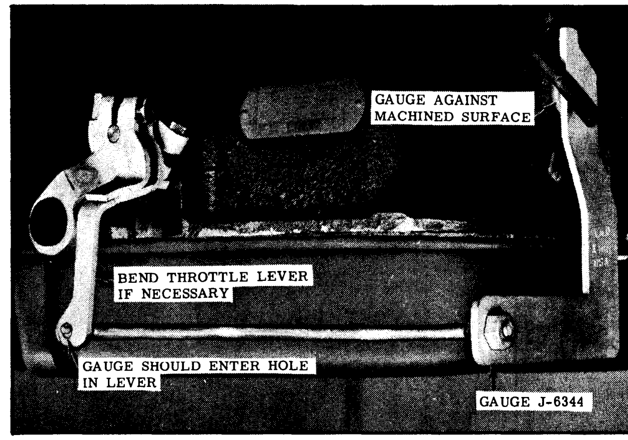


Fig. 3-158 Throttle Lever Adjustment

ADJUST THROTTLE LEVER ON SIDE OF TRANSMISSION (FIG. 3-158)

1. Remove clip and throttle rod "J" from throttle lever "G" on side of the transmission.
2. Hold throttle lever toward rear of transmission.
3. With throttle lever gauge J-6344 on machined surface on rear of transmission, rod should enter hole in throttle lever.
4. Use throttle lever bending Tool J-2029 to adjust throttle lever if necessary.

ADJUST THROTTLE ROD (Carburetor to Bellcrank on Dash)

1. With carburetor on slow idle adjust clevis to 3/8" clearance between rod assembly "C" and dash, if clearance is outside of 11/32" to 13/32".

ADJUST T.V. ROD (Transmission to Bellcrank on Cylinder Head)

1. Loosen jam nuts and remove both clevis pins and rods from bellcrank on rear of cylinder head.
2. With bellcrank held against the stop and T.V. rod pushed back against the stop, adjust clevis so that pin will enter freely into holes in clevis and bellcrank. (See Fig. 3-159)

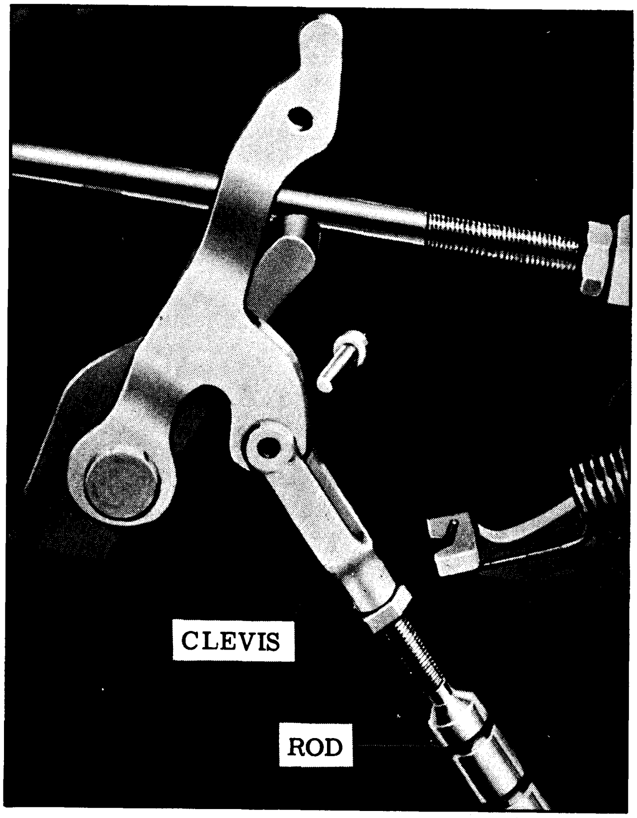


Fig. 3-159 Adjusting T.V. Rod

3. Install cotter pin and tighten jam nut. Bellcrank should still be against the stop. (If it is away from the stop the T.V. rod is adjusted too long.)
4. Adjust the short rod from the carburetor "A" so that the clevis pin just touches the gauge point on the bellcrank, or is one half turn short.

   NOTE: Throttle rod should be pulled lightly toward rear of engine to remove slack and bellcrank should be against the stop when adjustment is made. (See Fig. 3-160)
5. Install clevis pin and cotter pin and tighten jam nut.

THROTTLE STOP SCREW ADJUSTMENT (FIG. 3-161)

1. Hold choke wide open and pull forward on bellcrank on dash "D" until throttle is wide open. Then go beyond to the point of maximum transmission lever travel. This point is a matter of feel and care must be taken not to bend or stretch the linkage beyond the actual

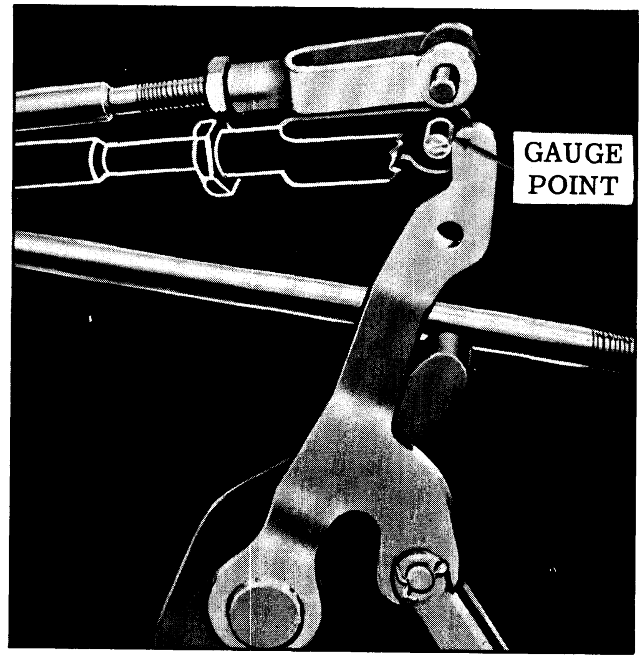


Fig. 3-160 Adjusting Carburetor Throttle Rod

point of maximum transmission lever travel.
2. With throttle held in this position adjust stop screw "M" to just touch the tang on the downshift lever "B".

   NOTE: This adjustment will prevent the linkage from bending when a detent downshift is made.

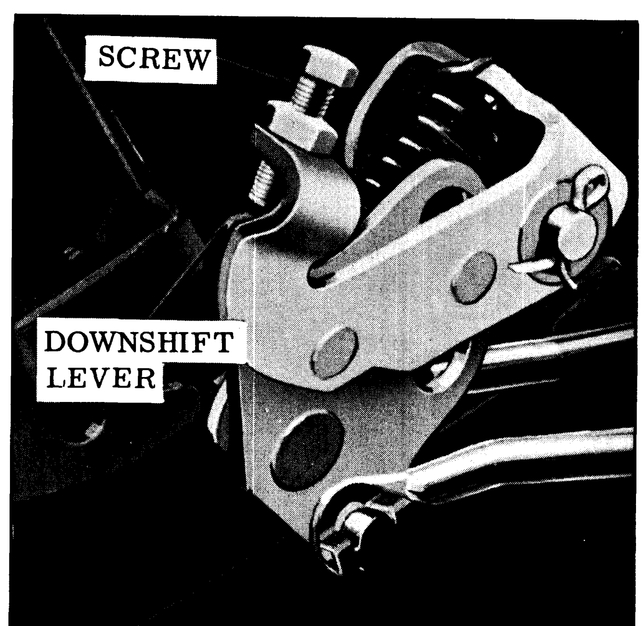


Fig. 3-161 Adjusting Throttle Stop Screw

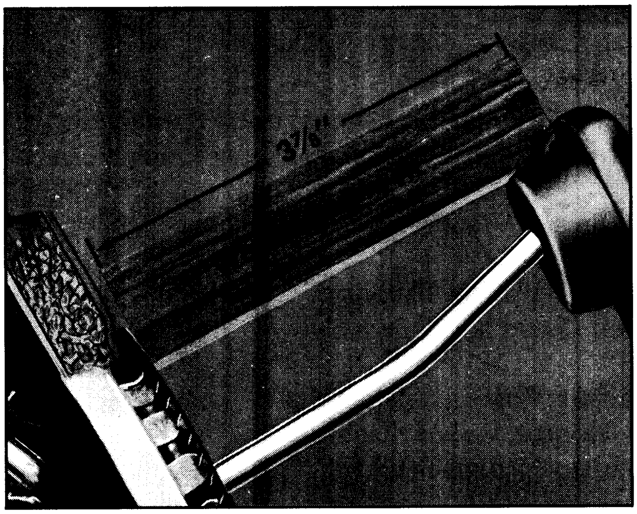


Fig 3-162 Accelerator Pedal Adjustment

ACCELERATOR PEDAL ADJUSTMENT (FIG. 3-162)

Place a wood block 3-7/8" long on the top center of the floor mat retainer and bring bottom of accelerator pedal down to rest on block. With carburetor in the slow idle position (choke completely off), pedal should just touch gauge block. If necessary to adjust, disconnect rod assembly "O" from bellcrank "D"; adjust rod "O" so that clevis just slides over pin with wood gauge block in position and carburetor in slow idle position. Reassemble rod "O", making sure open side of rod end is facing away from center of the engine, then remove wood gauge block.

MANUAL LEVER ADJUSTMENT

1. Set transmission manual lever in neutral detent position.
2. Disconnect manual rod from lower shift lever.
3. Hold lower shift lever upward so selector lever is positioned against stop in upper steering column.
4. Adjust manual rod clevis so pin will enter approximately 1/8" into lower shift lever bushing with selector lever against stop. (See Fig. 3-163)
5. Tighten clevis lock nut and connect manual rod to lower shift lever.

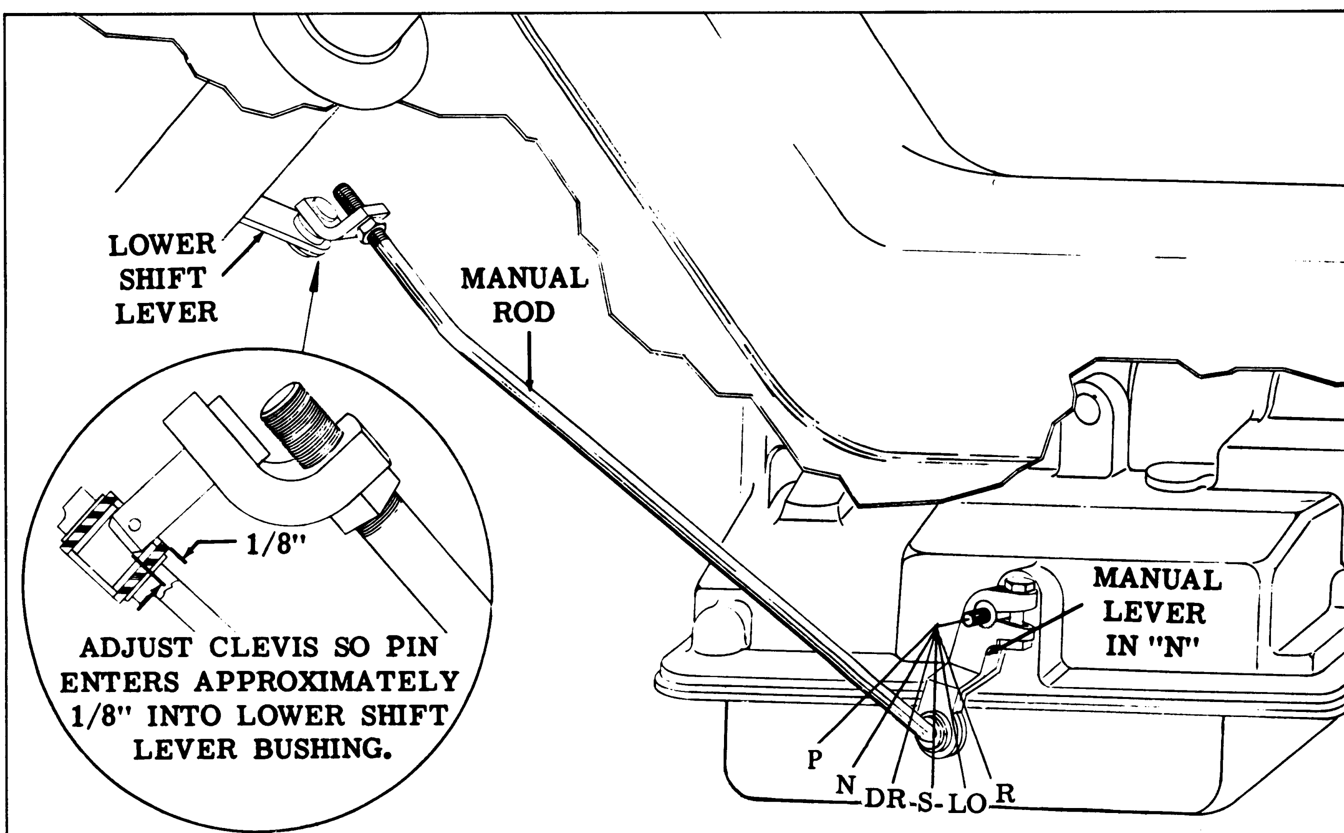


Fig. 3-163 Manual Lever Adjustment

DIAGNOSIS

CONDITION	CAUSE
Locks in 2nd & 4th	1. Overrun Clutch Plate Incorrectly Installed. 2. Front Sprag Clutch Broken.
Locks in 3rd	1. Rear Sprag Clutch Broken.
Misses Upshifts	1. Governor Valves Sticking. 2. Broken Governor Rings.
Misses 2nd	1. Governor Valves Sticking. 2. G-1 Booster Valve Sticking. 3. Transition Valve Sticking.
Misses 3rd	1. Transition Valve Sticking. 2. Rear Unit Clutch Slipping or Burned. 3. Rear Unit Clutch Apply Restricted or Leaking. 4. Incorrect Number of Clutch Plates.
No Drive in Dr. Range	1. Front Sprag Clutch Broken 2. Front Sprag Clutch Incorrectly Installed. 3. Rear Sprag Clutch Incorrectly Installed. 4. Adjust Manual Linkage. 5. Neutral Clutch Slipping or Burned. 6. Neutral Clutch Apply Restricted or Leaking. 7. Incorrect Number of Clutch Plates. 8. Insufficient Oil Pressure.
No Reverse, Slips	1. Reverse Piston Apply Restricted or Leaking. 2. Stationary Cone Key Missing. 3. Insufficient Oil Pressure. 4. Adjust Manual Linkage.
Parking Pawl Ratchets in N or Fails to Hold in Park	1. Adjust Manual Linkage
Reverse Drive in N	1. Stationary Cone Sticking.
Rough 3 to 4 Upshift	1. Check Carburetor Secondary for Sticking Open.
Selector Lever Won't Go Into R	1. Governor Valves Sticking. 2. Broken Governor Rings. 3. Reverse Blocker Piston Stuck.
Slips in 1st and 3rd in Drive	1. Front Sprag Clutch Slipping or Broken.
Slips or Misses 2nd and 4th	1. Front Unit Torus Cover: A. Seals Leaking B. Exhaust Valves Sticking C. Feed Restriction or Leak D. Signal Restriction or Leak

DIAGNOSIS (Continued)

CONDITION	CAUSE
Slips or Misses 2nd and 4th (cont'd.)	2. Low Oil Pressure 3. Limit Valve Sticking. 4. Coupling Valve Sticking.
Slips in All Dr. Ranges	1. Neutral Clutch Slipping or Burned. 2. Neutral Clutch Apply Restricted or Leaking. 3. Incorrect Number of Clutch Plates. 4. Low Oil Pressure.
Slips in 1st and 2nd in Dr. and S	1. Rear Sprag Clutch Slipping or Broken.
Slips in 3rd and 4th	1. Rear Unit Clutch Slipping or Burned. 2. Rear Unit Clutch Apply Restricted or Leaking. 3. Incorrect Number of Clutch Plates.
Slips in Super on Coast	1. Overrun Clutch Slipping or Burned. 2. Overrun Clutch Apply Restricted or Leaking.
Slips in Lo Range on Coast	1. Low Servo Apply Restricted or Leaking. 2. Low Band Broken or Not Anchored to Case.
Upshifts High	1. Governor Valves Sticking. 2. Leaking or Restricted Main Line Feed to Governor. 3. Broken Governor Rings. 4. Throttle Linkage Too Short.
Upshifts Low	1. Governor Valves Sticking. 2. Broken Governor Rings. 3. Throttle Linkage Too Long.
Valve Buzz	1. Incorrect Oil Level.
Front Oil Pump Noisy	1. Oil Level Low

TORQUE SPECIFICATIONS

LOCATION	TORQUE
TV Lever Stop to Manual V.B.	2-3 ft. lbs.
Bushing Retainer to Governor Body	2-3 ft. lbs.
Clutch V.B. to Channel Plate	2-3 ft. lbs.
Manual V.B. to Channel Plate	2-3 ft. lbs.
Reverse Blocker Body to Manual V.B.	2-3 ft. lbs.
Shift V.B. to Channel Plate	2-3 ft. lbs.
Cover to Rear V.B.	2-3 ft. lbs.
Front Plate to Clutch V.B.	2-3 ft. lbs.
Rear Plate to Clutch V.B.	2-3 ft. lbs.
Reg. V.B. Plate to Shift V.B.	2-3 ft. lbs.
Plate to Shift V.B.	2-3 ft. lbs.
Flywheel Assembly	6-7 ft. lbs.
Rear Pump Assembly	6-7 ft. lbs.
Torus Cover Assembly	6-7 ft. lbs.
Rear Pump Body to Case	10-12 ft. lbs.
Governor Cover to Body	6-8 ft. lbs.
Cover to Accumulator Body	12-15 ft. lbs.
V.B. to Case	6-8 ft. lbs.
Outer Throttle Lever	10-12 ft. lbs.
Front Pump Cover to Body	15-18 ft. lbs.
Case to Front Pump Body	10-13 ft. lbs.
Rear Pump Cover to Body	15-18 ft. lbs.
Oil Pan to Case	10-13 ft. lbs.
Cooler Adapter to Case	15-18 ft. lbs.
Outer Shifter Lever	10-13 ft. lbs.
Torus Cover to Flywheel	20-25 ft. lbs.
Front Pump Assy. to Center Support	20-25 ft. lbs.
Rear Pump Assy. to Case	20-25 ft. lbs.
Rear Bearing Ret. to Rear Pump	25-30 ft. lbs.
Rear Bearing Ret. to Case	25-30 ft. lbs.
Servo to Case	23-28 ft. lbs.
Flywheel Housing to Case	40-50 ft. lbs.
Case to Center Support	25-30 ft. lbs.
Oil Pan Drain Screw	35-45 ft. lbs.
Pressure Regulator Plug	3-6 ft. lbs.

FRONT SUSPENSION

CONTENTS OF SECTION 4

GENERAL DESCRIPTION

Oldsmobile's front suspension system is of the independent wheel type, utilizing upper and lower control arms. The knuckle support is attached to the upper and lower control arms by pivot pins. A threaded eccentric bushing in the upper end of the knuckle support provides for adjustment of caster and camber. The inner end of the control arms pivot on solid shafts attached to the frame front cross member.

The steering knuckle is attached to the knuckle support with a king pin carried in bushings in the knuckle. A thrust bearing located between the steering knuckle and support carries the vertical load.

Rubber bumpers mounted on the sides of the frame front cross member cushion the extreme downward movement of the control arms and rubber bumpers on the lower control arm assemblies cushion their extreme upward movement.

The direct acting type double action shock absorbers are mounted inside the coil springs. The upper end of the shock absorber is attached to the frame, and the lower end is attached to a bracket which is fastened to the spring seat in the lower control arm. Rubber bushings are used on the shock absorber upper and lower attachments to prevent metal to metal contact.

The upper end of the coil spring seats on an insulator in the frame, and the lower end rests in a seat attached to the lower control arm.

FRONT WHEEL BEARING ADJUSTMENT

The proper functioning of the front wheel suspension cannot be maintained unless the front wheel bearings are correctly adjusted. Cones must be a slip fit on spindle and bores lubricated to insure creep. Spindle nut must be free-running fit on threads.

The adjustment of front wheel bearings should be made as follows:

1. Tighten adjusting nut with torque wrench

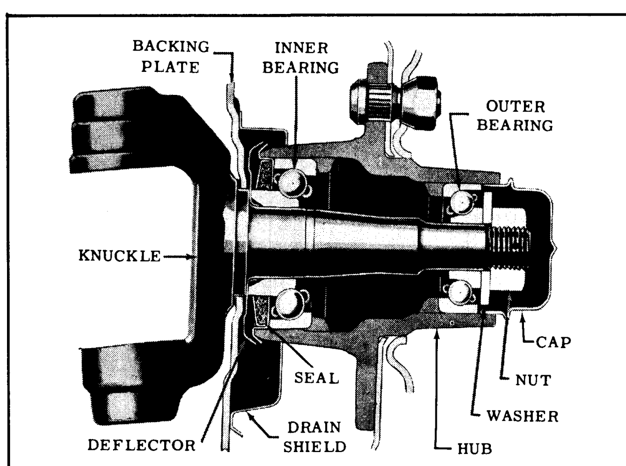


Fig. 4-1 Section Through Front Hub

to approximately 17 ft. lbs. to insure that all parts are properly seated and threads are free.
2. Back off nut and retighten to 4 ft. lbs.
3. If cotter pin hole in spindle and slot in nut line up, insert cotter pin; otherwise, back off adjusting nut to nearest line-up of slot and hole and insert cotter pin.

When front wheel bearings are lubricated, always see that they are adjusted properly. (See LUBRICATION WHEEL BEARINGS)

When installing front wheel hub and drum assembly, the complete inner bearing, including the cone, should always be assembled to the hub, and the assembly then installed on spindle. DO NOT PLACE THE INNER BEARING CONE ON WHEEL SPINDLE BEFORE INSTALLING WHEEL HUB AND DRUM.

CHECKING OF FRONT SHOCK ABSORBERS

Shock absorbers are sealed at the factory and cannot be disassembled for servicing. In case of malfunction, they should be replaced. Front shock absorbers can be checked on the car as follows:

1. Make sure upper end of shock absorber is securely mounted (both sides).
2. Disconnect shock absorber bracket from lower control arm (both sides).
3. By operating a shock absorber with each hand, work the units up and down simultaneously. The movement of the shock absorbers should be smooth, and it should require equal force to operate both units.

   NOTE: If the operation of the shock absorbers is erratic or unequal, it is

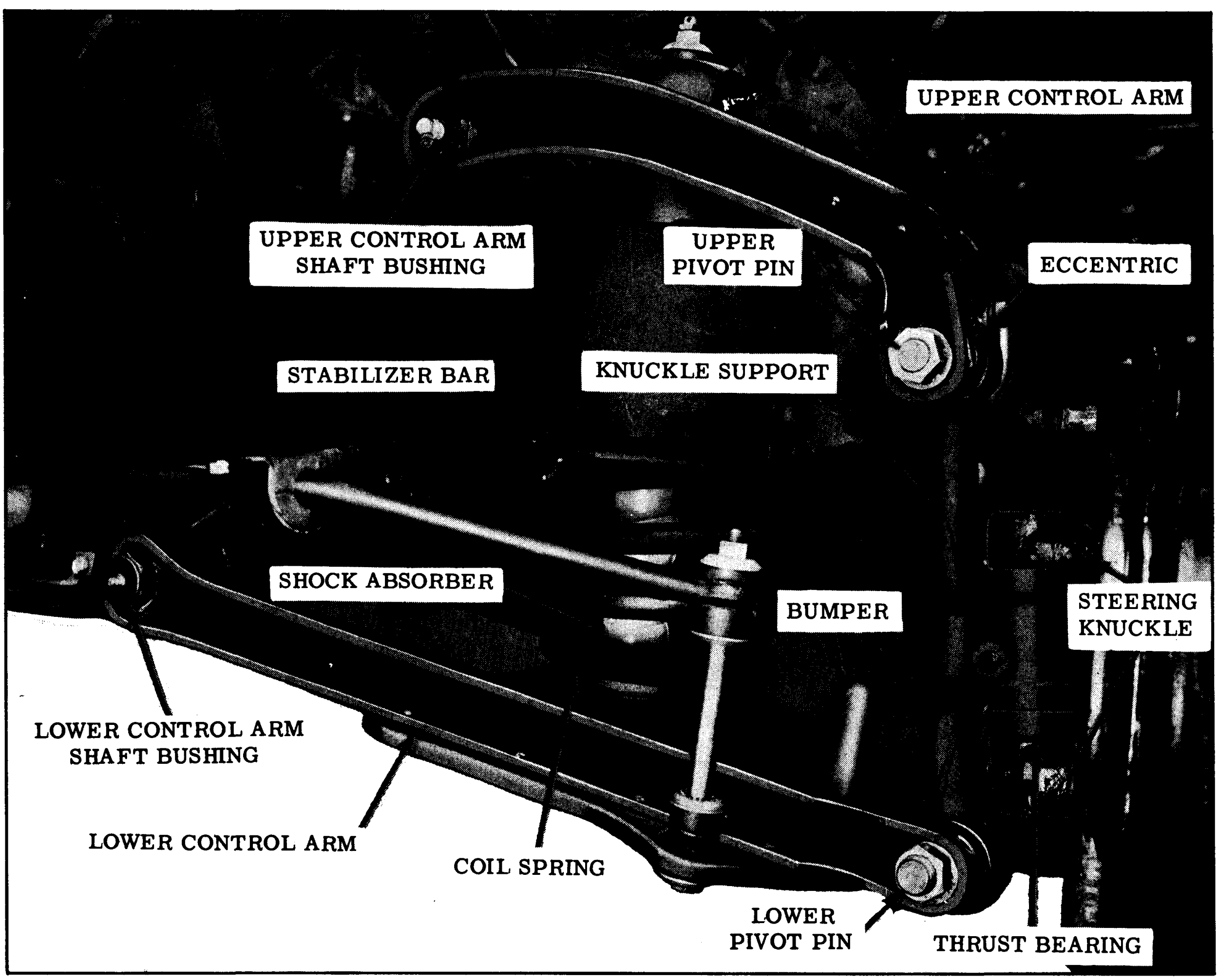


Fig. 4-2 Front Suspension

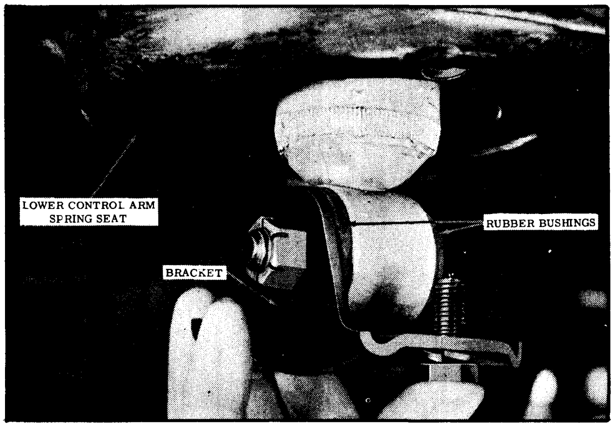


Fig. 4-3 Shock Absorber Removal

due to a malfunction of one or both of the units and will require replacement. In order to obtain proper riding characteristics, the shock absorbers must operate smoothly and at equal loads.

REMOVE AND REPLACE FRONT SHOCK ABSORBER

1. Remove the nut and jam nut on the upper stud of shock absorber, then remove metal retainer and rubber bushing.

   NOTE: Flats are provided on the stud so that it can be held with a wrench while loosening the nuts.
2. Remove two cap screws and lock washers attaching shock absorber bracket to lower control arm and remove shock absorber out through lower control arm spring seat. (See Fig. 4-3)
3. To remove bracket from shock absorber, remove bolt, then separate bracket and shock absorber and remove rubber bushings and sleeve from the shock absorber.

To install shock absorber, reverse sequence of operations and install nut on upper end of the shock absorber assembly to the limit of the threads. A soap solution may be applied to the lower rubber bushings to aid installation.

REMOVE AND REPLACE STABILIZER

1. Disconnect stabilizer linkage, each side, by removing nut from top of linkage bolt; pull out bolt from bottom of linkage, and remove retainers, grommets, and spacer.
2. Remove stabilizer bracket to frame bolts and remove stabilizer bar, rubber bushings, and brackets.
3. To replace, reverse sequence of operations. The rubber bushings should be positioned squarely in the brackets and the nut retaining the stabilizer link assembly should be drawn down to the limit of the threads.

IMPORTANT: Never lubricate stabilizer bar rubber bushings as they are dependent upon a bonding of the rubber to the bar for proper stabilizing action.

REBUSH KING PINS

1. Remove front wheel hub and drum assembly.
2. Remove backing plate without disconnecting brake hose and place out of way avoiding any strain on brake hose. Leave plain-arm connected to tie rod end.
3. Remove tapered king pin lock.
4. Remove upper and lower welch plugs from knuckle. Then clean up stake marks.
5. Drive out king pin using a copper or brass drift.
6. Press bushings from steering knuckle using Tool Set J-1061.

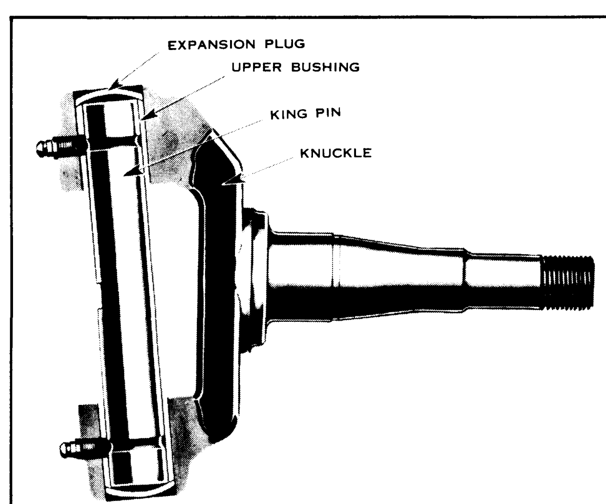


Fig. 4-4 King Pin Mounting

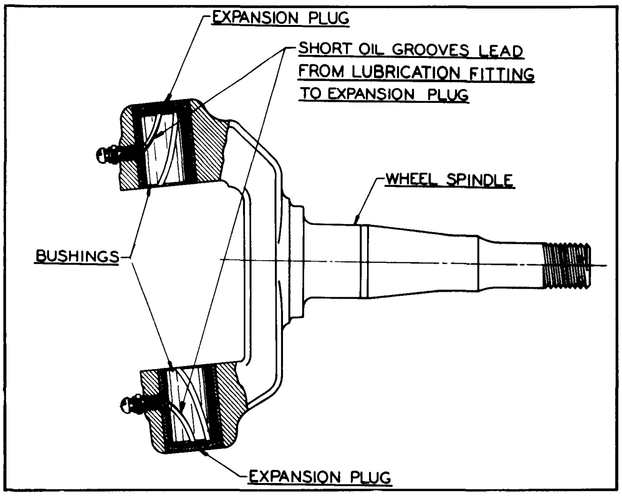


Fig. 4-5 Steering Knuckle Mounting

NOTE: The king pin bushings have two grooves on the inside diameter; one short groove leading from the oil hole to one end of the bushing and a long groove opposite the oil hole extending the entire length of the bushing. The short groove leads to the top on the upper bushing and to the bottom on the lower bushing. (See Fig. 4-5)

7. With lube hole in bushing in line with hole for fitting, press bushing into knuckle using Tool Set J-1061.
8. Burnish bushing using Tool Set J-1061.
9. Line ream bushing to size using Tool HM-592.

To assemble, reverse operations 1, 2, 3, 4, and 5. Use a flat punch to expand the welch plugs, then stake them in place. Be sure that thrust bearing is installed with manufacturer's name stamped on top side. If bearing is bound up or damaged, it should be replaced.

After assembled check caster, camber, and toe-in.

REMOVE UPPER PIVOT PIN AND ECCENTRIC BUSHING

1. Place jack under lower control arm, raise wheel off floor, and remove wheel.
2. Loosen knuckle support clamp bolt. (See Fig. 4-6)
3. Remove nut from front end of upper pivot pin.
4. Remove threaded pivot pin.

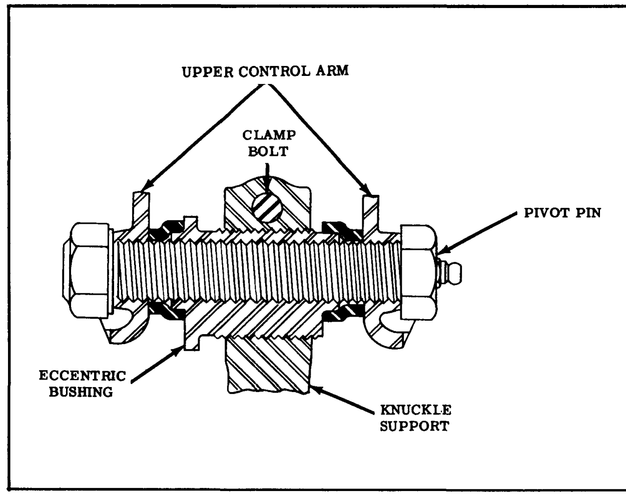


Fig. 4-6 Upper Pivot Pin

NOTE: To prevent damage to brake hose, fasten knuckle support to upper control arm with a piece of wire.

5. Remove threaded eccentric bushing from knuckle support. (Eccentric has left hand thread)

REPLACE UPPER PIVOT PIN AND ECCENTRIC BUSHING

1. Position the pivot pin rubber seals over the outer ends of the upper control arm to facilitate their installation over the pivot pin after assembly.
2. Install eccentric bushing from front into knuckle support so that the threaded O.D. of bushing is centralized; then tighten clamp bolt to keep bushing from turning.
3. Centralize knuckle support between forked ends of upper control arm and install pivot pin from rear. (50 to 60 ft. lbs. torque)
4. Install pivot pin nut and tighten (50 to 60 ft. lbs. torque)
5. Check to be sure pivot pin bolt head and nut are tightened securely against metal of control arm.
6. Using a heavy wire hooked tool, snap rubber seals over end of control arm and into place on pivot pin. (See Fig. 4-7)
7. Lubricate pivot pin.
8. Replace wheel and tire.
9. Adjust caster, camber, and toe-in.

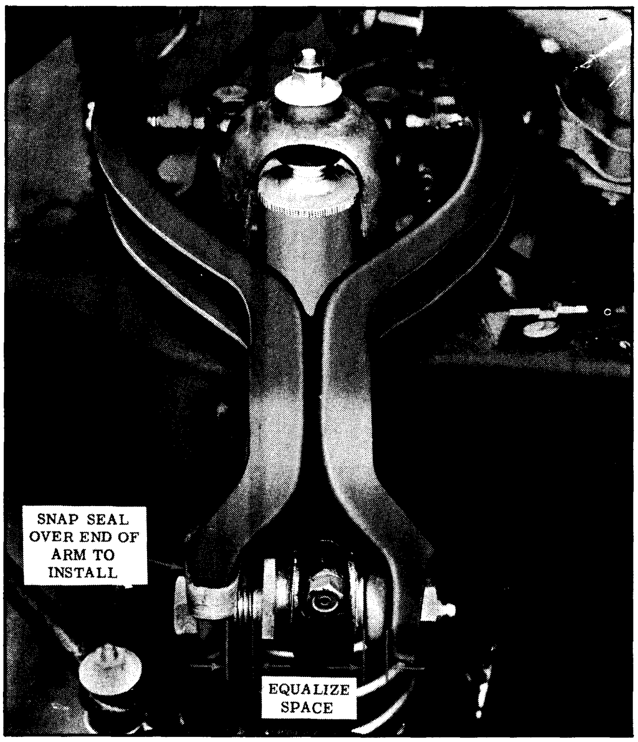


Fig. 4-7 Upper Pivot Assembly

REMOVE LOWER PIVOT PIN AND BUSHING

1. Place jack under lower arm, raise wheel off floor, and remove wheel.
2. Remove nut from front end of lower pivot pin. (See Fig. 4-8)
3. Remove lower pivot pin and bushing. (Use a long handle socket wrench to remove bushing and bear down with other hand on brake drum hub when working on L.H. side.)

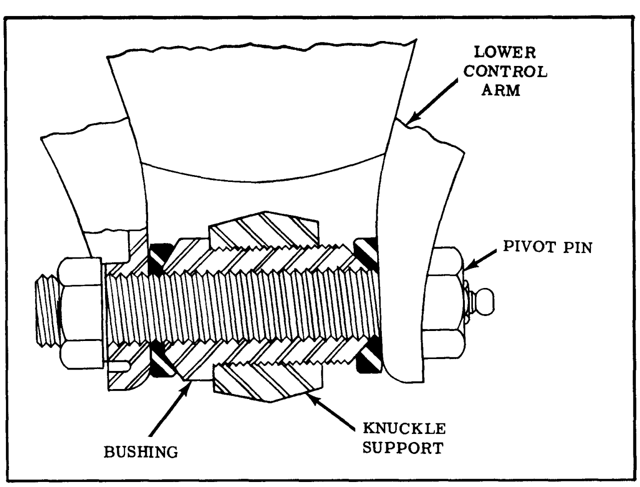


Fig. 4-8 Lower Pivot Pin

REPLACE LOWER PIVOT PIN AND BUSHING

1. Position pivot pin rubber seals over the forked outer ends of the lower control arm.
2. Install bushing into front of knuckle support and tighten 145 to 220 ft. lbs. torque.
3. Centralize lower pivot pin bushing with knuckle support between forked ends of lower control arm and install pivot pin from the rear. (50 to 60 ft. lbs. torque)

   NOTE: When the knuckle support is properly spaced between the ends of the lower control arm there should be approximately 1/8" clearance between the ends of the bushing and the inner surface of the front and rear control arm. (See Fig. 4-9)

4. Install pivot pin nut and tighten securely.
5. Lubricate pivot pin.
6. Replace wheel and tire.
7. Check wheel alignment.

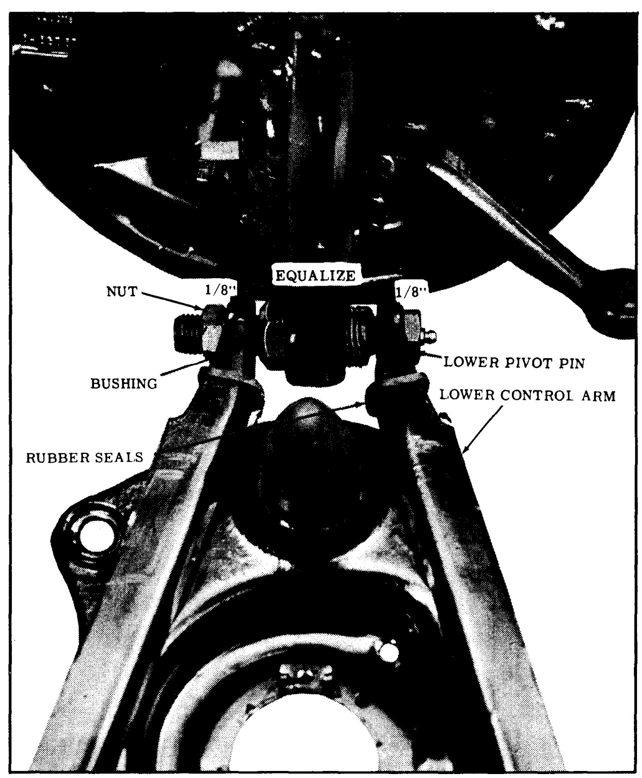


Fig. 4-9 Lower Pivot Assembly

FRONT COIL SPRING IDENTIFICATION

Coil springs may be identified by the part number stamped on the outside of one of the end coils.

NOTE: There is a top and bottom to the front coil spring. The top may be identified since the top coil is flattened at the end; the bottom is not. When assembling the front coil spring, be sure the flattened end of the spring is to the top and centralized by the pilot in the cross member. The end of the coil at the bottom indexes with the hole provided in the spring seat.

REMOVE FRONT COIL SPRING

1. Support car with floor stands.
2. Disconnect stabilizer link from lower control arm and remove rubber bumper from lower control arm.
3. Remove shock absorber.
4. Center jack pad under lower control arm pivot shaft and raise jack until it just contacts shaft.
5. Disconnect pivot shaft from front cross member.
6. Lower jack slowly, allowing control arm to drop out of position until spring is fully extended and remove spring.

REPLACE FRONT COIL SPRING

1. Place jack pad under lower control arm pivot shaft.
2. Position rubber insulator over pilot in cross member. Hold the upper end (flat end) of the coil spring in the cross member and raise the lower control arm until the spring seat contacts the lower coil of the spring, then rotate the spring so that the end of the bottom coil will index with the hole provided in the spring seat.
3. Raise control arm gradually, checking to see that spring is seated correctly top and bottom, and insulator is in place.
4. Use two metal rods to line up pivot shaft with bolt holes in cross member and install bolts. (55 to 60 ft. lbs. torque).
5. Connect stabilizer link, and install shock absorber and rubber bumper.

NOTE: If carrying height is changed, it may be necessary to readjust camber.

REMOVE LOWER CONTROL ARM PIVOT SHAFT

1. Complete steps under REMOVE FRONT COIL SPRING.
   NOTE: Before removing pivot shaft, loosen bushings.
2. Unscrew pivot shaft bushings and remove shaft from lower control arm assembly.

The lower control arm pivot shaft bushings have threads on the inside and outside of the bushing. The inside of the bushing threads onto the pivot shaft, but the bushing cuts its own thread in the lower control arm when a new lower control arm is used.

REPLACE LOWER CONTROL ARM PIVOT SHAFT

1. Install rubber seals on ends of pivot shaft.
2. Place pivot shaft in lower control arm assembly.
3. Start bushing on pivot shaft and into arm at same time, tightening bushing in place.
4. Center pivot shaft between control arms and install the other bushing as above, being sure threads index so there is no bind.
5. The distance between the center of the pivot shaft bolt holes and the inside face of the arm should be 1-1/2" at each end. Turn pivot shaft as necessary to centralize.
6. Position front coil spring.
7. Center jack under pivot shaft and compress spring. Use two rods or suitable tools to guide pivot shaft into proper position.
8. Install bolts and torque 55 to 60 ft. lbs.

REMOVE LOWER CONTROL ARM

1. Loosen lower pivot pin and pivot shaft bushings.

2. Proceed as outlined under REMOVE FRONT COIL SPRING.
3. Remove lower pivot pin.
4. Remove pivot shaft bushings and shaft.

REPLACE LOWER CONTROL ARM

If old lower control arm is to be used, be sure pivot shaft bushings properly engage existing threads in control arm so there is no bind. When installing a NEW lower control arm, the bushings must cut their own thread in the new control arm; therefore, an expander tool must be used to prevent the arms from moving inward during bushing installation.

To install a new lower control arm, proceed as follows:

1. Place Tool J-1052 in position and expand until distance between inside surfaces of inner ends of control arm assembly is 11-1/2". (See Fig. 4-10)
2. Apply chassis lubricant to pivot shaft threads and install rubber seals on shaft.
3. Position pivot shaft in control arm, and while holding shaft centered, start bushings on shaft and into arms.

   NOTE: Threads can be cut in the new control arm more easily if a coating of white lead is applied to the O.D. of the bushings.

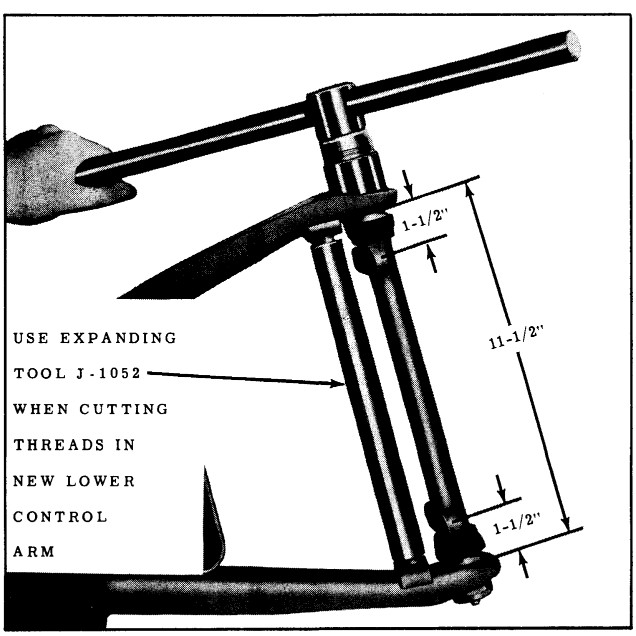


Fig. 4-10 Lower Pivot Shaft Installation

4. Tighten bushings until they are solidly seated against the shoulder.
5. Remove expander tool and turn shaft as necessary to centralize. (See Fig. 4-10)
6. Install lower pivot pin.
7. Complete procedure outlined under REPLACE FRONT COIL SPRING.
8. Check caster, camber, and toe-in.

REMOVE UPPER CONTROL ARM AND PIVOT SHAFT

1. Place jack under lower control arm, raise wheel off floor, and remove wheel.
2. Remove upper pivot pin.

   NOTE: To prevent damage to brake hose, fasten upper end of knuckle support to frame.
3. Remove two bolts holding upper control arm shaft to frame and remove shaft and control arm assembly. Flat washers and self-locking nuts on lower end of bolts can be reached through access hole in bottom of front cross member.
4. Remove threaded pivot shaft bushings and shaft from control arm.

REPLACE UPPER CONTROL ARM AND PIVOT SHAFT ASSEMBLY

If old upper control arm is to be used, be sure pivot shaft bushings properly engage existing threads in control arm so there is no bind. When installing a NEW upper control arm, the bushings must cut their own thread in the new control arm; therefore, an expander tool must be used to prevent the arms from moving inward during bushing installation.

To install a new upper control arm, proceed as follows:

1. Place Tool J-5799 in position and expand until distance between inside surfaces of inner ends of upper control is 6-9/16". (See Fig. 4-11)
2. Apply chassis lubricant to pivot shaft threads, and install rubber seals on shaft.
3. Position pivot shaft in control arm and while holding shaft centered, start bushings on shaft and into arms.

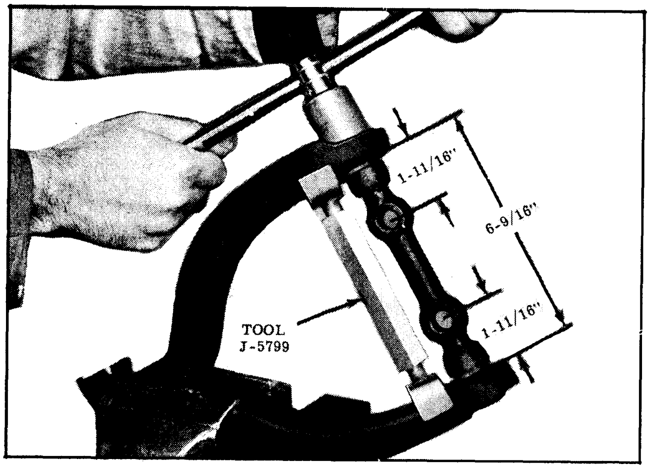


Fig. 4-11 Upper Pivot Shaft Installation

NOTE: Threads can be cut in the new control arm more easily if a coating of white lead is applied to the O.D. of the bushings.

4. Tighten bushings until they are solidly seated against the shoulder.
5. Remove expander tool and turn over pivot shaft as necessary to centralize.
6. Complete the installation by reversing steps 1, 2, and 3 of the removal operation.
7. Adjust caster, camber, and toe-in.

TUBELESS TIRES

The tubeless tires used by Oldsmobile as original equipment have a safety inner liner which, if punctured, tends to cling to the penetrating object forming a temporary seal until the object is removed. After this type of tubeless tire has been punctured, it should be repaired as covered in this section.

DEMOUNTING TUBELESS TIRES

There are several makes of tire mounting equipment, all of which do the job intended. No special equipment is required for this procedure. Demounting the tire can be done with tire machines or regular tire irons following the same procedure used in servicing tube and tire assemblies.

1. With the wheel assembly removed, inflate the tire to recommended pressure.
2. Dip assembly in water tank or run water over tire to locate leak. Mark location of leak with crayon.
3. Demount tire.
   The following procedure describes the use of tire irons to demount the tire.
   (a) Press both sides of the tire into the rim well; then, by using two tire irons, remove one side by removing the bead, taking small "bites" around the rim.
   (b) Turn the tire over, and again use tire irons, one between the rim flange and bead to pry the rim upward, the other to pry outward between the bead seat and bead as shown in Fig. 4-12.

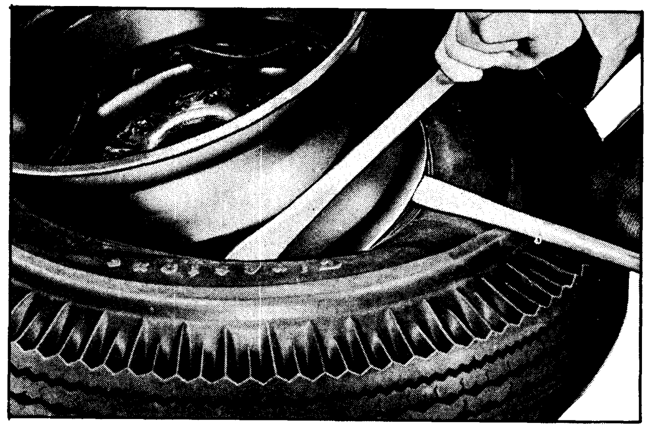


Fig. 4-12 Removing Tire

REPAIRING TUBELESS TIRES

There are several methods of repair for tires released by tubeless tire manufacturers, all of which are based on their own experience with tubeless tire repairs. Oldsmobile recommends either of two methods. They are:

1. The Hot Patch Method

   This method uses a patch containing its own fuel, to be ignited when vulcanization takes place.

2. The Self-Vulcanizing Method

   In this method, no heat is required because the vulcanizing action is chemically performed.

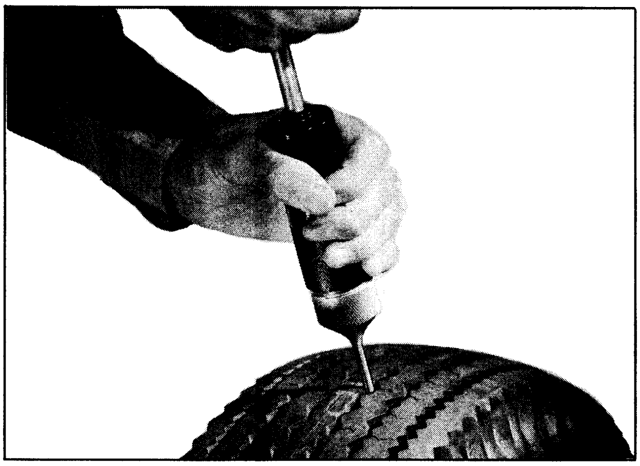


Fig. 4-13 Using Sealer Gun

Hot Patch Repair Method

This method is recommended for repairing punctures not exceeding 3/16" in diameter.

1. Clean out the injury with hand rasp furnished with the tire repair kit.
2. Using sealing gun, fill puncture from the outside of the tire as shown in Fig. 4-13.
3. Thoroughly clean inside of tire around injury with carbon tetra-chloride. (Oldsmobile recommends only the use of carbon tetra-chloride for this purpose.) Allow the cleaned area to dry.
4. Roughen area around injury with hand buffer or wire brush.
5. Spread an even coating of a good grade of rubber cement over the puncture, slightly larger than the patch area, and allow it to dry for 5 minutes.
6. Prepare patch material for igniting by loosening material slightly with point of a knife blade in the center of each side.
7. Carefully center hot patch over injury and hold in place using special hot patch clamp. Tighten clamp maximum finger tight. (See Fig. 4-14)
8. Ignite patch material. Allow to cool 15 minutes or until cool to touch.
9. Carefully remove metal cup and blow out any ashes remaining in tire.

Self-Vulcanizing Method

This method can be used for punctures

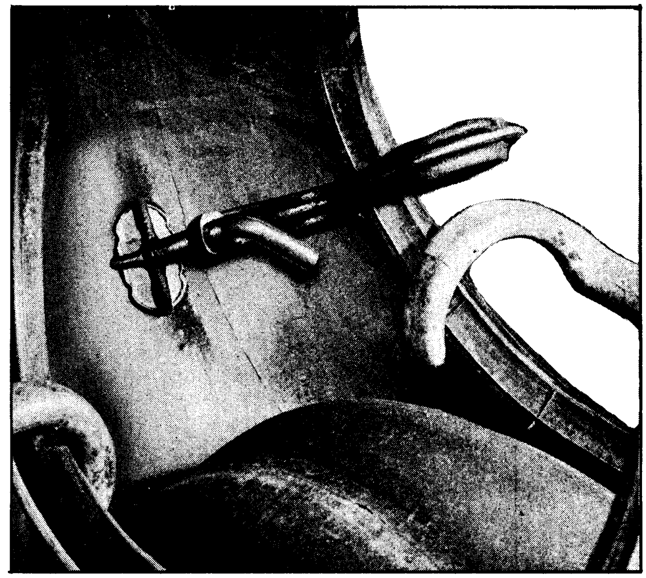


Fig. 4-14 Hot Patch Application

up to 3/16" in diameter. Oldsmobile recommends the use of the Firestone Tubeless Tire Repair Kit #3-K-164 (Self-Vulcanizing Method).

NOTE: This method should be used only for tires WITHOUT soft puncture-sealing material. The following procedure should be followed in using this kit.

1. Clean out the injury with the awl to remove puncturing object and foreign material.
2. Thoroughly clean the inside of the tire around the injury with carbon tetrachloride. Allow to dry.
3. Fill the injury with Filler Rubber (supplied in the kit) using the awl as follows:
   (a) Clean awl needle and dip in Self-Vulcanizing Fluid. From inside of tire, force needle through tire until point extends beyond tread.
   (b) Remove detachable handle from awl needle. Cut 1/8" by 1" strip of Filler Rubber, remove protective cover and insert into hole of awl needle with end of rubber strip extending beyond the needle. (See Fig. 4-15)
   (c) Pull needle through tire with pliers. Filler Rubber will remain in the puncture. Cut off excess rubber flush with inside of tire.

   The injury may also be filled

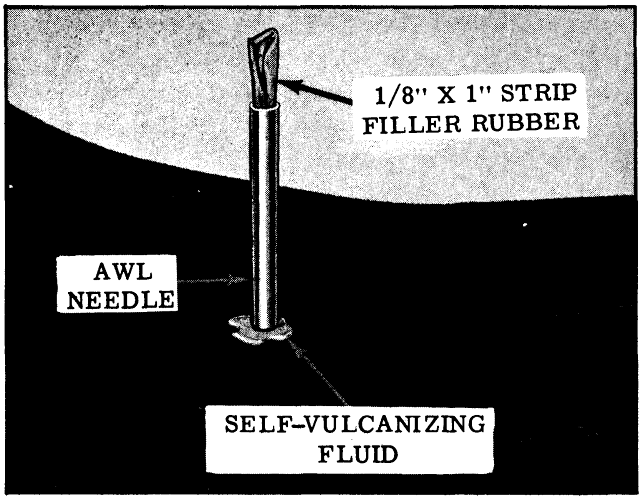


Fig. 4-15 Sealing Injury With Filler Rubber

from the outside or inside of the tire with a sealant gun. Hold gun tip firmly against puncture and force sealant through until it comes through the other side of the tire.

4. Thoroughly roughen area around puncture, slightly larger than patch, with wire brush included in kit. Remove all traces of lubricant, foreign material, etc. Do not use additional solvent after buffing.
5. Apply Self-Vulcanizing fluid over buffed area. Spread evenly with CLEAN finger. Allow to dry five minutes until no longer tacky. THIS IS IMPORTANT.

Fig. 4-16 Rolling the Patch

6. Remove foil backing from patch. Place over injury and stitch down firmly, especially the edges, with roller tool included in kit. To prevent buckling and insure a good seal, roll patch from the center toward the outer edges. Vulcanization is completed chemically. (See Fig. 4-16) The repaired tire can be placed back in service immediately.

Mounting Tubeless Tires

The general procedure is the same as for tube and tire installation except that extreme care must be exercised to prevent injury to the sealing bead and circumferential bead when forcing tire over rim.

Tire mounting machines or tire irons can be used.

1. Apply a light film of tire lubricating soap GM-2251 to sealing bead of tire.

   NOTE: The use of excessive lubrication may lead to rim slippage and subsequent breakage of air seal.
2. Carefully mount first bead in usual manner by using tire irons, taking small "bites" around rim, being careful not to injure the tire bead. (See Fig. 4-17)

   CAUTION: DO NOT use a hammer, as damage to the bead will result.
3. Install outer bead in the same manner.

Inflating Tubeless Tires

With reference to Fig. 4-18, you will note a tire mounting band is slipped around

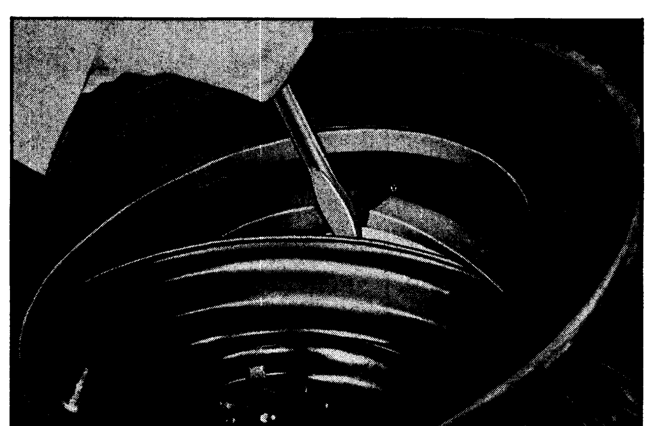


Fig. 4-17 Mounting Tire

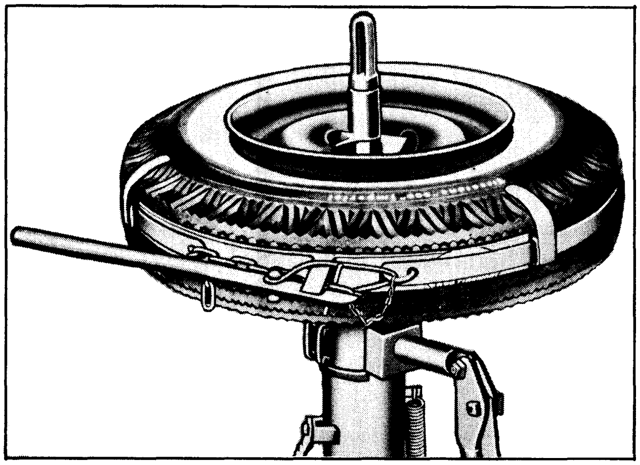


Fig. 4-18 Tire Band

the outside of the tire to compress center of tire tread to force bead out against the rim seats. A sash cord winched around a jack handle will answer the same purpose.

Tubeless tires are packaged with a cardboard liner which forms tires so the beads are forced out and eliminates the use of special expanding equipment. If the following instructions are adhered to, no problem should be experienced to inflate tubeless tires after they are mounted on the wheel.

NOTE: The object is to initially have both beads against the rim and inflate the tire with a few quick "shots" of air. This will seat the tire beads on the rim. To do this:

1. While holding the tire in upright position, press against the outside of the wheel. This will start the outside bead onto the bead seat.
2. Next, lean the tire so the weight of the wheel will help seat the inside bead.
3. Give a few quick "shots" of air to seat the tire beads on the bead seats.

   NOTE: If the air hose has the type nozzle without a valve core, the valve core in the tire stem can be removed so a large volume of air is permitted to enter the tire quickly and force the tire beads on the bead seats; then core can be replaced.
4. Inflate tire to 40 pounds.
5. Check to be sure that the bead positioning rib (outer ring of tire) is visible evenly just above the rim flange all the way around tire, both sides.
6. Deflate to recommended air pressure.

REPLACING TIRE AND TUBE ASSEMBLY WITH TUBELESS TIRE

When changing from tube and tire assembly to tubeless tires, the proper preparation of the rim and installation of the valve is important for satisfactory installation. These procedures follow under separate headings.

Preparation of the Rim

IMPORTANT: Rim must be clean and free from all rough spots or dents in rim flange.

1. Prepare rim by removing all particles of foreign matter from rim ledges and flanges. (See Fig. 4-19) Use a small piece of steel wool or emery cloth.

   IMPORTANT: Be sure the bead seat is clean.
2. Straighten the rim if it is bent or damaged.
3. Inspect the butt weld; make certain that there is no groove or high spot on the rim flanges; grooves or high spots must be filed flat or smooth to eliminate any possibility of air loss.
4. Inspect for loose wheel rivets (past models). Tighten loose rivets by peening the head of the rivet in the rim well with a ball-peen hammer, backed up with another hammer from the other side.

Fig. 4-19 Cleaning Rim

NOTE: DO NOT WELD LOOSE RIVETS.

Installation of the Valve

Because the use of the conventional inner tube has been eliminated with tubeless tires, it is necessary to install a special valve in the rim well.

The one piece "snap-in" type rubber valve is installed as follows:

1. Clean all particles of foreign matter from around the area and the edges of the valve hole in the rim with steel wool.
2. Use water or a very light film of liquid soap to lubricate the outside of the valve.

   NOTE: DO NOT smear the valve with grease or soap.
3. Insert the "snap-in" type rubber valve through hole in rim as far as it will go.

   DO NOT attempt to drive the valve in place in the rim.

   DO NOT grip the threads of valve with a pair of pliers and attempt to pull valve into rim.
4. Use a tire valve fishing tool as shown in Fig. 4-20 and pull the valve through hole in rim until valve snaps into position.

To remove a rubber "snap-in" valve from rim, force a small screwdriver blade between valve and edge of hole. Then, while prying on valve to start groove out of edge of hole, push the valve back through the rim.

IMPORTANT: To insure against air leaking around the valve, always use a new valve once a valve is removed from the rim.

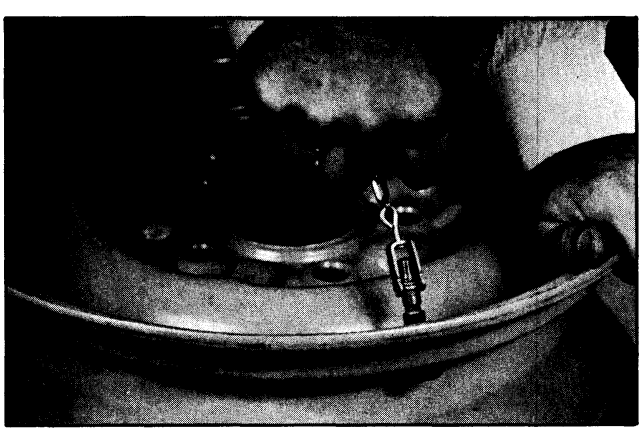


Fig. 4-20 Installing Valve

TIRE INFLATION

The importance of proper tire inflation cannot be overemphasized. Maintenance of the correct inflation pressure is one of the most important elements in tire care.

The recommended tire pressure for all models is 24 psi on the front and 22 psi on the rear. (Tires cold)

Too great tire pressure is detrimental, but not so much as under-inflation. Higher inflation pressure than recommended will cause:

1. A harder riding car.
2. Tire more susceptible to various types of bruises.
3. More tire chatter, resulting in uneven wear.
4. Fast tread wear at the center.

Even when a tire is properly inflated, it is not round. It is flat where it contacts the road so that the car at all times is actually being pushed up a hill. This condition is exaggerated on an under-inflated tire. More power is required; therefore, more gasoline consumed when driving with under-inflated tires.

Inflation pressures lower than recommended will result in:

1. Higher gasoline consumption.
2. Rapid and uneven wear on the edges of the tire tread.
3. A tire more susceptible to rim bruises and various types of rupture.
4. Increased cord fatigue or broken tire cords.
5. Hard steering.
6. Higher tire temperatures.
7. Car roll on sharp curves.
8. Tire squeal on curves.

TIRE NOISE

Complaints of axle noise are more frequently caused by tires than by differential gears, bearings, etc.

Tire noise is frequently diagnosed as axle noise. The process of determining whether the noise is caused by tires is relatively simple. Tire noise is related directly to the speed of the car and the road surface. Tests made for drive, float, and coast noise as used for differential testing will have little or no affect on noise level if tires are the cause.

VARIOUS TYPES OF TIRE WEAR

Tire wear may be divided into the following classifications:

1. Side wear due to improper camber.
2. Side wear due to rounding turns at high rate of speed (cornering).
3. Side wear due to excessively crowned roads.

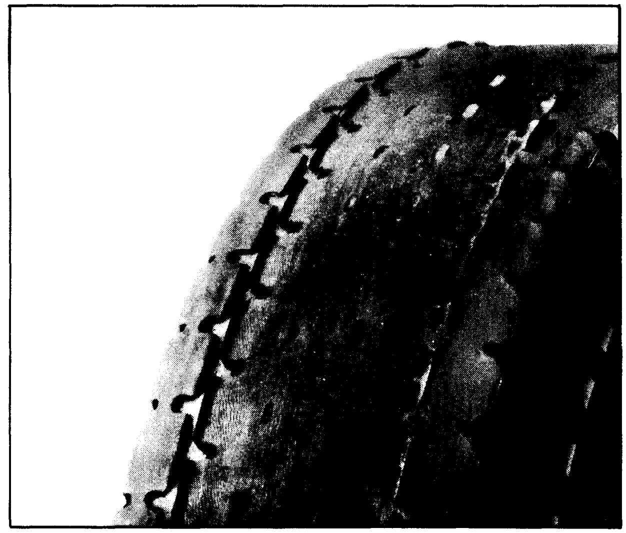


Fig. 4-23 Toe-In or Toe-Out Wear

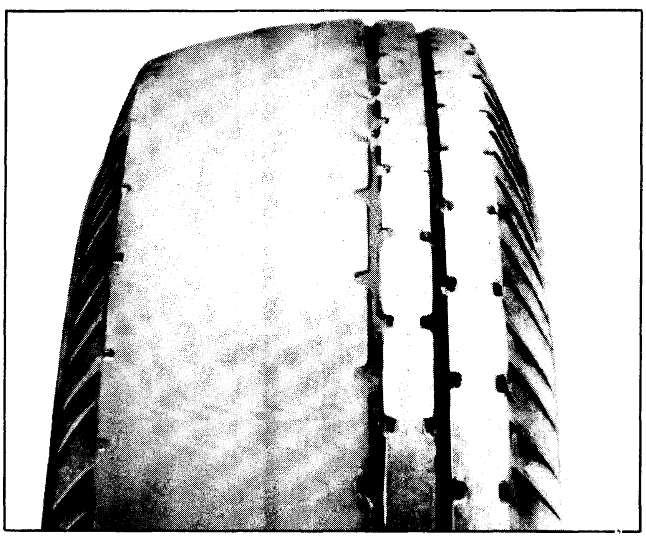


Fig. 4-21 Side Wear Due to Camber

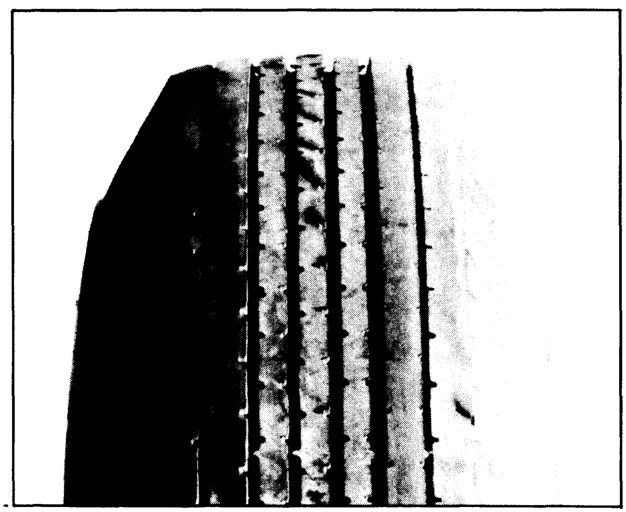


Fig. 4-24 Wear Due to Mechanical Conditions

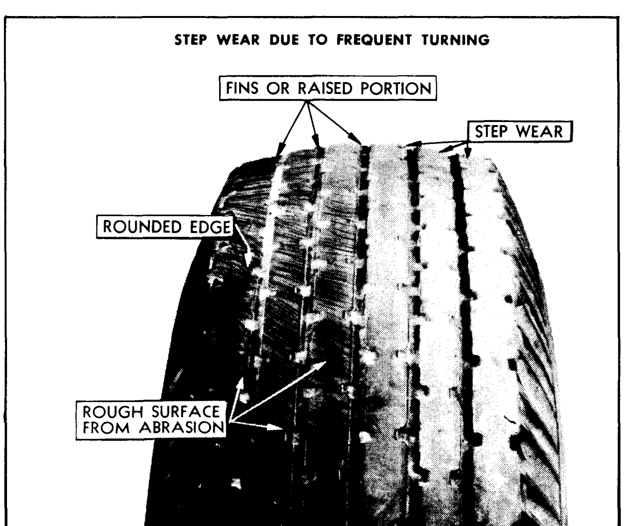


Fig. 4-22 Cornering Wear

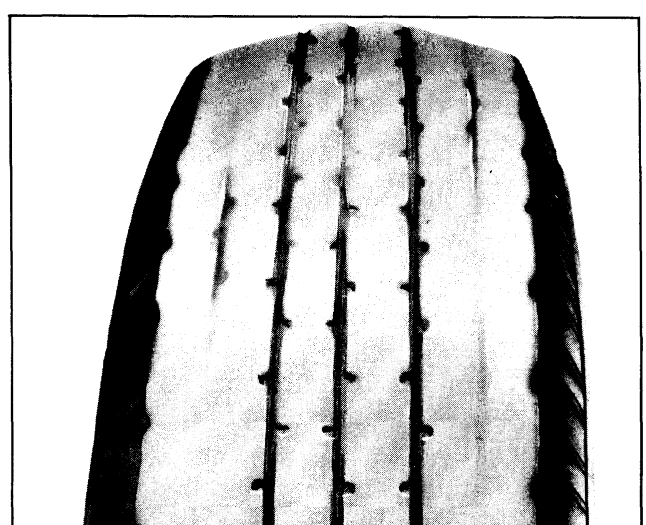


Fig. 4-25 Under Inflation

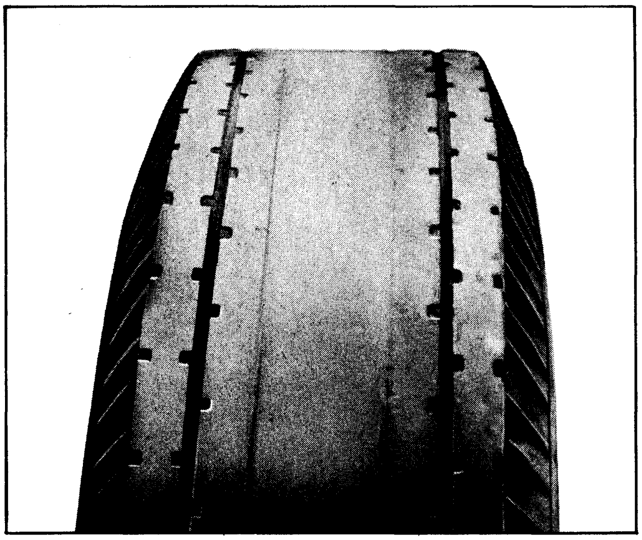


Fig. 4-26 Over Inflation

4. Toe-in or toe-out misalignment wear.
5. Uneven tire wear due to bent, loose, or misaligned parts (Mechanical Condition).
6. Side wear due to under-inflation.
7. Side wear due to unbalanced tire and wheel.
8. Rapid and uneven wear caused by sudden starts and stops.

Correction for Tire Wear

Correction for tire wear from excessive camber, caster, toe-out, and toe-in is a complete check and proper alignment of the front wheels.

WHEEL AND TIRE BALANCE

Wheel, tire, and brake drum balance must be maintained within certain limits; otherwise, wheel tramp and high speed shimmy will result.

Front wheel "tramp" and front wheel "shimmy" are two entirely different conditions. Front wheel tramp, which usually occurs at high speed, is a wheel "hop" caused from an unbalanced condition of wheels, loose linkage in the front end, or improperly operating shock absorbers.

Shimmy may occur at the lower speeds and is a wobbly condition of the front wheels caused from an unbalanced condition, loose front end linkage, loose steering gear parts, or faulty steering gear adjustment. Shimmy will be felt on the steering wheel; tramp will be felt in the whole car. Shimmy is a front wheel condition entirely, while tramp may result from either front or rear wheels.

Due to the irregularities in tread wear caused by sudden brake application, misalignment, low inflation pressure, tube or tire repair, etc., a wheel and tire assembly may lose its original balance. Consequently, if front end instability develops, the tire and wheel assembly should be checked for static and dynamic balance.

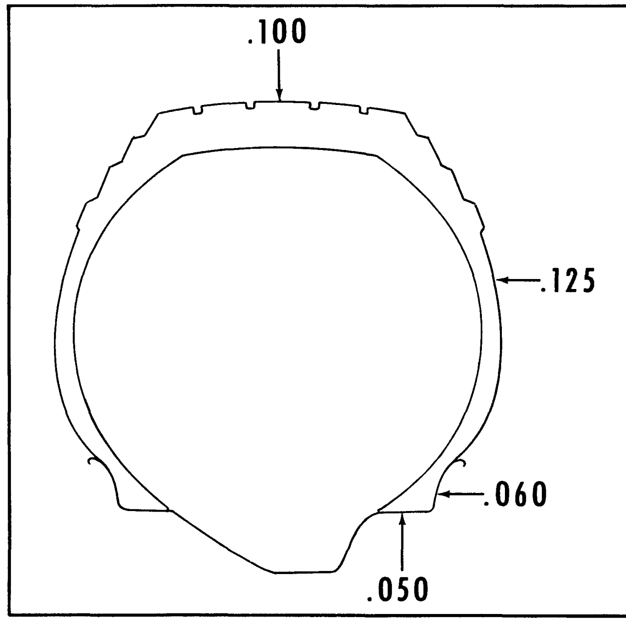


Fig. 4-27 Runout Specifications

TIRE AND WHEEL RUNOUT

Wheel and tire assemblies may be checked for runout with a dial indicator at points shown in Fig. 4-27. Runout should not exceed the following limits:

Tire Runout:	Radial	.100"
	Lateral	.125"
Wheel Runout:	Radial	.050"
	Lateral	.060"

NOTE: Tire runout should be checked as soon as possible after car has been driven to avoid false readings due to the tendency of tires to take a temporary "set" after standing for a few hours.

WHEEL ALIGNMENT

Front wheel alignment is the mechanics of adjusting all the interrelated factors affecting the running and steering of the front wheels of the automobile. Incorrect alignment of front wheels will result in hard steering and abnormal tire wear.

The front wheel alignment factors are:

1. CASTER. (See Fig. 4-28)
2. CAMBER. (See Fig. 4-30)
3. TOE-IN. (See Fig. 4-32)
4. KING PIN INCLINATION.
5. TOE-OUT (STEERING GEOMETRY).

Before any attempt is made to check or adjust Caster, Camber, Toe-In, King Pin Inclination, or Toe-Out, the following preliminary checks and necessary corrections should be made on those parts which influence the steering of the car:

1. Inflate tires to recommended pressure.
2. Check front wheel bearings for proper pre-load.
3. Check front wheels and tire assemblies for radial and lateral runout.
4. Grasp front bumper in center and raise and lower front end several times to allow frame to come to its normal level. If spotty tire wear is in evidence, observe especially for uneven action between right and left sides of car when car is raised and lowered.
5. Check shock absorber action.
6. Set front wheels in straight-ahead position.
7. Check front wheel alignment without passengers or load in or on car.

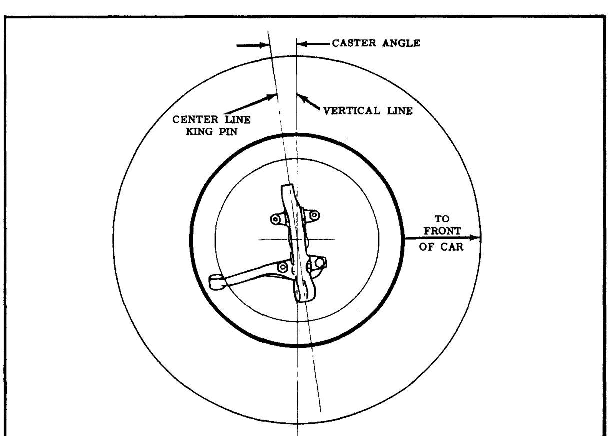


Fig. 4-28 Front Wheel Caster

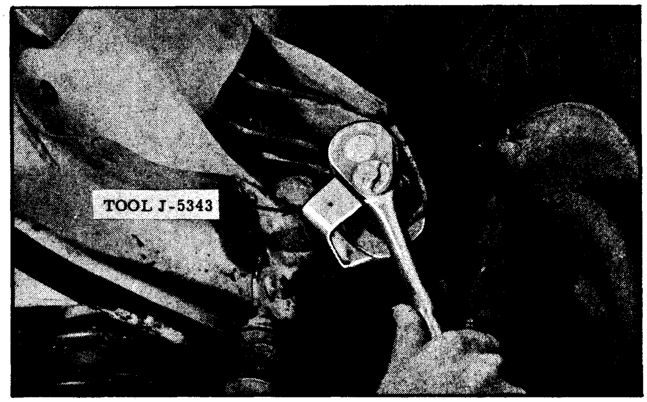


Fig. 4-29 Camber and Caster Adjustment

The method of checking alignment will vary depending on the type of equipment being used. The instructions furnished by the manufacturer of the equipment should be followed.

NOTE: Caster angle and camber angle should be within $1/2^{\circ}$ between right and left sides of car for best handling characteristics.

CASTER ADJUSTMENT
(0 to ¾ degree negative)

1. Loosen the clamp bolt at upper end of steering knuckle support.
2. Using special wrench J-5343, turn eccentric bushing to obtain desired adjustment. (Turn eccentric bushing in a clockwise direction to increase caster and in a counter-clockwise direction to decrease caster at each front wheel.)
3. Make camber adjustment, then tighten knuckle support clamp bolt.

CAMBER ADJUSTMENT
(¾° + to ¾° −)

1. Loosen clamp bolt at upper end of steering knuckle support.
2. Using special wrench J-5343, turn eccentric bushing to obtain desired adjustment.

   NOTE: Since the camber adjustment is controlled by the eccentric action of the bushing, 1/2 turn gives the maximum adjustment and is all that should be required. Furthermore, changing

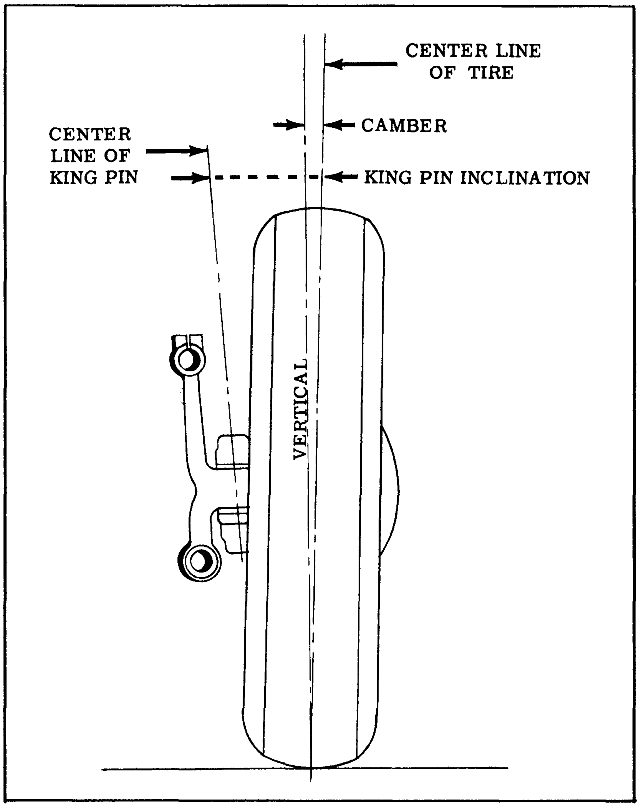


Fig. 4-30 Front Wheel Camber

camber will change caster angle slightly; however, caster angle usually will still be within limits.

3. After adjustment is completed, tighten knuckle support clamp bolt.

TOE-IN ADJUSTMENT
(1/16" to 1/8")

1. Loosen the clamp bolts at each end of the steering tie rod adjustable sleeves.
2. With steering wheel set in straight-ahead position, turn tie rod adjusting sleeves to obtain the proper toe-in adjustment.
3. When adjustment has been completed according to the recommended specifications, and tie rod end ball studs are riding squarely in their seats, position tie rod to relay rod ball studs to the bottom of the slot in the relay and then position clamps so that bolts are below the upper surface of adjusting sleeves. Edge of clamp must not be in slot. (See Fig. 4-33)

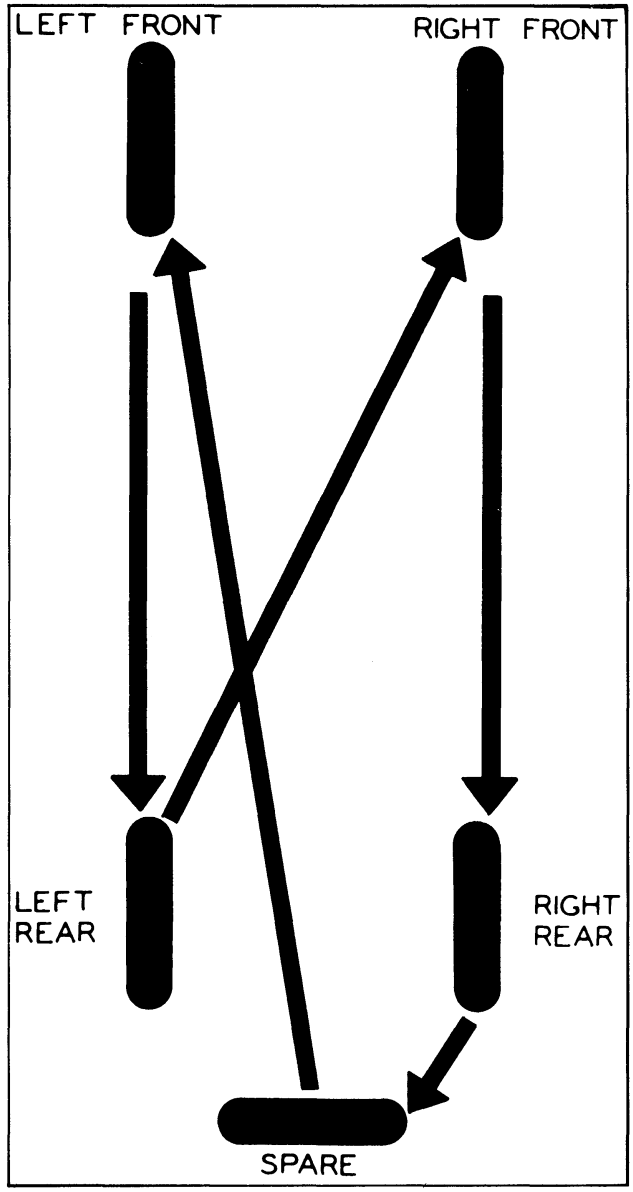


Fig. 4-31 Method of Rotating Tires

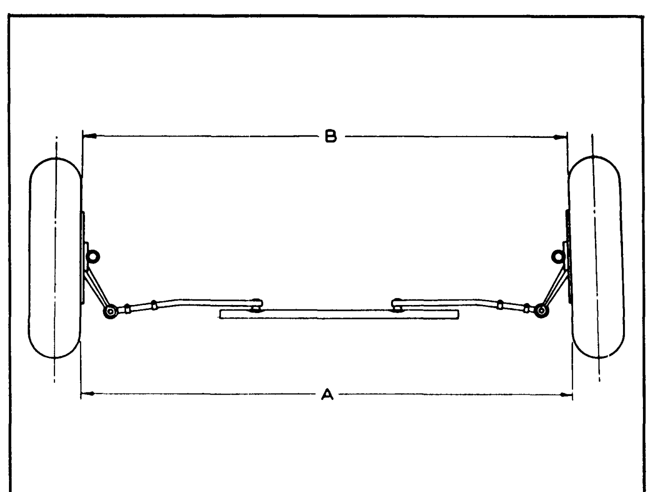


Fig. 4-32 Front Wheel Toe-In (A Minus B)

DIAGNOSIS

WHEEL BEARING NOISE

Wheel bearing noise may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing "pull" and "coast". A bad bearing will cause a knock or click approximately every two revolutions of wheel since the bearing rollers do not travel at the same speed as the wheel. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

HARD STEERING

Cause:
1. Low or uneven tire pressure.
2. Steering gear or connections adjusted too tight.
3. Insufficient or incorrect lubricant used.
4. Improper caster.
5. Upper or lower control arms bent.
6. Frame bent or broken.
7. Steering knuckle bent.

EXCESSIVE PLAY OR LOOSENESS IN STEERING SYSTEM.

Cause:
1. Steering gear or connections adjusted too loosely or worn.
2. Steering knuckle bearings worn.
3. Front wheel bearings incorrectly adjusted or worn.
4. Loose front stabilizer.

ERRATIC STEERING ON APPLICATION OF BRAKE.

Cause:
1. Low or uneven tire pressure.
2. Brakes incorrectly or unevenly adjusted. Dirt or grease on lining.
3. Incorrect or uneven caster.
4. Steering knuckle bent.
5. Loose steering linkage or suspension.

FRONT WHEEL SHIMMY

Cause:
1. Uneven tire pressure.
2. Steering connections incorrectly adjusted or worn.
3. Front wheel bearings incorrectly adjusted or worn.
4. Shock absorbers inoperative or leaking.
5. Steering knuckle bushings worn.
6. Toe-in incorrect.
7. Incorrect or uneven caster.
8. Steering knuckle bent.
9. Wheels, tires, or brake drums out of balance.
10. Excessive runout of wheels or tires.

CAR PULLS TO ONE SIDE.

Cause:
1. Low or uneven tire pressure.
2. Rear wheels not tracking with front wheels.
3. Brakes incorrectly or unevenly adjusted or dragging.
4. Shock absorbers worn or inoperative.
5. Toe-in incorrect.
6. Incorrect or uneven caster or camber.
7. Rear axle shifted.
8. Frame or member bent or broken.

WORN TIRE TREAD EDGES.

Cause:
1. Improper front end alignment.
2. High speed driving on curves.
3. Steering knuckle bent.
4. Steering plain-arm bent.

SCUFFED TIRES.

Cause:
1. Tires improperly inflated.
2. Wheels or tires out of true.
3. Steering knuckle bushings worn.
4. Toe-in incorrect.
5. Uneven caster.
6. Incorrect toe-out on turns.
7. Steering gear incorrectly adjusted.
8. Eccentric or bulged tires.

FRONT OR REAR WHEEL TRAMP.

Cause:
1. Wheels, tires, or brake drums out of balance.
2. Motor mountings faulty or torn loose.
3. Shock absorbers inoperative.
4. Loose or worn front wheel bearings.

CAR WANDERS.

Cause:
1. Low or uneven tire pressure.
2. Steering gear or connections adjusted too loosely or worn.

FRONT SUSPENSION SPECIFICATIONS

Subject and Remarks	All
1. CASTER ANGLE-DEGREES**	0° to - $3/4^{\circ}$ (Neg.)
2. CAMBER-DEGREES**	$-3/4^{\circ}$ to + $3/4^{\circ}$
3. TOE-IN	1/16" to 1/8"
4. KING PIN INCLINATION (at 0° camber)	5° 51' 10"
5. TOE-OUT	23° + $1/2^{\circ}$
6. TREAD	59"

** Maximum variation between the two sides of the car should not exceed $1/2^{\circ}$.

TORQUE TIGHTNESS CHART

Application	Ft. Lbs.
1. Front Stabilizer Shaft Bracket to Frame Bolts & Nuts	25-30
2. Upper Control Arm Pivot Shaft to Frame Bolts & Nuts	85-100
3. Upper Control Arm Pivot Pin & Nut	50-60
4. Lower Control Arm Pivot Shaft to Frame Bolts & Nuts	55-60
5. Lower Control Arm Pivot Pin & Nut	50-60
6. Knuckle Support Clamp Bolt	30-35
7. Knuckle Support Lower Bushing	145-220
8. Shock Absorber Upper & Lower Nuts	25-30
9. Shock Absorber Upper & Lower Lock Nuts	2-3
10. Shock Absorber Bracket to Control Arm Bolts	18-22
11. Wheel Nuts	75-85
12. Stabilizer Link Nut	14-17

WHEEL AND TIRE SPECIFICATIONS

1. WHEELBASE	88-122", 98-126"
2. WHEELS	
a. Rim Diameter	15"
b. Rim Width	5-1/2"
c. Bolt Circle	5"
d. Number of Studs	5
3. WHEEL BEARINGS	
a. Make	N.D.
b. Type	Ball
4. WHEEL AND TIRE BALANCE	
a. Front, Rear, Spare, (Maximum out of balance)	20 in. oz.

TIRE SIZES AND PRESSURES

Series	Equipment	Body Styles	Tire Size	Front	Rear
88	Standard	All models	7.10 x 15	24 lbs.	22 lbs.
88	Optional	All models	7.60 x 15	24 lbs.	22 lbs.
S88	Standard	All models	7.60 x 15	24 lbs.	22 lbs.
S88	Optional	All models	8.00 x 15	24 lbs.	22 lbs.
98	Standard	All models except convertibles	7.60 x 15	24 lbs.	22 lbs.
98	Optional	All models except convertibles	8.00 x 15	24 lbs.	22 lbs.
98	Standard	Convertibles	8.00 x 15	24 lbs.	22 lbs.

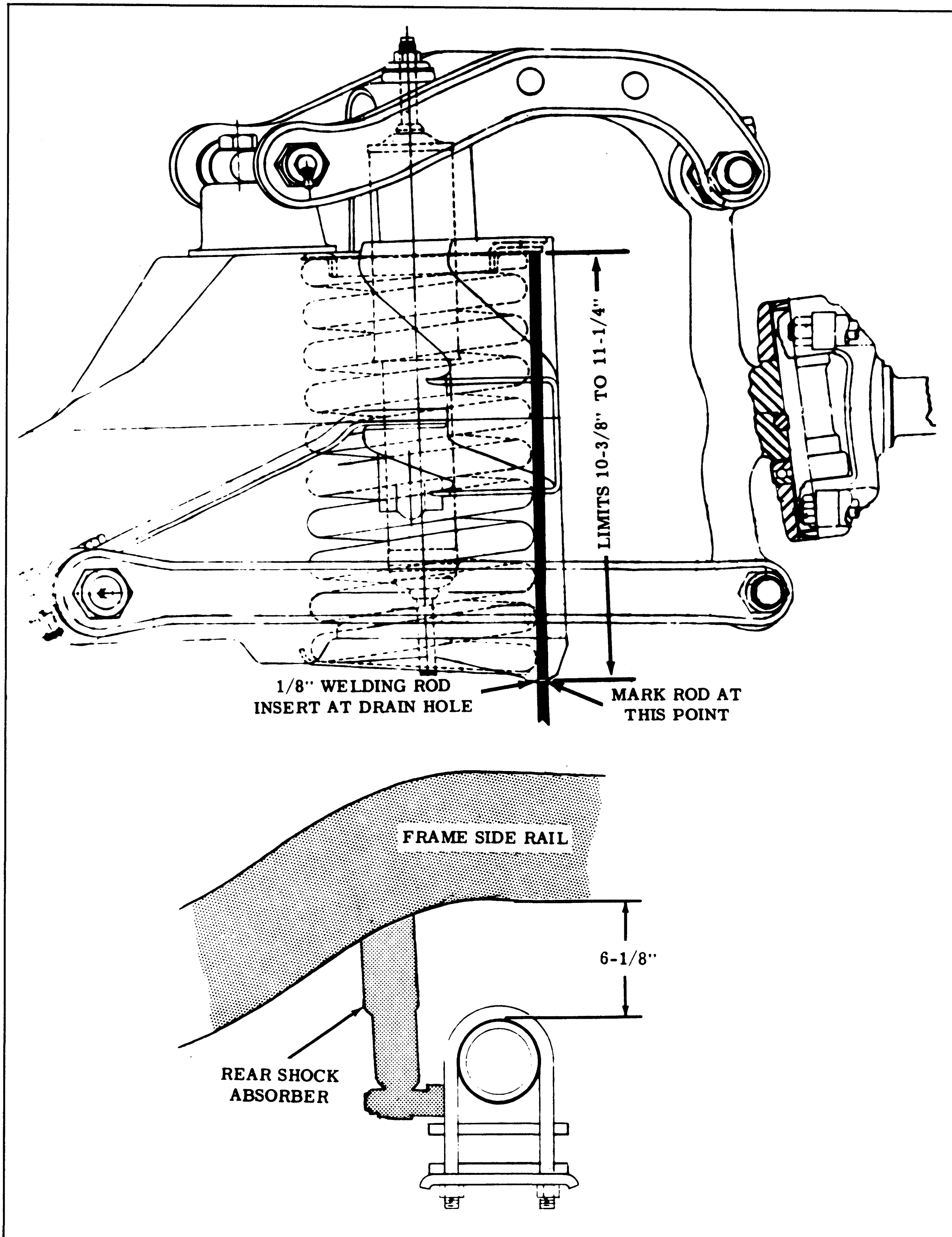
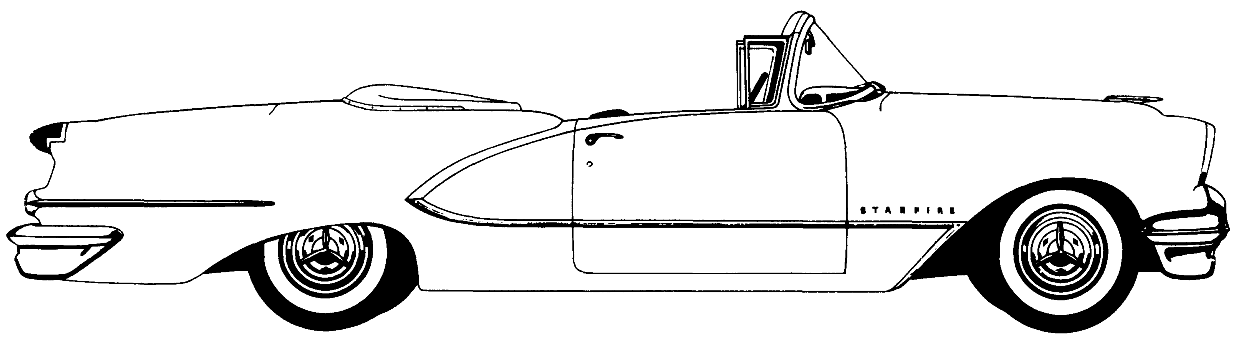
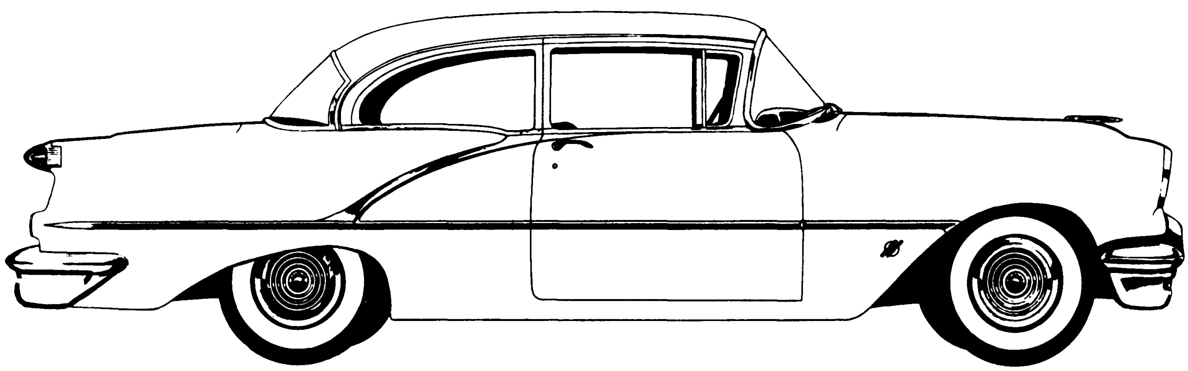


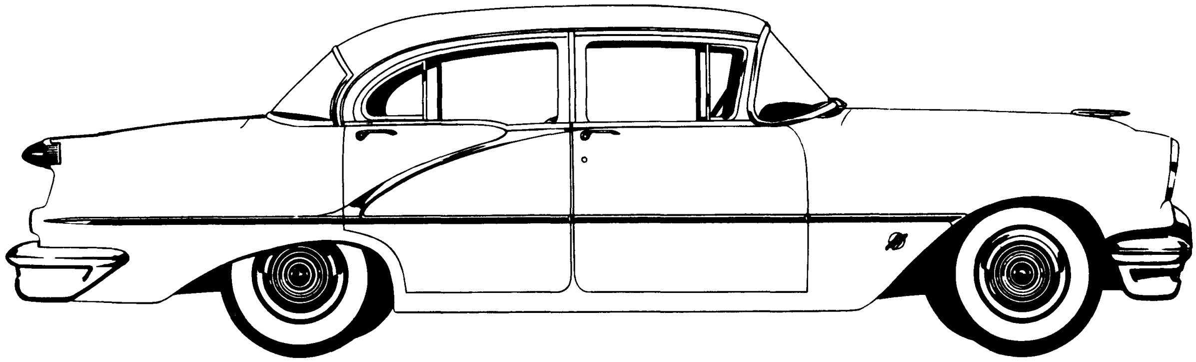
Fig. 4-33 Spring Carrying Heights



98 STARFIRE COUPE (DCR)



SUPER 88 2-DOOR SEDAN (DK)



SUPER 88 4-DOOR SEDAN (DS)

STEERING

CONTENTS OF SECTION 5

STANDARD STEERING

The steering gear is the recirculating ball nut type. The nut, mounted on the worm, is driven through steel balls which circulate in helical grooves in both the worm and nut. Return guides attached to the nut serve to recirculate the two sets of thirty balls through the grooves. (See Fig. 5-1)

The teeth on the sector, which is forged integral with the pitman shaft, are so designed that a "high point" or tighter fit exists between the nut and sector teeth when the front wheels are straight ahead. Proper engagement between the sector and nut may be obtained by moving the pitman shaft endwise which causes the slightly tapered sector teeth to properly engage the mating teeth on the nut.

Adjustment is accomplished by means of a screw which extends through the gear housing side cover. The head of the adjusting screw and a selectively fitted shim fit snugly into a T-slot in the end of the pitman shaft so that end play of the shaft is also controlled by the screw which is locked by an external lock nut.

ADJUSTMENTS

Before any adjustments are made to the steering gear in an attempt to correct such

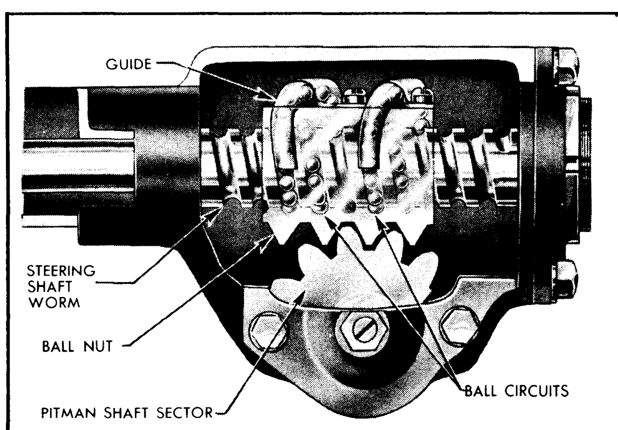


Fig. 5-1 Standard Steering Gear

conditions as shimmy, hard or loose steering, and road shocks, careful check should be made to determine that front end alignment, shock absorbers, wheel balance, and tire pressure are correct.

There are only two major adjustments of the recirculating ball nut type steering gear:

1. WORM BEARING ADJUSTMENT
2. HIGH SPOT ADJUSTMENT

CAUTION: It is very important that the worm bearing adjustment be checked and re-adjusted if necessary before the high spot adjustment is made. Failure to follow the proper sequence may result in damage to the steering gear.

Worm Bearing Adjustment

1. Disconnect the pitman arm from pitman shaft.
2. Loosen pitman shaft adjusting screw lock nut and back off adjusting screw a few turns.
3. With spring scale Tool J-544-A at the rim of the steering wheel, measure the pull which is required to keep the wheel in motion at about 30° off center. (See Fig. 5-2)
4. The pull required should be between 1/2 and 7/8 pounds. If it is not, it will be necessary to loosen lock nut at end of worm shaft with Tool J-4388 and turn worm bearing adjusting screw the required amount with Tool KMO-695 to bring the spring pull within limits. (See Fig. 5-3)

Fig. 5-2 Checking Worm Bearing Adjustment

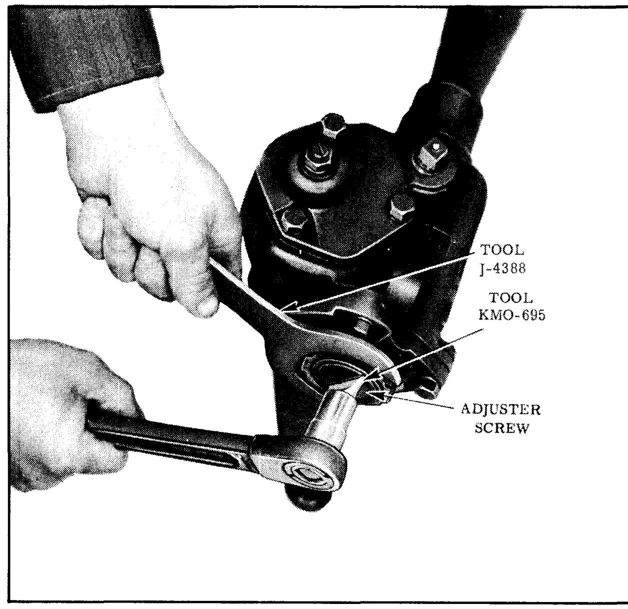


Fig. 5-3 Adjusting Worm Bearing

5. When adjustment is correct, retighten lock nut and recheck preload.

Over-Center Adjustment

1. The worm bearing adjustment having been made, the pitman shaft adjusting screw should be tightened until a pull of 1-1/2 to 2 pounds at the steering wheel rim is required to turn the wheel through the center range. (See Fig. 5-4)

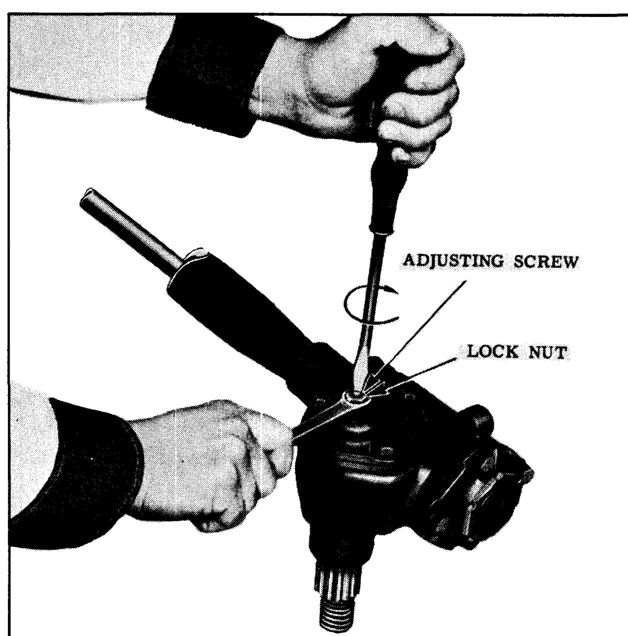


Fig. 5-4 Over-Center Adjustment

GEAR ASSEMBLY, REMOVE AND REPLACE

1. Remove steering wheel assembly, upper bearing spring and seat.
2. Turn back floor mat and remove mast jacket cover plate attaching screws.
3. Loosen upper and lower mast jacket clamps.
4. Hoist car and remove engine filler plate.
5. Remove pitman arm from pitman shaft.
6. Remove steering gear to frame mounting bolts.
7. Remove gear assembly by pulling it down out of mast jacket. To replace, reverse the above procedure.

IMPORTANT: Tighten upper mast jacket clamp before tightening steering gear to frame bolts.

DISASSEMBLE STEERING GEAR FIG. 5-5

1. Remove steering gear assembly from car and mount on holding fixture J-5205.
2. Rotate worm until nut is in center of travel, then remove side cover and pitman shaft from steering gear housing.
3. Loosen lock nut and back off adjusting screw from end of worm shaft.
4. Remove cover from lower end of worm shaft.
5. Push worm and shaft assembly, together with ball nut assembly, down through bottom of housing then remove bearings.
6. Remove ball return guide clamps and guides from ball nut, turn ball nut over, and remove balls; then, remove ball nut from steering shaft worm.

Remove and Replace Side Cover Needle Bearing

NOTE: The power steering gear end casting bearing puller, Tool J-5190, should be converted to J-5190-A for use on the standard steering gear by replacing the expander jaws and regrinding the taper on the screw as shown in Fig. 5-6.

1. Remove the pitman shaft and adjusting screw from the side cover.
2. Back out the forcing screw of Tool J-5190-A so the expander jaws can be fully retracted.
3. Place Tool J-5190-A through needle bearing in side cover.
4. Thread a 7/16" x 20 bolt in the adjusting screw hole in the side cover until Tool J-5190-A is raised up just enough for the knurled section to clear the bearing.

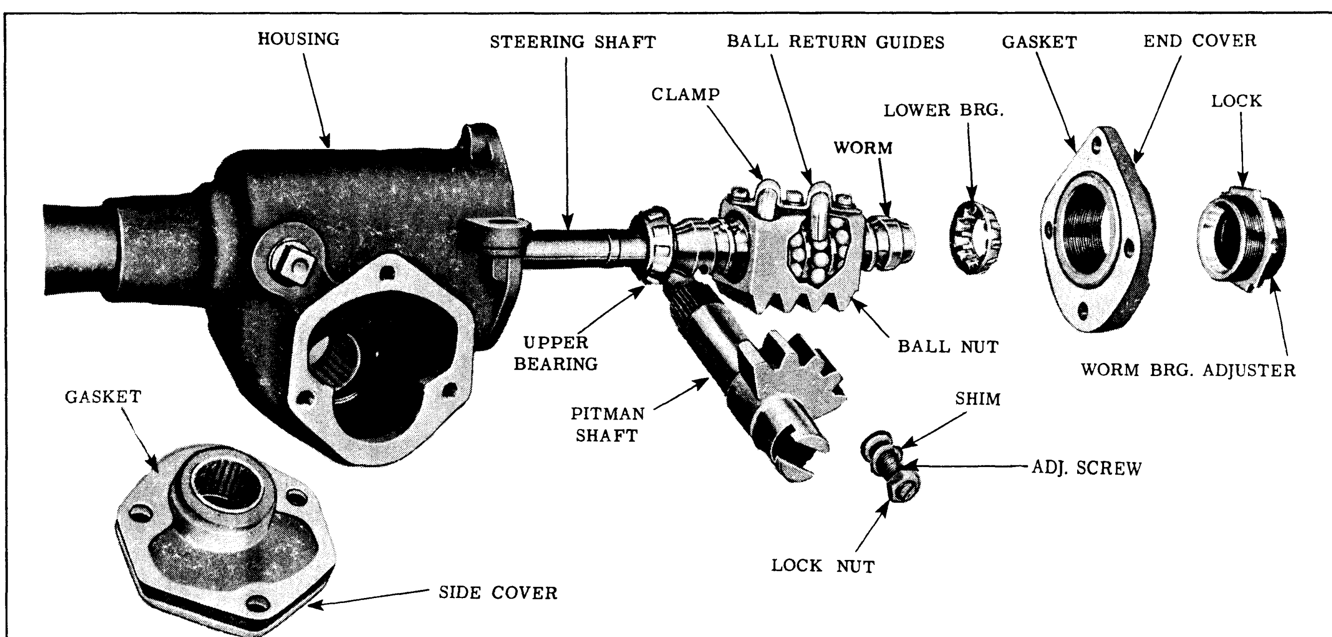


Fig. 5-5 Steering Gear Nomenclature

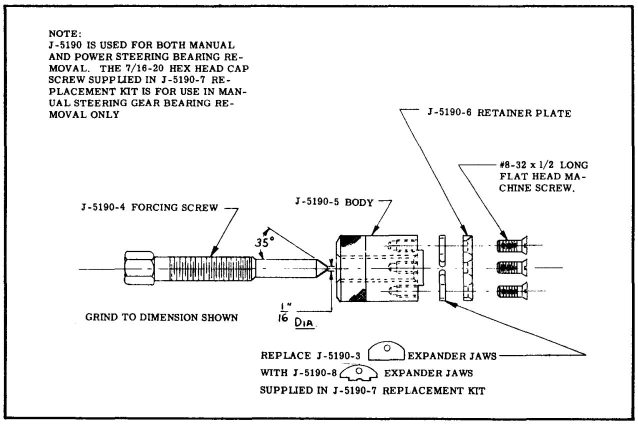


Fig. 5-6 Tool J-5190-A

NOTE: A 7/16" x 20 bolt is furnished in the kit with the new expander jaws.

5. Turn the forcing screw in to expand jaws and remove the bearing. (See 5-7)

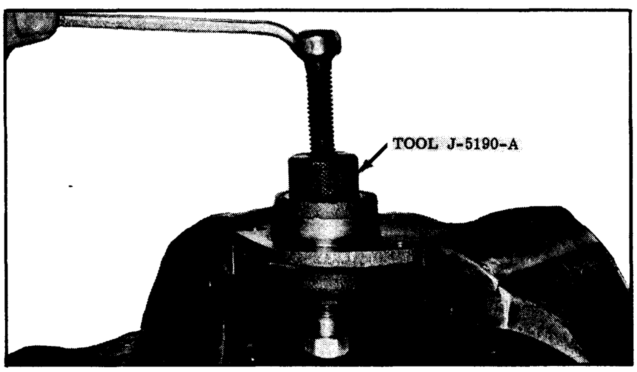


Fig. 5-7 Removing Side Cover Bushing

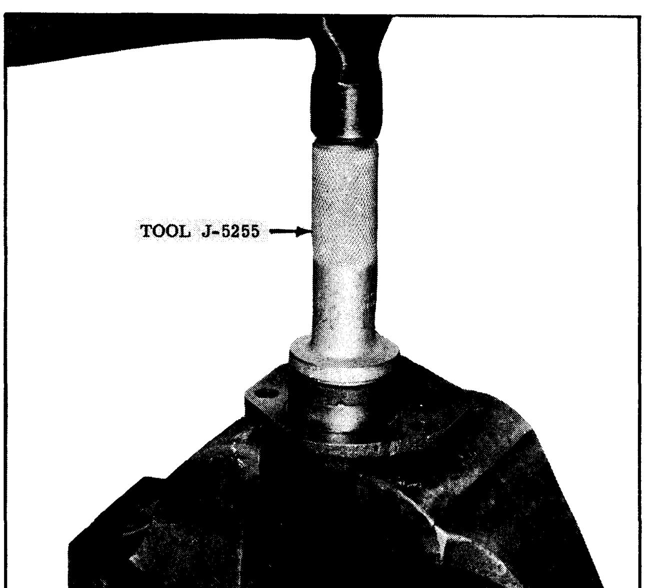


Fig. 5-8 Installing Side Cover Bearing

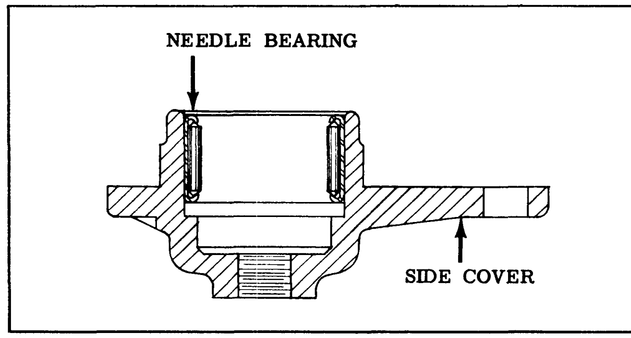


Fig. 5-9 Side Cover and Bearing

To install bearing, use Tool J-5255 and install the bearing flush with surface of the casting bore. (See Figs. 5-8 and 5-9)

IMPORTANT: One end of the needle bearing is stamped with the manufacturer's identification; always place the stamped end of the bearing against the shoulder of the installing tool so that the unstamped end of the bearing enters the casting first.

Remove and Replace Pitman Shaft Needle Bearing and Seal

1. Use Tool J-5254 to drive bearing and seal from housing as shown in Fig. 5-10.

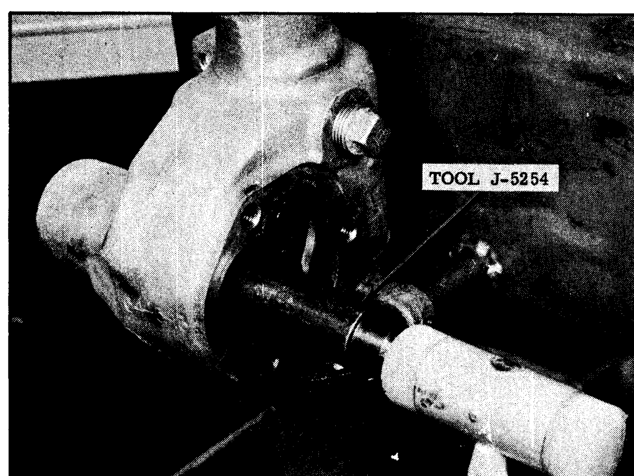


Fig. 5-10 Removing Bearing From Housing

2. Place stamped end of new bearing (manufacturer's name) against the shoulder of large end of Tool J-5254.
3. Install needle bearing in housing so that it is flush with shoulder of counterbore as shown in Figs. 5-11 and 5-12.

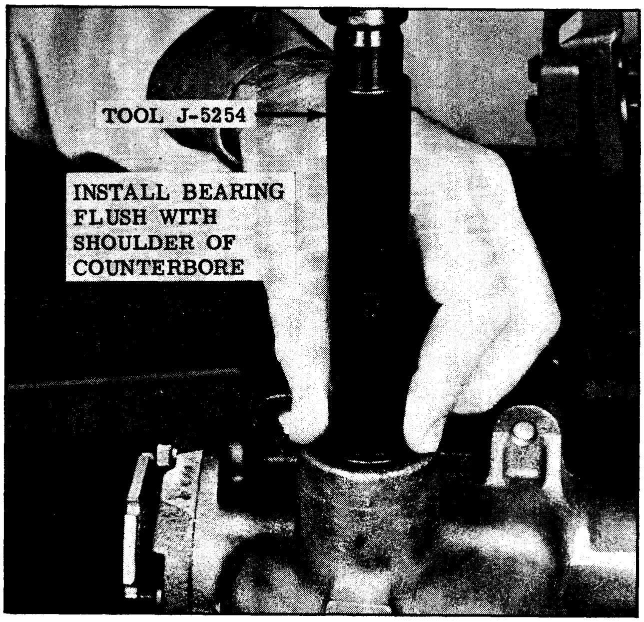


Fig. 5-11 Installing Bearing In Housing

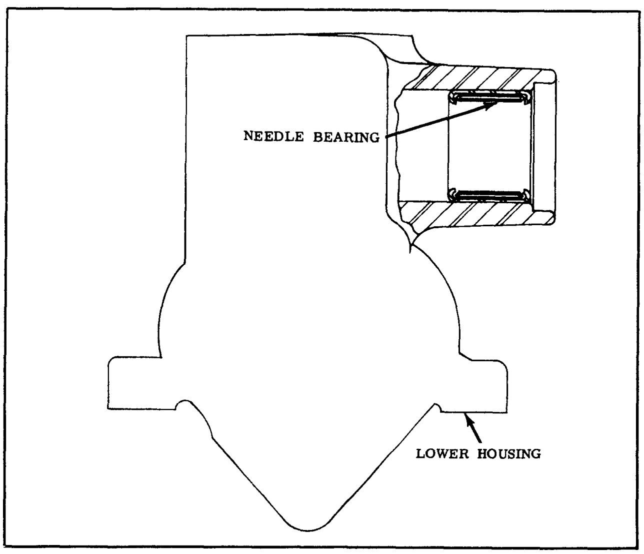


Fig. 5-12 Housing and Bearing

4. Install a new seal into housing with lip of seal facing inward. Drive seal flush with casting, using Tool J-5255. (See Fig. 5-13)

Remove Pitman Shaft Seal

When removing the seal, without removing the pitman shaft bearing, it will be necessary to use a small chisel to collapse the seal so that it can be lifted from the housing. (See Fig. 5-14)

Replace seal as in step 4 above.

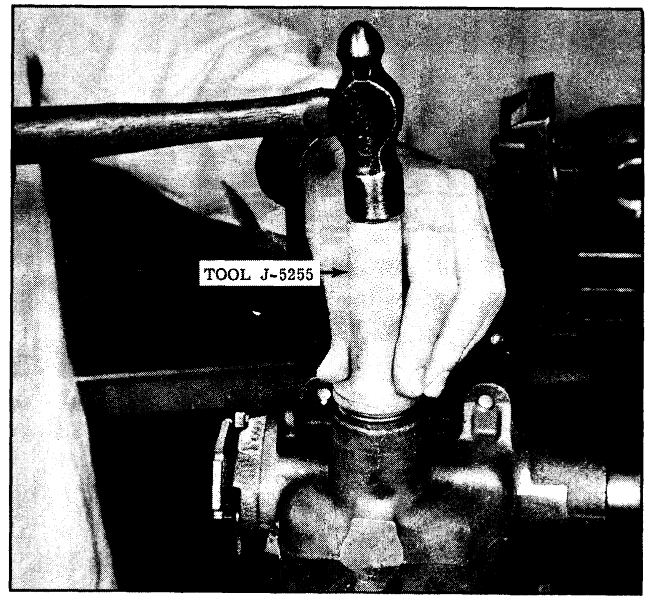


Fig. 5-13 Installing Pitman Shaft Seal

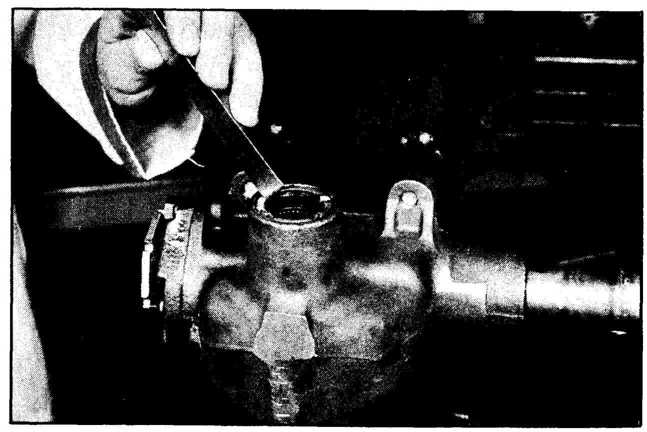


Fig. 5-14 Removing Pitman Shaft Seal

ASSEMBLE STEERING GEAR

1. Before assembling the steering gear, wash all parts in clean solvent and inspect balls, bearings, races, worm, and ball nut for any rough spots or defects.
2. Assemble ball nut on worm, making sure that there are 30 balls in each circuit, making a total of 60 balls. Install return guide clamps.
3. Assemble two roller bearings on worm shaft and replace worm and shaft in housing.
4. Attach end cover to lower end of housing, holding worm and bearings in place. (See Fig. 5-5)

NOTE: Adjuster screw should be adjusted just tight enough at this time to hold the bearing races in place. Final adjustment will be made later.

5. Install pitman shaft adjusting screw with lock nut to side cover, then assemble pitman shaft to adjusting screw and back screw out about 3/4".

NOTE: Particular care must be exercised to assure that teeth on pitman shaft do not bind with teeth on ball nut during installation.

6. Install pitman shaft and side cover assembly. After cover is tightened in place, tighten pitman shaft adjusting screw enough so that teeth on shaft and ball nut engage but do not bind. Final adjustmens will be made later.
7. Fill steering gear with steering gear lubricant.
8. Steering gear should be bench adjusted before it is assembled in car as follows:
   a. Place steering wheel on shaft.
   b. Turn steering gear from one extreme to the other to make certain there are no unusual binds.

      NOTE: Never allow ball nut to strike the ends of the ball races when reaching its extreme position due to the possibility of damaging ball guides.
   c. Adjust steering gear as outlined under:
      1. WORM BEARING ADJUSTMENT
      2. OVER-CENTER ADJUSTMENT
9. Remove steering wheel from shaft. Assemble steering gear in car and reinstall steering wheel.
10. When mark on steering wheel hub and steering shaft are lined up, wheel spokes should be horizontal as car is driven straight ahead.

    If this is not the case, it will be necessary to adjust the tie rod ends until steering wheel assumes its proper position. When a new steering gear is installed, it may be necessary to adjust steering wheel spoke alignment even though spoke alignment had been correct for the old gear.

STEERING LINKAGE FIG. 5-15

Steering Relay Rod

One end of the steering relay rod is mounted to the pitman arm, the other end

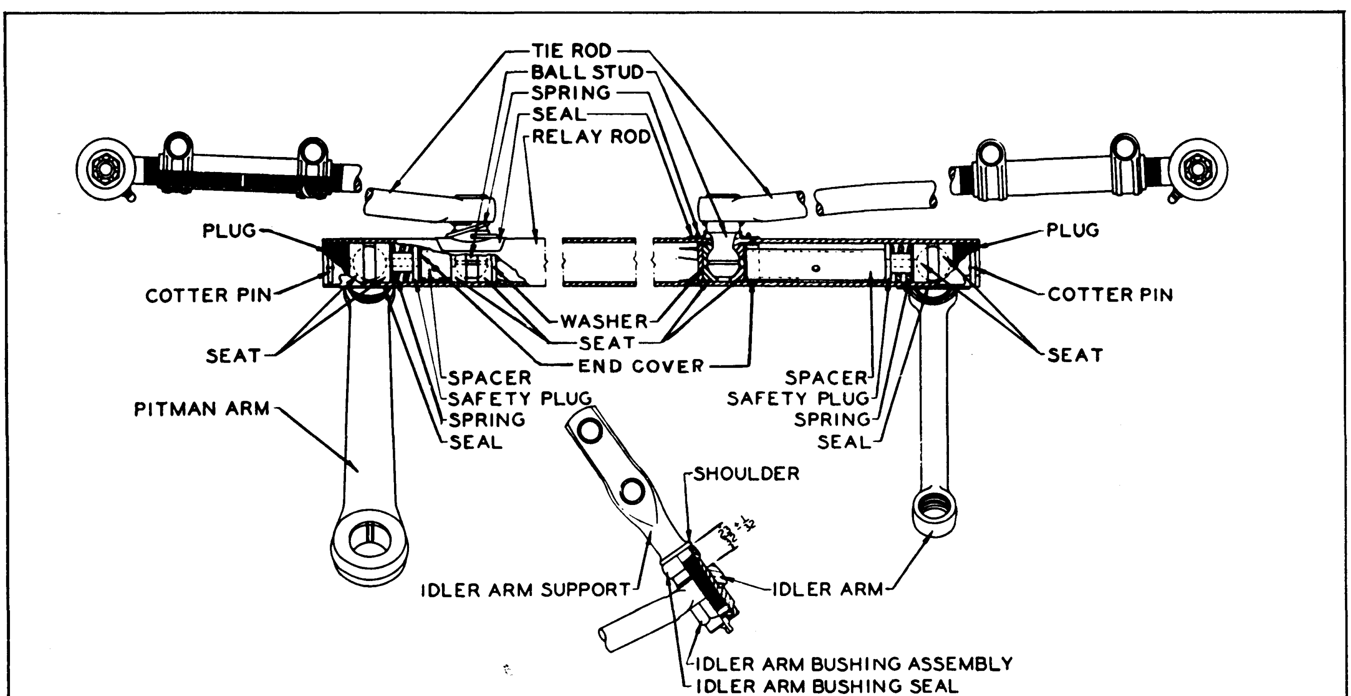


Fig. 5-15 Steering Linkage

is mounted to the idler arm. When installing the steering relay rod, the opening for the left hand tie rod ball stud is closer to the end of the rod than the opening for the right hand tie rod ball stud.

A grease retainer is fitted over the inner ends of the ball stud spacers.

Assemble parts in the steering relay rod as illustrated in Fig. 5-15. Notice that one of the spacers is longer than the other. The proper adjustment of the threaded end plugs on the steering relay rod is: Tighten plug, then back off 1/4 to 3/4 turn.

Steering Idler Arm

The steering idler arm is supported at the right hand front extension rail by means of an idler arm support.

The idler arm support bushing is prevented from loosening by the use of a right hand thread on the outside of the idler arm bushing and a left hand thread on the inside of the bushing and at the idler arm support. Whenever the idler arm is disassembled from the idler arm support, it must be reassembled so that there is a dimension of 23/32" between upper face of the idler arm and the shoulder on the support as shown in Fig. 5-15.

Since the right hand threads on the outside of the idler bushing thread into the idler arm and those on the inside thread onto the idler arm support, this adjustment must be made with the support removed from the frame, assembled to the bushing and the arm, and then the assembly mounted to the frame. To assemble the idler arm, proceed as follows:

1. Screw idler arm bushing into idler arm and tighten.
2. Screw idler arm support into bushing until the distance between the upper face of the arm and shoulder on the support is 23/32" as shown in Fig. 5-15.
3. Mount assembly to frame.

Tie Rod

Tie rod ends are serviced as an assembly. Both left and right tie rods are adjustable for length.

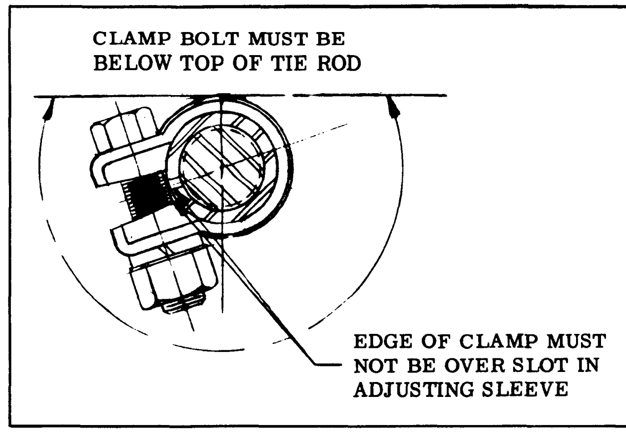


Fig. 5-16 Adjusting Sleeve Clamp Positioning

Tie rod ends should be replaced when tension is no longer present in the ball assembly.

When toe-in adjustment has been completed and tie rod end ball studs are riding squarely in their seats, position tie rod to relay rod ball studs to the bottom of the slot in the relay rod, and then position clamps so that bolts are below the upper surface of adjusting sleeves. Edge of clamp must not be in slot of sleeve. (See Fig. 5-16)

POWER STEERING

The new power steering gear assembly employs a flexible coupling which connects the gear assembly to the mast jacket assembly. (See Fig. 5-17) The flexible coupling permits self alignment of the assembly and cushions road shock. This

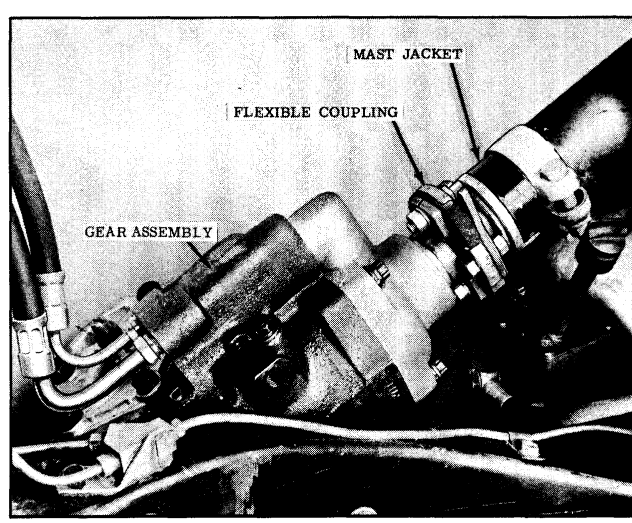


Fig. 5-17 Power Steering Gear

also permits the gear assembly or the mast jacket assembly to be removed from the car independently of each other.

All internal parts of the gear are lubricated with oil supplied by the pump, making it unnecessary to have a sealed gear box for grease.

A ball check permits oil to circulate in the system without overflowing the vented reservoir in the event of pump failure.

The steering gear satisfies two conditions which are: neutral (for straight ahead driving), and power assist (for turning). When effort is not being applied at the steering wheel, the worm shaft and spool valve automatically center themselves resulting in a neutral condition with all passages open so that only a low neutralizing oil pressure exists. Therefore, no power assist is obtained in the neutral position. Power assist is regulated by the spool valve which directs oil pressure to either end of the rack-piston. The spool valve is actuated by the "in" or "out" movement of the worm shaft in varying degrees dependent upon the amount of effort applied at the steering wheel.

NEUTRAL (Straight Ahead Position) FIG. 5-18

There are four centering springs attached to the thrust bearing, and four

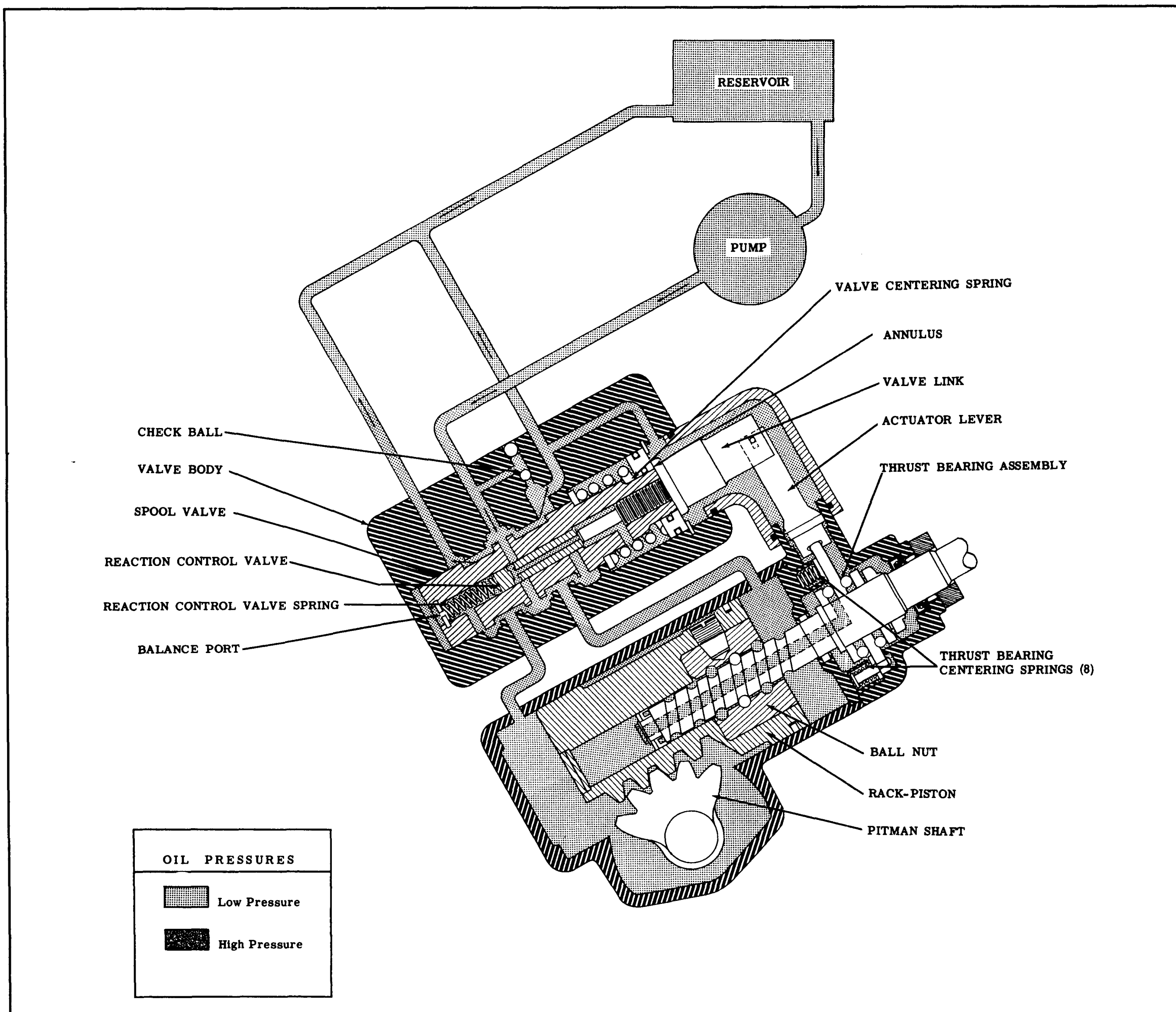


Fig. 5-18 Neutral Position

centering springs located between the adapter and the thrust bearing. The opposing forces from these two sets of springs center the worm shaft in a neutral position. When this condition exists, the thrust bearing holds the actuating lever at the center of its travel. In order for the valve assembly to move in either direction, it has to overcome the resistance of the large centering spring on the valve assembly. Therefore, since the actuating lever is being held by the thrust bearing, the valve is held in its neutral position by its centering spring. The reaction control valve, located inside the spool valve, is held in its open position by the reaction control spring.

With the valves in neutral position, oil pressure is directed from the pump to the valve body. Since all passages are open, oil is permitted to return to the pump. Oil is also directed to either end of the rack-piston; however, since oil is being returned to the pump, the oil in the housing is maintained at a very low pressure (approximately 30 to 50 p.s.i.) which acts as a cushion in absorbing road shock. In addition, this oil lubricates all components of the gear.

POWER ASSIST (For Turning)

Right Turn
FIG. 5-19

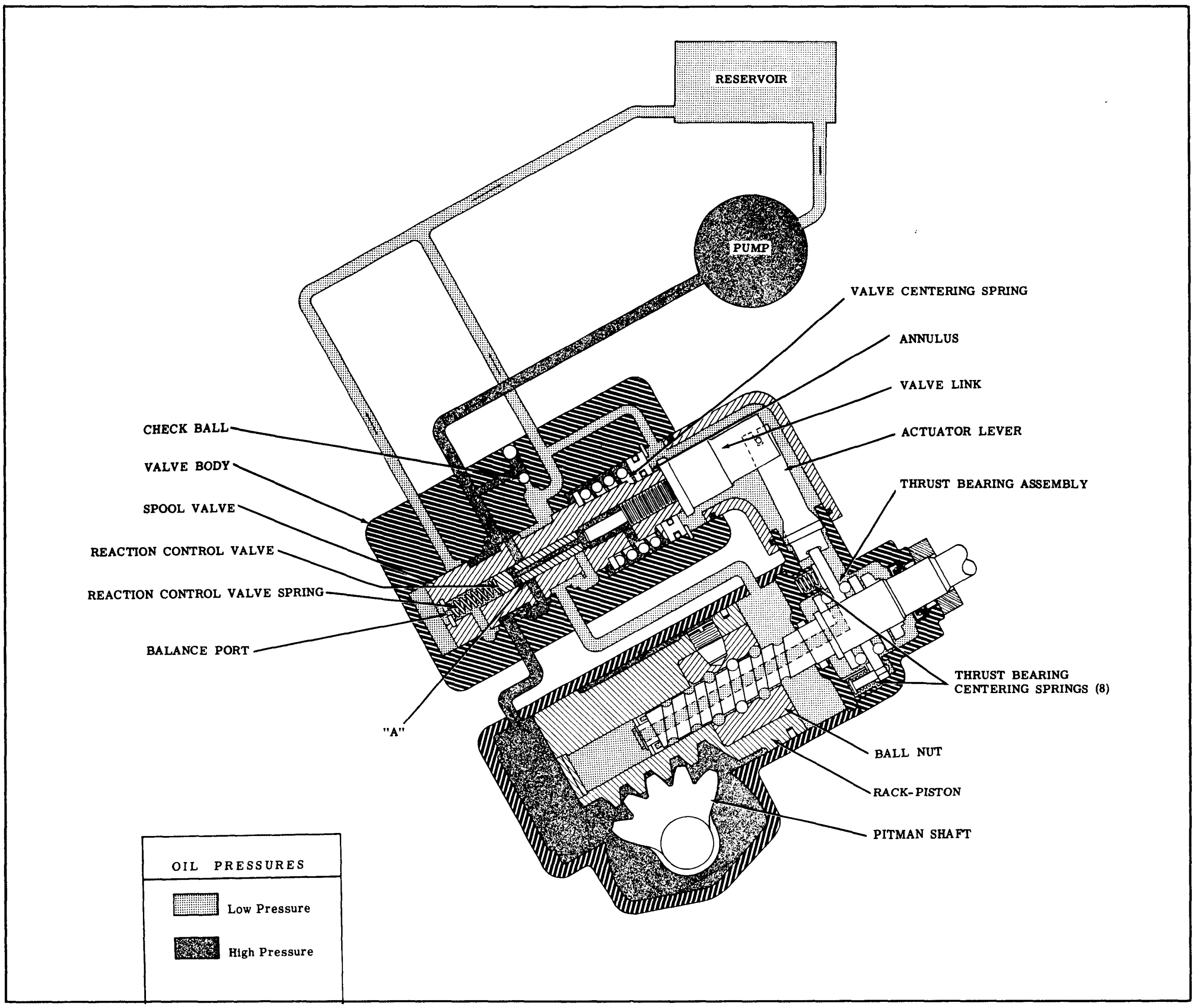


Fig. 5-19 Right Turn Position

When the steering wheel is turned to the right, the worm shaft threads into the ball nut. Due to the resistance of the front wheels through the sector to the rack-piston, the rack-piston tends to remain stationary. Due to the resistance to turning between the front wheels of the car and the roadbed, the steering worm tends to screw down into the ball nut; therefore, as the driver applies right turn effort to the steering wheel, the worm is allowed to move downward an imperceptible amount. As the worm moves downward it also moves the thrust bearing downward, which in turn causes the valve actuating lever to move the spool valve upward. While the valve assembly moves upward, the valve centering spring is compressed against the annulus (held by the snap ring.)

With the valve in this position, pump pressure is directed by the spool valve to the lower end of the rack-piston to assist in turning. As the rack-piston moves upward, oil on the upper end of the rack-piston is displaced past the spool valve and returns to the pump reservoir. When oil pressure is applied to the lower end of the rack-piston, the reaction control valve remains momentarily in its neutral position. Thus, oil pressure is directed through the reaction control valve and into the reaction chamber. As the oil pressure increases in the reaction chamber, it assists the valve centering spring in trying to center the spool valve; therefore, more effort is required at the steering wheel. It is this opposing pressure in the reaction chamber that gives the driver the "feel of the road". The higher resistance to turning, the more the valve assembly is moved upward and the higher the oil pressure on the rack-piston becomes. Since the amount of valve actuation and consequently the amount of hydraulic pressure in the cylinder is dependent upon the resistance to turning, the driver is assured of the proper amount of hydraulic assistance at all times, limited only by the capacity of the pump.

The pressure in the reaction chamber is limited to 250 p.s.i. by the reaction control valve. As the pressure in the reaction chamber builds up, the reaction control valve is forced downward against the reaction control spring and blocks off the passage at (A) Fig. 5-19. With the reaction pressure limited to 250 p.s.i., approximately 4 pounds effort on the steering wheel is required to turn the car in even the most difficult turning conditions.

The balance port Fig. 5-19 relieves pressure or vacuum at the lower end of the spool valve and reaction valve as it is open to the low pressure line at all times. The thrust bearing and the valve actuating lever are lubricated by the valve body low pressure return passage. Since this passage is open at all times, oil is permitted to enter and return as necessary dependent upon movement of the worm shaft and valve assembly.

Left Turn
FIG. 5-20

As effort is applied to the steering wheel for a left turn, the worm shaft will move upward because the rack-piston tends to remain stationary due to the resistance of the steering mechanism. As the worm shaft assembly moves upward, overcoming the tension of the centering springs mounted on the thrust bearing, the actuating lever moves the spool valve downward. The collar on the spool valve moves the annulus downward compressing the valve centering spring. With the spool valve in this position, pump pressue is directed to the upper end of the rack-piston to assist in turning. Oil on the lower end of the rack-piston is free to return to the pump.

For a left turn the valves function the same as for a right turn except for the following:

In the right turn position, the annulus is held stationary by a snap ring. The valve centering spring tries to center the spool valve by applying a force on the thrust washer. In the left turn position, the thrust washer is held stationary and the centering spring tries to center the spool valve by forcing the annulus upward.

When oil pressure is directed to the upper end of the rack-piston for a left

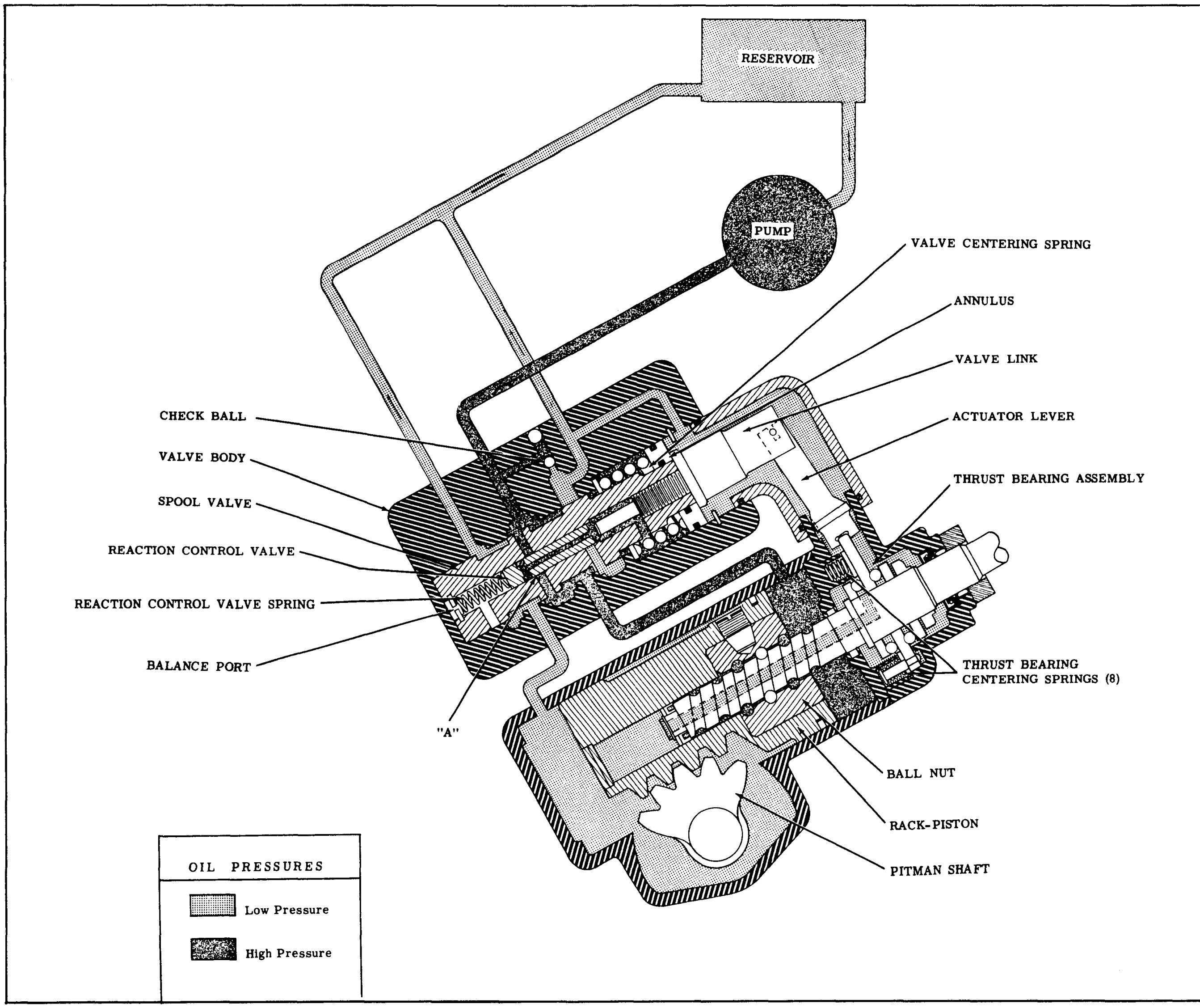


Fig. 5-20 Left Turn Position

turn, the oil pressure in this chamber is confined by the oil seal in the adapter, the rack-piston oil rings, and the oil seal on the end of the worm. To prevent a pressure or a vacuum in the chamber below the worm oil seal in the rack-piston, this chamber is vented by a passage inside the worm which extends into the end cover chamber.

MINOR SERVICE OPERATIONS

OIL RECOMMENDATIONS

The recommended oil for use in hydraulic steering system is the Hydra-Matic Transmission Fluid or TYPE "A". In an emergency, the system can be serviced with a good grade of SAE 10 or 10W oil.

The oil level should be checked regularly and maintained at the full mark.

PUMP BELT ADJUSTMENT

1. Loosen pump to bracket attaching bolts.
2. Place Tool J-5398 under pump body and over pivot cap screw as shown in Fig. 5-21.
3. With torque wrench (0-50 ft. lbs.) adjust drive belt tension to 30 ft. lbs.

The above adjustment corresponds to a belt deflection of 7/8" with 25 lb. pull applied midway between pump pulley and fan.

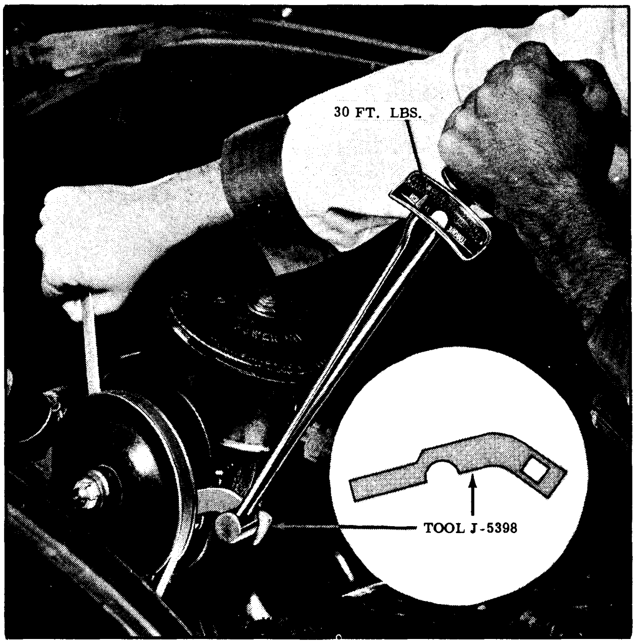


Fig. 5-21 Pump Belt Adjustment

POWER STEERING GEAR ADJUSTMENT (On Car)

The over-center adjustment is the only adjustment to be made on the car. However, in order to make this adjustment it is also necessary to check the ball nut and thrust bearing preload.

1. Disconnect the pitman arm from the pitman shaft.
2. Loosen adjusting screw lock nut and thread adjusting screw out to limit of its travel.
3. Using spring scale J-544-A, check and record the combined ball nut and bearing preload with gear on center (2-1/4 turns from either end of travel) and not moving spoke of steering wheel more than in a 6" arc. (See Fig. 5-22)

   NOTE: If this reading is less than 1/4 lb. or more than 1-1/4 lb., the ball nut and/or thrust bearing preloads are incorrect. It will be necessary to remove and disassemble the steering gear for the necessary adjustments or replacement of parts.
4. With gear on center, adjust pitman shaft adjusting screw so that over-center preload is 1/2 to 3/4 lb. in excess of the worm bearing and ball nut preload that was recorded. Check as shown in

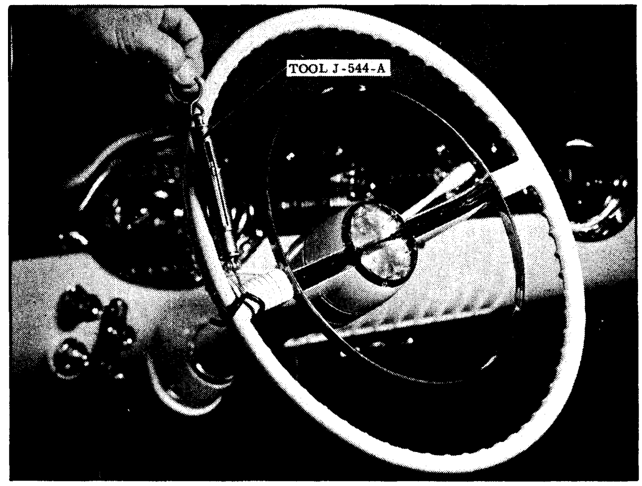


Fig. 5-22 Checking Over-Center Preload

   Fig. 5-22. Total over-center preload must not exceed 1-3/4 lbs.
5. When the correct over-center preload is obtained, tighten lock nut while holding adjusting screw and recheck preload.

OIL PRESSURE TEST

1. Disconnect the pressure line at oil pump, attach gauge Tool J-5176 to pump, and connect the hose to end of gauge where the valve is located. (See Fig. 5-23)
2. With engine at warm idle and gauge valve open, note the oil pressure on the gauge while turning steering wheel from one extreme position to the other. Especially note the maximum pressure which can be built up with the wheel held in either right or left extreme position.

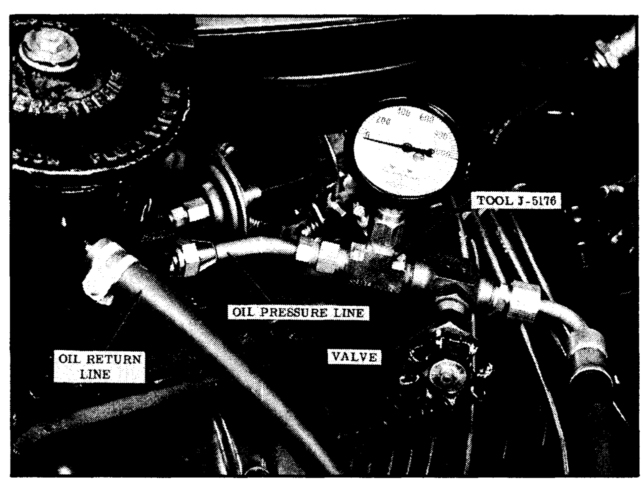


Fig. 5-23 Checking Oil Pressure

CAUTION: Do not hold wheel in extreme position for an extended period of time because it will drastically increase the oil temperature and cause undue wear on the oil pump.

3. With oil temperature between 150^{o}F. and 170^{o}F., as measured with a thermometer in the reservoir, the maximum oil pressure should not be less than 875 p.s.i. for satisfactory power steering operation.
4. If the maximum oil pressure is less than 875 p.s.i., it indicates trouble in the pump, oil hoses, steering gear, or a combination of these parts. To eliminate the hoses and gear, close the gauge valve and quickly test pressure of the pump only, with the engine at warm idle; then, open the valve to avoid increasing oil temperature.
5. Comparing the maximum pressures obtained in these two tests will indicate the source of trouble as follows:
   a. First test (step 2) pressure low, and second test (step 4) pressure normal, indicates faulty external oil lines or steering gear.
   b. First test (step 2) and second test (step 4) pressures equally low, indicates faulty oil pump. If above test shows trouble to be in pump, correct pump as necessary. If trouble is shown to be in steering gear or hoses, examine for external oil leaks and refer to DIAGNOSIS of steering gear.

POWER STEERING GEAR REMOVAL AND REPLACEMENT

1. Scribe alignment marks on the coupling flange and the steering shaft flange. (See Fig. 5-24)
2. Disconnect hoses from power steering pump and cap the pump and hose fittings.
3. Hoist car and remove engine filler plate.
4. Remove the 2 flexible coupling to coupling flange attaching nuts and lock washers.
5. Remove the 3 gear assembly to frame bolts, then remove gear assembly (with hoses attached) from the car.

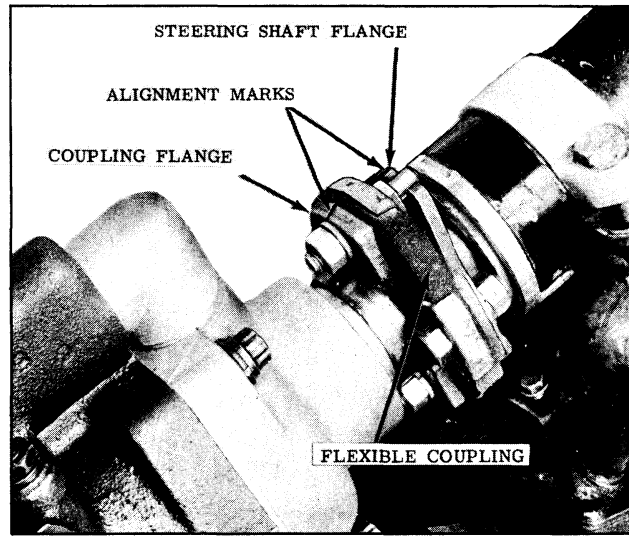


Fig. 5-24 Alignment Marks

When installing the gear assembly, align the coupling flange and the steering shaft flange alignment marks so that steering wheel will be positioned properly. Make sure that gear housing alignment pin enters hole in frame before tightening mounting bolts. The frame to gear assembly bolts should be torqued 40 to 50 ft. lbs. and the pitman arm nut 90 to 120 ft. lbs.

After the gear assembly is installed and hoses connected to the pump, add Hydra-Matic fluid to the reservoir to bring the fluid level to the full mark. With engine running, loosen bleed screw in pitman shaft side cover, turn the steering wheel through its full travel 2 or 3 times to allow air in the system to escape, and tighten bleed screw. Recheck oil level and add fluid if necessary.

GENERAL SERVICE PRECAUTIONS

1. Disassembly and reassembly of the unit and the sub-assemblies must be made on a clean work bench. As in repairing any hydraulically operated unit, cleanliness is of the utmost importance; therefore, the bench, tools, and parts must be kept clean at all times.
2. Extreme caution must be exercised during assembly of the unit in the manner in which the oil seals are handled. All seal protecting tools or devices must be used when assembling the

units with splined parts. The slightest flaw in the sealing surface can cause an oil leak.

3. The aluminum castings and the control valve parts are very susceptible to nicks, burrs, etc., and care should be exercised while handling them.
4. The internal snap rings should be expanded if they are to be reused. This will insure proper seating when installed.
5. Install new "O" rings when servicing a unit.
6. Sealing compound should not be used on seals in this unit.
7. During assembly of the unit, all internal parts must be lubricated with Hydra-Matic oil.
8. Before disassembly of the unit, thoroughly clean the exterior of the unit.

DISASSEMBLY OF GEAR FIG. 5-25

1. Mark alignment of coupling flange and worm shaft.

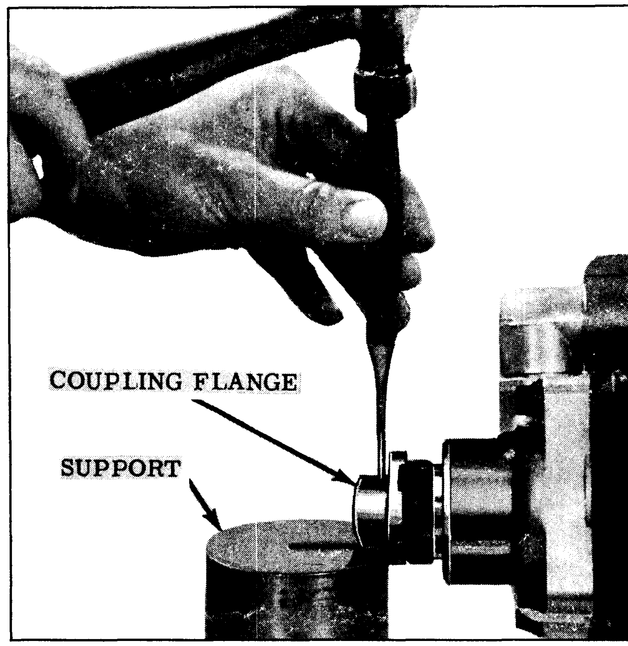


Fig. 5-26 Coupling Flange Pin Removal

2. Drive out coupling flange retaining pin. (See Fig. 5-26)
   NOTE: Coupling flange must be supported when driving out the pin to

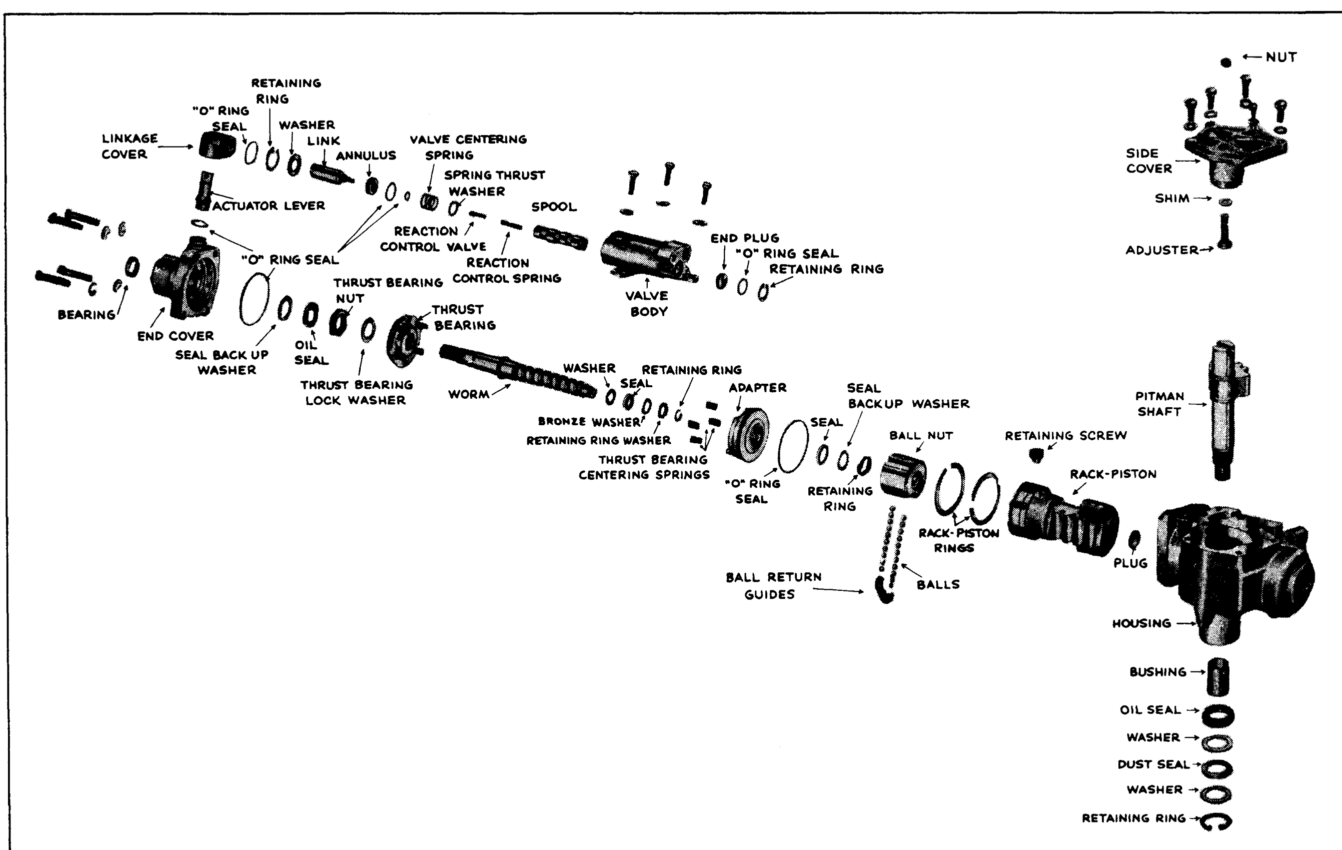


Fig. 5-25 Power Steering Gear

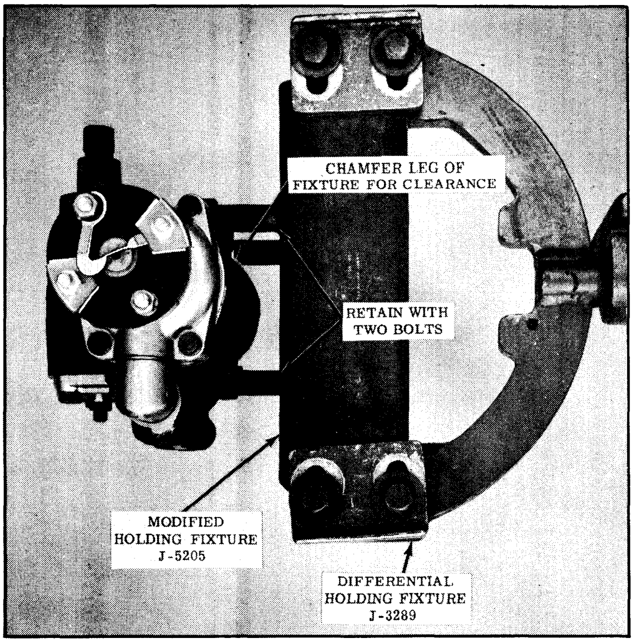


Fig. 5-27 Holding Fixtures

prevent damage to the bearing in the end cover.

3. Mount gear assembly on modified holding fixture J-5205, then, mount holding fixture and gear assembly on differential holding fixture J-3289. (See Fig. 5-27)
4. With the valve body facing down, remove plugs from the hydraulic hoses, then, turn coupling flange 2 or 3 times through its full travel to drain oil from gear.
5. Remove hoses from the valve body.
6. Turn fixture so that valve body faces up and remove 3 valve body cap screws, then, remove the valve body and linkage cover by pulling straight out from

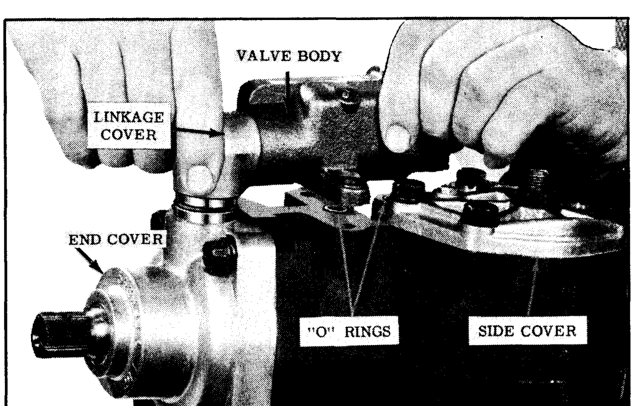


Fig. 5-28 Removing Valve Body

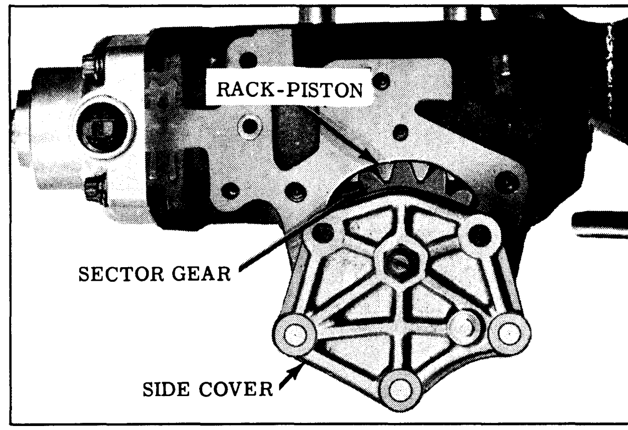


Fig. 5-29 Aligning Pitman Shaft for Removal

the housing. (See Fig. 5-28)

7. Remove the 2 valve body to housing "O" rings from the housing.
8. Loosen the pitman shaft adjusting screw lock nut.
9. Remove the 5 side cover cap screws and rotate the cover 1/2 turn.
10. Align pitman shaft gear with opening in housing. (See Fig. 5-29)
11. Tap the pitman shaft with a plastic hammer and pull the pitman shaft out of the housing.
12. Pull the coupling flange and felt wick from the worm shaft.
13. Pull the actuator lever from the end cover. (See Fig. 5-30)
14. Remove the 4 end cover attaching screws (use a 12 point socket), then pull end cover from the housing.
15. Pull out on the worm shaft until centering springs are exposed, then remove

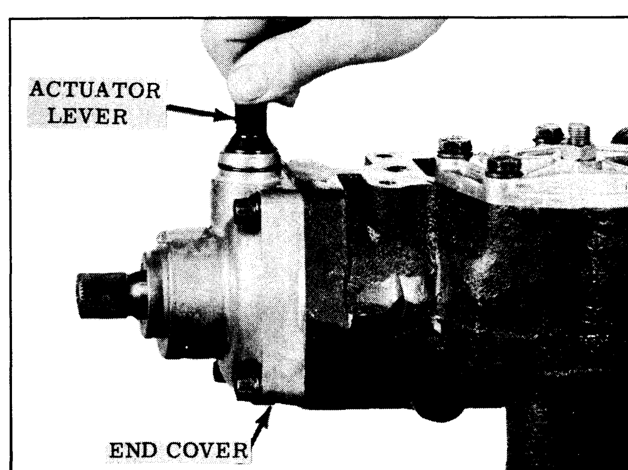


Fig. 5-30 Actuator Lever Removal

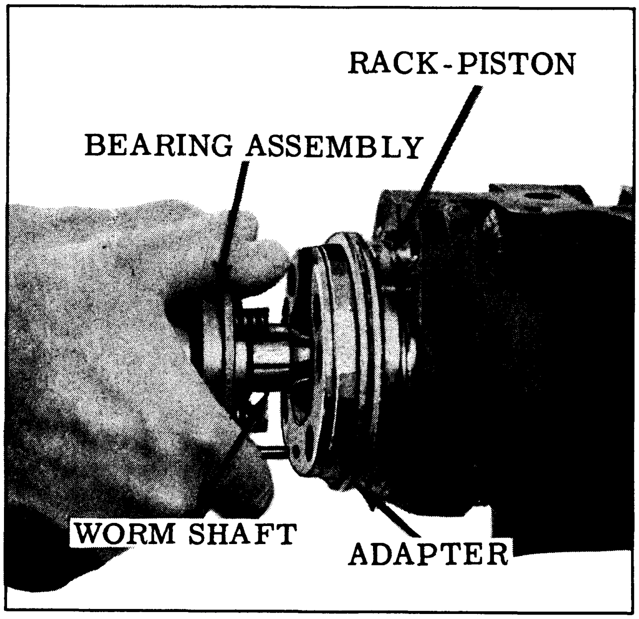


Fig. 5-31 Rack-Piston Removal

the 4 centering springs from the adapter. (See Fig. 5-31)

16. Pull the rack-piston and worm assembly from the housing.

SERVICING INDIVIDUAL UNITS

CONTROL VALVE ASSEMBLY

Disassembly

1. Pull linkage cover from the valve body and remove "O" ring.
2. Remove the larger snap ring with Tru-arc No. 1 internal pliers and pull the valve assembly and washer from the valve body.
3. Remove the washer and "O" ring from the valve assembly.
4. Remove valve body plug snap ring with Tru-arc No. 1 internal pliers; then,

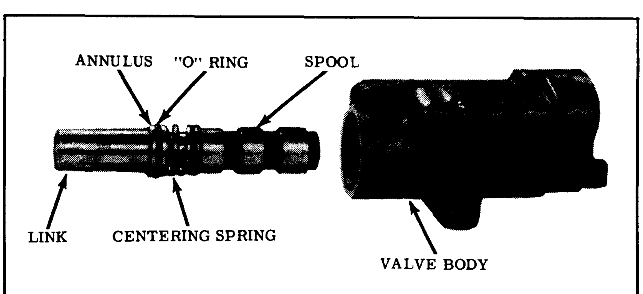


Fig. 5-32 Valve Assembly

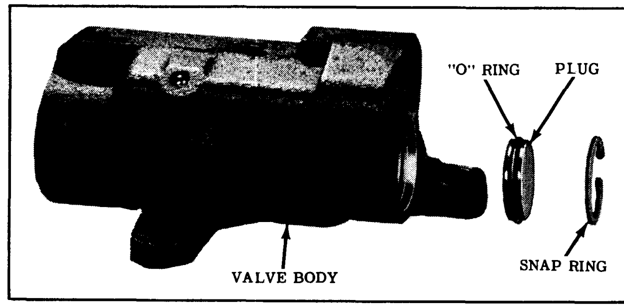


Fig. 5-33 Valve Body Plug

using a wood dowel, push plug from end of the valve body. (See Fig. 5-33)

5. If disassembly of valve assembly is necessary:
   a. Clamp end of spool valve in Tool J-6293; then, using Tool J-6224 remove the valve link. (See Fig. 5-34)
   b. Remove the annulus, valve centering spring, and thrust washer from the spool valve. (See Fig. 5-35)
   c. Remove the reaction control valve and spring from bore of spool valve.
   d. Remove inner "O" ring from annulus.
6. If hose connections were leaking at connector seats, remove one or both connectors as follows:
   a. Thread a nut and place a washer

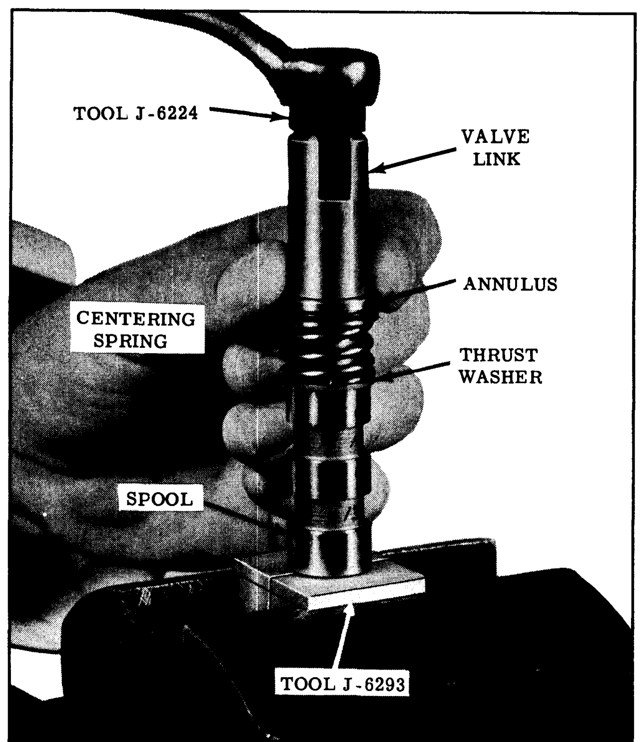


Fig. 5-34 Removing Valve Link

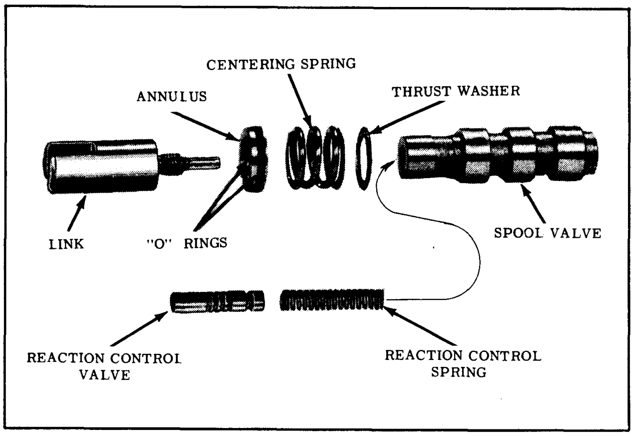


Fig. 5-35 Valve Assembly Nomenclature

over a 10-24 tap (for the small connector) or a 5/16-18 tap (for the larger connector).

b. Coat end of the tap with petrolatum to prevent chips from entering passage while tapping the connector.

c. With the valve body in a horizontal position, thread the tap into the connector not more than 3 turns.

d. Tighten nut to remove connector as shown in Fig. 5-36.

Cleaning and Inspection

1. Wash all parts in clean solvent, blow out all passages, and dry parts with compressed air.

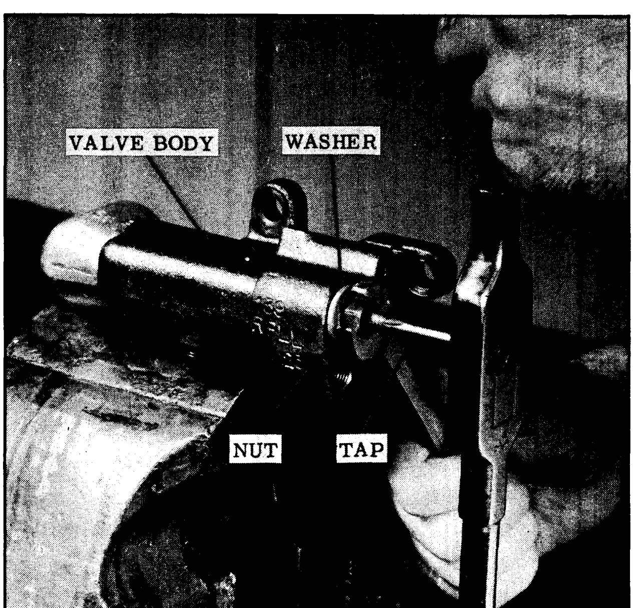


Fig. 5-36 Removing Connector

2. Check control valve body for scores, chips, or other irregularities.
3. Control valve must be free to move back and forth in the control valve body. Any minor nicks or scratches may be removed with a fine hone.

Assembly

1. Install new "O" ring on valve body plug, coat "O" ring with Hydra-Matic oil, and install plug and snap ring in end of valve body.
2. To reassemble valve assembly: (See Fig. 5-35)
   a. Clamp the end of the spool valve in Tool J-6293.
   b. Install reaction control spring and reaction control valve (open end out) into the spool valve.
   c. Install inner and outer "O" rings on the annulus and coat with Hydra-Matic oil.
   d. Install thrust washer (bevel side down), valve centering spring, and annulus (narrow land next to spring) on spool valve.
   e. Thread link into spool valve and torque 8 to 10 ft. lbs. using Tool J-6224.
3. To install new connectors, use Tool

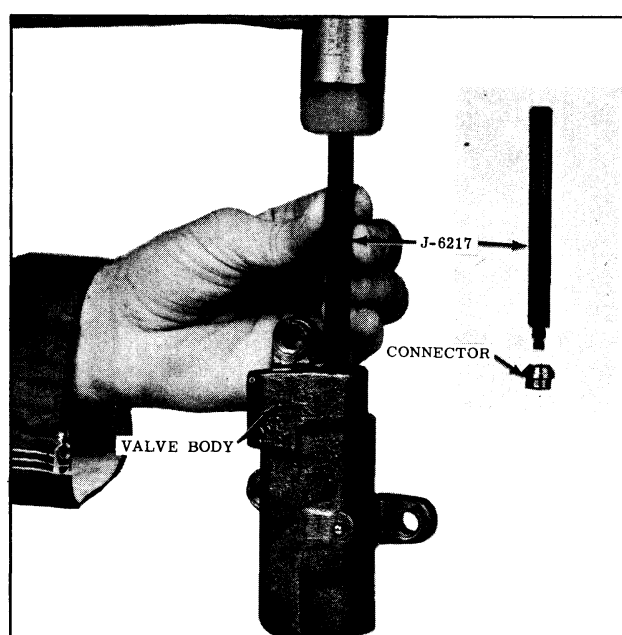


Fig. 5-37 Installing Connector

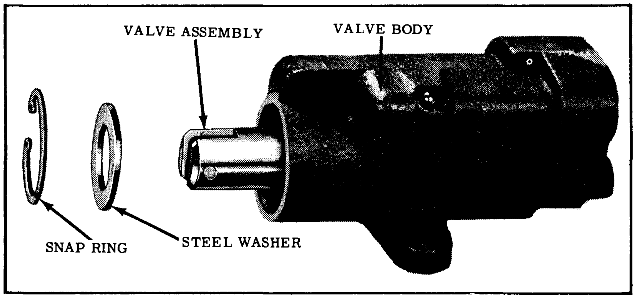


Fig. 5-38 Installing Valve Assembly

J-6217 to seat them in the valve body. (See Fig. 5-37)

4. Slide valve assembly into valve body, then place steel washer over link (chamfered side down). (See Fig. 5-38)
5. Install Tru-arc snap ring (bevel side out) to retain valve assembly.
6. Install new "O" ring on linkage cover and coat with Hydra-Matic oil.
7. Install the linkage cover and align valve link and linkage cover as shown in Fig. 5-39.

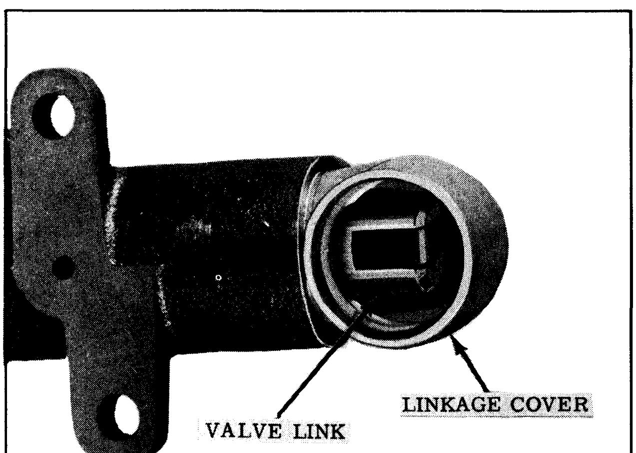


Fig. 5-39 Valve Cover and Link Alignment

PITMAN SHAFT AND COVER FIG. 5-40

Disassembly

1. Remove the pitman shaft adjusting screw lock nut.
2. Thread adjusting screw through pitman shaft cover, then remove cover, adjusting screw, and selective shim.
3. Remove "O" ring from cover.

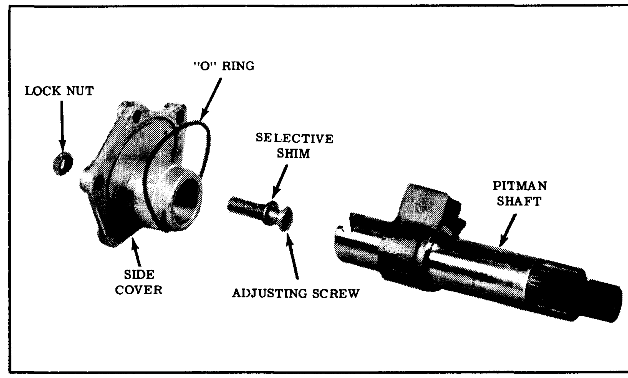


Fig. 5-40 Pitman Shaft and Side Cover

Cleaning and Inspection

1. Wash all parts in clean solvent, blow out all passages, and dry parts with compressed air.
2. Check pitman shaft upper and lower bushings for scoring or irregularities. Make sure that bearing surfaces of the shaft are not nicked or rough.
3. Check sealing surfaces of worm shaft and pitman shaft. Make sure they are free from roughness, nicks, etc. Minor irregularities in surface can be cleaned up by use of crocus cloth.
4. Check teeth on pitman shaft and rack-piston for nicks, burrs, or other irregularities.
5. The pitman shaft adjusting screw has a small nylon plug embedded in the threaded area which prevents oil from working up the threads. This screw with proper shim must be replaced upon reassembly.

Assembly

1. Check the end play of a new adjusting screw in the slot of the pitman shaft. The screw should rotate freely but not have more than .002" end clearance. Clearance may be checked as shown in Fig. 5-41. If the end play exceeds .002", select the proper shim to give the desired end play. (Shim thicknesses are .063", .065", .067", and .069".)
2. Thread the adjusting screw through the side cover until the side cover bottoms on the pitman shaft.

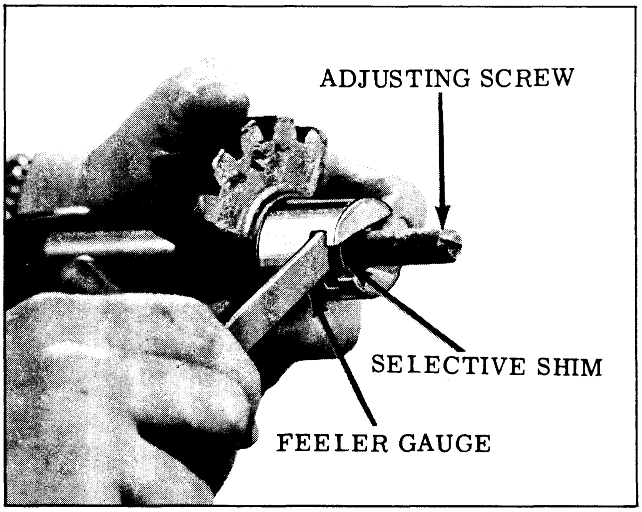


Fig. 5-41 Checking End Clearance

3. Install lock nut but do not tighten.
4. Install a new "O" ring into recess of side cover and retain with petrolatum.

END COVER

Disassembly

1. Remove the 2 "O" rings.
2. If necessary to replace needle bearing, drive out needle bearing washer and seal. (See Fig. 5-42)

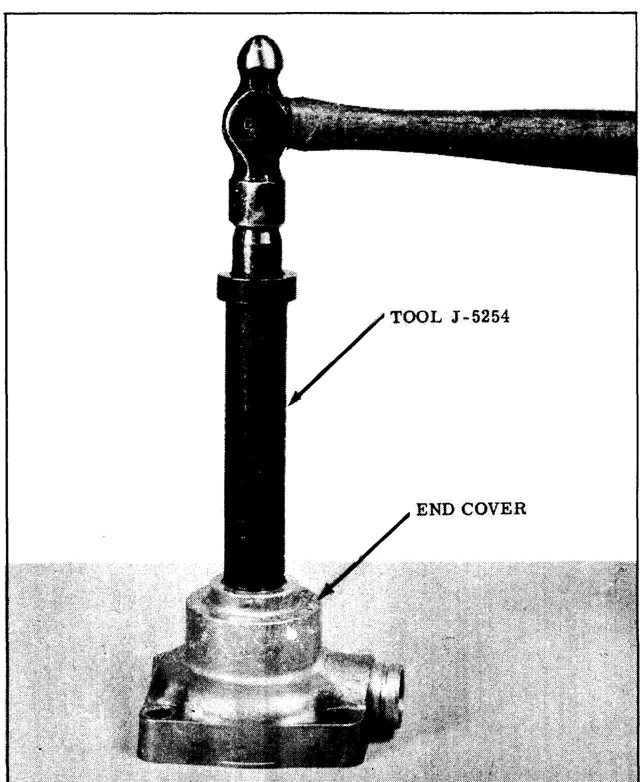


Fig. 5-42 Needle Bearing Removal

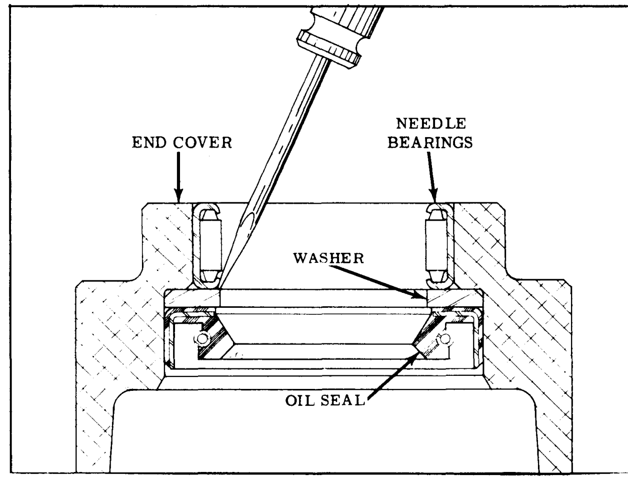


Fig. 5-43 Seal Removal

3. If bearing removal is not necessary, remove seal and washer as shown in Fig. 5-43.

Cleaning and Inspection

1. Wash all parts in clean solvent, blow out all passages, and dry parts with compressed air.
2. All mating surfaces must be free from nicks and burrs. Any irregularities may be removed with crocus cloth.
3. Inspect actuating lever bore in end cover for wear. If badly worn, the end cover should be replaced.

Assembly

1. If the needle bearing and seal were removed:
   a. Install washer in oil seal recess in cover.
   b. Place a new seal over the large end of Tool J-5254 with the lip facing the shoulder of the tool.
      CAUTION: Tool J-5254 must be free of burrs that could scratch the seal.
   c. Install seal so that it seats against the washer. (See Fig. 5-44)
      NOTE: Support the cover, since the tool will project through the end cover.
   d. Coat lip of seal with seal lubricant, Part No. 567196.

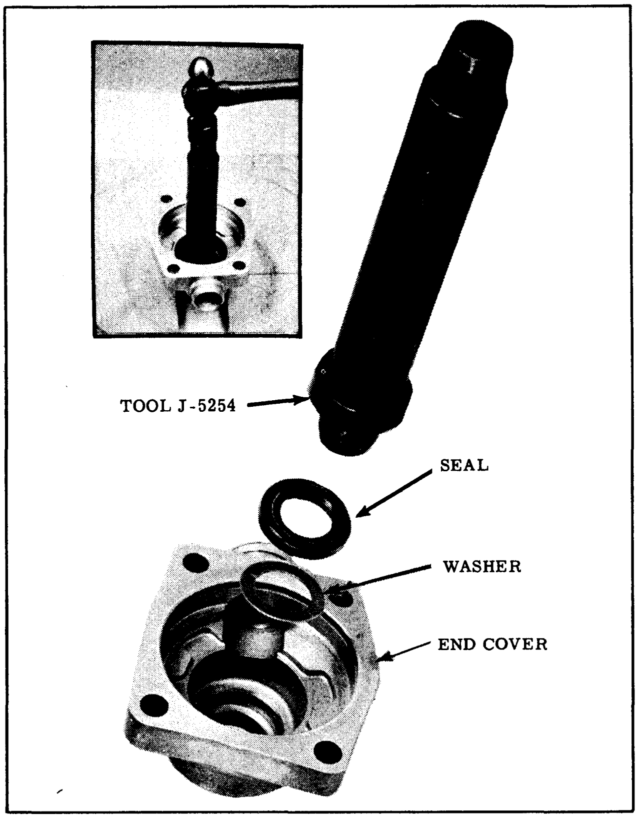


Fig. 5-44 Installing Seal

e. Place a new needle bearing over the large end of Tool J-5254 with the markings against the shoulder of the tool. (See Fig. 5-45)
f. Drive bearing into end cover until tool bottoms on cover.
g. Make sure needle bearings are free.

2. If seal only was removed, refer to steps a, b, c, and d above for installation.
3. Pack needle bearing with a fine fiber grease. (Universal Joint Bearing Grease)
4. Install "O" ring in end cover flange and in "O" ring groove on side of the cover. Coat both "O" rings with Hydra-Matic oil.

HOUSING

Disassembly

1. Remove pitman shaft seal by removing snap ring (use Tru-arc No. 3 internal pliers), steel washer, dust seal, and steel washer; then, pry out oil seal. (See Fig. 5-46)
2. If pitman shaft bushing replacement is necessary, drive bushing out with Tool J-6278. (See Fig. 5-47)
3. If the housing plug shows evidence of leakage, remove the staking with a hack saw, remove any burrs that could score the housing, and drive plug into housing.

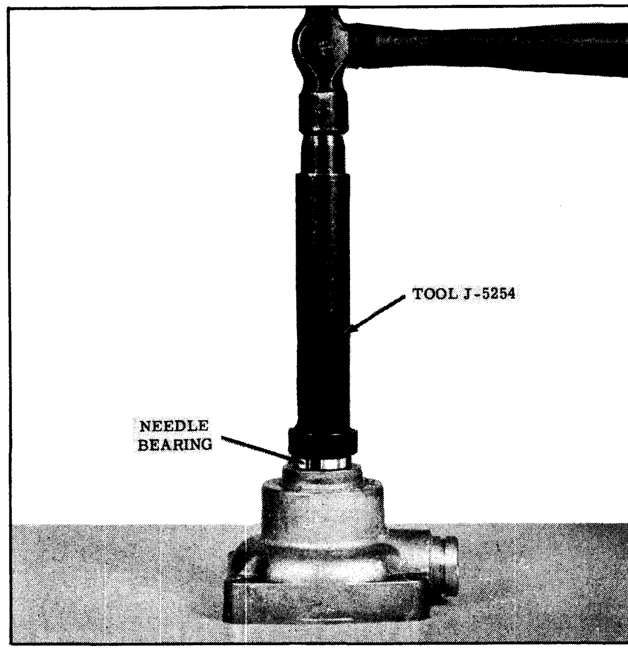


Fig. 5-45 Installing Bearing

Cleaning and Inspection

1. Wash all parts in clean solvent, blow out all passages, and dry parts with compressed air.
2. Check the housing for scores and undue wear.
3. All mating surfaces must be free from

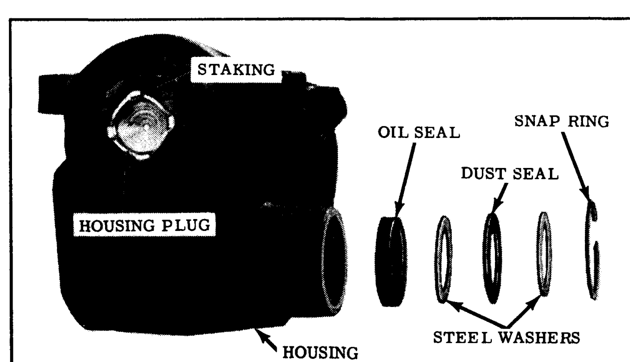


Fig. 5-46 Pitman Shaft Seals

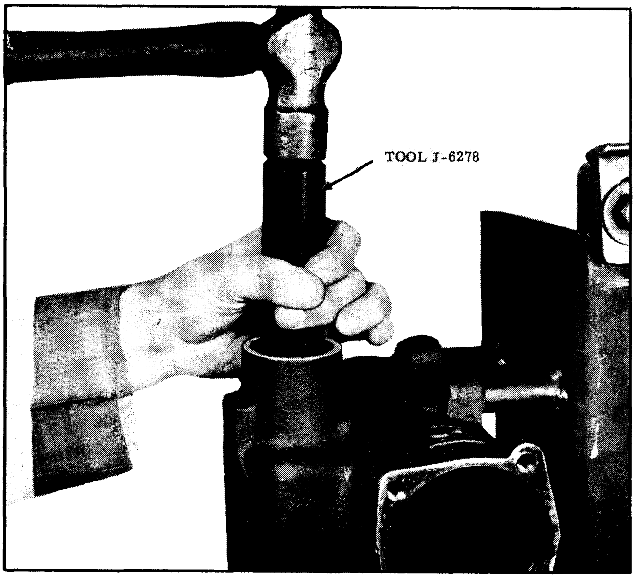


Fig. 5-47 Bushing Removal

nicks and burrs. Any irregularities may be removed with crocus cloth.

4. Check housing cylinder for a shoulder condition at either end of ring travel. If shoulder exists, due to excessive wear, housing replacement is necessary.

Assembly

1. If pitman shaft bushing was removed, place Tool J-6278-2 over Tool J-6278, slide the new bushing on the tool, and drive bushing into housing. (See Fig. 5-48)

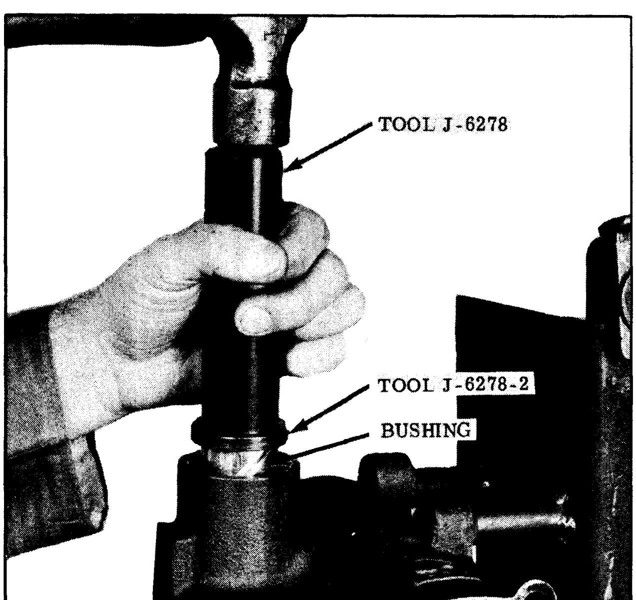


Fig. 5-48 Installing Bushing

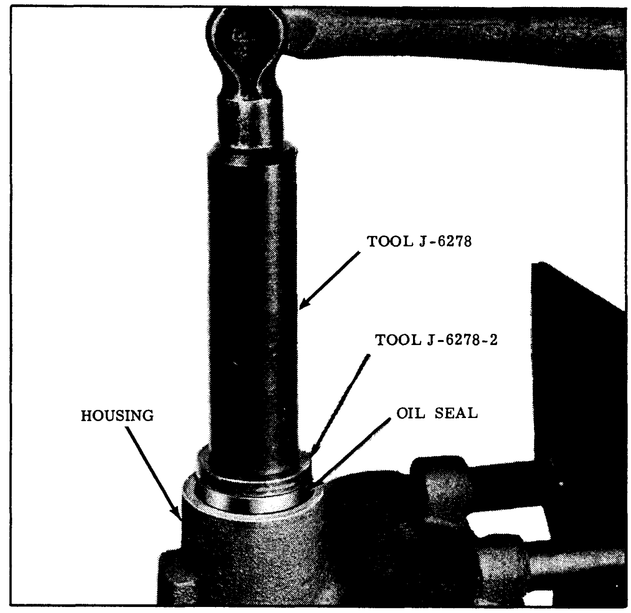


Fig. 5-49 Installing Oil Seal

2. With Tool J-6278-2 over Tool J-6278, slide seal on tool with lip of seal facing away from tool, and drive seal into housing. (See Fig. 5-49)
3. Coat the lip of the oil seal with seal lubricant, Part No. 567196.
4. Install steel washer, dust seal, and steel washer, then install Tru-arc snap ring.
5. If the housing plug was removed, install a new "O" ring coated with Hydra-Matic oil on a new plug, and tap plug into the housing.
6. While backing up plug, stake in 4 places 90° apart.

RACK-PISTON, WORM SHAFT, AND BALL NUT ASSEMBLY

Disassembly

1. Clamp rack-piston assembly in vise and remove set screw as shown in Fig. 5-50.
2. Turn ball nut 180 and pull worm shaft and ball nut assembly from rack-piston. Exercise care so that ball guides do not fall out of ball nut.
3. Tape the end of a 3 ft. length of string onto the ball nut so that the tape also retains the ball guides.

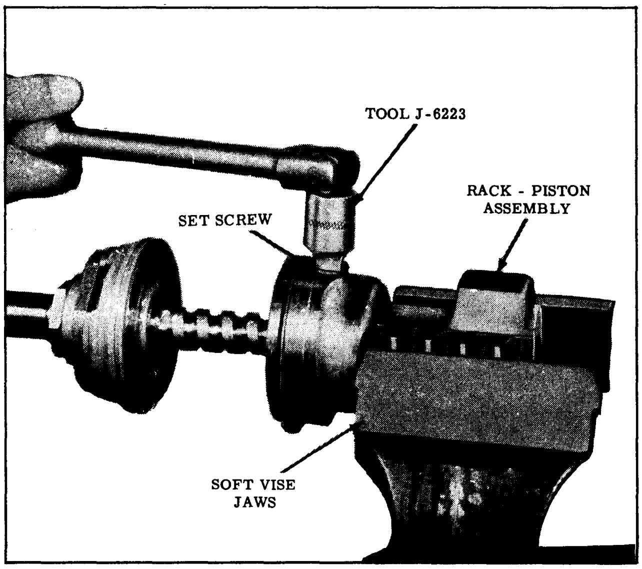


Fig. 5-50 Removing Set Screw

4. Tie the other end of the string to spring scale J-5178, then wrap string around ball nut 3 or 4 times.
5. Slowly pull on spring scale and check over-center preload. (See Fig. 5-51) Preload should be 1 to 6 lbs.

   NOTE: If over-center preload is not within limits, a new set of balls must be installed upon reassembly. Note the ball size stamped on the end of the ball nut. If over-center preload is incorrect, upon reassembly try a selective set of the next size larger balls if the preload is insufficient or a size smaller if the preload is in excess.

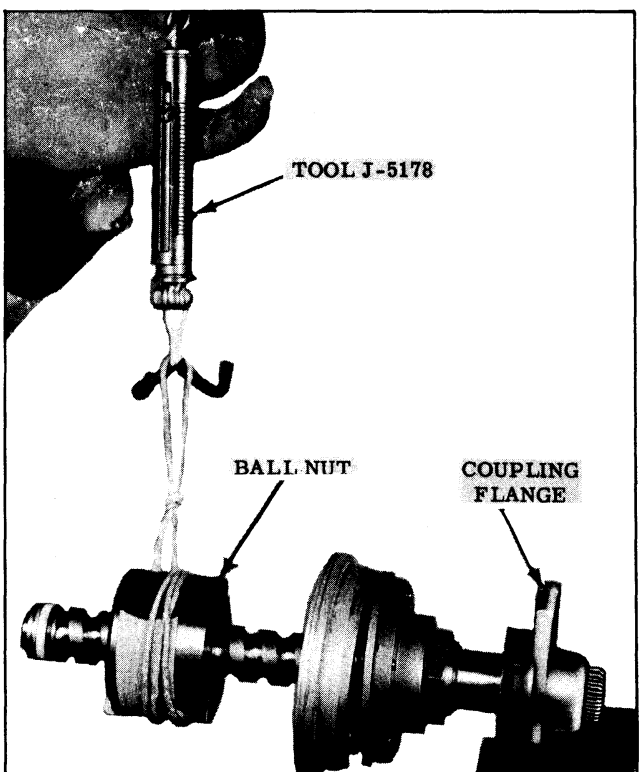


Fig. 5-51 Checking Over-Center Preload

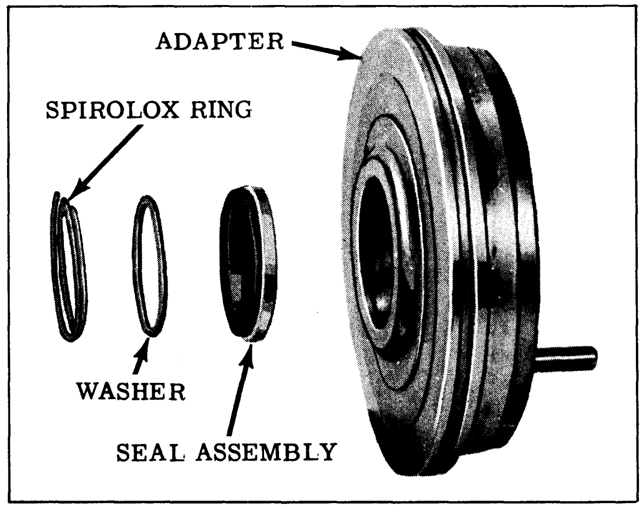


Fig. 5-52 Adapter Oil Seal

6. Remove the ball return guides. Rotate the worm back and forth until all balls have dropped out of the nut.
7. Remove the ball nut and adapter from the worm.
8. Remove the adapter "O" ring.
9. Remove the Spirolox ring and push the washer and seal assembly from the adapter. (See Fig. 5-52)
10. Cut and remove the worm shaft seal

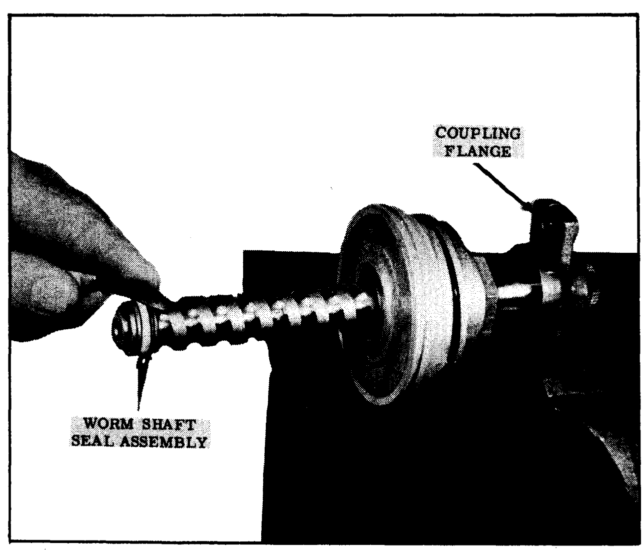


Fig. 5-53 Worm Shaft Seal Assembly

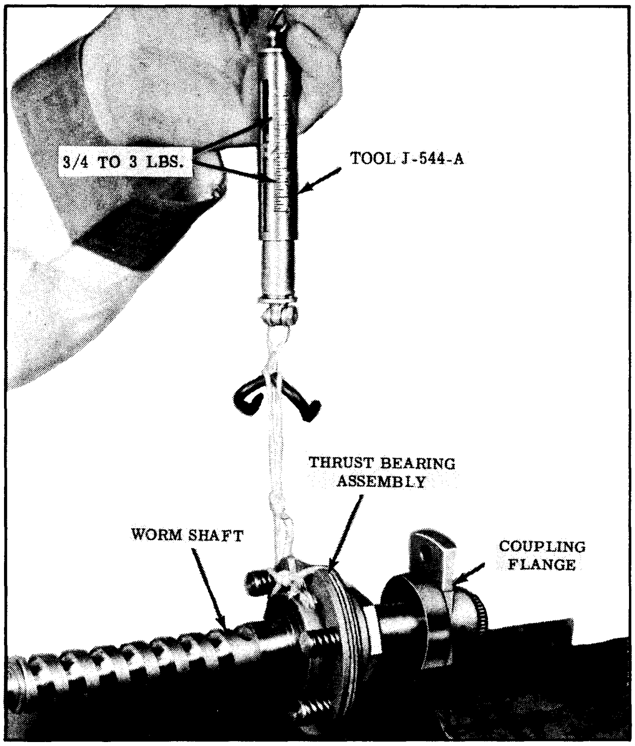


Fig. 5-54 Checking Thrust Bearing Preload

assembly, then remove the snap ring, retaining ring, bronze washer, and steel washer. (See Fig. 5-53)

11. Tie a 3 ft. length of string on a thrust bearing centering spring and to spring scale J-544-A. Support the assembly in a vise, wrap string around center race 2 or 3 turns, and check preload as shown in Fig. 5-54. (Preload should be 3/4 to 3 lbs.)

    NOTE: The above check will indicate one of three conditions:

    a. With the preload within tolerance and bearing not rough, further disassembly is not necessary.
    b. If the bearing is not rough but the preload is outside of the tolerance, it will be necessary to remove the adjusting nut, install a new one, and adjust preload to 1-1/2 lbs. (See Fig. 5-55)
    c. If the preload reading is erratic, indicating a rough bearing, it will be necessary to remove the bearing.

12. Remove oil rings from rack-piston if replacement is necessary.
13. Check plug in end of rack-piston. If loose, restake or replace plug.

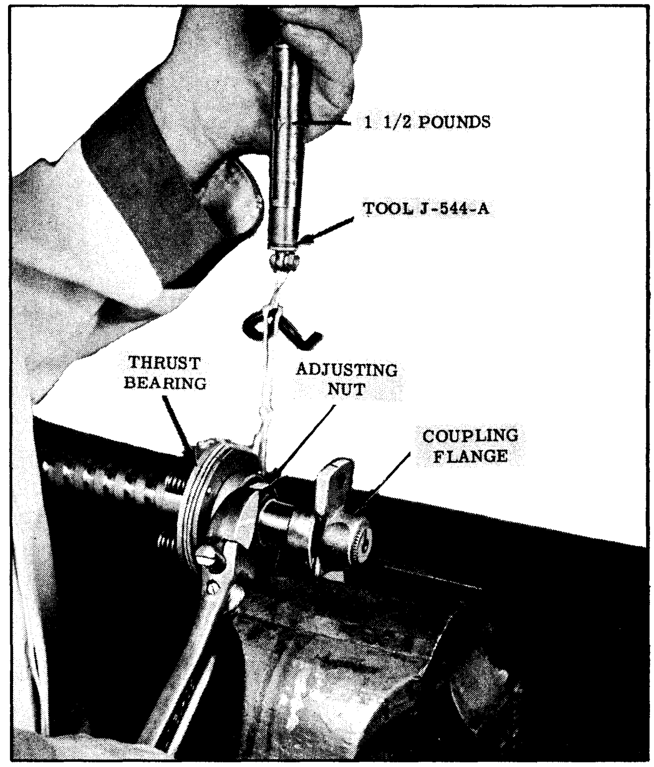


Fig. 5-55 Adjusting Thrust Bearing

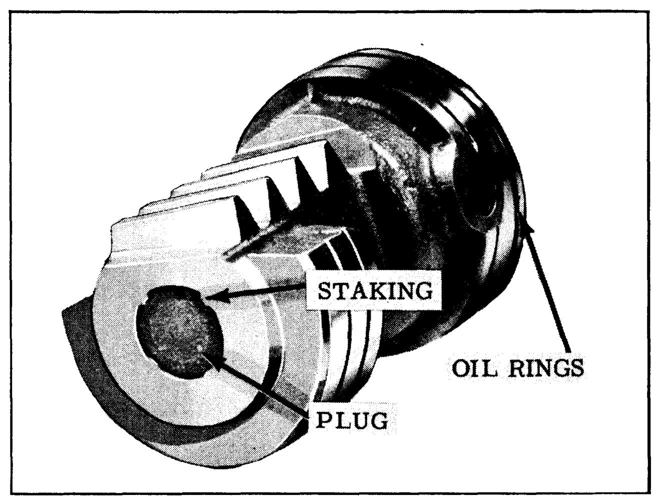


Fig. 5-56 Rack-Piston

Cleaning and Inspection

1. Wash all parts in clean solvent, blow out all passages, and dry parts with compressed air.
2. Check bearing assembly for undue wear or brinelling of the races.
3. Check sealing surfaces of worm shaft and pitman shaft. Make sure they are free from roughness, nicks, etc. Minor irregularities in surface can be cleaned up by use of crocus cloth.

4. All mating surfaces must be free from nicks and burrs. Any irregularities may be removed with crocus cloth.
5. Inspect the worm and ball nut grooves and all of the balls for wear or scoring. If either the worm or ball nut need replacing, both must be replaced as a matched assembly.
6. Make sure that the ends of the ball return guides are not damaged.

Assembly

1. If removed, install oil rings on rack-piston.
2. If thrust bearing was removed, oil a new bearing assembly and install bearing assembly over worm shaft with springs facing away from splined end of the shaft.
3. Install washer with tang in keyway and facing splined end of shaft. Install a new nut and adjust preload to 1-1/2 lbs. as outlined in step 11. (See Fig. 5-55) Stake nut into keyway of shaft and recheck preload.
4. Install new adapter oil seal assembly as shown in Fig. 5-57, then install steel washer and Spirolox ring.
5. Install a new "O" ring on adapter, then slide adapter over worm with holes in adapter facing bearing centering springs.
6. Slide ball nut over worm with beveled side of ball nut facing the seal end of the worm shaft.

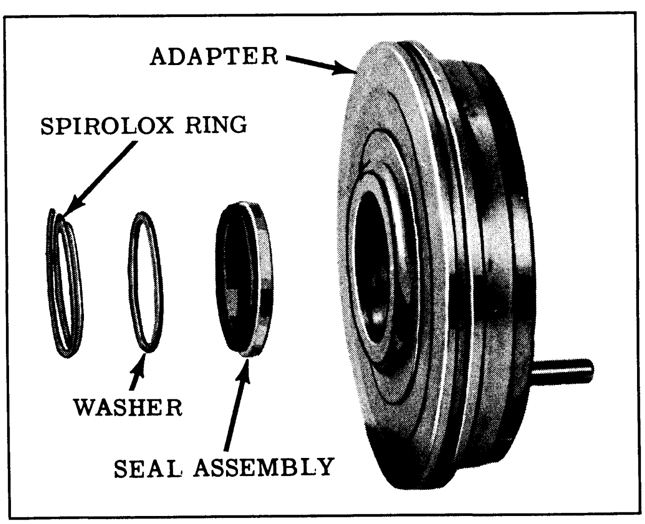


Fig. 5-57 Adapter Oil Seal

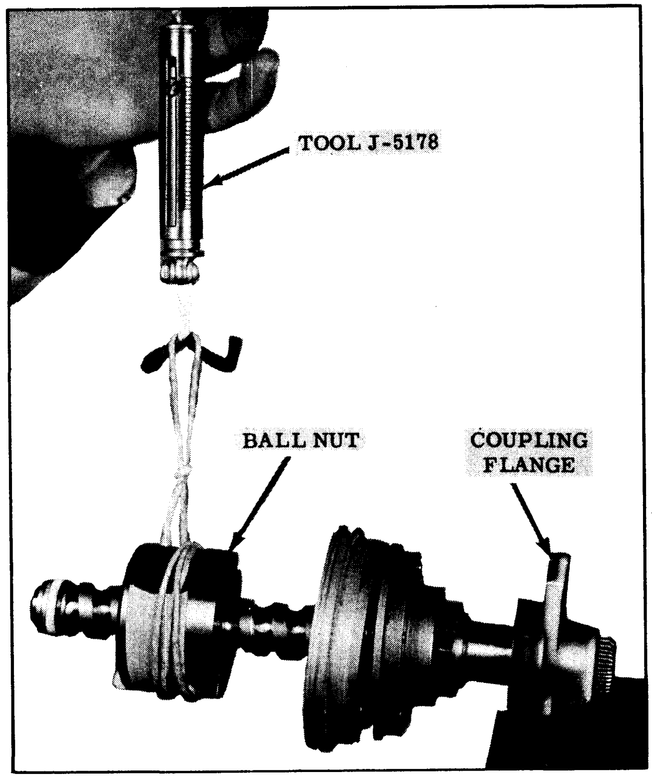


Fig. 5-58 Checking Over-Center Preload

7. Install 17 balls into ball nut and lubricate with Hydra-Matic oil.

   NOTE: Since the worm shaft is cam ground (thicker at the center), the balls can be installed easier if the ball nut is positioned near one end of the worm.
8. Install 6 balls into return guide and retain with petrolatum, then install assembly into ball nut.
9. Check ball nut over-center preload if it were necessary to install a new set of balls to correct the over-center preload. (See Fig. 5-58) After the correct preload is obtained, place masking tape over ball guides to prevent them from falling out.
10. Over the end of the worm, install the steel washer, seal assembly (neoprene next to steel washer), bronze washer, and retainer ring.
11. While holding assembled parts, press worm shaft into snap ring, then force snap ring into groove. (See Fig. 5-59)
12. Remove tape from ball nut assembly and install worm and ball nut assembly

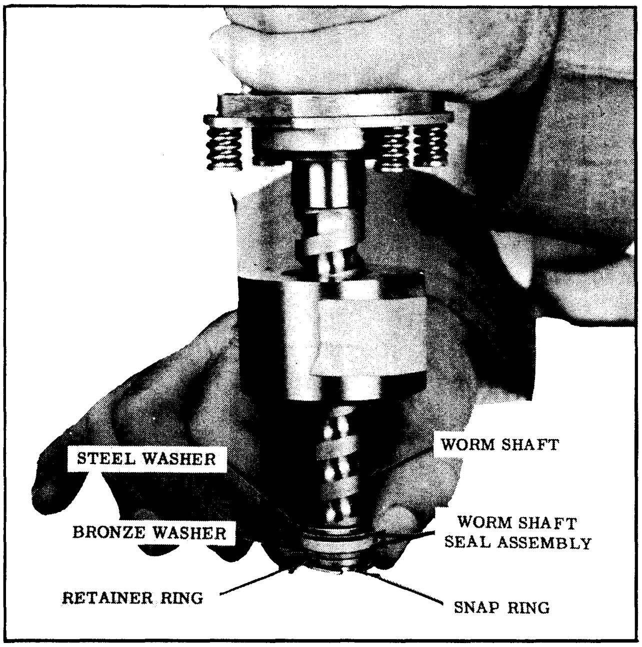


Fig. 5-59 Installing Worm Shaft Seal Snap Ring

into rack-piston with set screw holes aligned.

13. Clamp rack-piston in a vise and install a new set screw as shown in Fig. 5-60. Torque set screw 20 to 25 ft. lbs. then stake set screen so that rack-piston metal enters both ends of screw slot.

ASSEMBLY OF GEAR

1. Thread worm out of ball nut as far as possible, position ring gaps opposite each other, and coat oil rings and adapter "O" ring with Hydra-Matic oil.

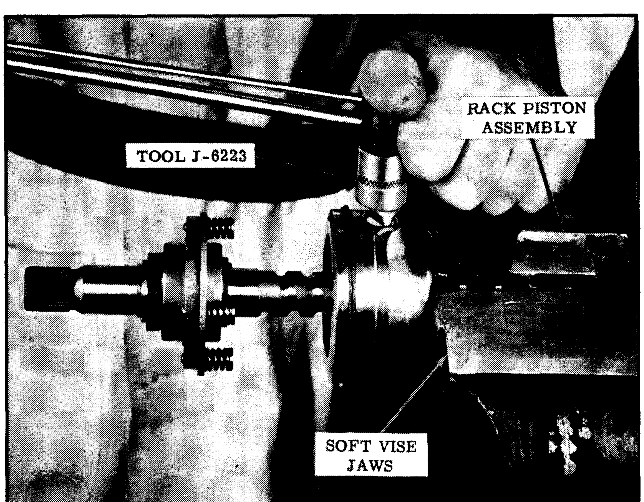


Fig. 5-60 Torqueing Set Screw

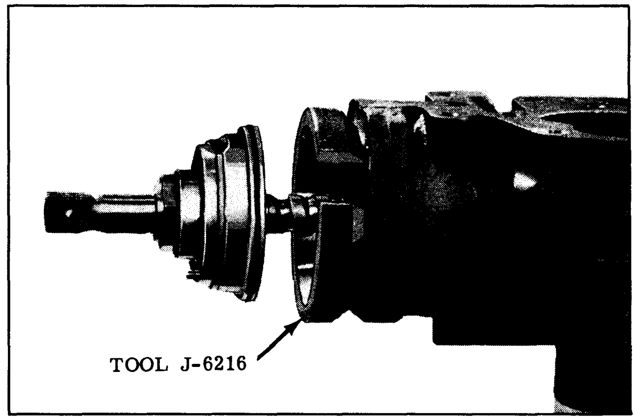


Fig. 5-61 Installing Rack-Piston

2. Turn the housing so that the valve body side is facing up, then place ring compressor Tool J-6216 in recess of housing. (See Fig. 5-61)
3. With the rack-piston teeth facing the pitman shaft area, push the rack-piston through the ring compressor so that the oil rings are just inside the housing, then remove ring compressor.
4. With the notch in the adapter facing the machined side of the housing, push the adapter into the housing recess.
5. Install the 4 centering springs into the shallow bores of the adapter. (See Fig. 5-62)
6. With the dowel hole in the bearing assembly aligned with the adapter dowel,

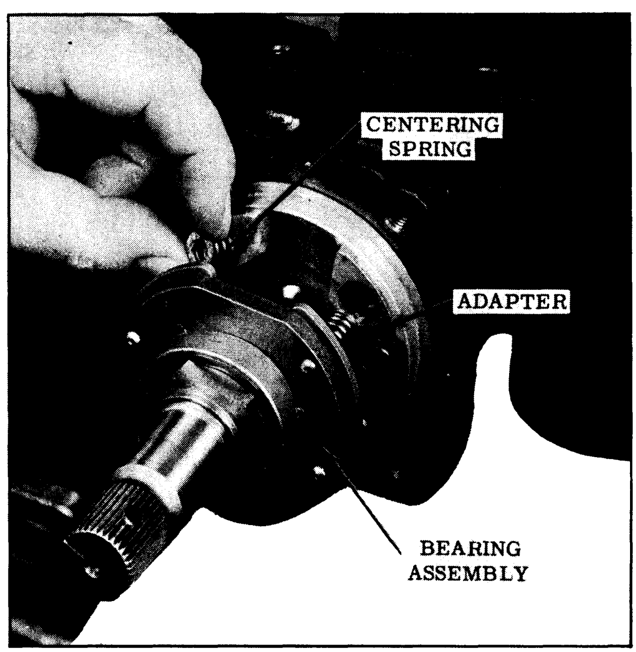


Fig. 5-62 Installing Centering Springs

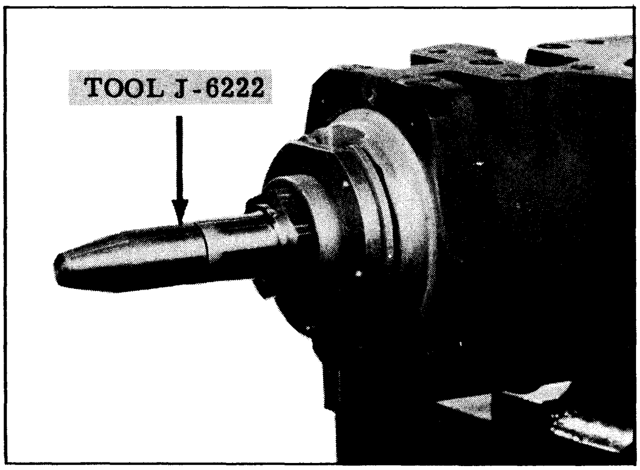


Fig. 5-63 Seal Protector

push the bearing assembly tight against the adapter.

7. Place Tool J-6222 over splines of worm shaft, then install end cover and torque cap screws 25 to 30 ft. lbs; remove Tool J-6222. (See Fig. 5-63)
8. Saturate coupling flange wick with Hydra-Matic oil and place over worm shaft.
9. Position coupling flange over worm shaft with alignment marks indexed, but do not install retaining pin.
10. Turn coupling flange so that rack-piston teeth are centered in the pitman shaft cover opening in the housing. Make sure that rack-piston teeth are square with center line of pitman shaft bushing. (See Fig. 5-64)
11. Wrap a piece of masking tape (7/8" wide - light weight) around the pitman

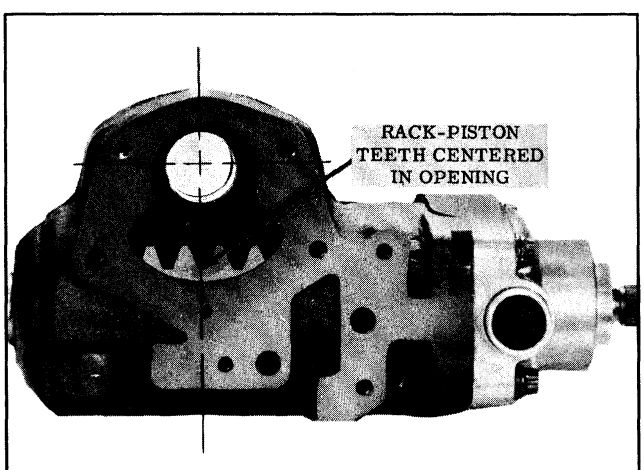


Fig. 5-64 Centering Rack-Piston Teeth

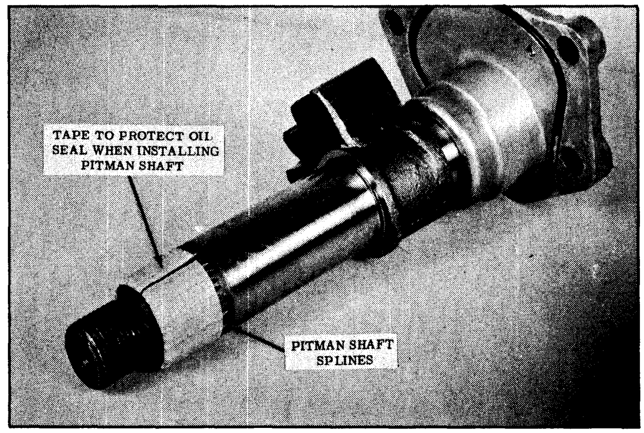


Fig. 5-65 Seal Protecting Tape

shaft spline one turn so that the tape starts and ends at the same wide serration. (See Fig. 5-65)

12. Install pitman shaft and side cover assembly. The center tooth of the pitman shaft must engage the center groove of the rack.
13. Install the side cover cap screws and torque the four 3/8" cap screws 25 to 30 ft. lbs. Torque the 5/16" cap screw 15 to 20 ft. lbs.
14. Install actuator lever in end cover and engage lever with the "flat" on the bearing assembly.
15. Install the 2 "O" rings in the housing. (See Fig. 5-66)
16. With the actuator lever engaged with the valve link pin, install valve body and torque cap screws 15 to 20 ft. lbs.
17. Make sure that the pitman shaft adjusting screw is backed all the way out.
18. Using Tool J-6281 and spring scale

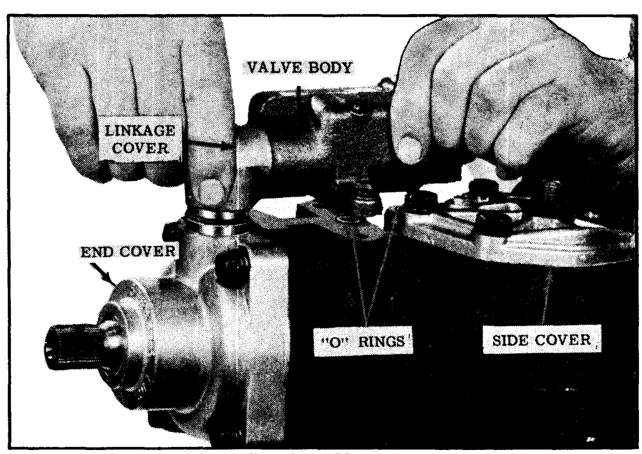


Fig. 5-66 Installing Valve Body

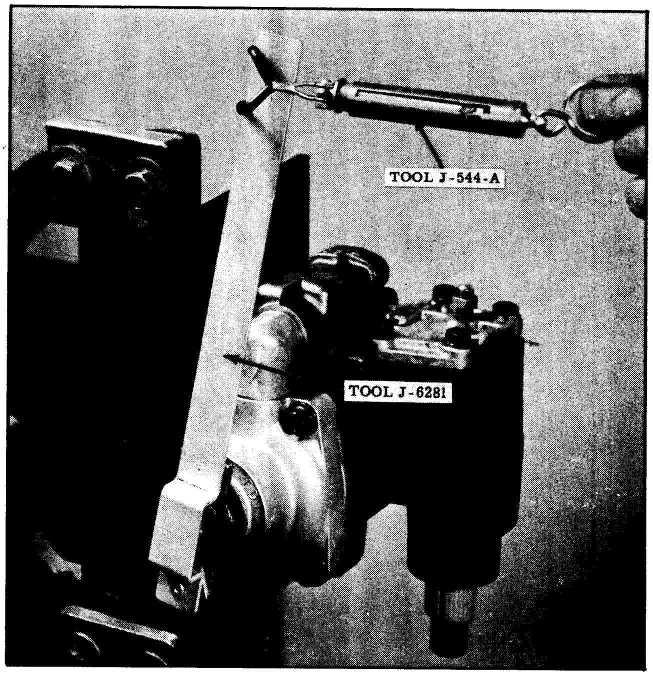


Fig. 5-67 Checking Ball Nut and Thrust Bearing Preload

J-544-A, check and record the combined ball nut and bearing preload with gear on center (2-1/4 turns from either end of travel) and not moving end of Tool J-6281 more than in a 6" arc. (See Fig. 5-67)

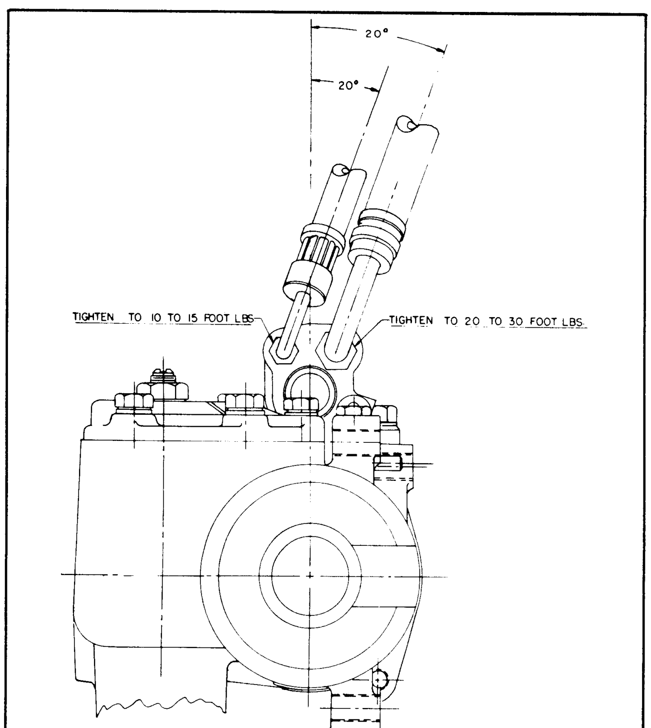


Fig. 5-68 Hose Installation

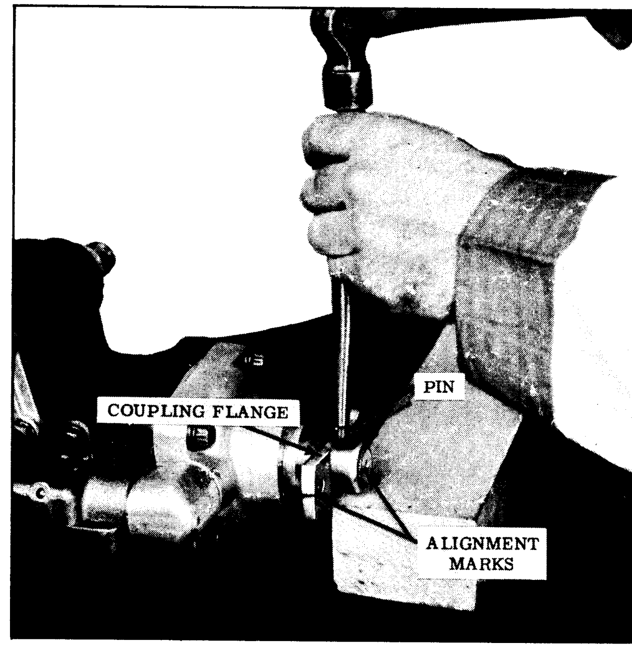


Fig. 6-69 Installing Coupling Flange Pin

19. Thread pitman shaft adjusting screw in until pitman shaft gear just touches the rack-piston.
20. While checking as in step 18, adjust pitman shaft screw so that 1/2 to 1 lb. in excess of ball nut and bearing preload is obtained.

    NOTE: Total over-center preload must be 1-1/4 to 1-3/4 lbs; if not, it will be necessary to check and/or readjust the thrust bearing and/or the worm and ball nut.
21. When correct over-center load is obtained, tighten adjusting screw lock nut and recheck over-center preload.
22. Install hoses as shown in Fig. 5-68.
23. Remove gear assembly from holding fixture and drive in coupling flange pin while supporting the worm shaft and flange. (See Fig. 5-69)
24. Make sure that housing alignment pin is extending approximately 5/8" from the housing. (See Fig. 5-70)

POWER STEERING PUMP

REMOVAL

1. Disconnect hoses from pump and cap pump fittings. Secure ends of hoses above fluid level.

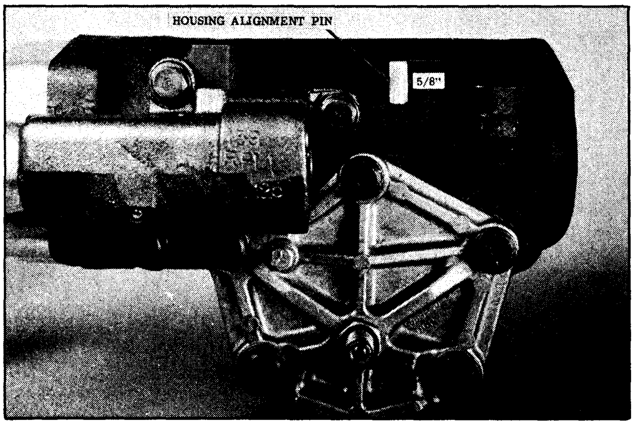


Fig. 5-70 Housing Alignment Pin

2. Remove pulley attaching nut.
3. Loosen pump to bracket cap screws, then remove pulley and belt.
   CAUTION: Do not hammer pulley off shaft as this may damage pump bearings.
4. Remove pump to bracket cap screws, then remove pump.

REPLACEMENT

1. Position pump on mounting bracket and install cap screws finger tight.

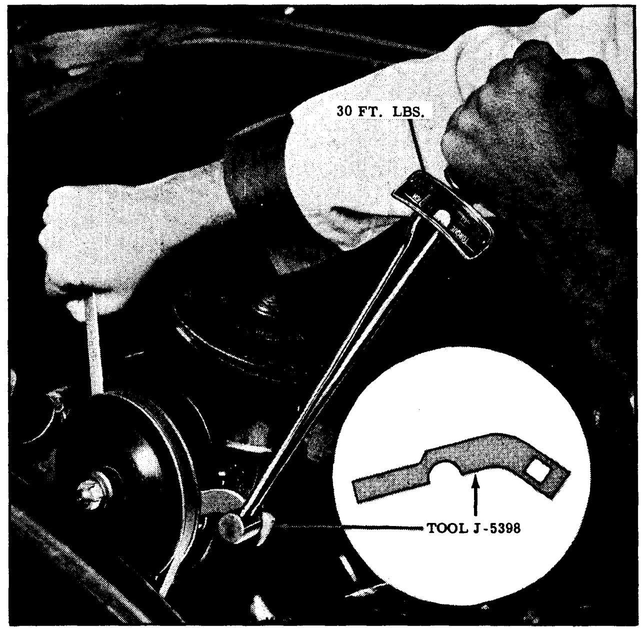


Fig. 5-71 Pump Belt Adjustment

2. Slide pulley on shaft and install pulley nut finger tight.
3. Connect and tighten hose fittings.
4. Fill reservoir with Hydra-Matic fluid, then bleed pump by turning pulley counter-clockwise until air bubbles cease to appear. Refill reservoir to proper fluid level if necessary.

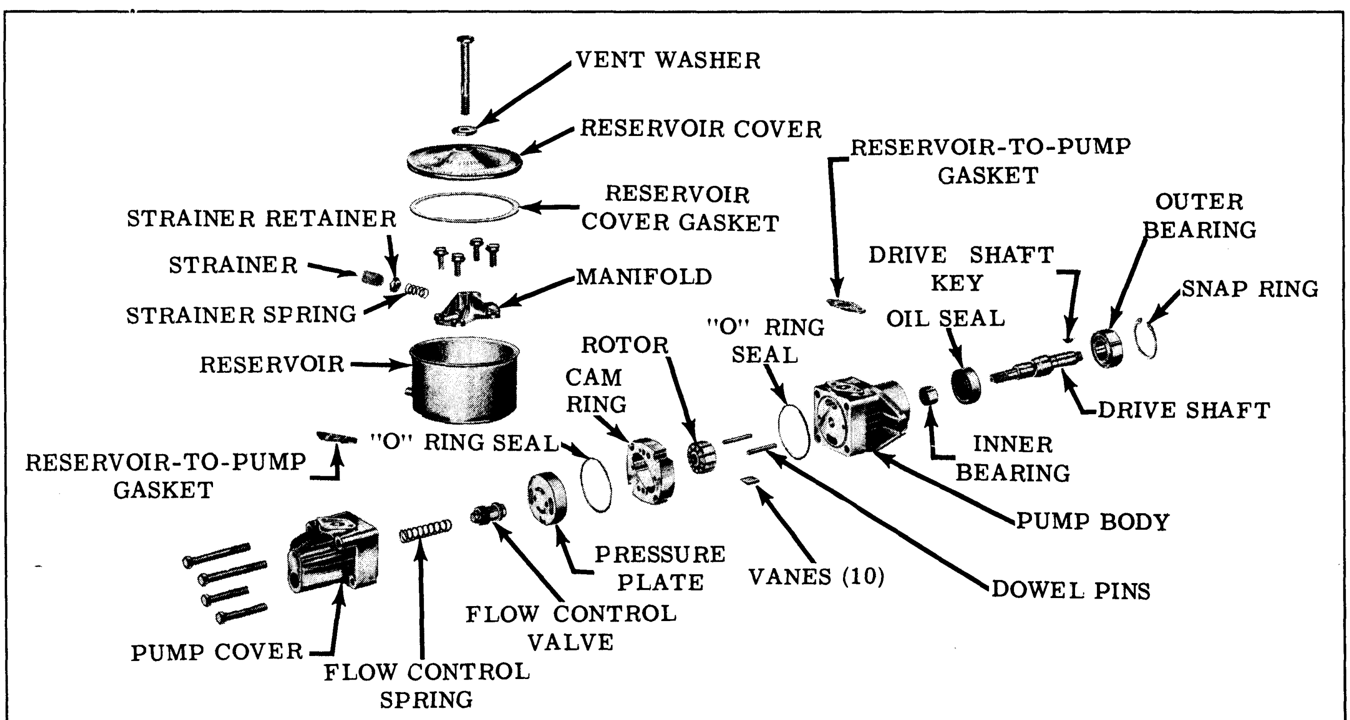


Fig. 5-72 Power Steering Pump

5. Adjust pump belt by placing Tool J-5398 under pump body and over pivot cap screw. (See Fig. 5-71) With torque wrench (0 - 50 ft. lbs.), adjust belt tension to 30 ft. lbs. Tighten pump to bracket cap screws.
6. Tighten pulley nut 35 to 45 ft. lbs.

DISASSEMBLY FIG. 5-72

With the inlet and outlet fittings capped to prevent entrance of dirt, thoroughly clean exterior of pump; then, remove fitting caps and proceed as follows:

1. Remove the reservoir cover and gasket, then drain reservoir.
2. Remove 4 cap screws from inside reservoir, then remove reservoir, manifold, strainer, spring retainer, spring, and the 2 cork gaskets with steel spacers.
3. Remove union fitting (with "O" ring seal) from pump cover.
4. Scribe alignment marks on pump body, cam ring, and cover. (See Fig. 5-73)

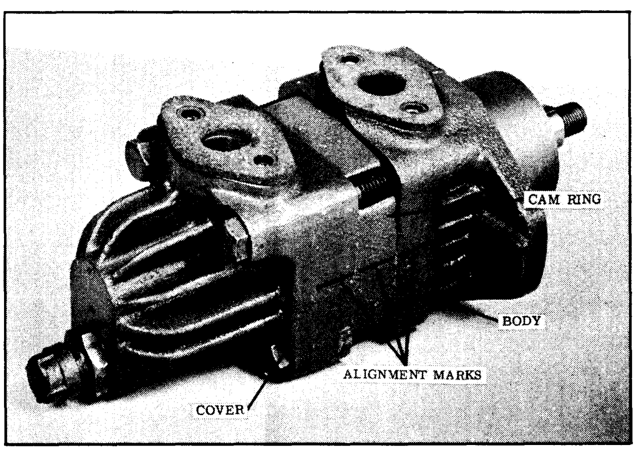


Fig. 5-73 Alignment Marks

5. Remove 4 pump cover to pump body attaching bolts, then carefully remove pump cover, flow control valve, and spring.
6. Lift the pressure plate from the cam ring, then remove the "O" ring. (See Fig. 5-74)
7. Lift the cam ring from pump body, then remove rotor, vanes, and "O" ring.
8. Remove snap ring from groove in pump body using Tru-arc No. 3 internal pliers.

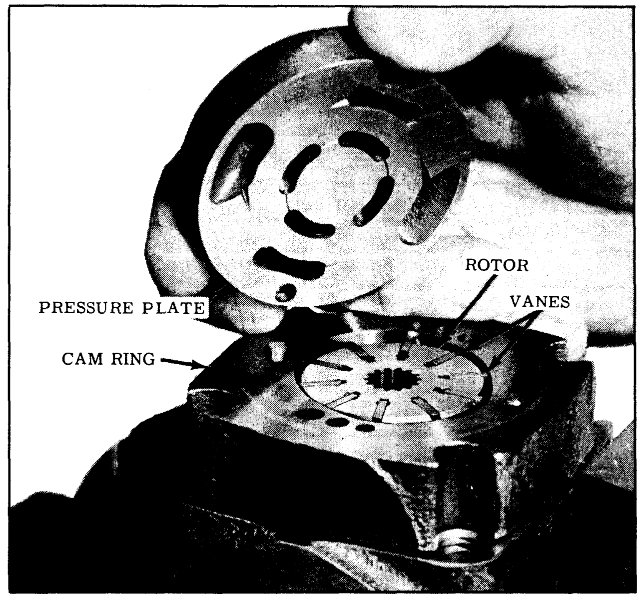


Fig. 5-74 Pressure Plate Removal

9. Tap drive shaft out of pump body. (Use a plastic hammer). (See Fig. 5-75)
10. If needle bearing replacement is necessary, drive needle bearing out of pump body using Tool J-6279. (See Fig. 5-76)
11. Remove seal from pump body as shown in Fig. 5-77.

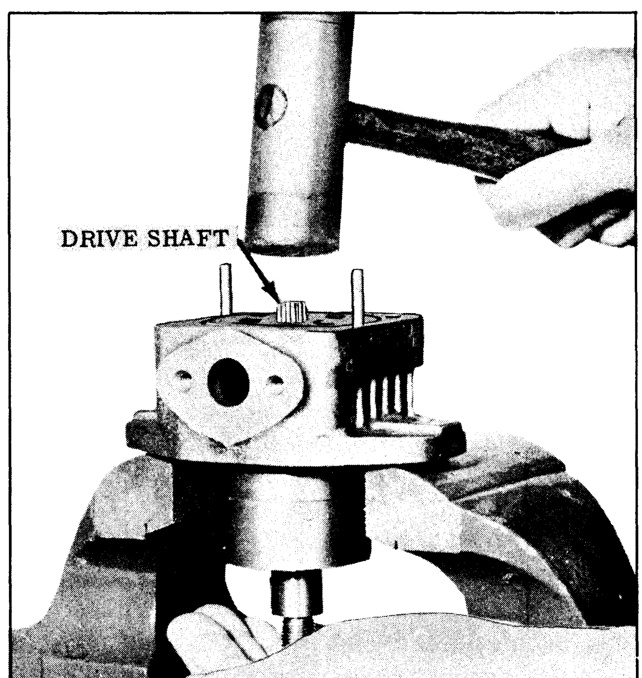


Fig. 5-75 Drive Shaft Removal

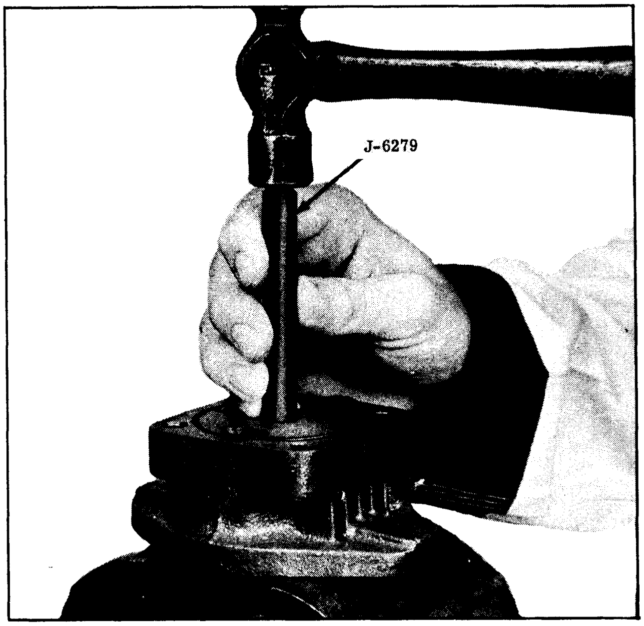


Fig. 5-76 Needle Bearing Removal

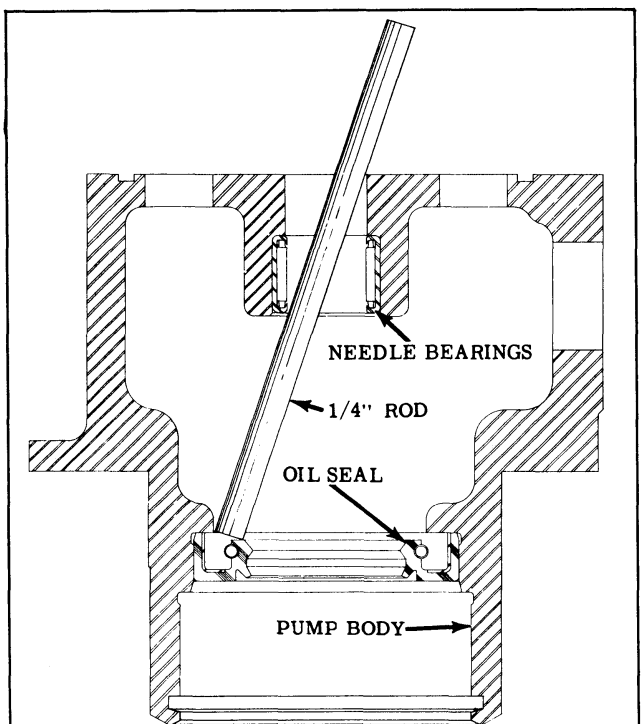


Fig. 5-77 Seal Removal

12. If outer bearing is to be replaced, remove key; then, press bearing from shaft.
13. The flow control and relief valve may be disassembled for cleaning. When disassembling valve, carefully remove plug to prevent loss of poppet ball or shims. (See Fig. 5-78)

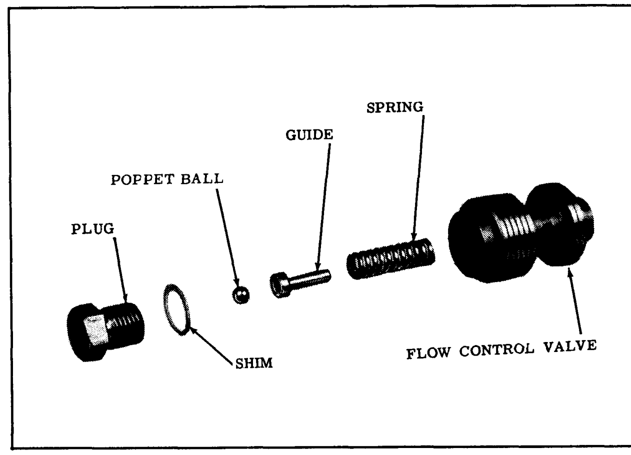


Fig. 5-78 Flow Control and Relief Valve

CLEANING AND INSPECTION

1. Wipe the bearing and shaft assembly with clean cloth; do not soak in cleaning solvent as the lubricant sealed into the bearing may be diluted by solvent. Wash all other parts in clean solvent, blow out all passages with compressed air, and air dry.
2. Inspect the drive shaft for wear and see that area of shaft on which the seal rides is entirely smooth and free of nicks. Check both bearings for roughness or noisy operation.
3. Check fit of vanes in slots of rotor. Vanes must slide freely but snugly in slots. Tightness may be relieved by thorough cleaning or removal of irregularities by honing with a fine stone. Replace rotor and/or vanes if excessive looseness exists between rotor and vanes.
4. Inspect all ground surfaces of the cam ring for roughness or irregular wear. Slight irregularities may be removed with a fine hone. Replace ring if inside cam surface is scored or worn.
5. Inspect the flat faces of the pressure plate and body for wear or scoring. Light scores may be smoothed by light lapping, after which all lapping compound must be thoroughly washed away.
6. Inspect ground surfaces of flow control valve. Check freedom of movement of flow control valve within its bore.

Slight irregularities may be corrected by honing with a fine stone.

7. Inspect all passages in cover and body for obstructions or dirt.

ASSEMBLY

In assembling the pump, use new "O" ring seals and gaskets. Make sure all parts are absolutely clean and lubricate all moving parts with clean Hydra-Matic fluid during assembly.

1. Assemble flow control and relief valve as shown in Fig. 5-78. Use the same number of shims removed, as altering the shim thickness will change relief pressure. Tighten the plug to approximately 4 ft. lbs.
2. If outer bearing was removed, press the new bearing onto the shaft by applying pressure on the inner bearing race. Install key in shaft.
3. If the needle bearing was removed, install bearing using Tool J-6280. (See Fig. 5-79)

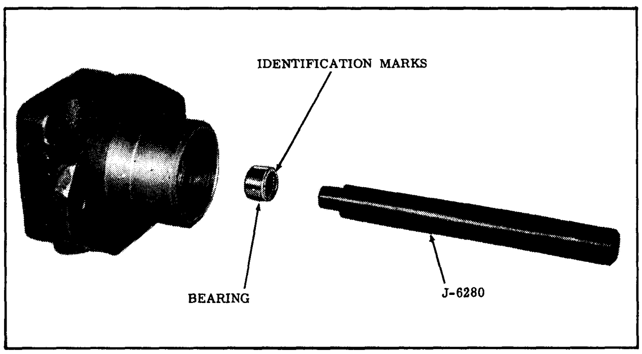


Fig. 5-79 Needle Bearing and Driving Tool

CAUTION: Identification marks on bearing must be against the shoulder of the tool when tapping bearing into place.

NOTE: Check needle bearing for freeness after bearing has been installed.

4. Place the seal over Tool J-5255 with lip of seal facing out. (See Fig. 5-80)
5. Drive seal into pump body until seal is flush with shoulder in pump body.
6. Install shaft and outer bearing assembly by tapping lightly on outer bearing race until face of bearing is below groove in pump body.

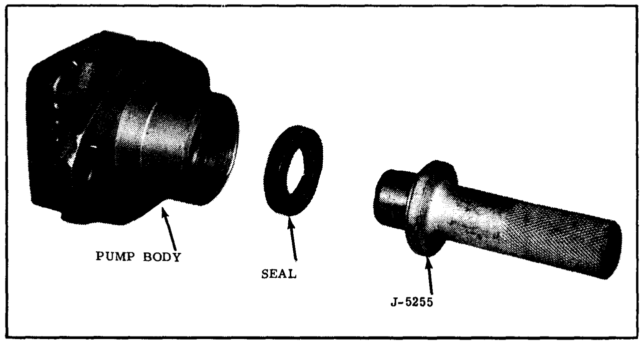


Fig. 5-80 Seal and Driving Tool

7. Install Tru-arc snap ring (with flat side towards bearing in pump body.)
8. Install a new "O" ring, dowel pins (if removed), and rotor with chamfer end of spline facing the pump body. (See Fig. 5-81)

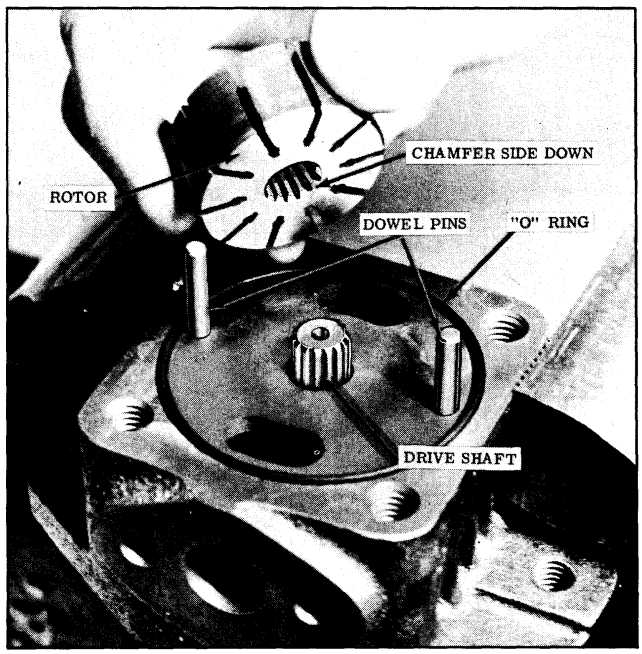


Fig. 5-81 Rotor Installation

9. Assemble the vanes in the rotor slots with the radius edge facing outward. (See Fig. 5-82)

   NOTE: If pressure line marks are apparent on the vanes, they should face the drive side of the rotor slot (trailing edge of the slot as the rotor is turned counter-clockwise when viewed from the rear of the pump).
10. Position cam ring over dowel pins with scribe marks aligned.

    NOTE: The arrow on the cam ring

Fig. 5-82 Installation of Vanes

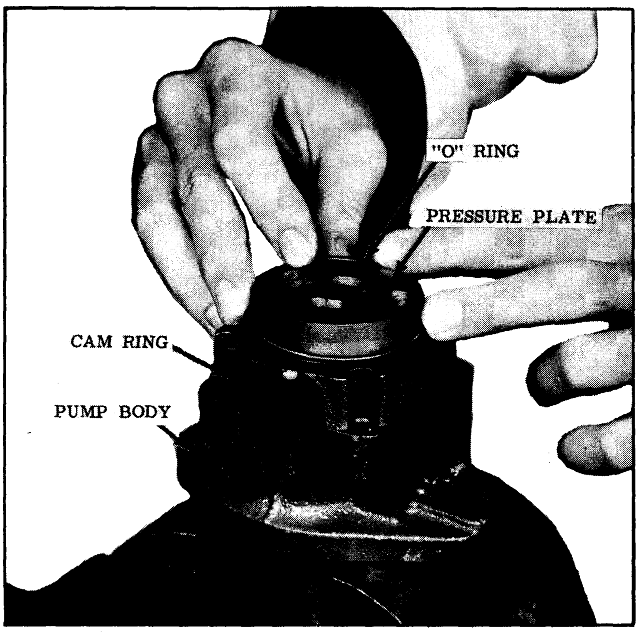


Fig. 5-83 Pressure Plate and "O" Ring

should point in a clockwise direction when pump is viewed from the front.

11. Place the pressure plate on the cam ring over the dowel pins. Place "O" ring around pressure plate. (See Fig. 5-83)
12. Place flow control spring into bore of pump cover and position plug end of flow control valve into spring.
13. Compress spring so that flow control valve enters the bore in the cover and

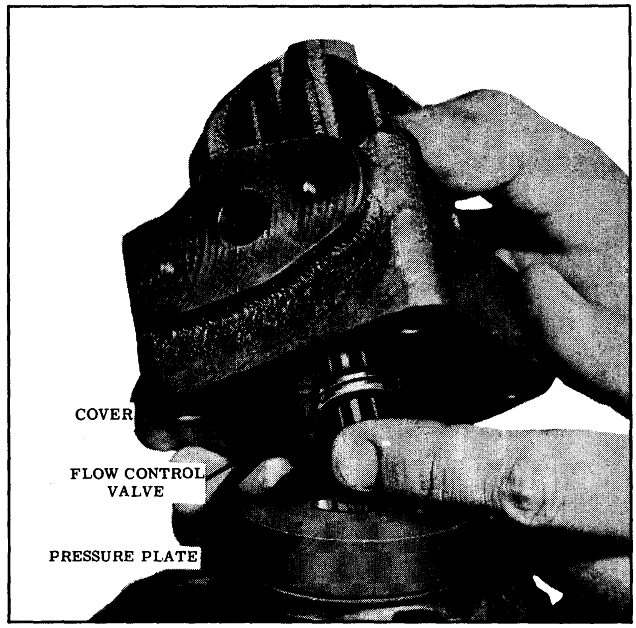


Fig. 5-84 Installing End Cover

while holding flow control valve, place the cover over the pressure plate. (See Fig. 5-84)

14. With scribe marks aligned, install the 4 attaching bolts finger tight.
15. Make sure that reservoir mounting surfaces are parallel, then tighten pump cover attaching bolts 25 to 30 ft. lbs.
16. Install new "O" ring on the union fitting, then install fitting into pump cover.
17. Position reservoir mounting gaskets (with spacers) on the pump assembly. (See Fig. 5-85)
18. Position the manifold inside of reservoir and place reservoir on top of mounting gaskets with all holes aligned,

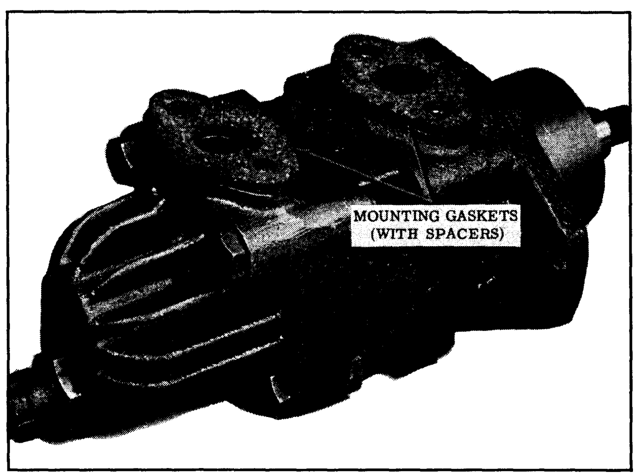


Fig. 5-85 Mounting Gaskets

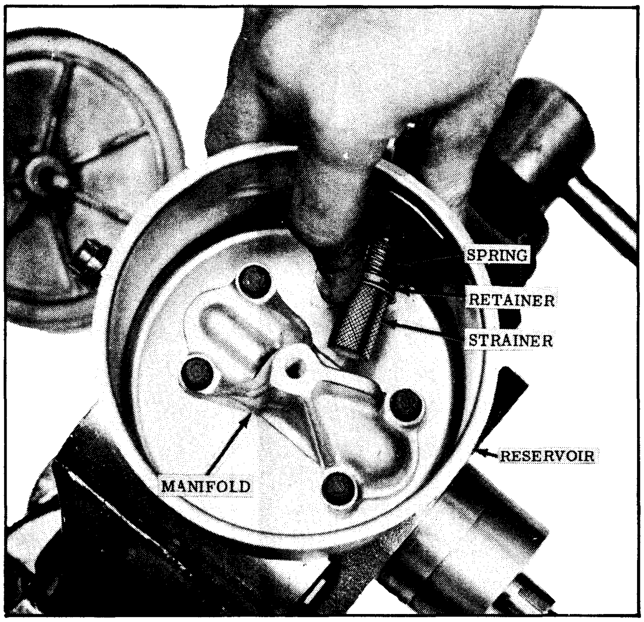


Fig. 5-86 Installing Strainer

then install and torque the 4 attaching screws 8 to 10 ft. lbs.

19. Install spring, retainer, and strainer as shown in Fig. 5-86. Be sure strainer seats into the manifold and the retainer.
20. Assemble the reservoir cover with gasket and vent washer finger tight, then cap inlet and outlet fittings to prevent entrance of dirt until the pump is installed on the car.

HORN BUTTON & STEERING WHEEL REMOVAL

Horn wire should be disconnected to prevent blowing of horn.

The horn button on the standard wheel is held in place by means of dimples on the horn button retainer cup. The horn button may be removed by inserting a sharp instrument underneath the edge of the horn button and prying upward. Removal of the steering wheel nut will permit removal of the contact assembly.

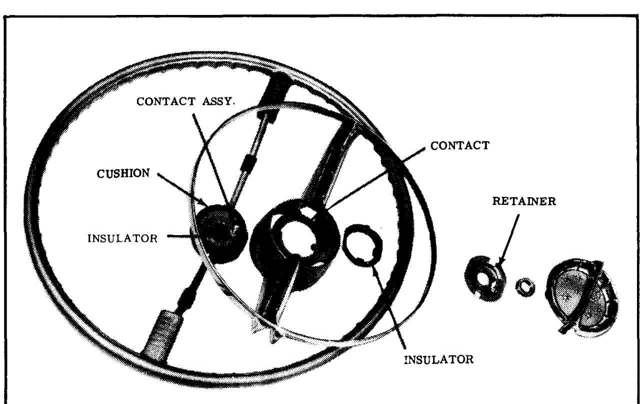


Fig. 5-87 Deluxe Steering Wheel Assembly

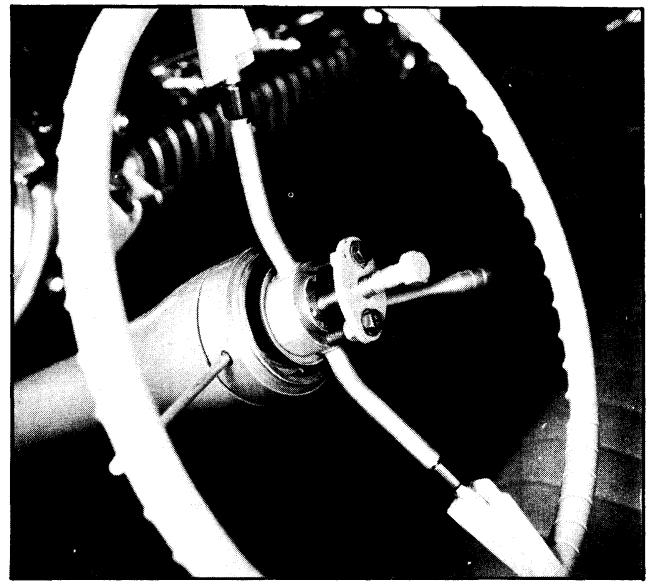


Fig. 5-88 Steering Wheel Removal

The deluxe horn button is held in place by two spring clips on the ends of the horn button which engage the horn ring hub. They are accessible from the underside of the wheel. To remove the horn button use a small screwdriver to relieve the spring tension on one end and lift the button from its seat.

The steering wheel nut will have to be removed in order to remove the horn contact plate, horn ring assembly, or steering wheel. (See Fig. 5-87)

A steering wheel puller should be used to facilitate removal of the wheel. (See Fig. 5-88)

UPPER BEARING—Remove and Replace

1. Remove steering wheel.
2. Disconnect horn wire from chassis wiring harness.
3. Remove horn wire clamp from mast jacket.
4. Using Tool J-5236, remove upper bearing and horn wire. (See Fig. 5-89)

To replace, reverse the above procedure.

NOTE: Tool J-5236 can be used to replace the upper bearing.

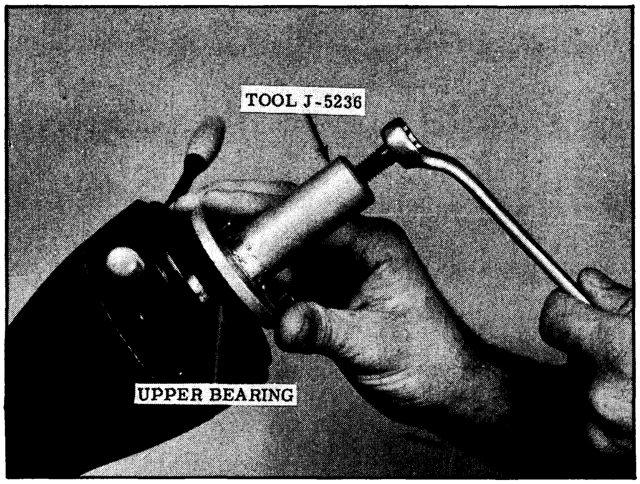


Fig. 5-89 Upper Bearing Removal

STANDARD STEERING MAST JACKET ASSEMBLY

Remove and Replace

1. Disconnect battery.
2. Disconnect shift rod from lower shift lever.
   NOTE: If car is equipped with Syncro-Mesh, remove cross shift lever from lower clamp. (See Fig. 5-90)
3. Loosen mast jacket lower clamp and slide clamp below mast jacket.
4. Loosen steering gear to frame mounting bots.
5. Remove steering wheel assembly, then remove upper bearing spring and spring seat.
6. Disconnect the horn wire from the chassis wiring harness under the in-

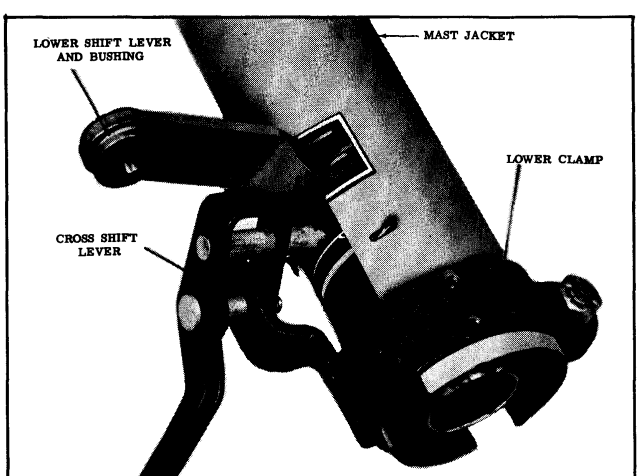


Fig. 5-90 Syncro-Mesh Shift Levers

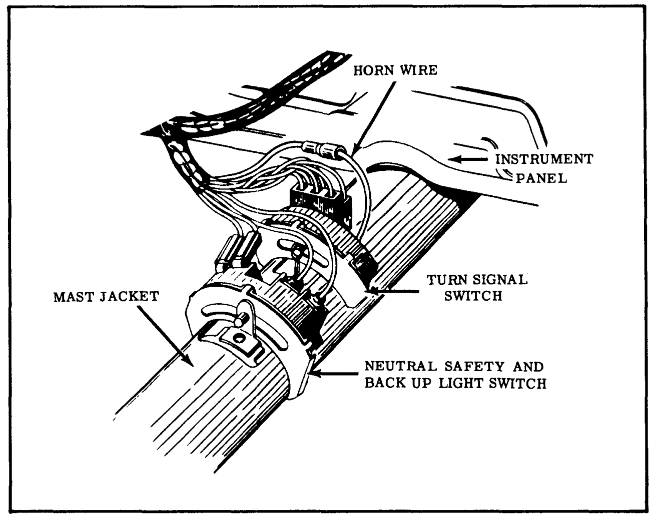


Fig. 5-91 Switch Locations

strument panel and remove grommet or hold down clip from mast jacket.

7. Using Tool J-5236, remove upper bearing.
8. If equipped with:
   Hydra-Matic - Disconnect the turn signal wires, neutral safety switch wires, and the back-up light wires from the switches on the mast jacket. (See Fig. 5-91) Remove the upper mast jacket clamp from the upper bracket, then remove the H-M indicator pointer from the shifter tube. (See Fig. 5-92)
   Syncro-Mesh - Disconnect the turn signal wires from the chassis

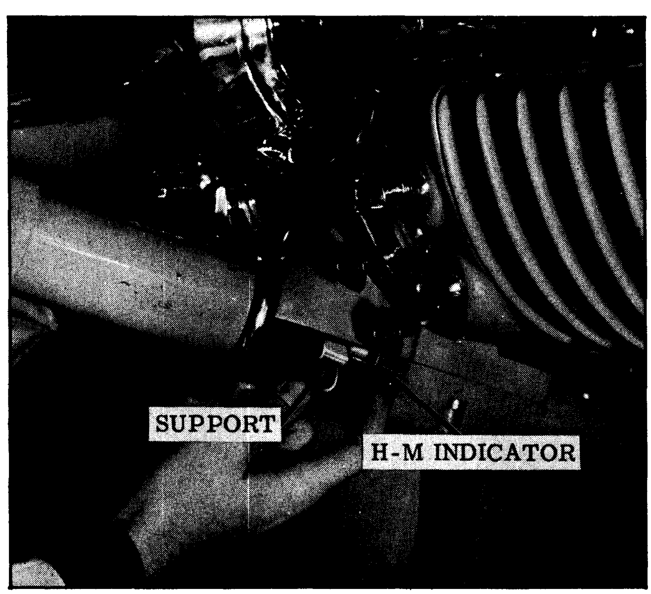


Fig. 5-92 H-M Indicator Needle Removal

wiring harness from under the instrument panel.
9. Loosen mast jacket grommet hold down clips, disconnect stop light wires from switch, and remove mast jacket cover plate.
   NOTE: If equipped with power brakes, remove pedal and pedal bracket. Remove power brake cylinder mounting bolts, permitting power cylinder to rest on frame.
10. Remove mast jacket upper clamp.
11. Slide mast jacket assembly off steering shaft. To replace, reverse the above procedure.

NOTE: Before tightening upper and lower clamps, locate mast jacket to provide 1/8" to 3/16" clearance between the steering wheel and turn signal collar. If equipped with Hydra-Matic, the H-M indicator needle should be aligned with "N" with the selector lever in neutral position and adjust the neutral safety switch. Make sure felt on needle just contacts rubbing surface in instrument cluster.

POWER STEERING MAST JACKET ASSEMBLY

Remove and Replace

1. Disconnect battery.
2. Disconnect shift rod from lower shift lever.
   NOTE: If car is equipped with Syncro-Mesh, remove cross shift lever from lower clamp. (See Fig. 5-90)
3. Remove steering wheel assembly, then remove upper bearing spring and spring seat.
4. Disconnect the horn wire from the chassis wiring harness under the instrument panel and remove grommet or hold down clip from mast jacket.
5. Using Tool J-5236, remove upper bearing.
6. If equipped with:
   Hydra-Matic - Disconnect the turn signal wires, neutral safety switch wires, and the back-up light wires from the switches on the mast jacket. (See Fig. 5-91) Remove the upper mast jacket clamp from the upper bracket, then remove the H-M indicator pointer from the shifter tube. (See Fig. 5-92)
   yncro-Mesh - Disconnect the turn signal wires from the chassis wiring harness from under the instrument panel.
7. Loosen mast jacket grommet hold down clips, disconnect stop light wires from switch, and remove mast jacket cover plate.
   NOTE: If equipped with power brakes, remove pedal and pedal bracket. Remove power brake cylinder mounting bolts, permitting power cylinder to rest on frame.
8. Remove mast jacket upper clamp.
9. Slide mast jacket assembly off steering shaft.
   NOTE: If steering shaft or flexible coupling is to be replaced, scribe an alignment mark on the coupling flange adjacent to the large type flexible coupling bolt so that the parts may be lined up correctly upon reassembly. (See Fig. 5-93)

To replace, reverse the above procedure.

NOTE: Before tightening upper and lower clamps, position the lower bearing retainer in the mast jacket to provide 1/8" to 3/16" clearance between the steering wheel and the turn signal collar. If equipped with Hydra-Matic: Check and adjust the neutral safety switch, adjust the turn signal

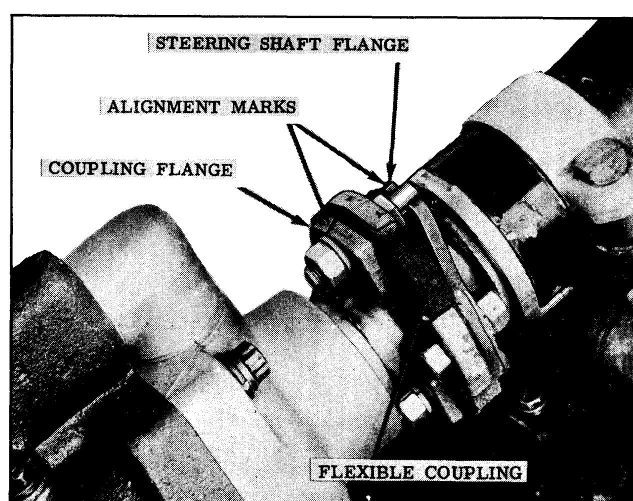


Fig. 5-93 Alignment Marks

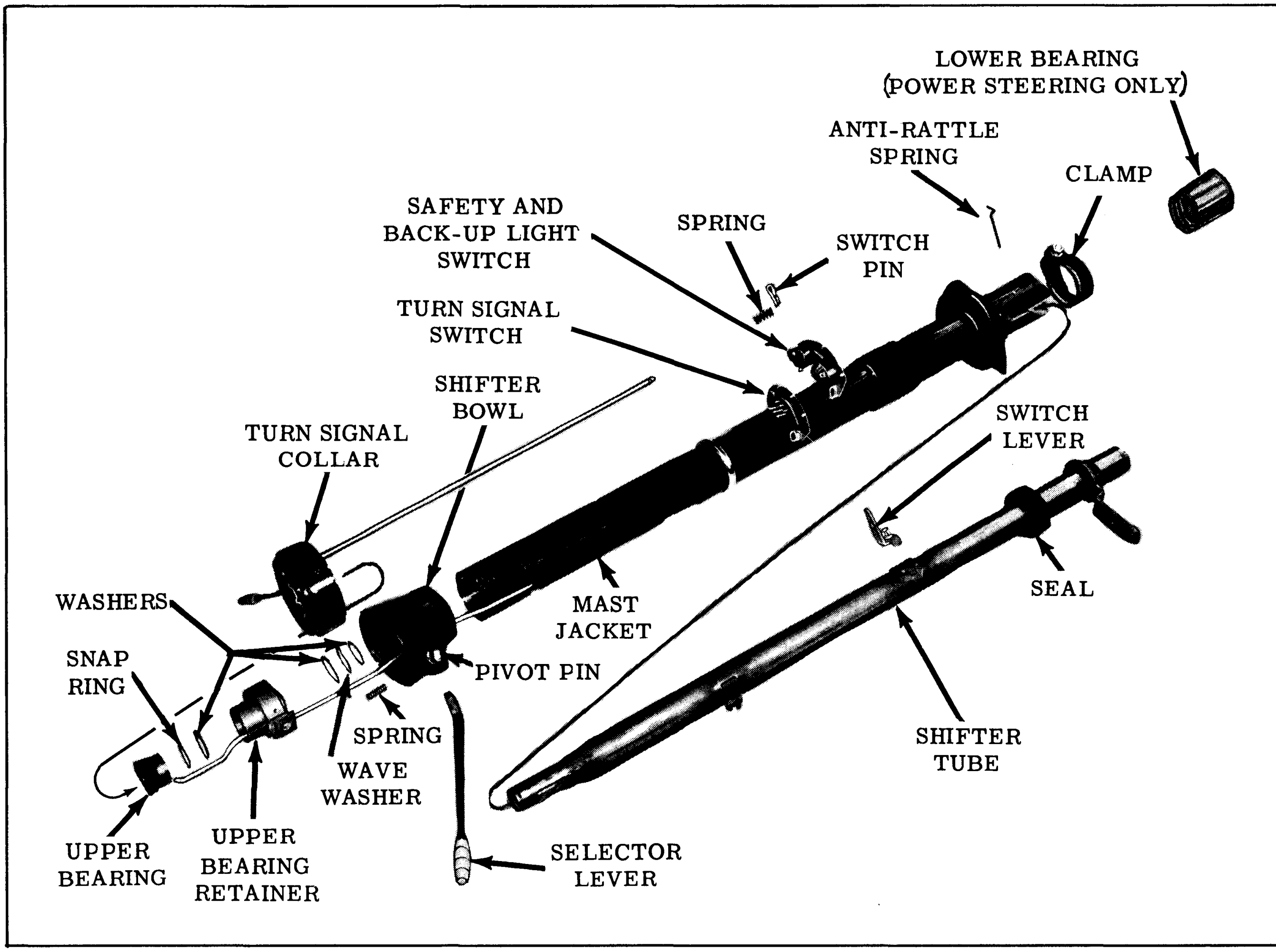


Fig. 5-94 Mast Jacket Assembly (Hydra-Matic)

switch, align the H-M indicator needle with the "R" with the selector lever in the reverse position. Make sure felt on needle just contacts rubbing surface in instrument cluster.

MAST JACKET DISASSEMBLE AND ASSEMBLE

Hydra-Matic Models FIG. 5-94

1. Remove turn signal switch from side of mast jacket.
2. Remove the switch pin and spring from the turn signal rod.
3. Remove turn signal collar mounting screws, then pull turn signal collar and rod from the mast jacket.
4. If necessary to disassemble the turn signal collar, move the turn signal lever to the left turn position and slide the turn signal rod from the collar. (See Fig. 5-95) Unscrew the lever from the collar, then pry the ring from the collar. From the upper side of the turn signal collar, remove the plate from the collar.
5. Remove the combination neutral safety switch and back-up light switch from the mast jacket. Remove switch lever from shifter tube.
6. From inside the upper bearing retainer, remove the snap ring and washer from the shifter tube.
7. Push shifter bowl downward on mast jacket, then remove the three upper bearing retainer screws.
8. Remove upper bearing retainer, then remove flat washer, wave washer, and flat washer from the shifter tube.
9. Pull the shifter bowl and selector lever assembly from the mast jacket.

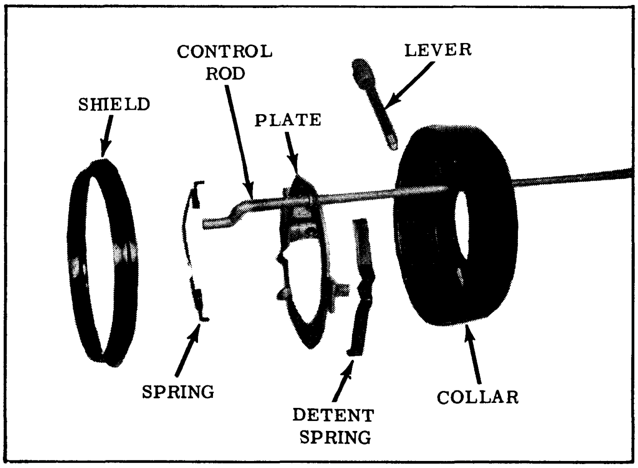


Fig. 5-95 Turn Signal Collar (Hydra-Matic)

10. If necessary to replace the selector lever or the shifter bowl, drive the pivot pin from the shifter bowl, then remove the selector lever and spring from the shifter bowl.
11. For power steering; loosen the lower clamp, pull the lower bearing retainer from the mast jacket, then remove the lower clamp.
12. Remove the anti-rattle spring wire from the lower end of the mast jacket, then pull shifter tube out of mast jacket.
13. If necessary to service the lower bearing retainer assembly (power steering), the bearing assembly and dust seal may be driven out of the retainer. (See Fig. 5-96) If shifter tube bushing replacement is necessary, it may be driven from the retainer.

To reassemble, reverse the above procedure. If the lower bearing assembly was disassembled (power steering), saturate the felt on the bearing and the felt dust seal with engine oil. To install the lower bearing, place the bearing in the retainer, then drive the dust seal and retainer into the bearing retainer. (See Fig. 5-96) Lubricate the inside diameter of the shifter tube bushing with special seal lubricant 567196. When installing the shifter tube bushing, it should bottom in the counterbore of the retainer.

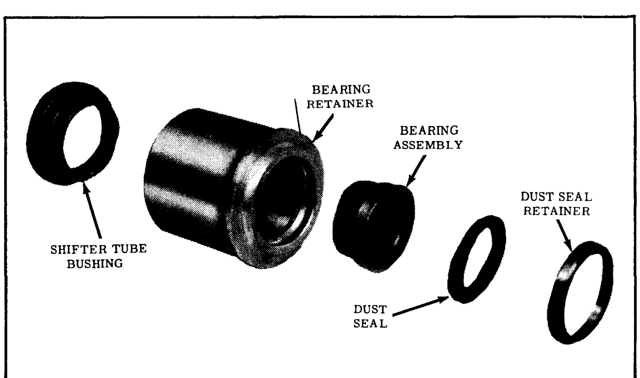


Fig. 5-96 Lower Bearing Retainer Assembly

MAST JACKET, DISASSEMBLE AND ASSEMBLE

Syncro-Mesh Models FIG. 5-98

1. Remove turn signal collar mounting screws and remove collar and wire assembly. (See Fig. 5-97)
2. Pull rubber boot back from shift lever retainer nut. Remove retainer nut and spring from shifter bowl.
3. Remove shift lever, seat and anti-rattle spring.
4. Remove shifter stud.
5. Remove snap ring, wave washer, flat washer, shifter bowl and special washer from end of mast jacket.
6. For power steering, loosen lower clamp and pull lower bearing retainer assembly and clamp from end of mast jacket.
7. Remove retainer ring from inside lower end of mast jacket and slide shifter tube assembly out of lower end of mast jacket.

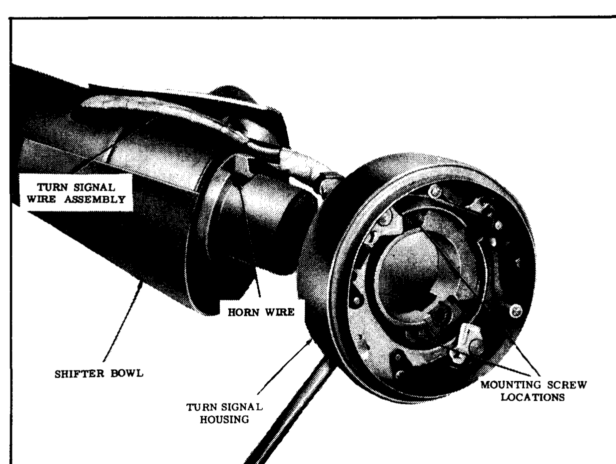


Fig. 5-97 Turn Signal Collar (Syncro-Mesh)

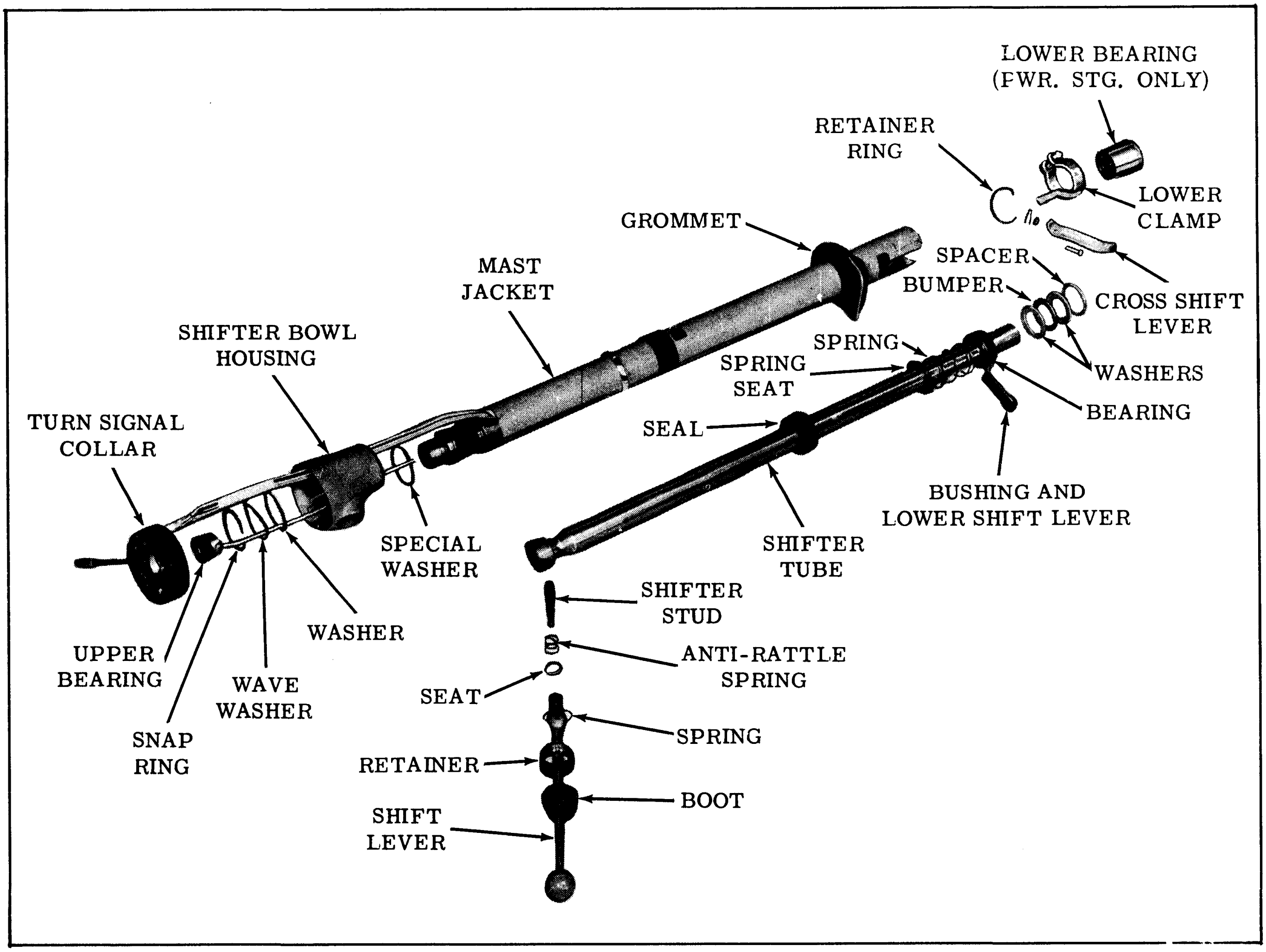


Fig. 5-98 Mast Jacket Assembly (Syncro-Mesh)

8. If necessary to service the lower bearing retainer assembly (power steering), the bearing assembly and dust seal may be driven out of the retainer. (See Fig. 5-96) If shifter tube bushing replacement is necessary, it may be driven from the retainer.

To reassemble, reverse the above procedure paying particular attention to the following: If the lower bearing assembly was disassembled, saturate the felt on the bearing and the felt dust seal with engine oil. To install the lower bearing, place the bearing in the retainer, then drive the dust seal and retainer into the bearing retainer. (See Fig. 5-96) Lubricate the inside diameter of the shifter tube bushing with special seal lubricant 567196. When installing the shifter tube bushing, it should bottom in the counterbore of the retainer.

Torque shifter stud 25 to 30 ft. lbs.

NOTE: Using a reworked 9/16" socket and pin (Fig. 5-99) will permit torqueing the shifter stud.

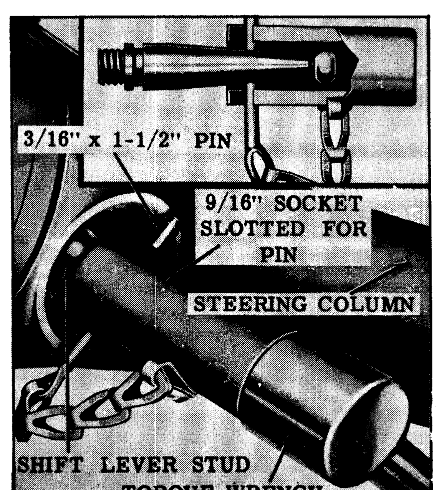


Fig. 5-99 Shifter Stud Tool

DIAGNOSIS OF STANDARD AND POWER STEERING

NOTE: Items identified by (S.S.) apply to standard steering only and items identified by (P.S.) apply to power steering only. All items not identified by (S.S.) or (P.S.) apply to both units.

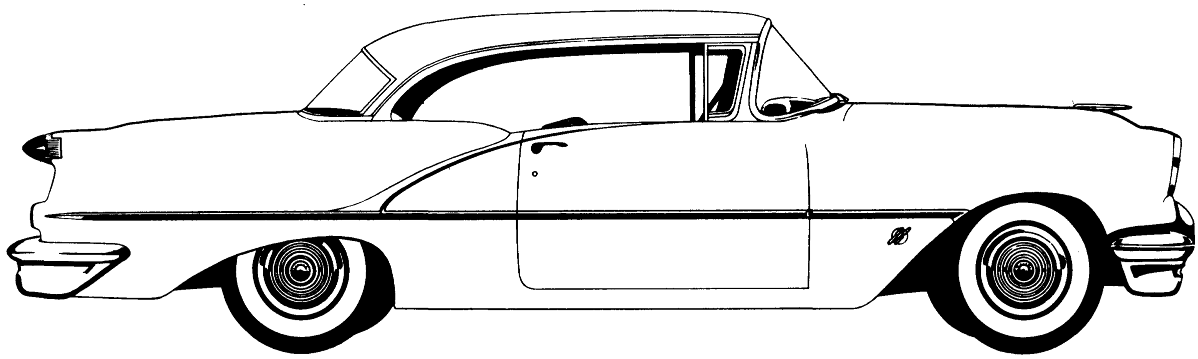
CONDITION	CAUSE	CORRECTION
Hard Steering	1. Steering gear adjustments tight	1. Adjust to specification
	2. Loose pump belt (P.S.)	2. Adjust to specification
	3. Low oil level in reservoir (P.S.)	3. Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.
	4. Lack of lubrication in linkage or front suspension.	4. Add lubricant where needed
	5. Tires not properly inflated.	5. Inflate to recommended pressure
	6. Insufficient oil pressure	6. See OIL PRESSURE TEST
Poor return of steering gear to center	1. Tires not properly inflated	1. Inflate to specification
	2. Incorrect caster or toe-in, front wheels	2. Adjust to specification
	3. Tight steering linkage	3. Lubricate or otherwise free up
	4. Steering gear misalignment (S.S.)	4. Reposition gear housing at frame
	5. Tight king pins in bushings	5. Lubricate or otherwise free up
	6. Tight sector to rack-piston adjustment	6. Adjust in car to specification
	7. Sticky or faulty control valve (P.S.)	7. Free up valve assembly
	8. Valve body improperly positioned on steering gear	8. Loosen valve body screws, allow valve body to center itself and retighten.
	9. Ball nut and worm preload too tight (P.S.)	9. Remove gear and replace balls as required
	10. Worm thrust bearing adjustment too tight (P.S.)	10. Remove gear and adjust to specification
Car leads to one side or the other	1. Due to front end misalignment	1. Adjust to specifications
Momentary increase in effort when turning wheel fast to the right (P.S.)	1. Air in system	1. Bleed gear.

CONDITION	CAUSE	CORRECTION
External oil leaks (Wipe gear thoroughly and make sure source of leakage is determined) (P.S.)	1. Loose hose connection 2. Damaged hose 3. Housing end cover seal 4. Housing end cover "O" ring seal 5. Adapter "O" ring seal 6. Side cover "O" ring seal 7. Linkage cover "O" ring seals 8. Valve to gear housing "O" ring seals 9. Pitman shaft seal 10. Valve end plug "O" ring seal 11. Porous casting	1. Tighten 2. Replace 3. Remove gear and replace seal. 4. Remove gear and replace seal. 5. Remove gear and replace seal. 6. Remove gear and replace seal. 7. Remove gear and replace seals. 8. Remove gear and replace seals. 9. Remove gear and replace seal. 10. Remove gear and replace seal. 11. Replace casting.
Gear noise (rattle or clunk)	1. Loose over-center adjustment NOTE: A slight rattle may occur on turns because of the increased lash off the "high point". This is normal, and the lash must not be reduced below the specified limits to eliminate this slight rattle. (P.S.)	1. Adjust to specification.
Gear noise ("hissing" sound) (P.S.)	There is some noise in nearly all power steering systems. One of the most common is a "hissing" sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. Hiss may be expected when steering wheel is at end of travel.	Do not replace valves unless "hiss" is extremely objectionable. Slight hiss is satisfactory and in no way affects steering. A replacement valve may also exhibit slight noise and is not always a cure for the objection.
Excessive wheel kickback or loose steering	1. Lash in steering linkage. 2. Air in system	1. Adjust affected parts. 2. Add oil to pump reservoir and bleed.

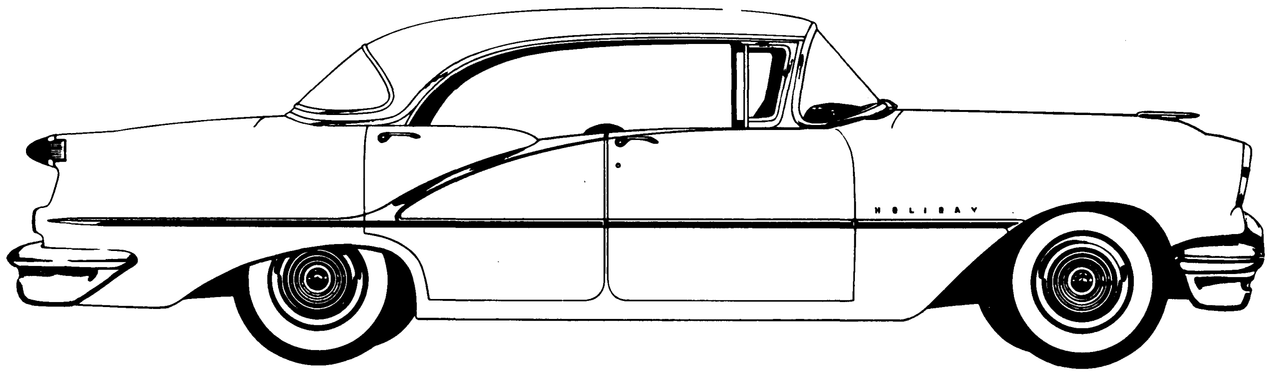
CONDITION	CAUSE	CORRECTION
Excessive wheel kickback or loose steering	3. Excessive lash between pitman shaft sector and rack-piston (P.S.). Ball nut (S.S.)	3. Adjust to specification.
	4. Loose worm thrust bearing adjustment	4. Adjust to specification.
Steering wheel surges or jerks when turning with engine running	1. Loose pump belt	1. Adjust to specification.

STEERING TORQUE TIGHTNESS CHART

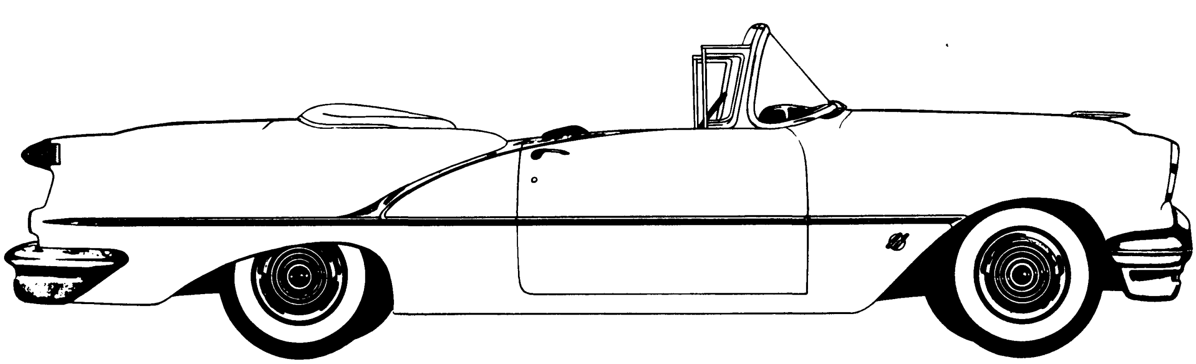
Application	Ft. Lbs.
1. Idler Arm Bushing	100 Min.
2. Pitman Arm Nut	90-120
3. Steering Gear to Frame Bolts	40-50
4. Steering Idler Arm Support to Frame Bolts	25-30
5. Steering Wheel Nut	25 Min. & Stake
6. Tie Rod Clamp Bolts	20-25
7. Tie Rod to Steering Arm Nut	40-45
8. Shift Control Lever Retainer (SM)	20-25
9. Power Steering Drive Belt Tension (Using Tool J-5398)	30
10. Shift Stud to Shift Tube (SM)	50-55



SUPER 88 HOLIDAY COUPE (DHC)



SUPER 88 DELUXE HOLIDAY SEDAN (DHS)



SUPER 88 CONVERTIBLE COUPE (DCR)

REAR SUSPENSION

CONTENTS OF SECTION 6

REAR SPRINGS, REMOVE AND REPLACE

1. Hoist rear of car.
2. Disconnect shock absorber from rear axle spring seat.
3. Remove "U" bolts, insulators, and spring clamp plate.
4. Use jack to raise axle housing slightly off spring, then remove rear spring shackle bolts. (See Fig. 6-2)
5. Disconnect front of spring from front hanger by removing the front spring nut and bolt, then remove spring.

To replace spring, reverse sequence of operations. A soap solution may be applied to rubber bushings to aid installation. When replacing spring, insert only the outer rubber bushing in the front spring eye before placing spring in hanger. The inner

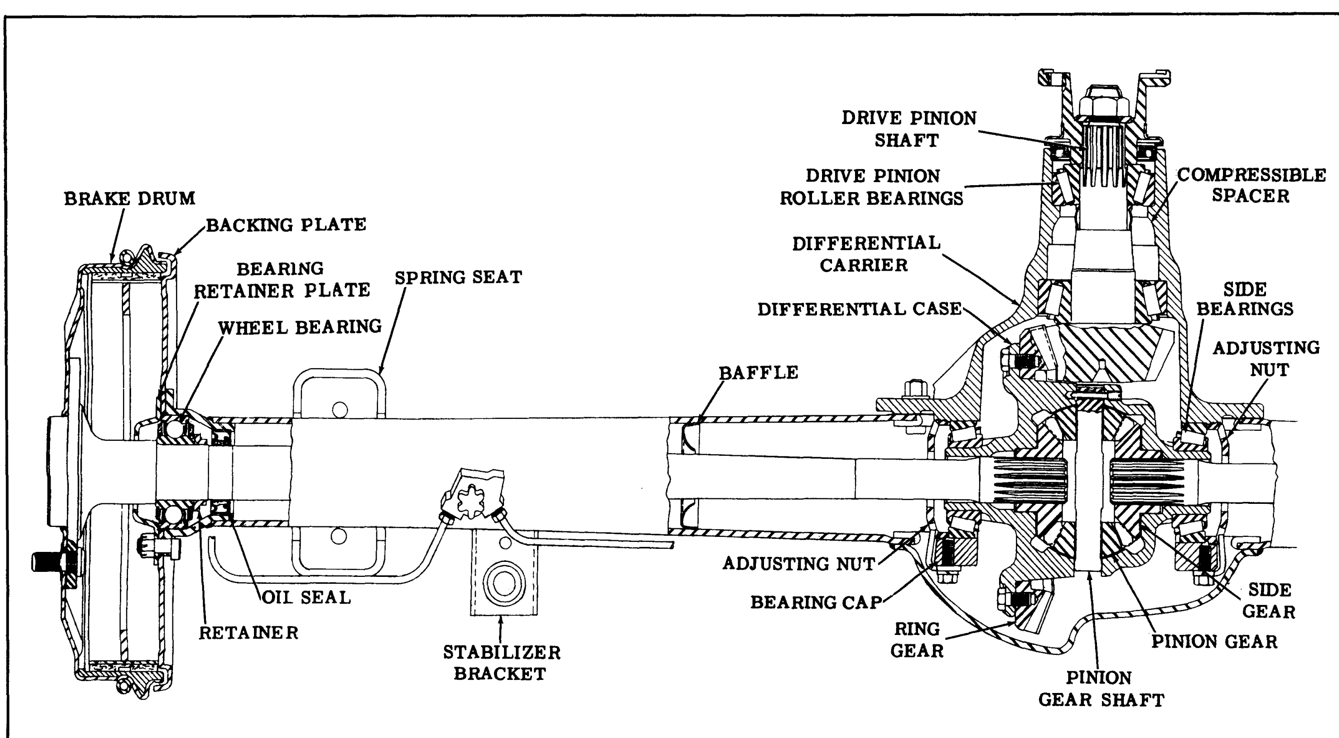


Fig. 6-1 Rear Axle Assembly

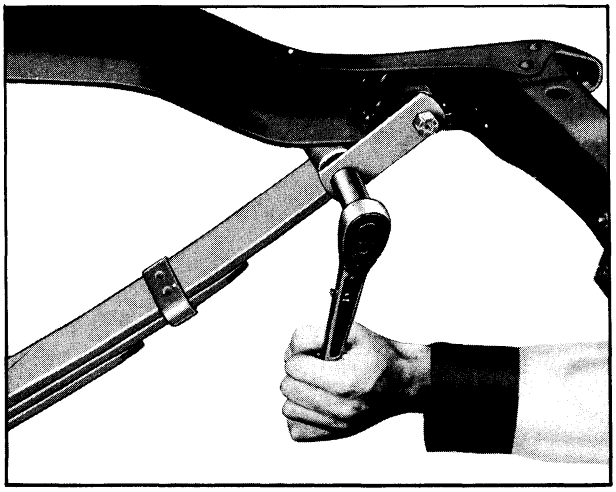


Fig. 6-2 Removing Spring Shackle Bolt

rubber bushing can be inserted into the spring eye through the hole in the front spring hanger after the spring is in place. (See Fig. 6-3) Allow weight of car to rest on springs before tightening nuts on spring shackle and front eye bolts.

REAR SHOCK ABSORBER

Rubber insulated double action shock absorbers are of the direct acting type. If found to be leaking or improperly operating, the complete shock absorber assembly should be replaced.

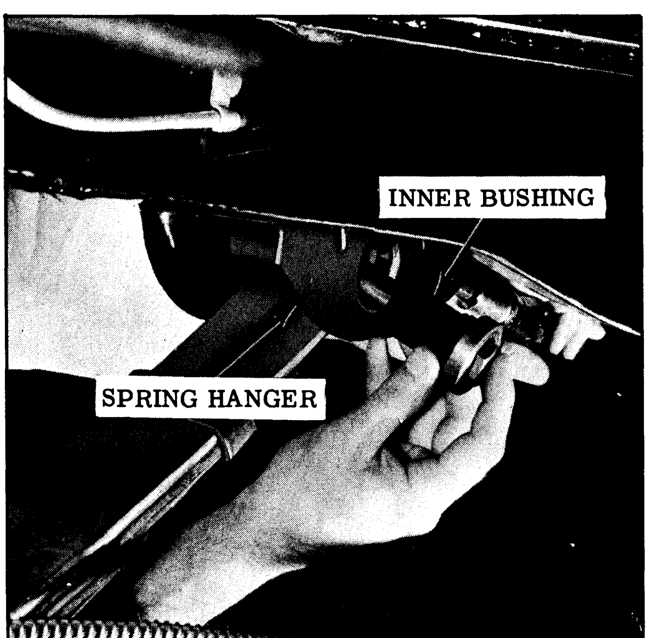


Fig. 6-3 Installing Rear Spring Front Bolt

Checking Rear Shock Absorber Operation

Disconnect lower end of both shock absorbers. By operating a shock absorber with each hand, work the shocks up and down simultaneously. The movement of the shocks should be smooth and it should require equal force to operate both shock absorbers.

NOTE: If the operation of the shocks is erratic or unequal, it is due to a malfunction of one or both of the units and will require replacement. In order to obtain proper riding characteristics, the shocks must operate smoothly and at equal loads.

Remove Rear Shock Absorber

1. Remove shock absorber lower mounting nut, retainer, and rubber bushing from spring seat stud.
2. Remove shock absorber upper mounting nut, bolt, and spacers from frame cross member.
3. Remove shock absorber, bushings, and sleeve type spacer.

To install, reverse sequence of operations, making sure bushings are in the proper position. A soap solution may be applied to rubber bushings to aid installation.

REAR STABILIZER

The stabilizer bar is attached to the frame by two rubber bushings, two brackets, and four bolts. The rubber bushings can be changed without disconnecting the stabilizer links. When installing new rubber bushings on the stabilizer bar, the bushings should be installed dry, and care used to center the bushings in the stabilizer bar brackets. (See Fig. 6-4)

NOTE: Stabilizer bracket bolt heads should face the rear of car so that the bolts will clear the shock absorbers.

PROPELLER SHAFT ASSEMBLY

Propeller Shaft Removal and Replacement

1. Remove four rear universal joint bolts.

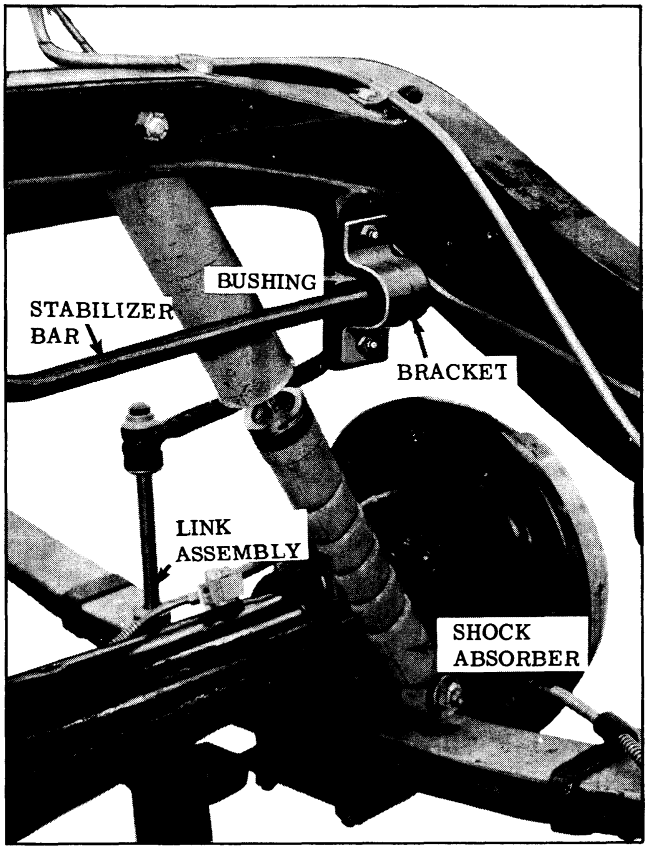


Fig. 6-4 Stabilizer and Shock Absorber

2. Use a piece of soft wire or a heavy rubber band to hold trunnions onto spider journals and prevent loss of bearing assemblies when joint is disconnected.
3. Mark the universal joint trunnions and companion flange and then disconnect universal joint from companion flange.

To install, apply one ounce of seal lubricant, Part No. 567196, to the splines of the slip yoke and use new companion flange locks under the "U" joint attaching bolts. Torque bolts 18 to 22 ft. lbs.

Disassemble Universal Joint

1. To remove the bearing assemblies that are assembled directly into the yoke:
   a. Remove snap rings.
   b. Push one bearing assembly toward spider; thus forcing out opposite bearing assembly.
   c. Reverse, pushing on spider to remove other bearing assembly.

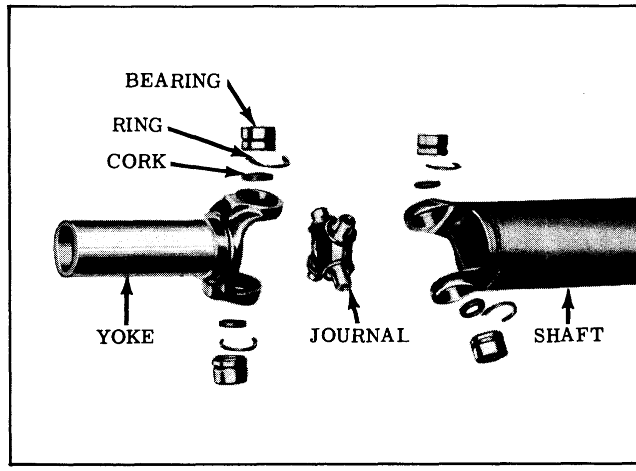


Fig. 6-5 Universal Joint Details

   d. It may be necessary to remove one dust shield from spider to remove spider from yoke.

When a universal joint is disassembled all parts should be thoroughly washed, and before the joint is reassembled, the reservoir in each journal of the spider filled with fine fiber grease. New cork packing should be used at each bearing assembly when reassembling the joint.

Assemble Universal Joint

In assembling the universal joint the disassembly procedure should be reversed.

When reassembling:

1. Use new snap rings.
2. When installing slip yoke to transmission main shaft, apply one ounce of seal lubricant, Part No. 567196, to the splines to provide lubrication. Also see that the surface of yoke where transmission dust shield contacts is smooth.

The propeller shaft is a balanced unit and should be kept free of undercoating or other material which may upset the balance.

AXLE SHAFT

Remove Axle Shaft

1. Remove wheel.

   NOTE: Wheel nuts on left side of car, front and rear, have left hand threads.

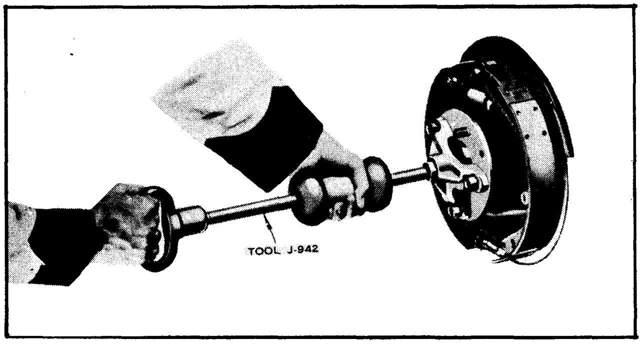


Fig. 6-6 Removing Axle Shaft

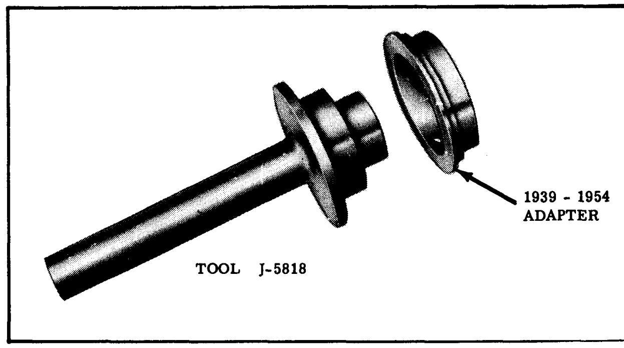


Fig. 6-7 Axle Shaft Seal Installer

2. Remove the two Tinnerman nuts from wheel studs which hold the brake drum in place and remove the drum.
   NOTE: If Tinnerman nuts are removed by turning off threads, they can be used again; however, if nuts are damaged in any way they should be replaced.
3. Remove nuts from the four bolts attaching brake backing plate to axle housing.
4. Pull axle shaft bearing retainer plate away from backing plate, taking care not to dislodge backing plate as brake line may be damaged.
5. Withdraw axle shaft and bearing assembly. Use Tool No. J-942 if bearing is a tight press fit in the axle housing. (See Fig. 6-6)
   NOTE: Extreme care must be exercised to prevent the axle shafts from dragging on oil seal. Bearings should be covered with a clean cloth to prevent dirt getting into bearings.
6. Replace one backing plate attaching nut to hold plate in position.

Replace Axle Shaft

NOTE: Before replacing axle shafts examine oil seals. The oil seal has feather edges which form a tight seal around the axle shaft. If these feather edges are damaged in any way oil will leak past the seal. Furthermore, if the seal is not properly installed in the axle housing a leak is likely to occur around its outside diameter. When installing an oil seal apply sealer around its outside diameter, then install seal using Tool J-5818. (See Fig. 6-7)

Before installing axle shaft examine the surface of the shaft on which the seal wipes to make sure that it is smooth and free from tool marks. If necessary, dress down shaft with crocus cloth.

If roughness or excessive play is detected in wheel bearing it will need to be replaced. (See SEALED WHEEL BEARINGS - REAR)

Axle shafts are serviced with wheel studs pressed into the flange of the shaft. The threads of these studs are left hand for the left hand side of the car and right hand for the right hand side of the car, thereby making the right and left hand shaft assemblies different for service.

1. Remove temporary nut holding backing plate axle housing.
2. Clean inner surface of backing plate and place new gasket over backing plate mounting studs. Clean gasket side of retainer plate.
3. Slide axle shaft and bearing assembly into place. EXTREME CARE MUST BE EXERCISED WHEN SLIDING THE AXLE SHAFT THROUGH THE AXLE SHAFT OIL SEAL TO AVOID DAMAGING THE SEAL.
4. Place retainer plate over backing plate mounting studs and install self-locking nuts; torque 50 to 55 ft. lbs.
5. Replace brake drum and wheel assembly.

Remove and Replace Axle Shaft Bearing

1. Remove bearing retainer collar after splitting with cold chisel as shown in Fig. 6-8. Do not damage axle shaft.

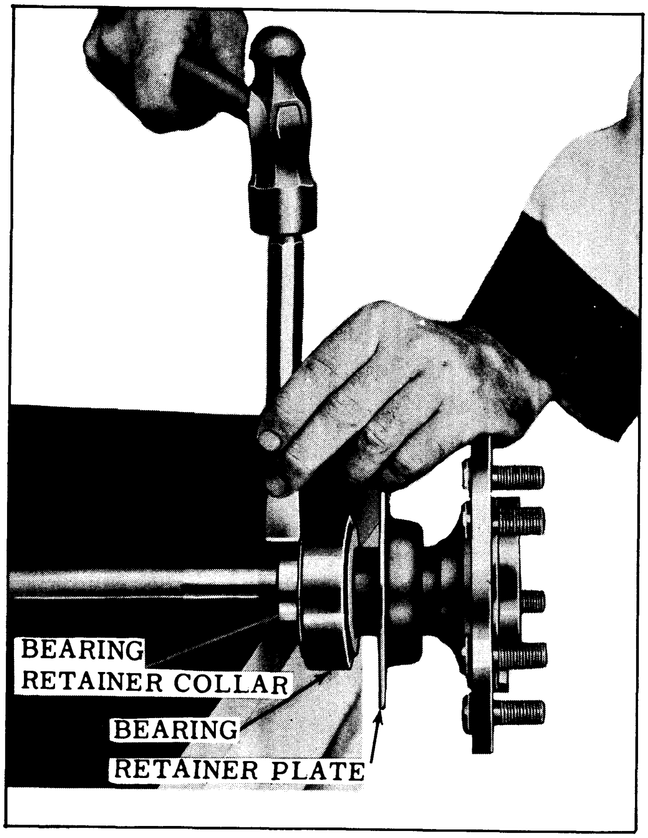


Fig. 6-8 Removing Wheel Bearing Retainer

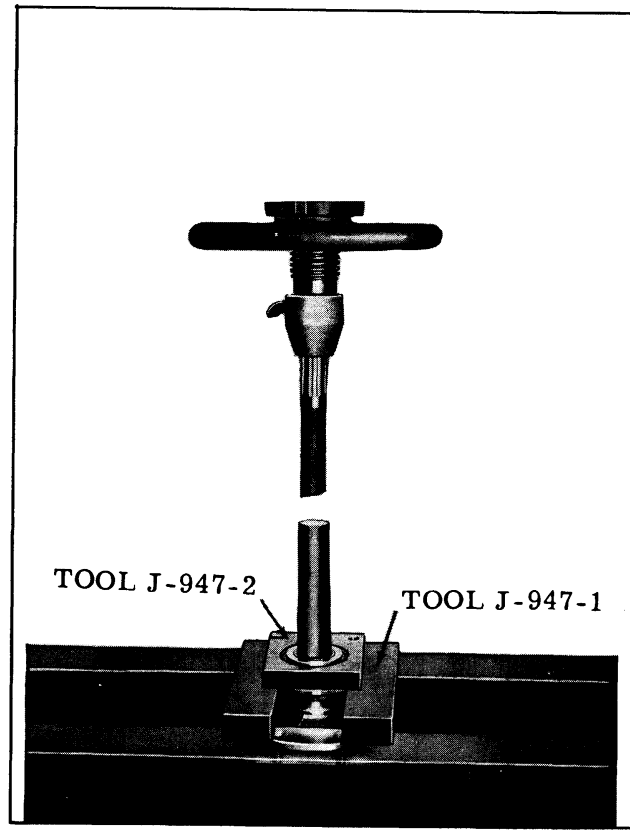


Fig. 6-9 Removing Axle Shaft Bearing

2. Engaging outer race of bearing with Tool J-947-2, used in conjunction with J-947-1, press off bearing in arbor press. Remove bearing only when a new bearing is to be installed. (Tool J-947-2 is used during removal to prevent breakage of the bearing outer race which could result in personal injury.)
3. Using Tool J-947-3 in conjunction with plate J-947-1 press bearing over axle shaft, being sure that pressure is applied to inner race of bearing. After bearing has been pressed firmly against axle shaft shoulder press new bearing retainer collar in place firmly against bearing with chamfered end of collar toward bearing. Do not burr chamfered end of retainer collar or damage shaft surface on which oil seal will run.

Sealed Wheel Bearings—Rear

The sealed rear wheel bearings are built with .012" to .015" end-play between

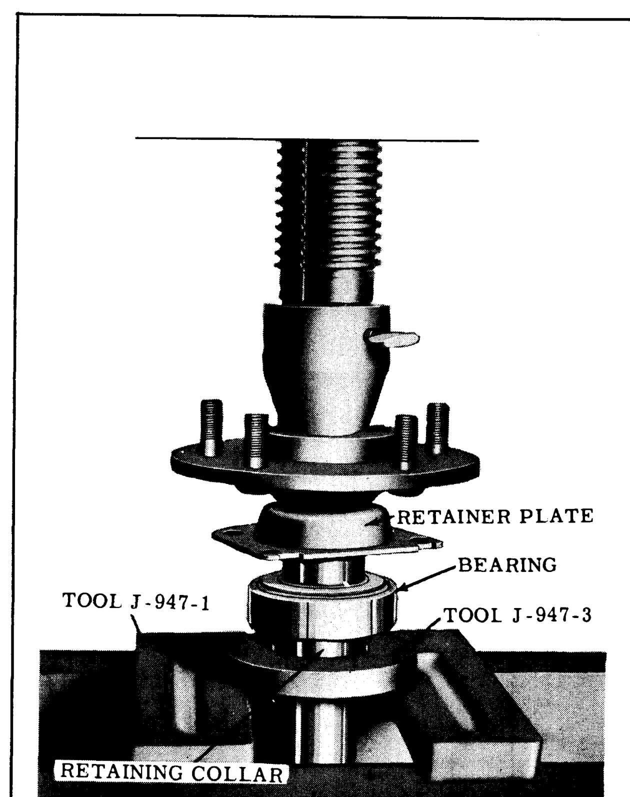


Fig. 6-10 Installing Axle Shaft Bearing Retainer

balls and races and should not be rejected unless end-play is greater than .020" or definite roughness between ball and race can be felt when bearing is rotated by hand. The bearing should be checked for end-play and roughness before it is removed from the axle shaft because if bearing has been removed from the axle shaft it cannot be used again.

NOTE: Tipping of either race can cause a large error in end-play reading.

REPLACEMENT OF PINION OIL SEAL

1. Disconnect propeller shaft from companion flange.
2. Mark the position of the companion flange, pinion shaft, and nut so that they can be reinstalled in the same positions.
3. Remove companion flange nut using Tool J-5293 to hold flange. Remove washer.
4. Remove companion flange using puller J-962 and adapter J-5294.
5. Remove oil seal by prying it out of carrier with a blunt tool.
6. Examine surface of companion flange for tool marks, nicks, or damaged surface. If damaged, replace flange as per instructions under REPLACEMENT OF COMPANION FLANGE.
7. Coat sparingly outside diameter of new seal with Permatex No. 3 and install seal using driver J-5395 to properly locate seal in carrier. (See Fig. 6-11)
8. Apply seal lubricant, Part No. 567196, to the O.D. of the companion flange and sealing lip of new seal.
9. Install companion flange and tighten nut to the same position as marked in step 4 above, then tighten nut 1/16" beyond aligning marks.

REPLACEMENT OF COMPANION FLANGE

1. Remove both rear wheels and brake drums.
2. Remove both axle shafts BEING CAREFUL NOT TO DRAG THE AXLE SHAFTS ACROSS THE SEAL.

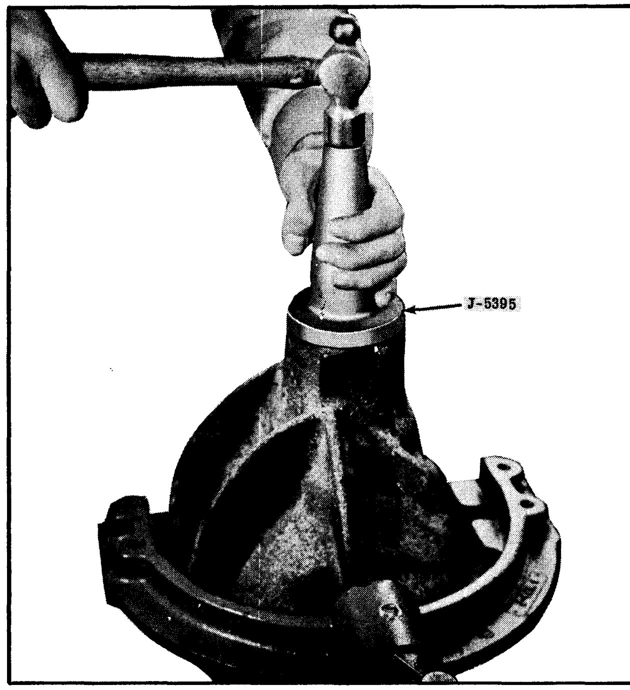


Fig. 6-11 Installing Pinion Oil Seal

3. Disconnect rear universal joint.
4. Remove companion flange nut using holding Tool J-5293.
5. Remove washer and then remove companion flange using puller J-962 and adapter J-5294. (See Fig. 6-12)
6. Install new companion flange, replace washer, and companion flange nut.
7. While holding companion flange with Tool J-5293 and using a 1-1/4" socket wrench, tighten the nut a little at a

Fig. 6-12 Removing Companion Flange

time and turn the pinion several revolutions after each tightening to seat the rollers, checking the pre-load friction of bearings each time with an inch pound torque wrench until preload friction is 15 to 20 inch pounds.

NOTE: In no case should the friction exceed 25 inch pounds if the differential has been in use.

8. Connect rear universal joint.
9. Carefully install axle shafts to avoid dragging shafts across seals.
10. Install drums and wheels.

DIFFERENTIAL, REMOVE

1. Remove the axle shafts.
2. Clean the differential carrier and the axle housing around carrier to prevent dirt entering the housing or falling on the gears.
3. Disconnect the propeller shaft at the rear universal joint after having wired the trunnion blocks together to avoid the loss of bearings. Mark the joint so that it can be replaced in the same position.
4. Drain the oil by removing nuts from carrier mounting studs and moving carrier away from axle housing.

   CAUTION: Do not wash the exterior of the carrier until differential has been disassembled. This will avoid washing dirt into the bearings.

DIFFERENTIAL, INSTALL

IMPORTANT: Differential gears that have failed or bearings that are damaged by chipping are certain to leave particles of metal in the housing. These particles of foreign material must be thoroughly cleaned from the housing before installing the carrier to prevent repeat failure.

Bearings that are not chipped, but are loose (lapped-in) are an indication of dust, grit, or dirt in the oil that caused the bearings to fail. This too must be thoroughly cleaned from the housing before installing the carrier to prevent repeat failure of bearings.

To assure that the housing is clean, thoroughly wash the interior of the housing with clean solvent. Loosen any particles that may be lodged by tapping the housing its entire length, then wipe the inside of housing dry to remove all metal particles.

1. Clean the gasket surface on housing and install a new gasket.
2. Install carrier over studs, apply Permatex No. 2 on threads of each stud, use plain washers ahead of nuts, and tighten nuts evenly to draw carrier pedestal caps squarely into support in housing.
3. Tighten nuts 45 to 50 ft. lbs. torque.
4. Install axle shafts, brake drums, wheels, and propeller shaft.
5. With car sitting level, fill the rear axle housing to filler plug level. If new gears were installed, use EXTREME PRESSURE lubricant furnished with new gears; otherwise, use SAE 90 Multi-Purpose Hypoid lubricant.

   CAUTION: If new gears and/or bearings are installed, DO NOT DRIVE CAR OVER 50 MILES PER HOUR OR USE FULL THROTTLE FOR THE FIRST 50 MILES. This will permit proper "break-in" of the gears and bearings.

DIFFERENTIAL DISASSEMBLY

Careful inspection of the differential while disassembling the unit will assist in determining the cause of axle noise, as in many instances improper Side Bearing Tension, Backlash, and/or End-Play in Pinion Shaft are the basic causes of the noise.

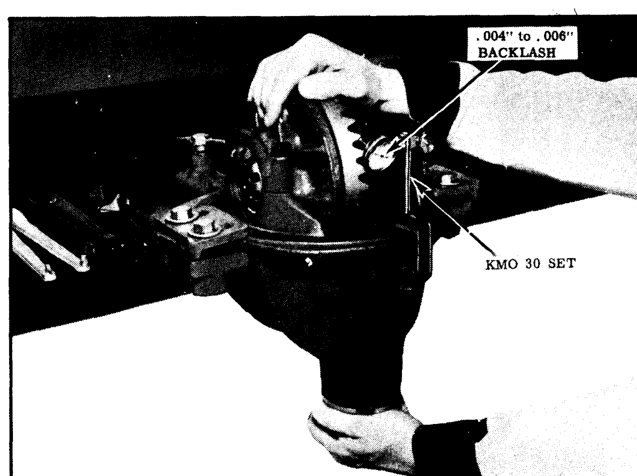


Fig. 6-13 Measuring Back Lash

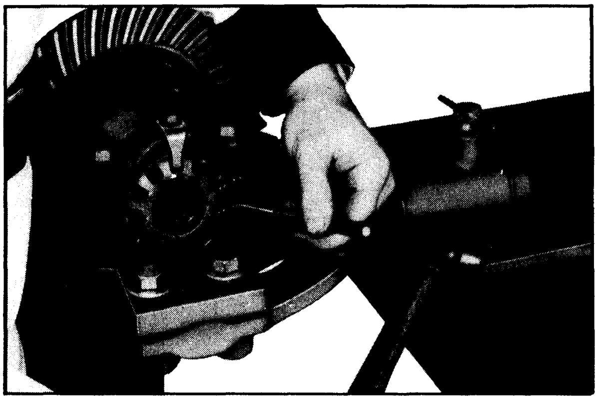


Fig. 6-14 Marking Adjusting Nut

1. Make sure the companion flange nut is tight and check pinion bearing preload.
2. Check tightness of the ring gear to differential case cap screws. They should be 55 to 60 ft. lbs.
3. Measure the backlash between ring gear and pinion gear for reassembly purposes when original gears are reinstalled. (See Fig. 6-13)
4. Mark the adjusting nut, bearing cap, and carrier with two marks as shown in Fig. 6-14; also, mark the left side in the same manner using one mark. These marks will serve for location and adjusting purposes when rebuilding differential with the original gear set.
5. Remove bearing cap lock screws and locks.
6. Loosen each bearing cap attaching bolt (1/4 to 1/2 turn) just enough to turn adjusting nut. (Tap lightly on bearing cap to assure freeness of nut in threads.)
7. Back off the right hand adjusting nut (one opposite ring gear) and watch or feel the edge of the outer race turn along with the adjusting nut.

   NOTE: The outside bearing race should start to turn the instant the adjusting nut is loosened. It should continue to turn until the adjusting nut is loosened 1-1/2 to 3 notches from center punch marks on carrier to point where bearing race stopped turning.
8. Inspect the surface of the ring gear and pinion teeth for nicks, burrs, scoring, or other damage.
9. Remove the bearing cap bolts, bearing caps, and adjusting nuts.
10. Place one or two fingers in the differential case hub (holding the side bearing outer races against rollers) and lift the case assembly from carrier. (See Fig. 6-15)

    DO NOT DROP OR MIX THE DIFFERENTIAL SIDE BEARING OUTER RACES. THEY MUST BE ASSEMBLED TO THEIR RESPECTIVE BEARINGS.
11. Turn the assembly to a horizontal position as shown in Fig. 6-16; then, using Tool J-5293 to hold pinion, remove the companion flange nut using a 1-1/4" socket.
12. Remove washer.

    CAUTION: To avoid possibility of

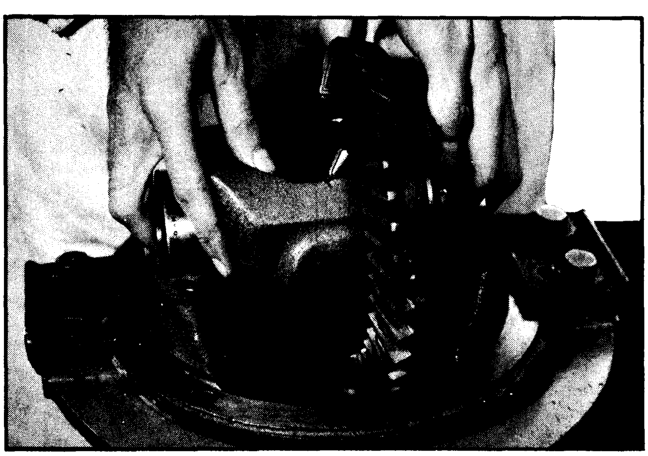


Fig. 6-15 Removing Differential Case

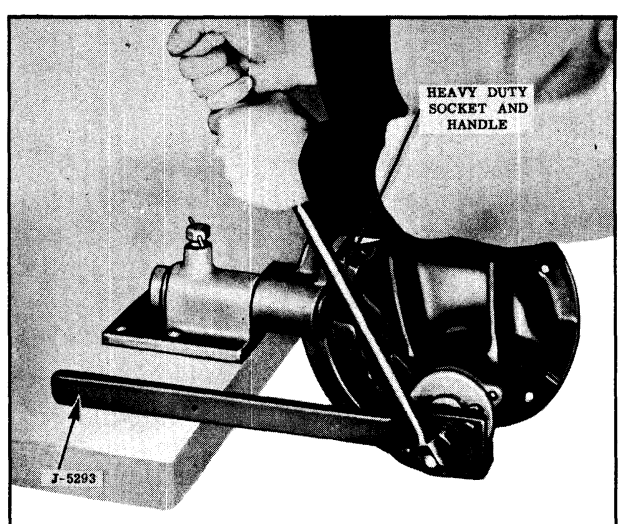


Fig. 6-16 Removing Companion Flange Nut

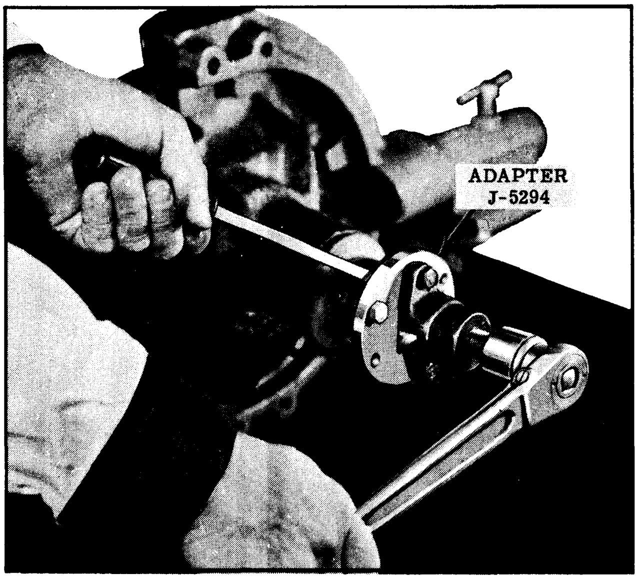


Fig. 6-17 Removing Companion Flange

dropping pinion assembly, leave the carrier in a horizontal position until the pinion assembly is removed.

13. Using companion flange puller J-962 and adapter J-5294, remove companion flange. (See Fig. 6-17)
14. Remove the pinion shaft, rear bearing, and compressible spacer as an assembly as follows:
    a. Remove pinion by hand if it has a sliding fit in front bearing.
    b. If pinion has a light press fit in the front bearing, lightly tap the pinion free with a composition hammer.
    c. If pinion has a tight press fit in front bearing, remove with an arbor press. (See Fig. 6-18)

    NOTE: In some cases, a shim .037" to .045" thick will be found between the spacer and inner race of the front pinion bearing. This shim is used in production to salvage the compressible spacer should the recommended preload be exceeded. It can be used by mechanics in the same manner, and its use will be covered later.

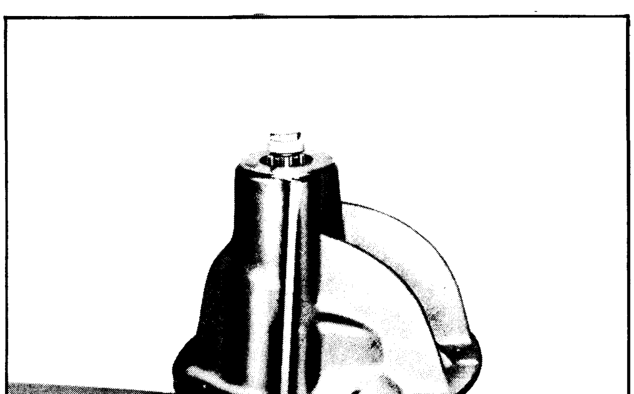


Fig. 6-18 Removing Pinion Assembly

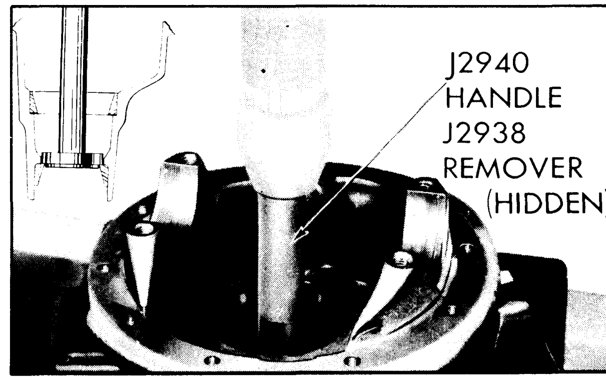


Fig. 6-19 Removing Front Bearing Outer Race

15. Remove the oil seal by prying it out of the carrier.
16. Remove the front inner race and roller assembly.
17. Press the front bearing outer race from carrier using Tool J-2938. (See Fig. 6-19)
18. Press rear bearing outer race from carrier using Tool J-2936. (See Fig. 6-20)
19. Remove pinion adjusting shims from carrier.

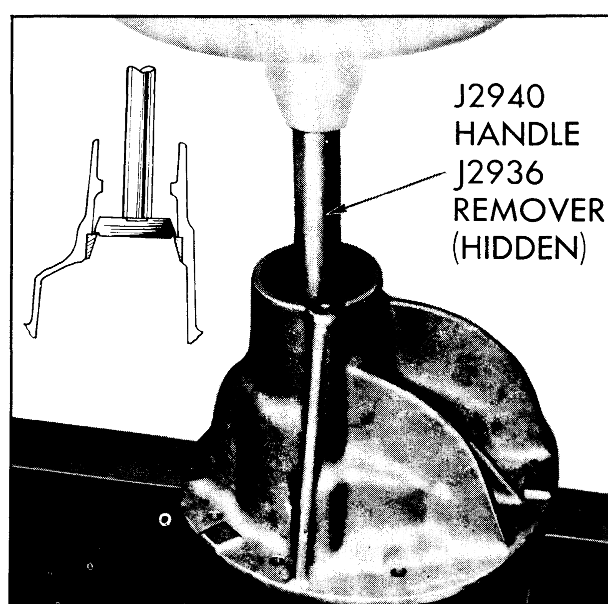


Fig. 6-20 Removing Rear Bearing Outer Race

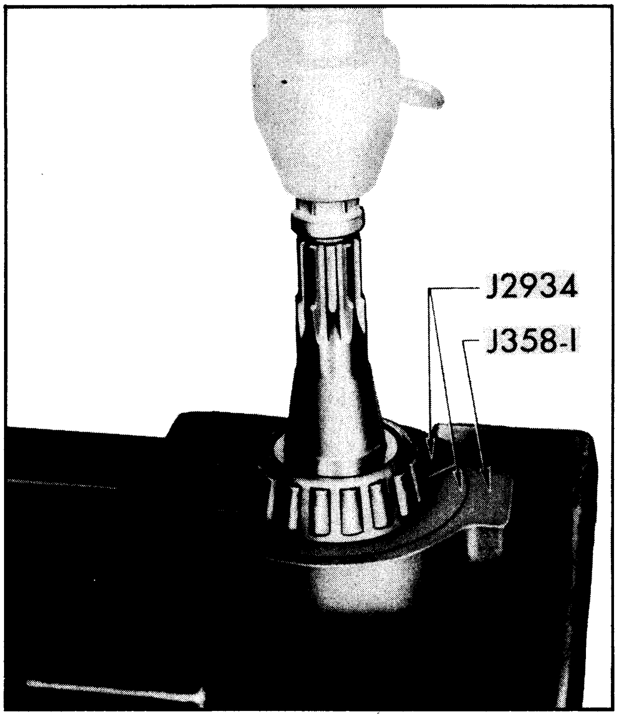


Fig. 6-21 Removing Rear Bearing

20. If the rear bearing is to be replaced, use Tool J-2934 and J-358-1 placed in an arbor press as shown in Fig. 6-21, to press the rear bearing inner race and roller assembly off the pinion shaft.
21. Drive lock pin into cross shaft, then remove the cross shaft internal pinion gears, side gears, and thrust washers from case.
22. Remove lock pin from cross shaft.

NOTE: If the ring gear or differential case is to be replaced, remove ring gear from case. Do not remove the side bearing inner race from the differential case hubs unless the side bearings are to be replaced. When inspection indicates the need for removing a side bearing, proceed as follows:

23. Remove side bearing from case by using differential side bearing remover TR-278-R. (See Fig. 6-22) Be sure ends of puller are placed in recess in differential case. Light tapping on end of screw will aid in breaking bearing loose.

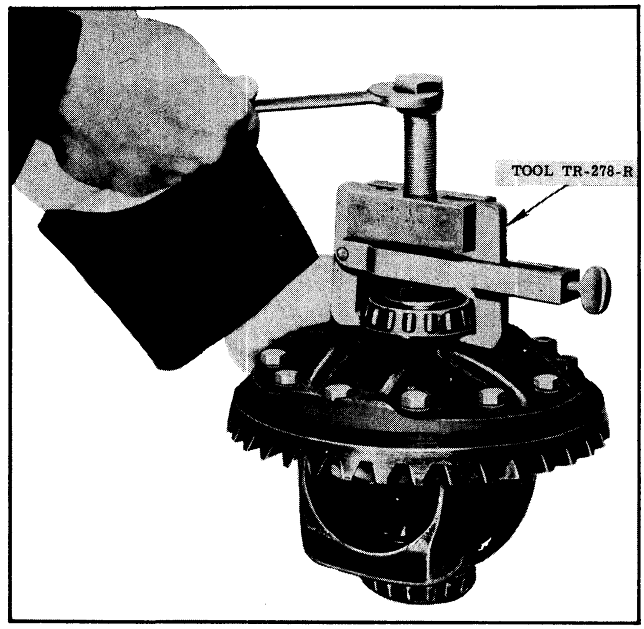


Fig. 6-22 Removing Side Bearings

INSPECTION OF PARTS

1. Clean all differential bearings thoroughly in clean gasoline or kerosene (do not use a brush). Examine bearings visually and by feel. All bearings should feel smooth when oiled and rotated with hand pressure.

NOTE: Small minute scratches and pits that appear on rollers and races at low mileage are due to the initial pre-load, and bearings having these marks should not be rejected.

2. Examine the pinion oil seal surface of the carrier housing. Surface should be clean and free of nicks.
3. Examine seal surface of companion flange for nicks, burrs, or rough tool marks which would cause damage to seal and result in an oil leak. Replace if damaged.
4. Examine the differential ring gear and pinion teeth for nicks, burrs, and scoring. Any of these conditions will require replacement of the gear set.
5. Inspect the differential pinion cross shaft for unusual wear; also, the pinion and side gears and thrust washers. Black spots on copper plated pinion cross shaft may be caused by certain

lubricants, but are not cause for replacement unless surfaces are deeply pitted or corroded.

6. Check the press fit of the side bearing inner race on the differential case hub by prying against the shoulder at the puller recess in the case. Side bearings must be a tight press fit on the hub.
7. Remove welch plug at front of carrier. Clean oil passages and carrier.
8. Apply a small amount of Permatex #3 to outside of a new plug. Drive plug flush with face of carrier.
9. Diagnosis of the differential failure; i.e. chipped bearings, loose (lapped-in) bearings, chipped gears, etc., is a warning that some foreign material is present; therefore, the axle housing must be cleaned.

MARKING ON DIFFERENTIAL CARRIER AND PINION

Before assembling a differential the correct number of shims to locate the drive pinion properly must be determined from markings on the differential carrier and end of pinion gear. Pinions seldom require marking.

The differential carrier is marked on the face of the flange. (See Fig. 6-23) "D" means "deep" and "S" means "shallow" depth of bore to the shoulder for the rear bearing. The digit following the letter designates the number of thousandths "deep" or "shallow".

If shims are required, to correct an error in pinion machining, a number will be marked on the end of the pinion, indicating in thousandths of an inch the shims required to position pinion in carrier; i.e. + 2 requires .002" added shim thickness and - 2 requires .002" less shim thickness. (See Fig. 6-24)

Pinions ground to zero specifications are not marked as they are considered "O" and do not require any more or less shims to compensate for pinion position.

Due to bearing thickness tolerance used in production, shim thickness as found in new differentials may vary slightly from the following shim chart.

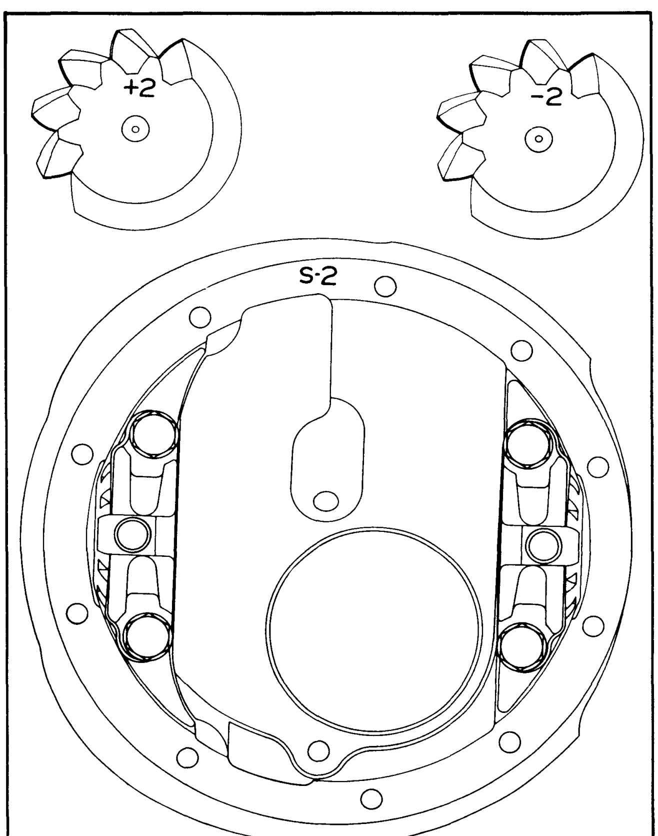


Fig. 6-23 Pinion and Carrier Markings

SHIM THICKNESS	
509263-SHIM (.002)-PLAIN 509264-SHIM (.003)-BLUE 509265-SHIM (.004)-COPPER 509266-SHIM (.005)-PLAIN 509267-SHIM (.010)-PLAIN	USE THESE SHIMS IN COMBINATIONS AS SHOWN BELOW TO GET REQ'D. TOTAL THICKNESS

.002 = .002	.011 = .004 + .004 + .003
.003 = .003	.012 = .004 + .004 + .004
.004 = .004	.013 = .005 + .004 + .004
.005 = .005	.014 = .010 + .004
.006 = .003 + .003	.015 = .010 + .005
.007 = .004 + .003	.016 = .010 + .003 + .003
.008 = .004 + .004	.017 = .010 + .004 + .003
.009 = .005 + .004	.018 = .010 + .004 + .004
.010 = .010	.019 = .010 + .005 + .004

CARRIER DEPTH MARKING		PINION MARKING								
		MINUS					PLUS			
		-4	-3	-2	-1	0	+1	+2	+3	+4
5.570	S-5		.002	.003	.004	.005	.006	.007	.008	.009
5.571	S-4	.002	.003	.004	.005	.006	.007	.008	.009	.010
5.572	S-3	.003	.004	.005	.006	.007	.008	.009	.010	.011
5.573	S-2	.004	.005	.006	.007	.008	.009	.010	.011	.012
5.574	S-1	.005	.006	.007	.008	.009	.010	.011	.012	.013
5.575	0	.006	.007	.008	.009	.010	.011	.012	.013	.014
5.576	D-1	.007	.008	.009	.010	.011	.012	.013	.014	.015
5.577	D-2	.008	.009	.010	.011	.012	.013	.014	.015	.016
5.578	D-3	.009	.010	.011	.012	.013	.014	.015	.016	.017
5.579	D-4	.010	.011	.012	.013	.014	.015	.016	.017	.018
5.580	D-5	.011	.012	.013	.014	.015	.016	.017	.018	.019

Fig. 6-24 Pinion Shim Chart

Service should always use the shim chart to correctly position the pinion when rebuilding a differential using new gears, bearings, or carrier.

HOW TO USE THE SHIM CHART

Read the markings on the carrier and pinion (See Fig. 6-23), and then refer to the "SHIM CHART". (See Fig. 6-24)

In the column "Carrier Depth Marking" read to the right to the "Pinion Marking" "Minus" or "Plus" vertical column. The intersection of the vertical (pinion) column with the horizontal (carrier) column shows the correct total shim thickness for this particular carrier and pinion.

Example A - Carrier which is marked "S-2" with a pinion marked "+2" requires total shim thickness of .010" with average bearings. Use shim thickness chart to identify (by color) thickness of shims and combination of shims to use to get required thickness. Measure plain shims with a micrometer.

WHEN TO USE A NEW COMPRESSIBLE SPACER

A new compressible spacer should be used under any of the following conditions:

1. When a new ring gear and pinion set is installed.
2. When either front or rear pinion bearing is changed.
3. When a new carrier is used.

NOTE: If a new compressible spacer is not available, then the original spacer can be used with a shim (.037" to .045") thick placed between the spacer and front bearing race.

If a production shim .037" to .045" thick was found between the spacer and roller assembly, the shim should be discarded and a new compressible spacer used.

ASSEMBLY OF DIFFERENTIAL CARRIER

1. Install correct number of pinion adjusting shims against shoulder of rear bore in carrier.

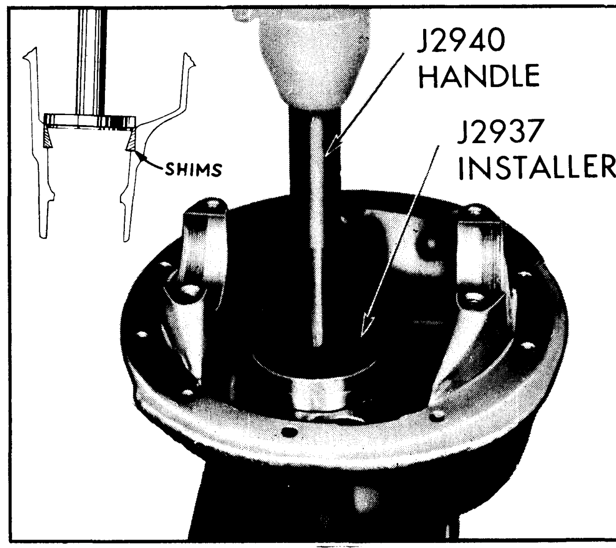


Fig. 6-25 Installing Rear Pinion Outer Race

2. Press outer race of rear bearing firmly in place against shims and shoulder in the carrier. (See Fig. 6-25)
3. Press outer race of front pinion bearing firmly against shoulder in the carrier. (See Fig. 6-26)
4. Press the rear bearing inner race and roller assembly firmly in place against shoulder on pinion shaft. (See Fig. 6-27)
5. Place the compressible spacer with the large inside diameter against pinion shoulder and shim if used, over the pinion shaft.

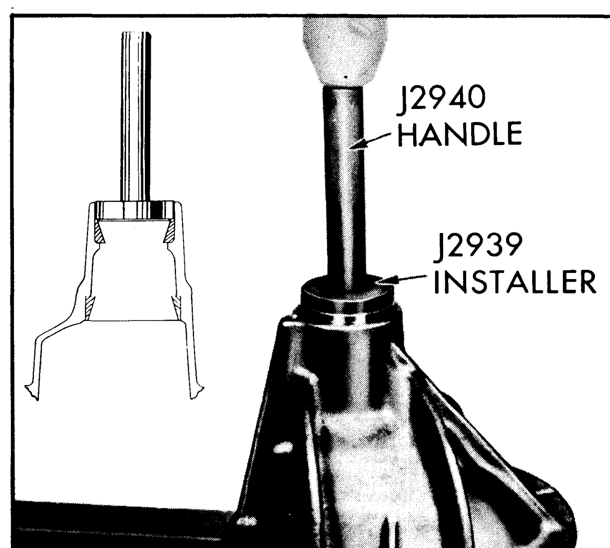


Fig. 6-26 Installing Front Pinion Outer Race

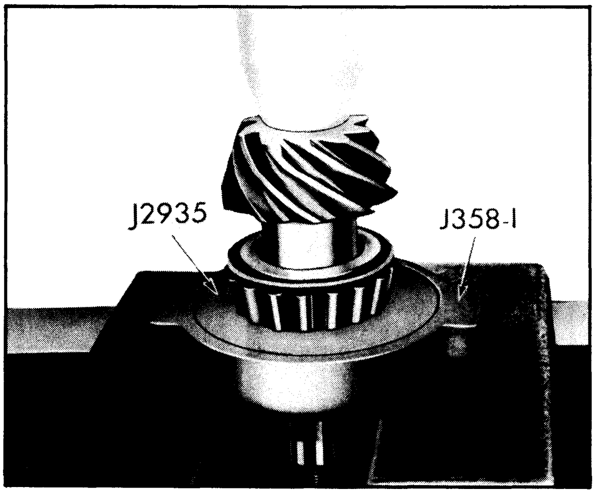


Fig. 6-27 Installing Bearing Race On Pinion Shaft

6. Place the pinion assembly into position in the carrier and slide the front bearing over the pinion shaft.
   NOTE: If the pinion shaft is a press fit in the front bearing use an arbor press to install the bearing. Use the small end of a discarded compressible spacer as a tool to press the bearing onto the pinion shaft while supporting the pinion gear. (See Fig. 6-28)
7. Coat the outer diameter of a new pinion oil seal with Permatex No. 2 (use sparingly).

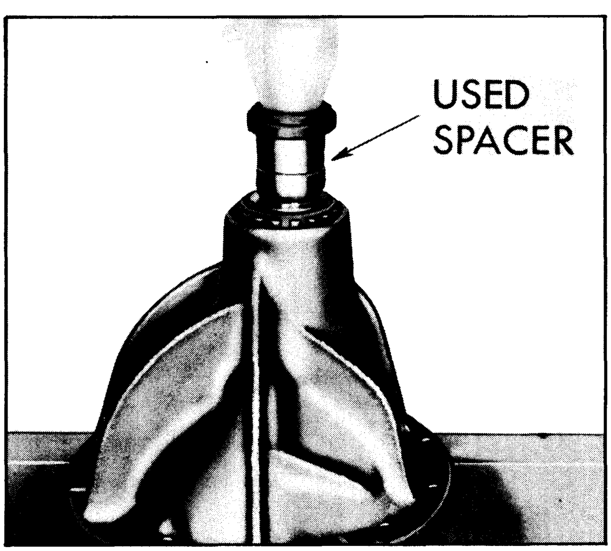


Fig. 6-28 Pressing Front Bearing Over Pinion Shaft

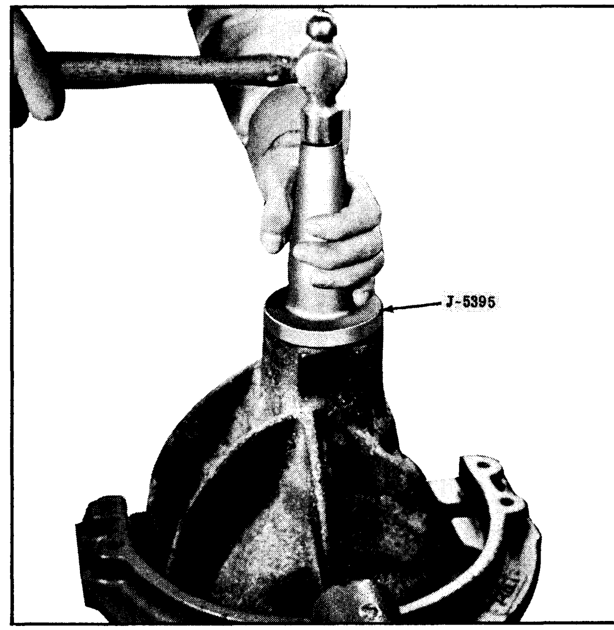


Fig. 6-29 Installing Pinion Oil Seal

8. Just start the seal into carrier by tapping lightly and then finish driving the seal in place with front pinion seal installer J-5395.
   NOTE: Pinion seal installer J-5395 properly locates the pinion seal to its correct depth in the carrier without possible damage to the seal retainer. (See Fig. 6-29)
9. Apply seal lubricant, Part No. 567196, to the O.D. of the companion flange.
10. While supporting the pinion gear, press the companion flange onto the pinion shaft and down to the front spacer.
11. Oil the flat washer and threads of pinion shaft and then install the washer and nut.

ADJUSTING THE PINION BEARING PRE-LOAD

CAUTION: Extreme care must be used in tightening companion flange nut to preload pinion bearings correctly. Incorrect pre-load may result in bearing failure. Never back off nut to secure proper preload if specified pre-load has been exceeded. If specified maximum pre-load is exceeded, it will be necessary to use a new spacer or .037" to .045" thick shim.

Position assembly as shown in Fig. 6-30

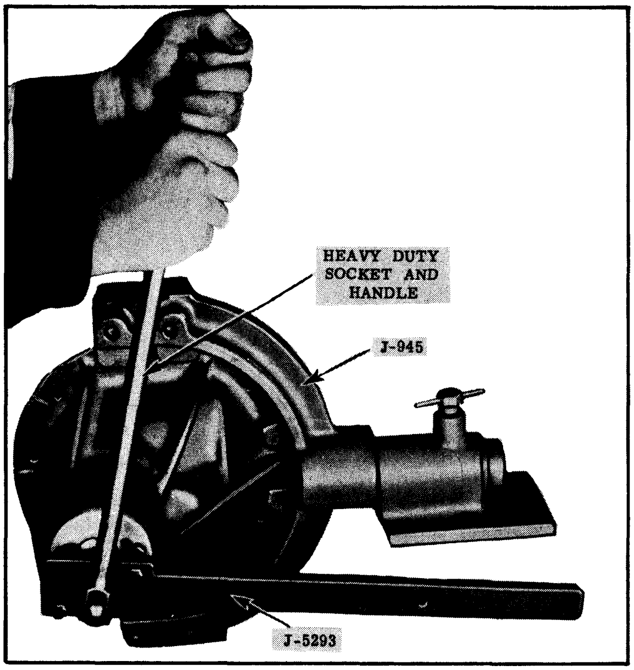


Fig. 6-30 Tightening Companion Flange Nut

and tighten companion flange nut using flange holding Tool J-5293 and a heavy duty socket until all end play in pinion assembly is removed. Continue to tighten nut carefully, not more than 1/6 turn at a time, then turn pinion several revolutions to seat rollers and check friction with an inch-pound torque wrench (Fig. 6-31) or spring scale J-544-A (Fig. 6-32).

Repeat tightening and checking until preload friction is 24 to 32 inch-pounds for new bearings, or 15 to 20 inch-pounds for old bearings.

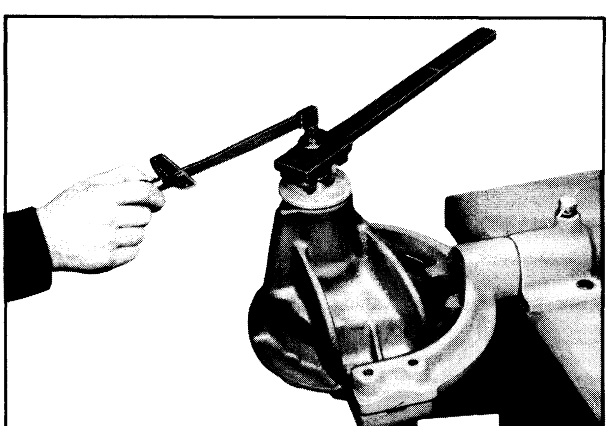


Fig. 6-31 Measuring Bearing Preload With Torque Wrench

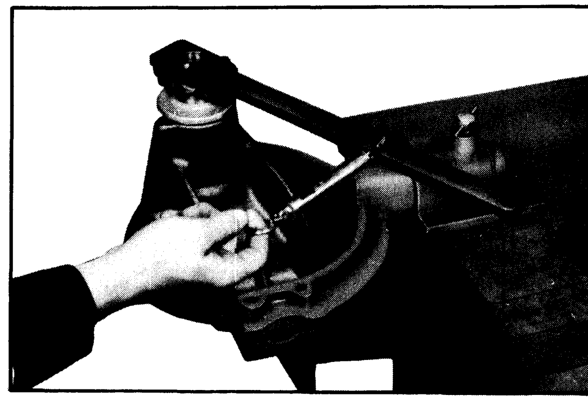


Fig. 6-32 Measuring Bearing Preload With Spring Scale

NOTE: If spring scale J-544-A is used to check pre-load friction, it should be hooked to companion flange holding Tool J-5293 at a point 10 inches from pinion shaft center. (See Fig. 6-32) Readings in Pounds times 10 will give inch-pounds. Thus 3 pounds on a spring scale will indicate 30 inch-pounds. Readings between pound graduations must be read in tenths rather than in ounces; for example, 2 lbs. 8 oz., is read 2.5 lbs. times 10 = 25 inch-pounds.

ASSEMBLY OF DIFFERENTIAL CASE

1. Oil the surfaces of the side gears, pinion gears, and thrust washers.
2. Place the side gear thrust washers over gear hub and install side gears in carrier case.
3. Holding the upper side gear up into its bore, position one pinion gear (without washer) between side gears and rotate gears until pinion gear is directly opposite from loading opening in case.
4. Place the other pinion in position between side gears making a visual check to see that cross shaft holes are lined up.
5. Rotate gears in position to assure cross shaft holes in gears are lined up with cross shaft holes in case. If not, pinion will require repositioning in side gear teeth.
6. With gears properly meshed, rotate assembly just enough to permit working

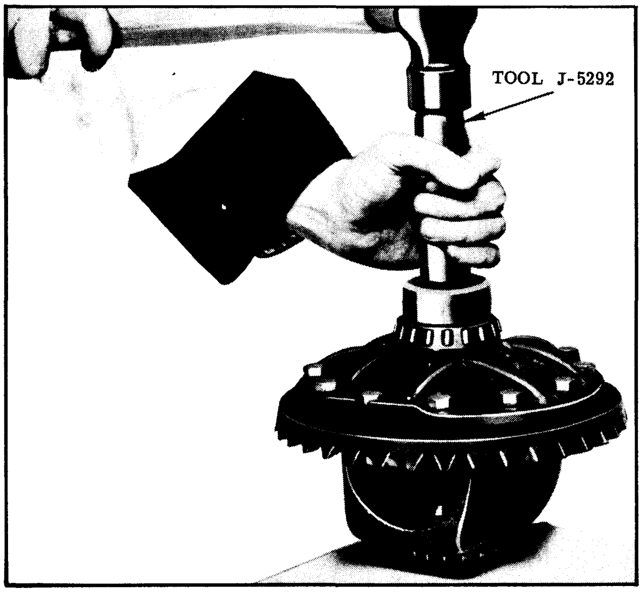


Fig. 6-33 Installing Side Bearing

the pinion thrust washers into position between gears and case.

7. Install the pinion cross shaft and lock it in place with lock screw and lock washer.
8. Hold the differential side bearing outer races in position over the side bearings and carefully lower the differential case and ring gear assembly into carrier cross bore, engaging with the pinion teeth.
9. Move the assembly toward the pinion until the lash between the ring gear and pinion is taken up.
10. Place the adjusting nuts (right and left) in position squarely against the bearing outer races and into the threads of carrier pedestal.

    NOTE: Rotate the adjusting nuts back and forth a few times by hand to be sure they are free and correctly positioned in threads. Leave the nuts snug against the bearing.
11. Install the bearing caps as marked.

    NOTE: The pedestal bearing caps will seat onto the carrier pedestals with proper alignment of threads if the adjusting nuts are properly seated, threads not crossed, and pedestal caps not interchanged.
12. Install the cap screws (no washers are used) and draw them down only sufficient to lightly hold the caps in place. This can be done by drawing them down snugly and then loosening them approximately 1/4 to 1/2 turn. Use differential side bearing adjuster J-972 to check tightness of adjusting nuts.

ADJUSTING BACKLASH AND SIDE BEARING TENSION

NOTE: Whenever new parts; i.e. gear sets, bearings, etc., are installed, the markings on the carrier and adjusting nut to indicate the original position of gears and side bearing load should be disregarded.

With pedestal caps tightened just snug, proceed as follows:

1. Back off the right hand adjusting nut (one opposite ring gear) approximately three turns (just enough so lash between ring gear and pinion can be removed).
2. Tighten the left hand adjusting nut to move ring gear into mesh with pinion until all lash is removed, then back off three notches.

    NOTE: This is only a starting point and may need to be readjusted depending on the backlash present after making the following adjustments.
3. Tighten the right hand adjusting nut, watching and/or feeling the outer race of bearing. When the bearing race starts to turn along with the adjusting nut, indicating tension on bearing, continue to tighten two notches; align slot in nut with cap screw hole in bearing cap.
4. Tighten bearing cap bolts 70 to 75 ft. lbs.
5. Clamp indicator to differential carrier and check backlash between ring gear and pinion, using dial set KMO-30. (See Fig. 6-34). Backlash should be .004" to .008" minimum at closest point when checking two places on gear 180 apart. However, as much as .012" may be necessary in some cases to correct tooth contact for noise.

    NOTE: If backlash is not within limits, it will be necessary to move ring gear away from pinion to increase backlash or closer to pinion to decrease backlash. To do this, and at

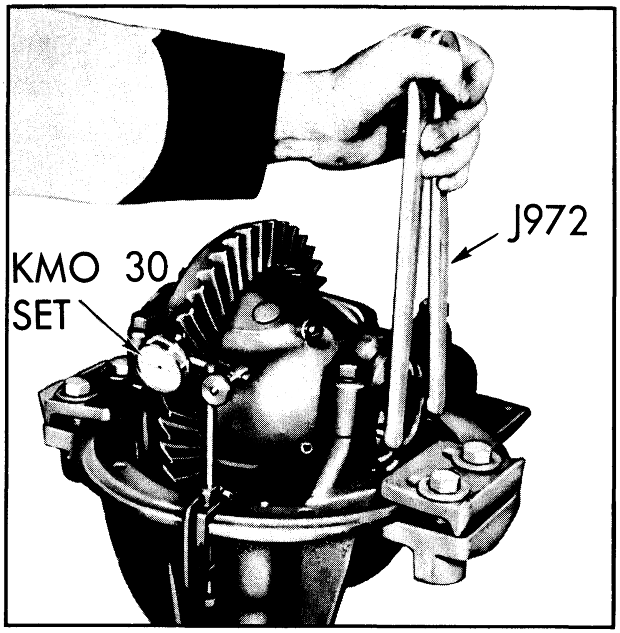


Fig. 6-34 Checking Backlash

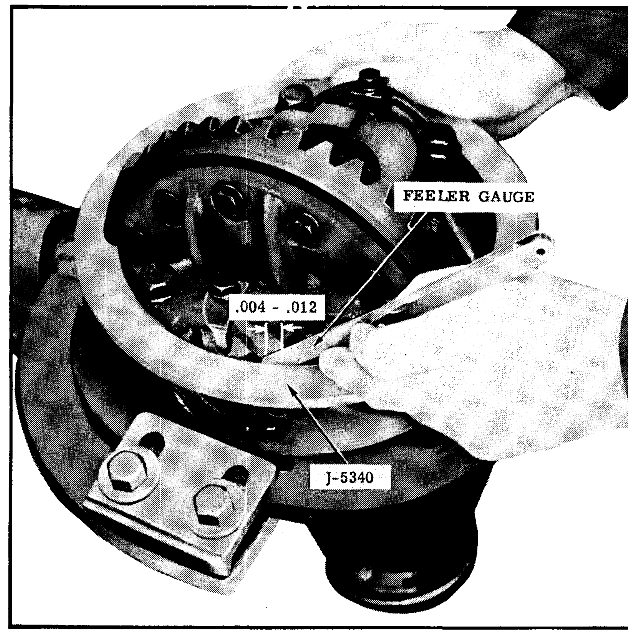


Fig. 6-35 Measuring Pedestal Spread

the same time retain the two notches tension on the side bearing, proceed as follows:

6. Loosen pedestal cap bolts slightly, then move both adjusting nuts one notch at a time until correct backlash is obtained. If left nut is backed off one notch, right nut must be tightened one notch. Be sure bearing cap bolts are tightened 70 to 75 ft. lbs. each time backlash is checked.

MEASURING PEDESTAL SPREAD

1. Position gauge J-5340 over pedestal caps as shown in Fig. 6-35. Clearance should be .004" to .012" between gauge and machined surface of pedestal cap.
2. If clearance is LESS THAN .004" loosen the RIGHT hand side bearing cap bolts and loosen adjusting nut 1/2 notch and again tighten pedestal cap bolts and recheck clearance.

NOTE: The right hand adjusting nut should not be loosened more than 1/2 notch from the original two notches tight position. This will leave a side bearing tension of no less than 1-1/2 notches tight.

If when measuring pedestal spread (as outlined in item 1) the clearance is found to be MORE than .012", then the RIGHT hand adjusting nut should be TIGHTENED 1 notch.

NOTE: The 1-1/2 to 3 notches tension on the side bearing is very important to obtain the recommended bearing pre-load. The .004" to .012" clearance between the gauge J-5340 and the pedestal cap is important to obtain the recommended press fit of the carrier into the pedestal supports in the housing.

AXLE HOUSING ALIGNMENT

If rear tire wear indicates that the axle housing may be bent, the alignment can be checked as follows:

1. Back the car squarely onto an alignment machine.
2. Compensate for wheel run-out the same as for checking front wheel toe-in.
3. Check the amount of toe-out, which should be 0" to 1/16".

   NOTE: Due to the fact that the car is backed onto an alignment machine, the actual toe-out will be read on the scale as toe-in. However, if the toe-out is checked with a tram gauge, disregard the aforementioned.
4. If a tram gauge is used for checking toe-out, it will still be necessary to perform steps 1 and 2 in order to

check camber, which should be $1/4^{\circ}$ negative to $1/2^{\circ}$ positive.

The necessary straightening operations may be performed using frame straightening equipment without removing the axle housing from the car. This procedure will allow checks during the straightening operation to determine when the housing is within the prescribed limits.

DIAGNOSIS

The differential is often blamed for noises which originate from other sources, such as muffler roar, tires, body drumming, wheel bearings, universal joints, transmission, etc.

TIRE NOISE - Different types of road surfaces will affect tire noise but will not affect rear axle noise. For road testing, select a level tarvia or asphalt road, as this type road surface practically eliminates tire noise. For test purposes only, inflating all tires to approximately 50 lbs. pressure will materially alter noise caused by tires, but will not affect noise caused by the rear axle. Rear axle noise usually ceases when coasting with transmission in neutral at speeds under 30 m.p.h.; however, tire noise continues with lower tone as car speed is reduced. Rear axle noise always changes when comparing "pull" and "coast", but tire noise remains about the same.

WHEEL BEARING NOISE - Wheel bearing noise may be confused with differential noise; however, a rough rear wheel bearing produces a vibration or growl which continues with car coasting with transmission in neutral. A bad bearing will cause a knock or click approximately every two revolutions of wheel since the bearing rollers do not travel at the same speed as the rear axle shaft. To determine which wheel bearing is noisy, hoist the car and spin each wheel while listening at the hub cap.

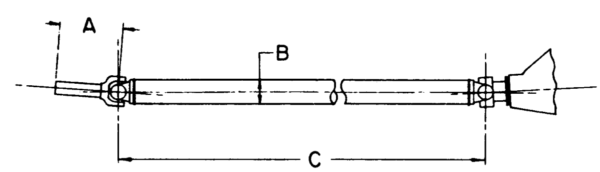
DIFFERENTIAL SIDE AND PINION GEARS - Differential side gears and pinions seldom cause noise because their movement is slight on straight ahead driving. Noise produced by these gears will be most pronounced on turns.

RING AND PINION GEAR NOISE - These generally show up as drive noise, coast noise, or float noise. Drive noise is most pronounced on constant acceleration through the speed range. Coast noise is most pronounced when the car is allowed to coast through the speed range while in gear. Float noise is the most pronounced while holding the car speed constant at various speeds. Drive, coast, and float noises will be very rough and irregular if the differential or pinion shaft bearings are rough, worn, or loose.

ENGINE AND TRANSMISSION NOISE - Note speed at which noise occurs, and with car standing, accelerate the engine to approximate speed where noise was noticed. If a similar noise is produced with the car standing, it cannot be due to the rear axle.

PINION BEARING AND CARRIER BEARING NOISE - Rough or brinelled pinion bearings produce a continuous whine starting at a relatively low speed. The noise is most noticeable with a light pull between 18 and 25 miles per hour.

1956 PROPELLER SHAFT INFORMATION



MODEL	TRANSMISSION	PROPELLER SHAFT A	B	C
88	SYNCRO-MESH	5.06	3.25	59.00
88	HYDRA-MATIC	5.25	3.00	55.00
S88	HYDRA-MATIC	7.60	3.00	55.00
98	HYDRA-MATIC	7.60	3.00	59.00

Fig. 6-36 Propeller Shaft Chart

REAR SUSPENSION SPECIFICATIONS

1. REAR AXLE
   a. Tread . . . . 58"
   b. Road Clearance at Differential . . . . 8-5/32"
   c. Allowable Out-of-True of Housing on the Vertical
      (At Rear Wheel) . . . . $1/4^{o}$ neg. to $1/2^{o}$ pos. camber
      Allowable Out-of-True of Housing on the Horizontal
      (At Rear wheels). . . . . 0" to 1/16" Toe-out
   d. Pinion Bearings (Front & Rear) - Type . . . . Taper Roller
   e. Differential Side Bearing - Type . . . . Taper Roller
   f. Rear Wheel Bearings - Type . . . . Shielded Ball
   g. Capacity . . . . 4-3/4 Pints

2. PROPELLER SHAFT
   a. Outside Diameter
      Synchro-Mesh . . . . 3-1/4"
      Hydra-Matic . . . . 3"
   b. Length: Between Center Line of U Joints
      Hydra-Matic 88 and S88 . . . . 55"
      S-M and 98 H-M. . . . . 59"

3. SPRING
   a. Length . . . . 58"
   b. Width . . . . .2-1/2"

REAR SUSPENSION TORQUE TIGHTNESS CHART

	Application	Ft. Lbs.
1.	Differential to Axle Housing Bolts	45-50
2.	Differential Pedestal Cap Bolts	70-75
3.	Propeller Shaft Flange Bolts	18-22
4.	Rear Shock Upper Pivot Bolt & Nut	55-65
5.	Rear Shock Lower Stud to Shock Nut	60-65
6.	Rear Shock Lower Stud to Spring Seat Nut	60-65
7.	Rear Spring Axle U-Bolt Nuts	50-55
8.	Rear Spring Front Pin Nut	60-65
9.	Rear Spring Shackle Nuts	60-65
10.	Rear Stabilizer Shaft Bracket to Cross Member Bolts & Nuts	25-30
11.	Ring Gear Bolts	45-55
12.	Wheel Nuts	65-70
13.	Speedometer Cable Nut	
	Speedometer Head (Upper)	1.5-2.5
	Transmission (Lower)	3-4

1956 SPEEDOMETER GEAR AND DRIVE DATA

* - Same as Standard Tires
** - Parts List Groups 35-O and 35-OP
\# - Parts List Group 35N
\## - Parts List Groups 97-35 and 98-35

Series	Axle Ratio	Bodies	Tire Size	Speedo Gear & Sleeve Assembly	Part No.
88 SM	40:11 Std.	ALL	7.10 x 15 Std.	8:21	1315066
88 SM	41:12 Std.	ALL	7.60 x 15 Over	8:20	1321528
88 SM	40:11 Air Conditioning	ALL	7.60 x 15 Std.	8:20	#1321528
88 HT	40:13 Std.	ALL	7.10 x 15 Std.	9:20	1344673
88 HT	40:13 Std.	ALL	7.60 x 15 Over	**9:19	1344672
88 HT	42:13 Export Option	ALL	7.10 x 15 Std.	9:21	##1344674
88 HT	42:13 Export Option	ALL	7.60 x 15 Over	9:20	##1344673
88 HT	42:13 Air Conditioning	ALL	7.60 x 15 Std.	9:20	#1344673
88 HT	41:12 Air Cond. Hilly	ALL	7.60 x 15 Std.	9:21	#1344674
S88 All	42:13 Std.	DK,DHC,DHS&DS	7.60 x 15 Std.	15:34	8616674
S88 All	41:12 Std.	DCR	7.60 x 15 Std.	15:36	8616676
S88 All	40:13 Plains	DK,DHC,DHS&DS	7.60 x 15 Std.	15:32	8616672
S88 All	42:13 Std.	DK,DHC,DHS&DS	8.00 x 15 Over	**15:33	8616673
S88 All	41:12 Std.	DCR	8.00 x 15 Over	**15:35	8616675
S88 All	40:13 Plains	DK,DHC,DHS&DS	8.00 x 15 Over	*15:32	8616672
S88 All	41:12 Export Option	DK,DHC,DHS&DS	7.60 x 15 Std.	15:36	##8616676
S88 All	41:12 Export Option	DK,DHC,DHS&DS	8.00 x 15 Over	15:35	##8616675
S88 All	41:12 Air Conditioning	DK,DHC,DHS&DS	7.60 x 15 Std.	15:36	#8616676
S88 All	41:12 Air Conditioning	DCR	8.00 x 15 Std.	15:35	#8616675
S88 All	41:12 Air Conditioning	DK,DHC,DHS&DS	8.00 x 15 Over	15:35	#8616675
S88 All	40:11 Air Cond. Hilly	DK,DHC,DHS&DS	7.60 x 15 Std.	15:38	#8616678
S88 All	40:11 Air Cond. Hilly	DCR	8.00 x 15 Std.	15:37	#8616677
S88 All	40:11 Air Cond. Hilly	DK,DHC,DHS&DS	8.00 x 15 Over	15:37	#8616677
98 All	41:12 Std. (Incl. Air Cond.)	DHC,DHS&DS	7.60 x 15 Std.	15:36	8616676
98 All	41:12 Std.	DCR	8.00 x 15 Std.	15:35	8616675
98 All	40:13 Plains	DHC,DHS&DS	7.60 x 15 Std.	*15:32	8616672
98 All	41:12 Std. (Incl. Air Cond.)	DHC,DHS&DS	8.00 x 15 Over	**15:35	8616675
98 All	40:13 Plains	DHC,DHS&DS	8.00 x 15 Over	*15:32	8616[illegible]
98 All	40:11 Air Conditioning	DCR	8.00 x 15 Std.	15:37	#861[illegible]
98 All	40:11 Air Cond. Hilly	DHC,DHS&DS	7.60 x 15 Std.	15:38	#86[illegible]
98 All	40:11 Air Cond. Hilly	DHC,DHS&DS	8.00 x 15 Over	*15:37	#8[illegible]

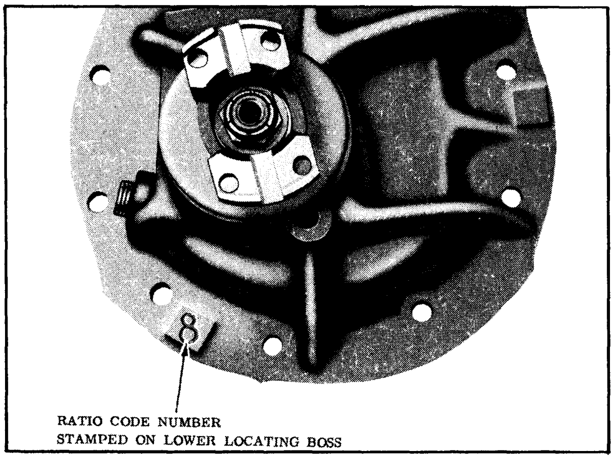


Fig. 6-37 Rear Axle Ratio Location

AXLE RATIO CHART

CODE	RATIO	
6	40:11	(3.64:1)
8	41:12	(3.42:1)
9	42:13	(3.23:1)
0	40:13	(3.08:1)

BRAKES

CONTENTS OF SECTION 7

The brake mechanism includes a hydraulically operated system and a mechanically operated parking brake. The hydraulic brake system applies the brake shoes simultaneously at all four wheels. The parking brake applies the brake shoes at rear wheels only. They are applied through cable and lever linkage by means of the parking brake pedal mounted below the instrument panel and released by a pull knob mounted on the instrument panel.

The brake shoes with an improved backing plate contact area are protected from water, dirt, and other foreign matter by the forming of the brake backing plate around the edge of the brake drum.

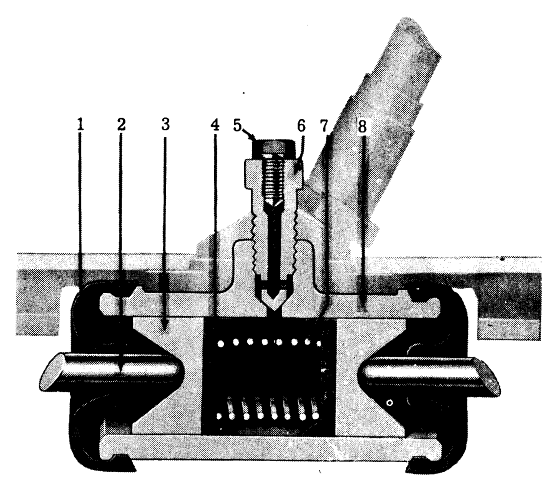
The possibility of any oil dripping onto the braking surfaces is prevented by a sump in the stamped wheel bearing retainer which catches any small amount of oil which might leak past the bearing seal.

STOPLIGHT SWITCH (Standard Brake)

The stoplight switch used with the standard brake is bolted to the underside of the toe pan, and is actuated by the movement of the brake pedal. There is not any adjustment, and the only service required is replacement when inoperative.

MASTER AND WHEEL CYLINDERS

The standard master brake cylinder is



1. Rubber Boot
2. Connecting Link
3. Piston
4. Rubber Cup
5. Bleeder Valve Screw
6. Bleeder Valve
7. Spring
8. Cylinder

Fig. 7-1 Wheel Cylinder Details

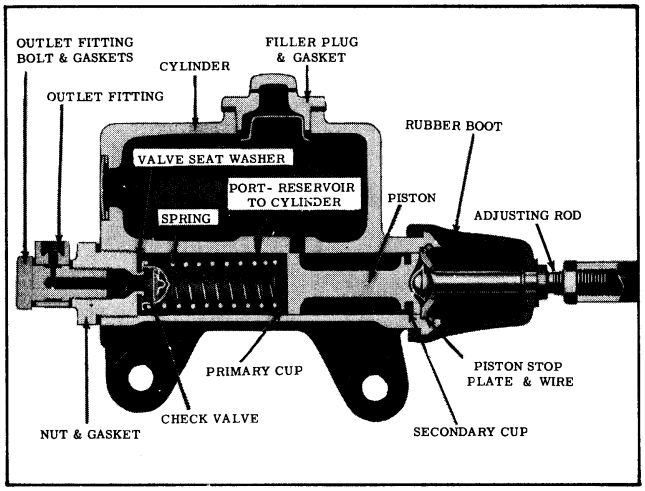


Fig. 7-2 Master Cylinder Details

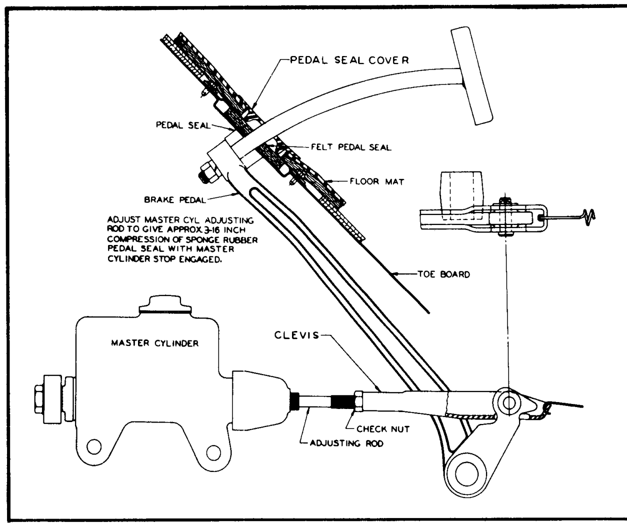


Fig. 7-3 Brake Pedal Adjustment

located on the left chassis frame front extension. Figs. 7-1 and 7-2 show the construction of the wheel cylinders and master cylinder.

NOTE: The diameters of wheel cylinder pistons and rubber cups are 1-3/32" for the front and 31/32" for the rear brakes. The diameters of the master cylinder piston and rubber cups are 1". When new cups or pistons are installed the correct size must always be used.

BRAKE PEDAL ADJUSTMENT

Before adjusting pedal, be certain that pedal returns freely to stop, not binding on the pedal shaft, that the pedal retracting spring has not lost its tension, and that the pedal rod is not binding in the rod seal.

In order to insure proper clearance at the toe board when in the released position, the master cylinder rod (14), Fig. 7-2, must be so adjusted that it rests against stop (13) in the master cylinder when the sponge rubber pedal bumper is only slightly compressed between the pedal casting and the toe board. There should be at least 3/16" free movement of pedal measured at the pad.

If above relationship does not exist, the master cylinder piston (11) will be held forward in the cylinder and cup (9) will cover port (8) causing brakes to drag, or lock up under some conditions. Therefore, it is important to adjust the master cylinder push rod clevis accurately. (See Fig. 7-3)

MINOR BRAKE ADJUSTMENT

(Shoe Adjustment for Loss of Pedal, Due to Lining Wear)

1. Be sure parking brake is fully released, then hoist car.
2. Remove adjusting hole cover from backing plate. Expand brake shoes by turn-adjusting screw using Tool J-1603-A (moving outer end of tool toward center of wheel expands shoes) until heavy drag is felt on brake drum, then turn adjusting screw in opposite direction approximately sixteen notches.
3. Replace adjusting screw hole cover.

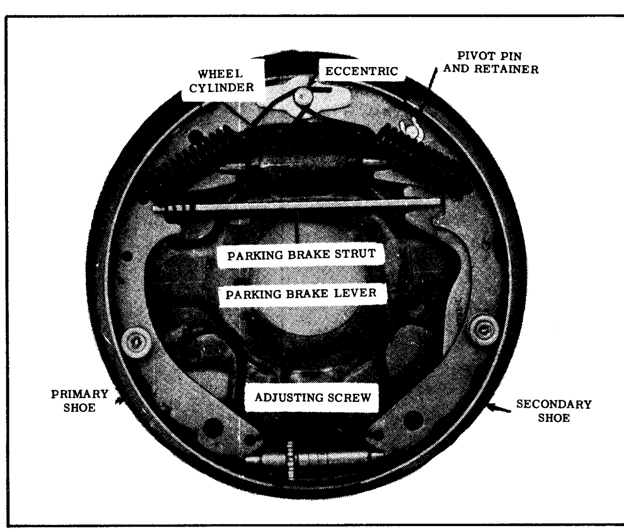


Fig. 7-4 Rear Brake Details

4. Repeat steps 2 and 3 for other wheels.
5. Fill master cylinder with brake fluid to proper level.

   NOTE: If it is necessary to take up adjusting screw more than 50 notches, or car mileage indicates linings may be worn to rivets, then wheels and drums should be removed and linings inspected as outlined under BRAKE SHOE REPLACEMENT. It is suggested that brake lining be checked on front wheels at the time of wheel bearing repack.

PARKING BRAKE ADJUSTMENT

1. Release parking brake.
2. Make minor brake adjustment if there is excessive brake pedal travel.
3. Adjust the front cable so that the intermediate lever is held from seating itself on the end of the seat in the left hand "X" member by 1/32" - 3/32".
4. Adjust rear brake cables to remove all possible slack without moving brake shoes from released position. Distribute the adjustment between the cables so that the equalizer link is parallel to the propeller shaft when the clevis pin is installed.
5. Lock clevis jam nuts and install cotter pins. Always install clevis pins with head at top.

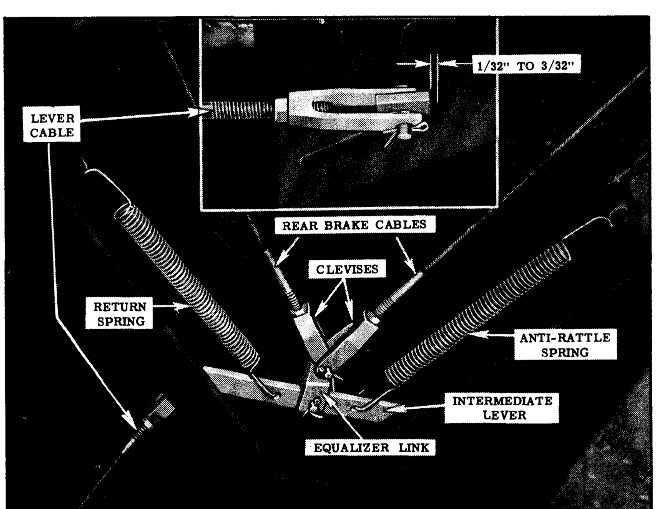


Fig. 7-5 Parking Brake Linkage

MAJOR BRAKE ADJUSTMENT (Anchor Pin Adjustment)

The purpose of this adjustment is to insure proper positioning of new linings. No attempt should be made to correct brake pull by changing the anchor pin setting once the linings have been seated.

1. Remove wheels.
2. Expand brake shoes by turning adjusting screw using Tool J-1603-A (moving outer end of tool toward center of drum expands shoes) until heavy drag is felt on brake.
3. Release adjusting screw on all four brakes approximately sixteen notches (until brake drums are free of drag) and replace adjusting screw hole covers.
4. Move adjusting screw end at primary shoe against drum by inserting a suitable flat tool, such as a thin screw driver, into the slot provided in the brake drum, then turn the drum backwards and force the end of the primary shoe against drum. Check clearance at anchor and adjusting ends of the secondary shoes with a .015" feeler inserted in the brake drum slot. If these clearances are not equal within plus or minus .002", adjust anchor and adjusting screw as required. However, the clearance at the anchor end of the shoe should not be more than that at the adjusting screw end.

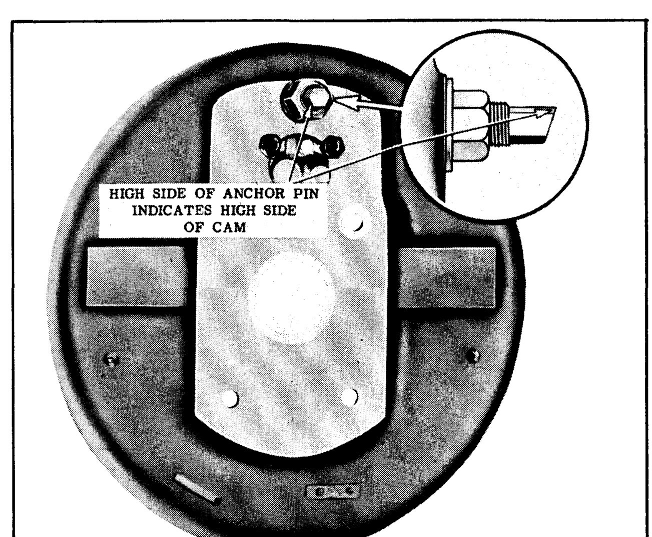


Fig. 7-6 Anchor Pin Adjustment

The exposed end of the anchor pin has a beveled face. The high side of the bevel designates the high side of the eccentric. Hold anchor pin and tighten anchor pin lock nut as tightly as possible.

BLEEDING OF LINES

Whenever a hydraulic line is disconnected from the master cylinder, the brake system must be bled at all four wheel cylinders. Whenever a line is disconnected from any individual wheel, it is necessary that the wheel cylinder be bled.

The correct sequence for bleeding is left front, right front, left rear, and right rear.

Before the brakes are bled, the reservoir should be filled with GM Brake Fluid No. 11 and kept at least one-half full of fluid during the bleeding operation if a pressure tank is not used.

To bleed the brake system of air, the following procedure is recommended when a pressure tank is used. After the tank is connected to the master cylinder, and pressure raised in the brake system to 20-30 psi, proceed as follows:

1. Remove screw from center of bleeder valve at wheel cylinder, then attach bleeder tube. (See Figs. 7-1 and 7-7) Allow tube to hang into clean container.

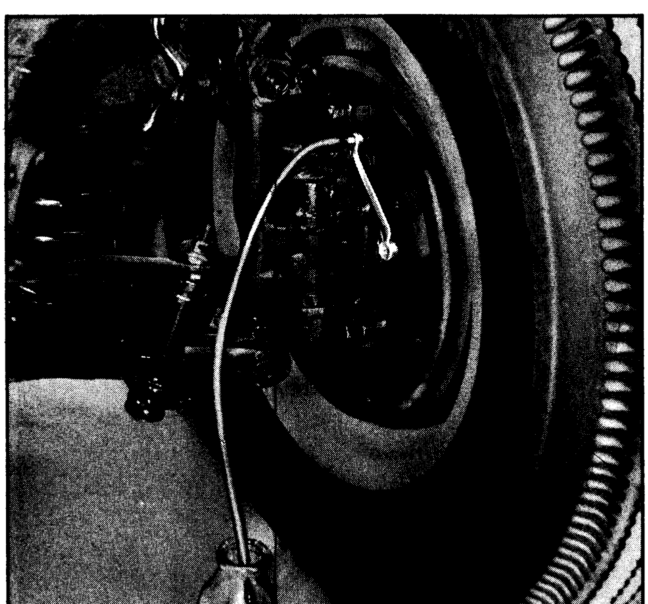


Fig. 7-7 Brake Bleeding Operation

Be sure end of tube is submerged in brake fluid.
2. Unscrew bleeder valve three-quarters of a turn. Watch flow of fluid from tube and when all air bubbles cease to appear, close bleeder valve.
3. Repeat this operation on all wheel cylinders that need bleeding.
4. Disconnect pressure tank and test brakes.

When pressure bleeding equipment is not available, air may be purged from the system with the brake pedal. To use this method proceed as follows:

1. Starting at left front wheel, remove screw from bleeder valve and attach bleeder tube, allowing tube to hang submerged in brake fluid in a clean glass jar. (See Fig. 7-7) Remove screw from bleeder valve, then unscrew bleeder valve three-quarters of a turn, depress pedal full stroke and allow it to return slowly making sure end of bleeder tube is under surface of liquid in container. Continue operating pedal until liquid, containing no air bubbles, emerges from bleeder tube.

   CAUTION: Bleed tube must always be used when bleeding brakes. The end of tube must be below level of brake fluid in glass jar. Refill reservoir as necessary to maintain a sufficient amount of fluid while bleeding brakes.
2. Close bleeder valve securely. Remove bleeder tube, replace screw, and proceed one brake at a time as follows: Right front, left rear, and right rear.
3. When bleeding operation is completed, refill reservoir to within 1/2" of top of master cylinder gasket surface and then replace filler cap.

BRAKE PEDAL REMOVAL

1. Disconnect pedal rod from brake pedal.
2. Disconnect pedal return spring.
3. Remove horseshoe retainer from end of pedal pivot shaft.
4. Remove pedal shaft screw.
5. Push shaft through pedal.
6. Loosen brake pedal adjusting rod check

nut. (If check nut is just loosened, it will facilitate reassembly.)

7. Turn master cylinder adjusting rod out of master cylinder clevis.
8. Disassemble clevis from brake pedal.

To assemble, reverse sequence of operations and adjust pedal clearance. (Refer to BRAKE PEDAL ADJUSTMENTS)

BRAKE SHOE REPLACEMENT

When brake lining replacement is necessary, normally all shoes and linings are replaced. In no case should a single shoe and lining be replaced. In exceptional cases it may be satisfactory to replace the shoes and linings on both front wheels or both rear wheels.

It is recommended that the entire hydraulic system be thoroughly cleaned and flushed with Declene Flushing Fluid any time a major brake adjustment is made.

For brake lining inspection, lubrication of brake parts, or replacement of linings and shoes, proceed as follows:

1. Hoist car and remove wheels.
2. Remove brake drum assemblies.
3. Check linings for wear. (If linings are worn nearly flush with rivets, new Oldsmobile Linings should be installed.)
4. Examine brake drum braking surfaces for smoothness. It is often possible to remove a slightly scored or scratched condition by the use of emery cloth.

   If, after this has been done, the surfaces are not smooth, the drums should be turned to .060" greater than the original inside diameter; that is, after turned, the diameter should be 11.060". Oversize brake linings should be used with turned drums.

   NOTE: The smoothness of the surfaces of the drum does not mean that the surfaces must be entirely free from grooves. The edges of the grooves, however, must be smooth.
5. Remove shoes and disconnect brake cables from operating levers.
6. Disconnect parking brake cable clevises at equalizer link.
7. Clean all rust from shoes, inner surfaces of brake backing plates, and all metal contacting points. Apply a thin coat of Lubriplate or its equivalent to the backing plate ledges, against which the shoes operate, and all metal contacting points.
8. Clean exposed portions of brake cables. Pull cables rearward through conduits, lubricate freely with Brake Cable Lubricant (Lithium Soap Grease), and return to normal position. Remove any excess lubricant.
9. Tighten all brake backing plate mount-bolts 50-55 ft. lbs. torque.
10. Check king pin bushings for looseness.
11. Reassemble brakes, connecting parking brake cables to rear brake operating levers.
12. Install brake drum assemblies, being sure that adjusting screws are backed off sufficiently.
13. Adjust front wheel bearings.
14. Check anchor pin settings and adjust if necessary. (See ANCHOR PIN ADJUSTMENT)
15. Adjust brake shoes as described under MINOR BRAKE ADJUSTMENT.
16. Fill master cylinder to prescribed level.
17. Replace wheels and test brakes.

SERVICING MASTER AND WHEEL CYLINDERS

CAUTION: It is important that no attempt be made to recondition a brake master or wheel cylinder bore as a means of salvaging the cylinders.

Reconditioning of the bores leaves the walls sufficiently rough to cause premature failure of the rubber cups. It also enlarges the bore to the extent that the standard size pistons will no longer fit properly. OVERSIZE PISTONS AND CUPS ARE NOT AVAILABLE. Master cylinder and wheel cylinder repair kits contain a complete set of standard parts to repair one cylinder.

NOTE: When reassembling the master cylinder, the small coils of conical spring (7) must be placed over the check valve (6) and the large coil against the primary cup (9).

BRAKE FLUID

Use only GM Brake Fluid No. 11.
CAUTION:
DON'T attempt to salvage used brake fluid.
DON'T allow grease, paint, oil, or brake fluid to come in contact with brake lining or brake drum.
DON'T clean rubber parts or inside of cylinders with anything but a good grade of clean alcohol or Declene.
DON'T use kerosene or gasoline.
DON'T reline shoes with other than OLDSMOBILE linings.
DON'T allow the reservoir to become less than one-half full of brake fluid.
DIAGNOSIS (Refer to BRAKE DIAGNOSIS, Power Brake Section)

POWER BRAKES

DESCRIPTION

The power brake assembly is a self-contained vacuum and hydraulic unit, utilizing engine intake manifold vacuum and atmospheric pressure to reduce brake pedal effort.

Oldsmobile uses both Bendix and Moraine units. The Bendix and the Moraine assemblies can be distinguished by the difference in the master cylinder castings. The Bendix master cylinder is cast of light alloy metal and the Moraine master cylinder is of cast iron. Internally, the Bendix and Moraine power brake units differ in construction, but both units are designed to seal off the vacuum from the units when the pedal is in the released position.

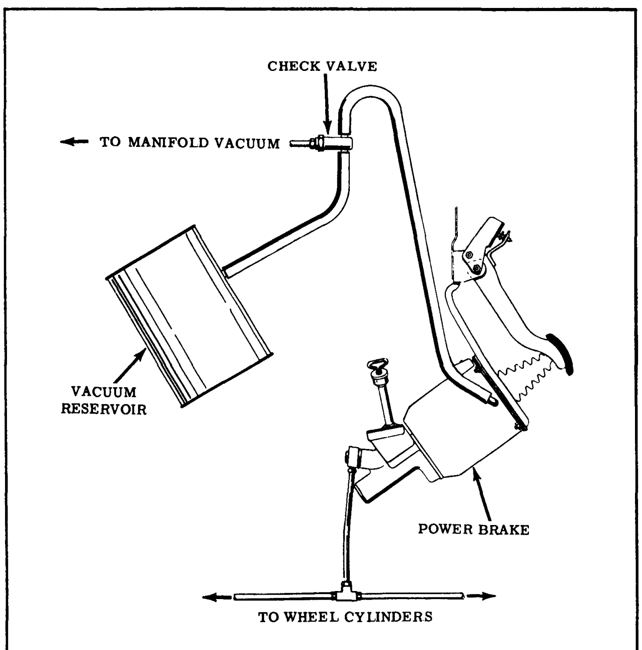


Fig. 7-8 Power Brake System Layout

This design, combined with a vacuum check valve traps manifold vacuum in the reservoir at the highest manifold vacuum available, making possible three or four normal brake applications after the engine has been shut off for several hours or more. Should the engine stall, several applications of the brakes can still be made. If the vacuum supply were depleted, application could be made manually as in a conventional system; however, more effort is required due to the lack of power assist.

PERIODIC SERVICE

Each time the car is in the service department, the brake pedal height should be observed. Brakes should be adjusted when the pedal pad to floor clearance is less than 1" with brakes applied and engine running.

Each time the chassis is lubricated, check level of brake fluid in reservoir. Fluid level in the Bendix unit should be above the "L" mark on the dip-stick. Fluid level in the Moraine unit should be high enough to register on the dip-stick. Replenish as necessary with G.M. Brake Fluid No. 11. Also, brake hoses and lines should be inspected for signs of chafing, deterioration, or other damage.

Each time the power brake unit is removed from the car, or whenever the air cleaner is readily accessible, the air filter element should be cleaned in solvent and air dried.

BLEEDING

Power brakes can be bled in the same manner as a standard brake system. When pressure bleeding equipment is not available, do not use the vacuum assist. The engine should not be running and the vacuum reserve should be depleted by applying the brake several times before starting the fluid bleeding procedure.

REMOVAL AND REPLACEMENT

Vacuum Reservoir

The vacuum reservoir is located under the right front fender on the fender filler plate. No service is required other than replacement for leakage. To replace, the right fender must be removed.

Power Brake Unit

1. Disconnect positive battery cable at junction block on right fender filler plate. Disconnect solenoid lead wire (purple) from wiring harness, then pull cable through sleeve on power brake.
2. Disconnect the flex line at the power brake master cylinder. Use care to prevent dirt entering the flex line and secure the line so that the open end is above the level of the junction assembly to prevent loss of fluid. Plug the master cylinder outlet with a rubber stopper.
3. Disconnect leads from stoplight switch and fold back floor mat.
4. Remove three brake pedal bracket attaching bolts, (A), Fig. 7-9. Remove bracket and pedal assembly.
5. Remove mast jacket grommet retainer clip and slide grommet up mast jacket.
6. Remove mast jacket cover plate attaching screws, (B).
7. Loosen speedometer cable hold-down clip and slip cable from under clip, then remove the speedometer cable and grommet from the mast jacket cover plate.
8. Remove the two cover plate to power cylinder bolts, (C), and remove the cover plate while positioning the power brake unit so it rests on the edge of the opening in the toe pan.
9. Disconnect the vacuum hose and remove the power brake unit through the toe pan opening.

   NOTE: When reinstalling hose, position the clamp so the screw head may be reached from below the car.

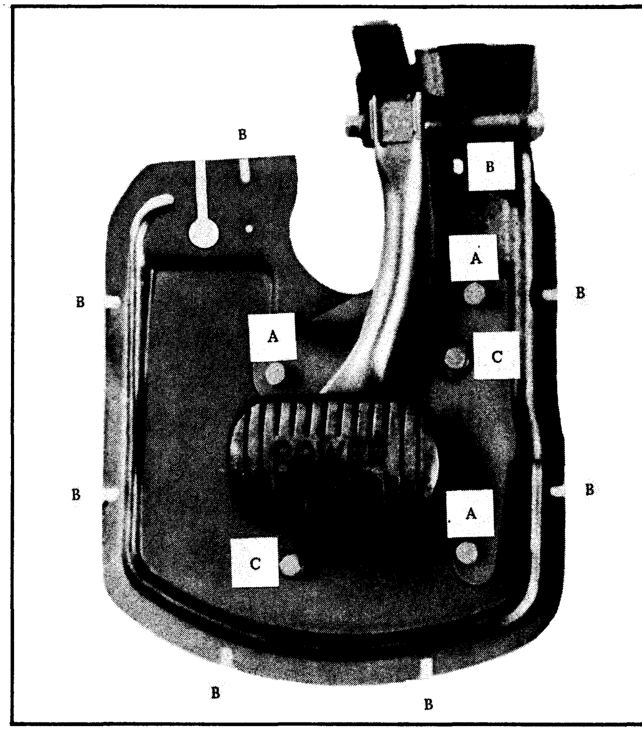


Fig. 7-9 Power Brake Attaching Screws

To replace, scrape off old sealing compound, then place a 5/16" bead of medium bodied sealer around entire toe pan groove and reverse sequence of operations. The master cylinder may be filled before installation. Avoid depressing the push rod until flex line is connected. Torque brake pedal attaching bolts (A) and cover plate to power cylinder bolts (C) 30-45 ft. lbs. (See Fig. 7-9) Always use new copper washers at outlet fitting. Fill master cylinder with G.M. Brake Fluid No. 11 and bleed system. Following replacement, test brakes and adjust stoplight switch. (See ELECTRICAL SECTION)

MORAINE POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 7-10)

In the released position, both sides of the vacuum piston are open to atmospheric

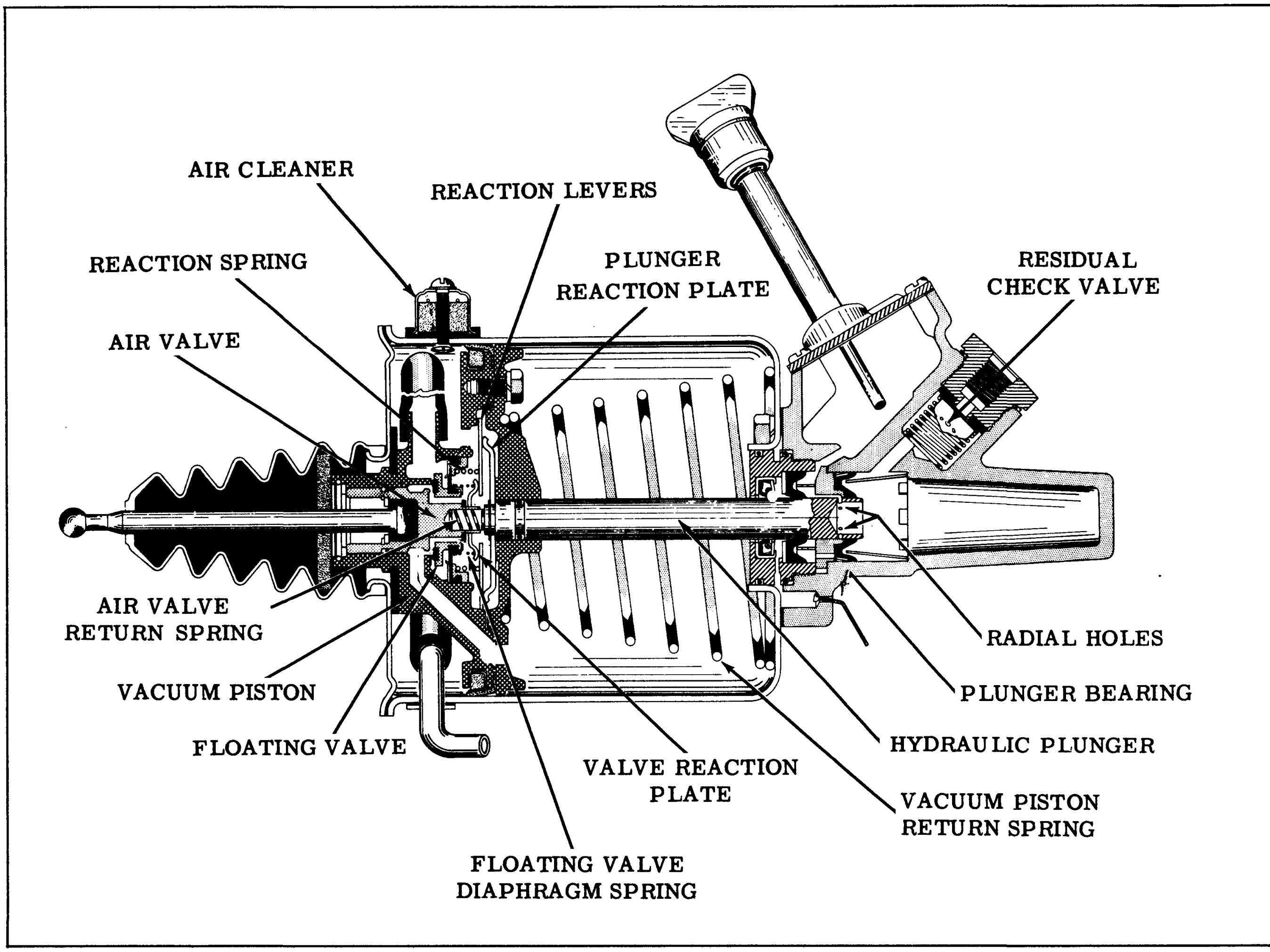


Fig. 7-10 Released Position

pressure; therefore, the piston is balanced in atmospheric pressure and the vacuum piston is held in its released position by the piston return spring. This condition is accomplished by the following.

Vacuum is shut off within the vacuum piston since the floating valve is held on its seat by the floating valve diaphragm spring. The air valve and push rod assembly is held in its released position away from the floating valve by the air valve return spring. Atmospheric pressure, after passing through the air cleaner, enters the power cylinder at the rear side of the vacuum piston. It then passes through holes in the vacuum piston to the air valve where it is admitted to the forward side of the vacuum piston.

The valve reaction plate is held against the reaction levers by the floating valve diaphragm spring which also assists the reaction spring in holding the reaction levers and plunger reaction plate against their stops.

The hydraulic plunger, being attached to the vacuum piston assembly, is also held in the released position by the piston return spring. In this position, the radial holes in the forward end of the plunger are open to the grooves on the inner diameter of the plunger bearing and fluid can flow freely in either direction between the hydraulic cylinder and the fluid reservoir. This compensates for expansion, contraction, or leakage of fluid in the hydraulic system. The fluid in the lines to the wheel cylinders is trapped by the residual check valve, thus maintaining pressure in the lines as in a conventional braking system.

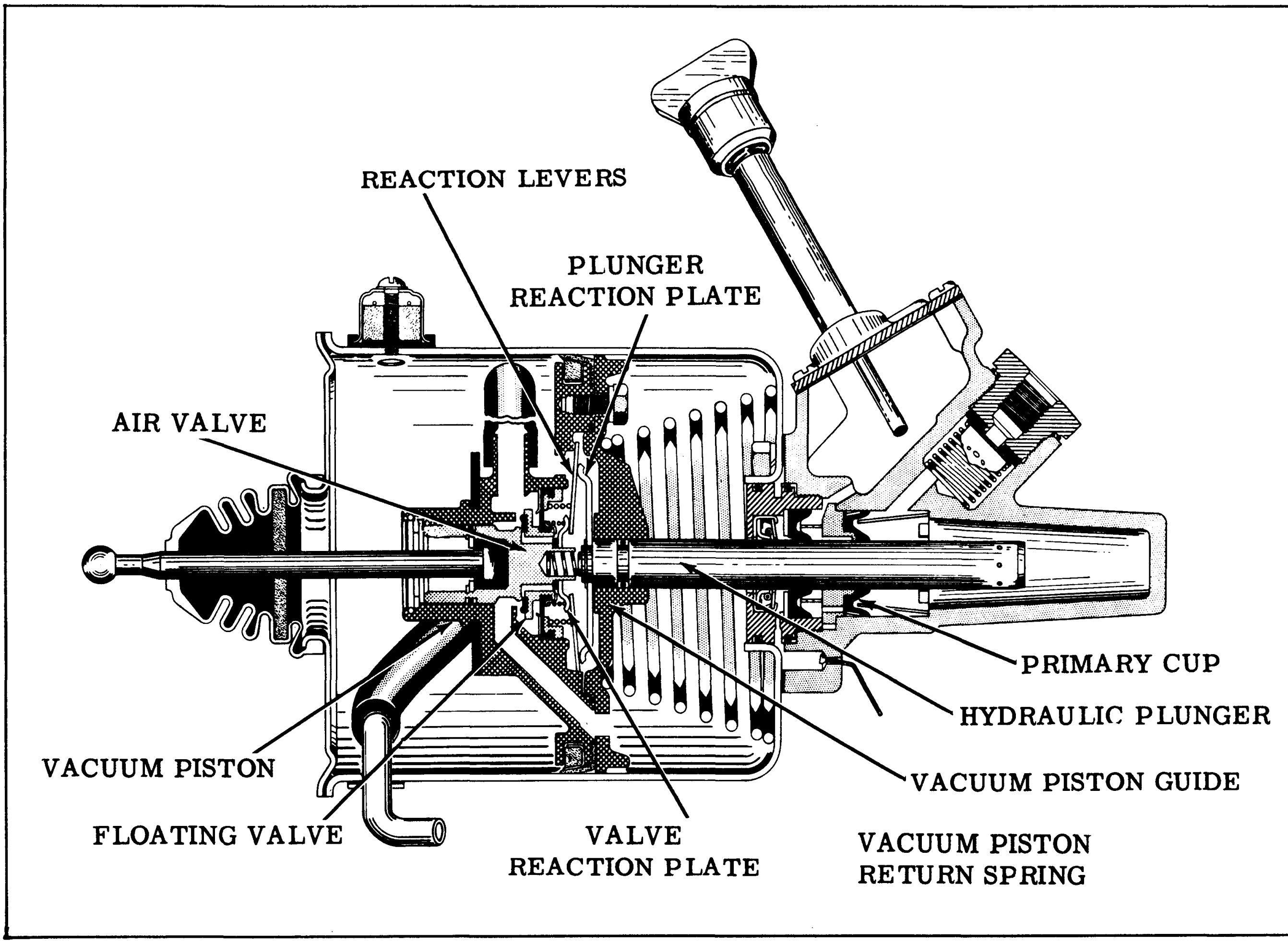


Fig. 7-11 Applying Position

Applying Position (Fig. 7-11)

In the applying position, vacuum exists on the forward side of the vacuum piston and atmospheric pressure on the rear side of the vacuum piston overcomes the piston return spring and forces the vacuum piston in the apply position. This condition is accomplished by the following.

Atmospheric pressure is blocked off from the forward side of the vacuum piston as the air valve contacts the floating valve. Further movement of the air valve pushes the floating valve from its seat in the vacuum piston and permits vacuum to be communicated to the forward side of the vacuum piston. Atmospheric pressure on the rear side of the vacuum piston moves the piston and the hydraulic plunger in the applied direction.

As the hydraulic plunger moves forward, the radial holes at the end of the plunger pass the primary cup, sealing off the fluid reservoir from the hydraulic cylinder. Further movement of the plunger in the applied direction forces fluid out of the master cylinder under pressure through the hydraulic lines into the wheel cylinders to apply the brakes.

As the pressure build-up takes place in the master cylinder, force on the end of the plunger moves the plunger reaction plate away from the vacuum piston guide, which causes the reaction levers to pivot against the valve reaction plate. The valve reaction plate then transfers the force to the air valve and push rod assembly, thus giving the driver brake "feel". By design, this brake "feel" is such that approximately 40% of the load on the hydraulic plunger is

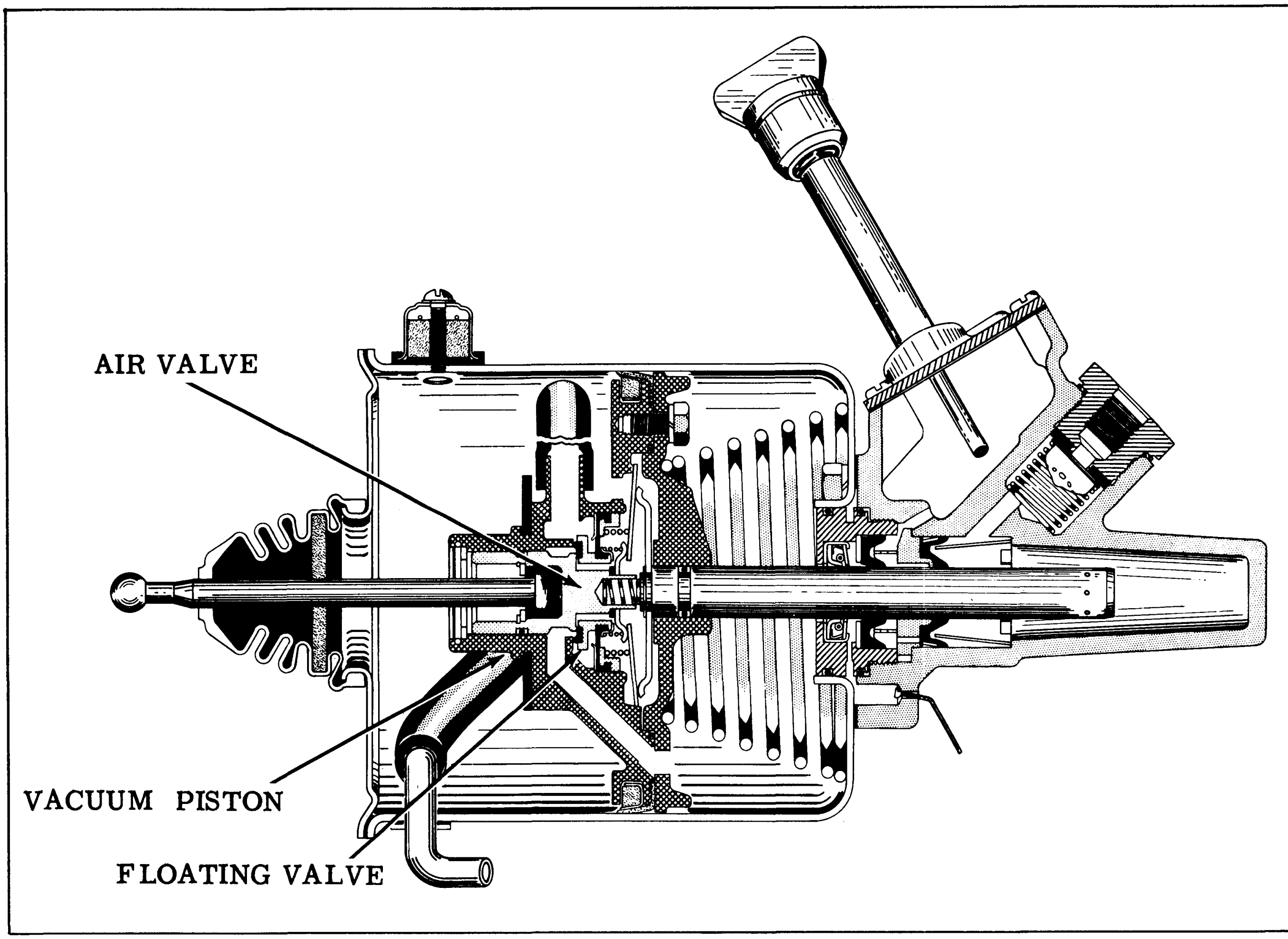


Fig. 7-12 Holding Position

supplied by the driver, while the remainder is supplied by atmospheric pressure on the rear side of the vacuum piston.

Holding Position (Fig. 7-12)

When the desired brake application has been reached, the driver stops increasing the brake pedal force, which in turn holds the push rod and air valve stationary. The vacuum piston will continue to move forward as in the applied position until its seat rests against the floating valve. At this point, both the air valve and the floating valve are closed and no further movement takes place until the force on the pedal is either decreased or increased.

DISASSEMBLY OF MORAINE POWER BRAKE (Fig. 7-14)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Clean all dirt from the outside of the power brake unit. Remove dip-stick and gasket and empty brake fluid from master cylinder casting.
2. Mount unit in holding fixture J-5433 with adapter J-5796 if available. (See Fig. 7-13) If holding fixture is not available, clamp master cylinder end of unit in a vise.
3. Remove the screw attaching air cleaner unit to power cylinder. Removal of the air cleaner must precede disassembly of internal parts to avoid damage to large leather piston packing inside power cylinder. Disassemble air cleaner.
4. Remove boot and felt washer.

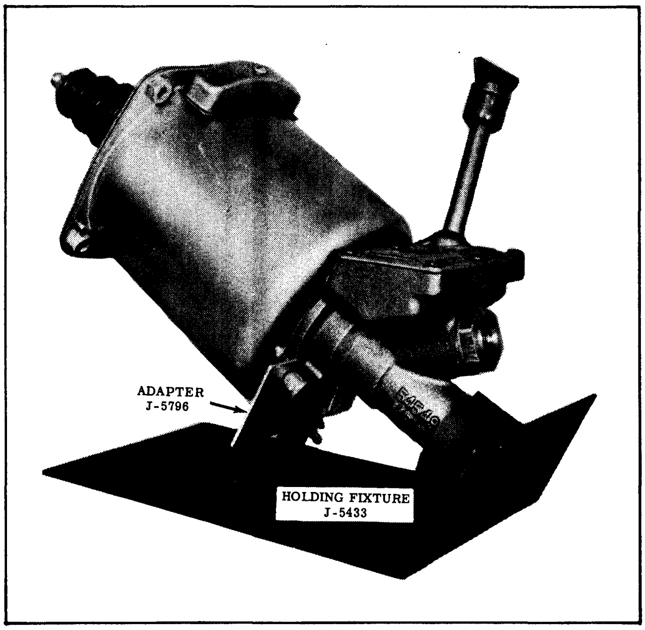
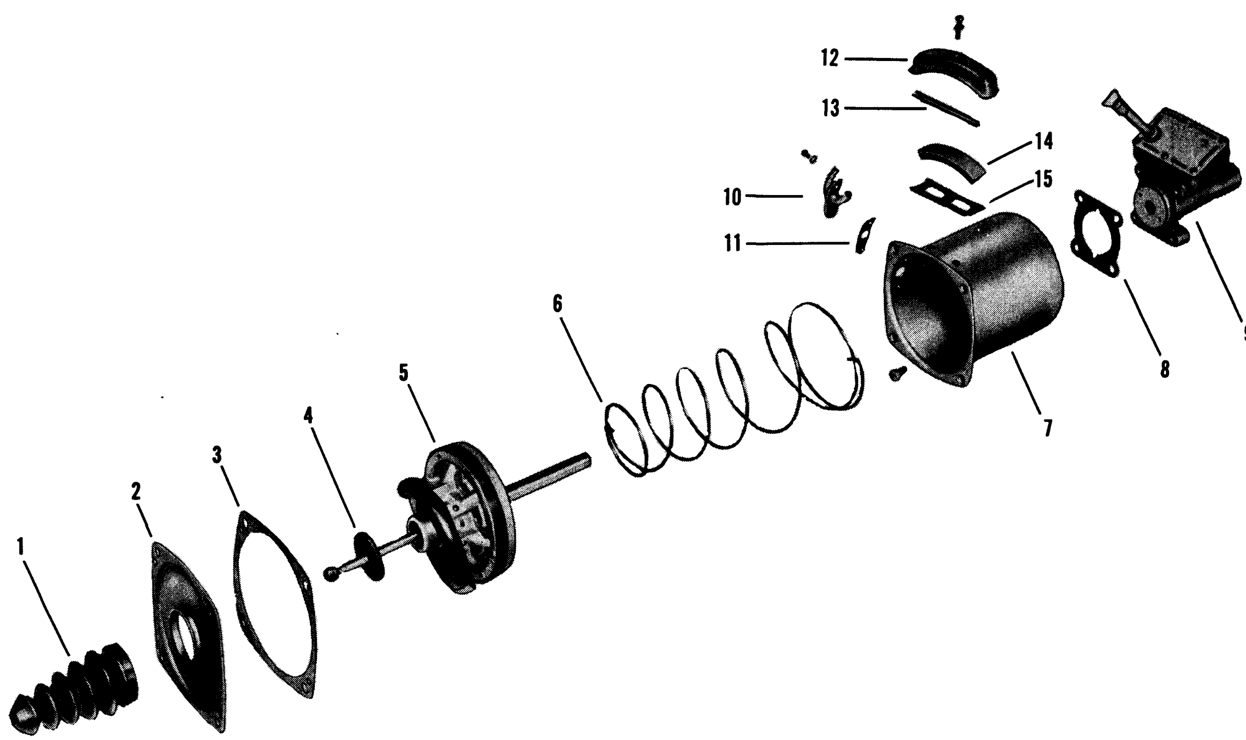


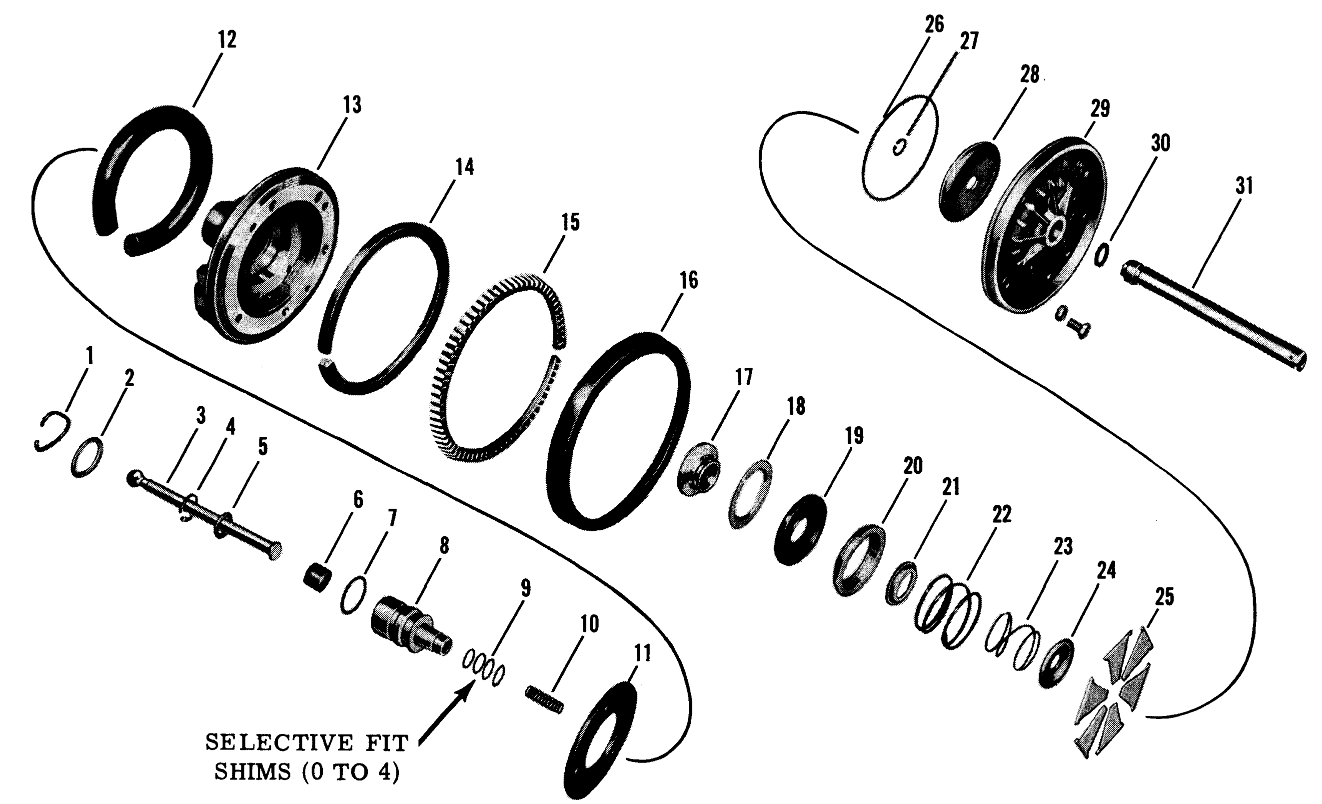
Fig. 7-13 Power Brake Holding Fixture

5. Remove the two end plate attaching screws, then remove the end plate and gasket.
6. Remove rubber hose from vacuum inlet tube inside the power cylinder.
7. Push the vacuum piston assembly back into the power cylinder so that it will not interfere with the inlet tube removal. Holding the vacuum piston in this position with one hand, remove the two screws that hold the vacuum inlet tube to the outside of the power cylinder. Removal of the vacuum inlet tube permits the vacuum piston return spring to force the vacuum piston assembly out of the power cylinder under heavy spring tension.
8. Remove the large vacuum piston return spring from the power cylinder.
9. Scribe alignment marks across power cylinder and master cylinder casting. Remove the four cap screws from the inside of the power cylinder,



1. Boot	6. Vacuum piston return spring	11. Gasket
2. End plate	7. Power cylinder	12. Air cleaner cover
3. Gasket	8. Gasket	13. Hairpin spring
4. Felt washer	9. Master cylinder	14. Filter element
5. Vacuum piston assembly	10. Vacuum inlet tube	15. Gasket

Fig. 7-14 Moraine Power Brake



1. Lock ring
2. Washer
3. Push rod
4. Snap ring
5. Washer
6. Push rod bumper
7. "O" ring
8. Air valve
9. Selective shims
10. Air valve return spring
11. Vacuum piston stop bumper
12. Vacuum hose
13. Vacuum piston
14. Lubricating wick
15. Seal expander
16. Leather packing
17. Floating valve
18. Diaphragm retainer plate
19. Diaphragm
20. Diaphragm retainer ring
21. Valve spring retainer
22. Reaction spring
23. Floating valve spring
24. Valve reaction plate
25. Reaction levers
26. "O" ring
27. Snap ring
28. Reaction plate
29. Vacuum piston guide
30. "O" ring
31. Master cylinder plunger

Fig. 7-15 Vacuum Piston Assembly

then remove the power cylinder and gasket.

NOTE: The power cylinder pilots on the extended area of the cylinder plug and should be removed carefully.

DISASSEMBLY OF VACUUM PISTON (Fig. 7-15)

1. Remove vacuum hose from vacuum piston assembly.
2. Remove lock ring as shown in Fig. 7-16 and remove push rod and air valve assembly. Remove the stop plate washer.
3. Hold the vacuum piston assembly as shown in Fig. 7-17, then carefully pull out air valve and push rod. The air valve return spring, and

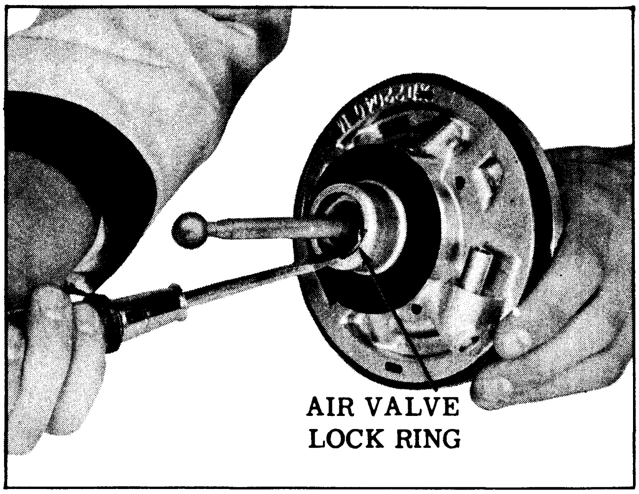


Fig. 7-16 Removing Air Valve Lock Ring

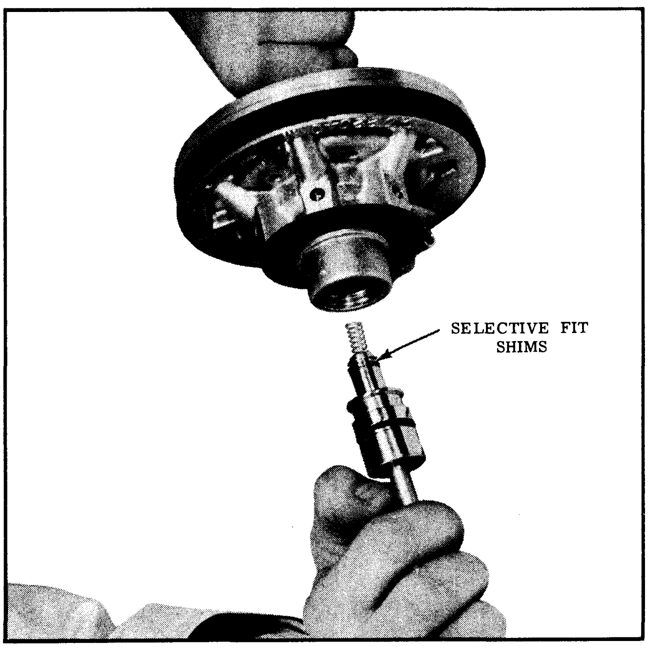


Fig. 7-17 Removing Air Valve

valve shims will come out with the air valve.

NOTE: Observe the number of shims, if any, on the air valve.

4. Remove shims and "O" ring from air valve.
5. It is not necessary to remove the push rod from the air valve unless it is noisy or excessively loose. If necessary, remove Tru-Arc snap ring from inside of air valve with Tru-Arc internal No. 1 pliers (J-5403). Pull out washer and push rod from air valve, then remove rubber bumper from end of push rod.

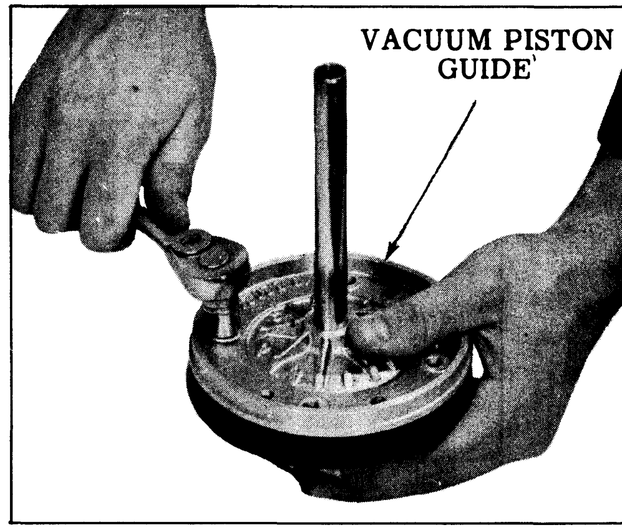


Fig. 7-18 Removing Vacuum Piston Guide

6. Set the vacuum piston assembly on hub end and loosen the four vacuum piston cap screws. (See Fig. 7-18) Press down on the piston guide and remove the screws, then lift off the piston guide and hydraulic plunger assembly. Remove "O" ring from vacuum piston guide.
7. Slide the vacuum piston guide off the hydraulic plunger and remove the "O" ring from the plunger.
8. If necessary to separate the reaction plate or plunger, remove Truarc ring with Truarc external No. 2 pliers (J-4880).
9. From counterbore of vacuum piston, remove six reaction levers, reaction spring, valve reaction plate, and floating valve spring.

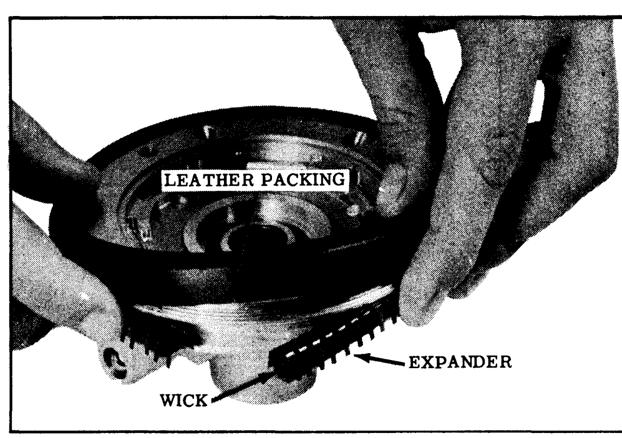


Fig. 7-19 Removing Leather Packing

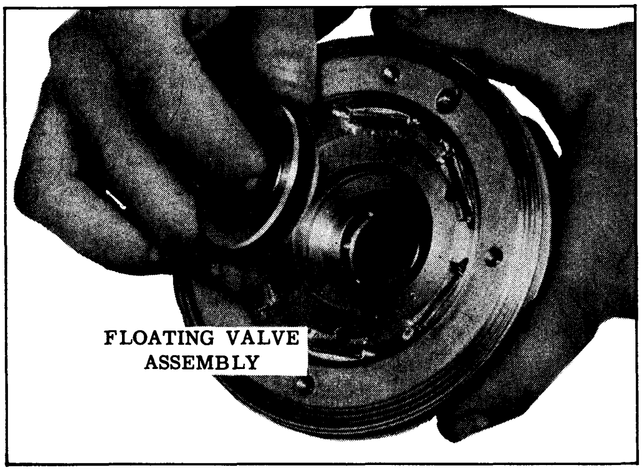


Fig. 7-20 Removing Floating Valve Assembly

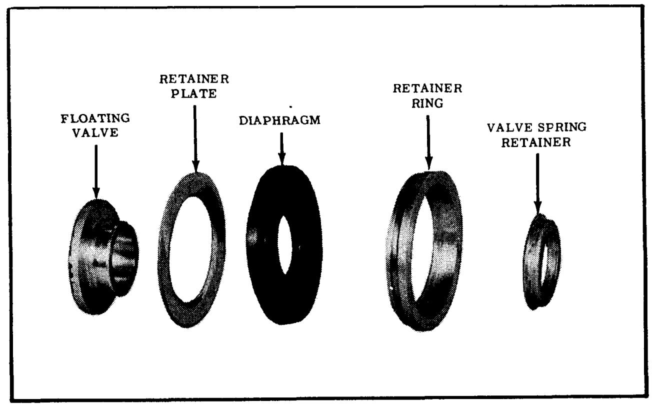


Fig. 7-21 Floating Valve Assembly

10. Lift leather packing off vacuum piston, then remove the expander and wick. (See Fig. 7-19)
11. Pull the floating valve assembly from the vacuum piston. (See Fig. 7-20)
12. If necessary to disassemble floating valve, proceed as follows:
    a. Unseat valve spring retainer with small screw driver. (See Fig. 7-21)
    b. Press the floating valve through the diaphragm. This also frees the diaphragm retainer plate.
    c. Remove the diaphragm from the groove in the retainer ring.
13. Remove rubber vacuum piston stop washer from hub flange of vacuum piston.

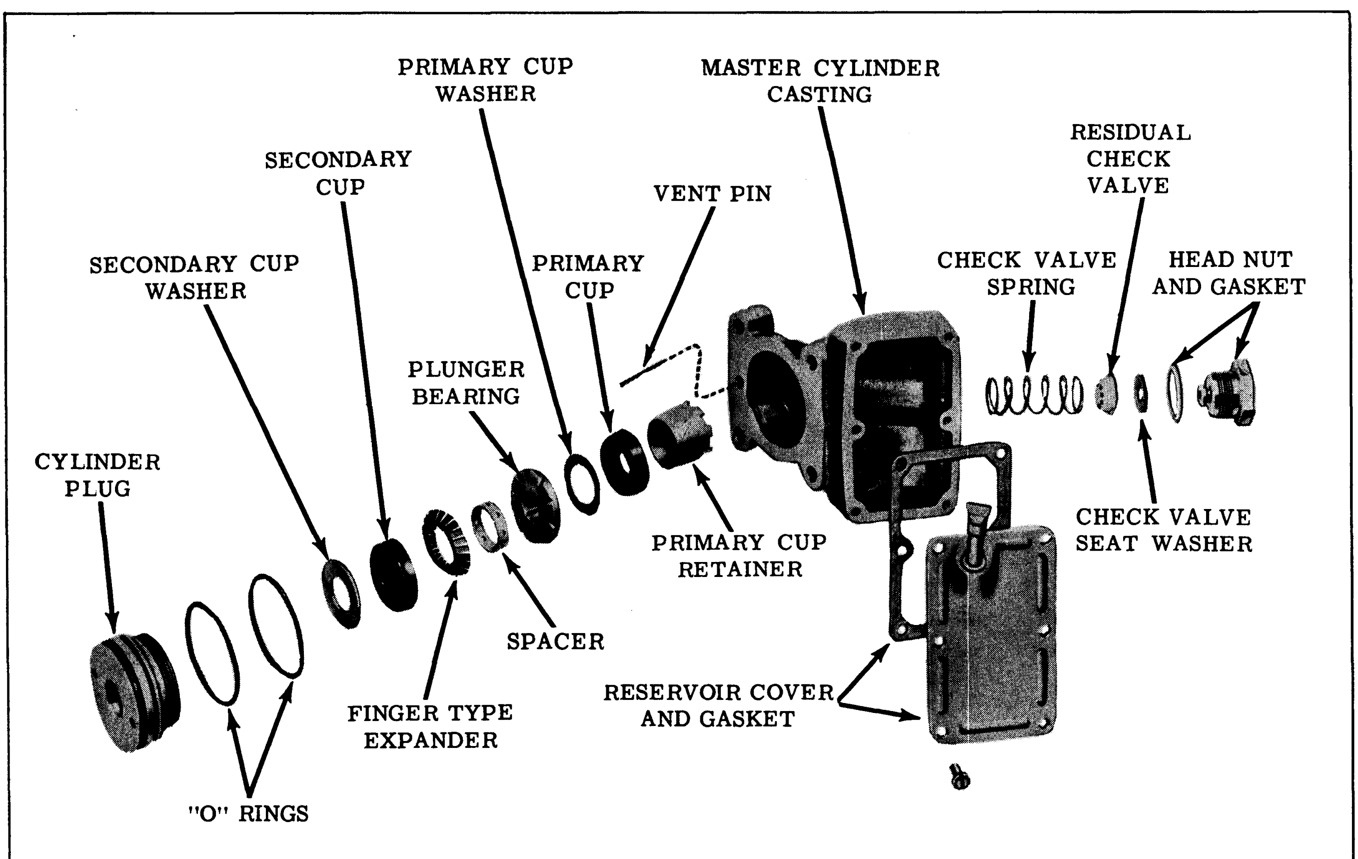


Fig. 7-22 Master Cylinder

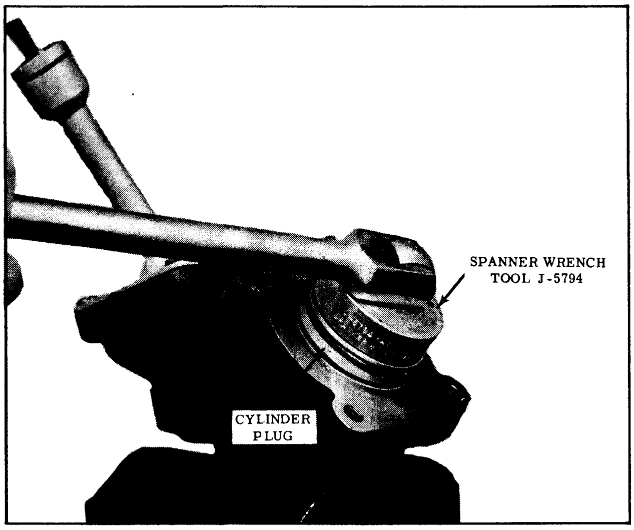


Fig. 7-23 Removing Cylinder Plug

DISASSEMBLY OF MASTER CYLINDER (Fig. 7-22)

1. Clamp master cylinder casting in vise with cylinder plug up. Remove cylinder plug using special spanner wrench Tool J-5794. (See Fig. 7-23)
2. Remove two "O" rings from outside diameter of cylinder plug.
3. Remove secondary cup and washer from inside of plug. DO NOT attempt to remove the seal assembly from cylinder plug. If the vacuum seal is defective, the cylinder plug and vacuum seal must be replaced as an assembly.
4. From the bore of the master cylinder, lift out expander, spacer, plunger bearing, washer, primary cup, and retainer.
5. Remove head nut assembly and copper gasket.
   CAUTION: The head nut is under spring tension. Guard against the residual valve spring falling from bore. Remove residual check valve and spring. Remove rubber check valve seat washer from button on head nut.
6. Scratch alignment mark on reservoir cover and casting. Remove reservoir cover and gasket.
7. Inspect vent on underside of casting. If vent hole is clogged and cannot be cleaned out so that the pin rides free, the pin may be straightened and removed through the counterbore end of the vent hole.

CLEANING AND INSPECTION MORAINE POWER BRAKE

CLEANING

Thoroughly wash all parts in alcohol, blow out all passages, and air dry. Place clean parts on clean paper.

INSPECTION

Power Cylinder

In addition to parts contained in repair kits, inspection of parts should be made as directed below.

Inspect for scoring, pitting, dents, nicks, or damaged threads. Small imperfections may be smoothed out by fine crocus cloth; replace if badly damaged.

Master Cylinder Casting

Examine bore down one inch from open end. For primary cup to seal properly, this portion of bore must be free from scores, deep scratches, and corrosion. Machined bore of the master cylinder may be cleaned with crocus cloth. The three gasket surfaces must be smooth and free of nicks. Check for cracks and damaged threads. Passages in reservoir should be clean.

Cylinder Plug Assembly

Cavities should be free of imperfections to allow good seat for secondary cup. Check outside surfaces for damaged threads and clean grooves. Be sure small radial holes are open and clean. Inspect seal for wear and proper tension. The vacuum seal and cylinder plug are serviced as an assembly.

Head Nut Assembly

Check for damaged threads and smooth seat. Replace if damaged.

Residual Check Valve and Spring

Check for distortion and deterioration of rubber.

Dip-Stick

Check for damaged threads or badly worn gasket. Be sure breather holes are clean and open.

Hydraulic Plunger

Examine carefully for nicks, corrosion, and abrasion. Radial holes in counterbore should be open. If scored or pitted, replace with new plunger.

Hydraulic Plunger Bearing

Grooves and holes must be clean. Check fit of hydraulic plunger in bearing. Replace if worn or damaged.

Vacuum Inlet Tube

Make sure braze is secure and tube plate is not distorted.

Air Filter Assembly

Replace filter element if filled with dirt or damaged. Replace rubber gasket if cracked or torn.

Air Valve

Check for scratches, dents, distortion, or corrosion on both outside and inside surfaces. Check seat for smoothness and flatness. Should have free sliding fit when inserted in vacuum piston bore. Replace if worn or damaged.

Floating Valve Assembly

Check for distortion of metal parts and deterioration or abrasions of rubber parts. Replace if worn or damaged.

Vacuum Piston and Guide

Check for cracks, distortion, damaged lever seats or rough and uneven floating valve seat. Be sure all openings and passages are clean.

Reaction Levers

Check for distortion. The levers may be straightened with a mallet if they are not badly distorted.

ASSEMBLY OF MORAINE POWER BRAKE UNIT

ASSEMBLY OF MASTER CYLINDER (Fig. 7-24)

1. Place residual check valve spring in 1" threaded bore in master cylinder casting. Nest residual valve assembly into the valve spring. Button check valve seat onto head nut and fit copper head nut gasket over threaded end of head nut. Screw head nut in place carefully to avoid tilting the check valve. Torque 80 to 90 ft. lbs.
2. Install reservoir cover and new gasket. Note cover to reservoir casting alignment marks to insure filler tube is correctly located. Install dip-stick and gasket.
3. Clamp master cylinder in vise in vertical position with large counterbore facing upward. Wipe counterbores and threads with a thin coating of brake fluid. Place conical primary cup retainer with notched end down into open end of bore; press primary cup into bore with lip facing and centered over small end of conical retainer. Place thin blued steel primary cup washer in place on back of primary cup. Place bearing into bore with notched side up, making sure that the hub of the bearing fits into the counterbore on the back of the primary cup. Place spacer on top of bearing, and position new expander on top of spacer with fingers pointing down, making sure spacer and expander are centered over bearing.
4. Assemble the cylinder plug as follows: Install two new "O" rings in the grooves on O.D.

   CAUTION: Do not place "O" ring in second groove that has four small vent

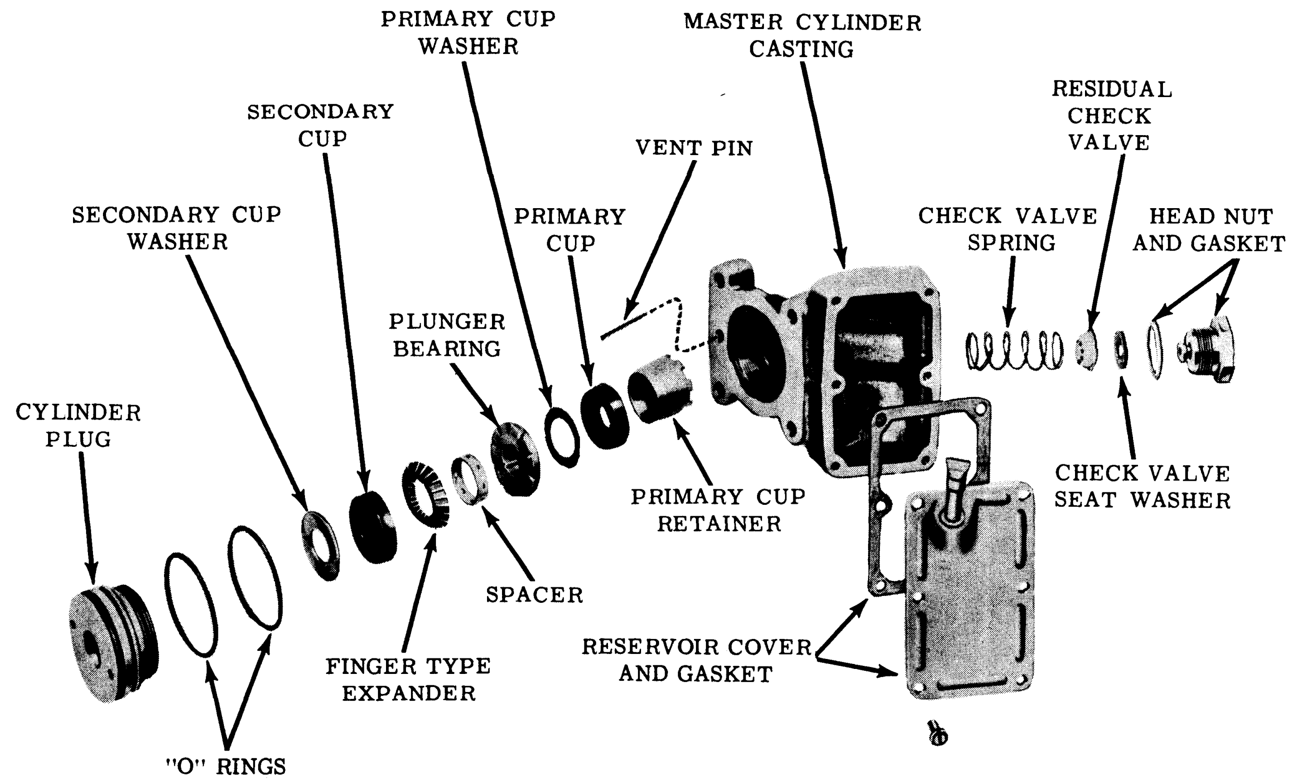


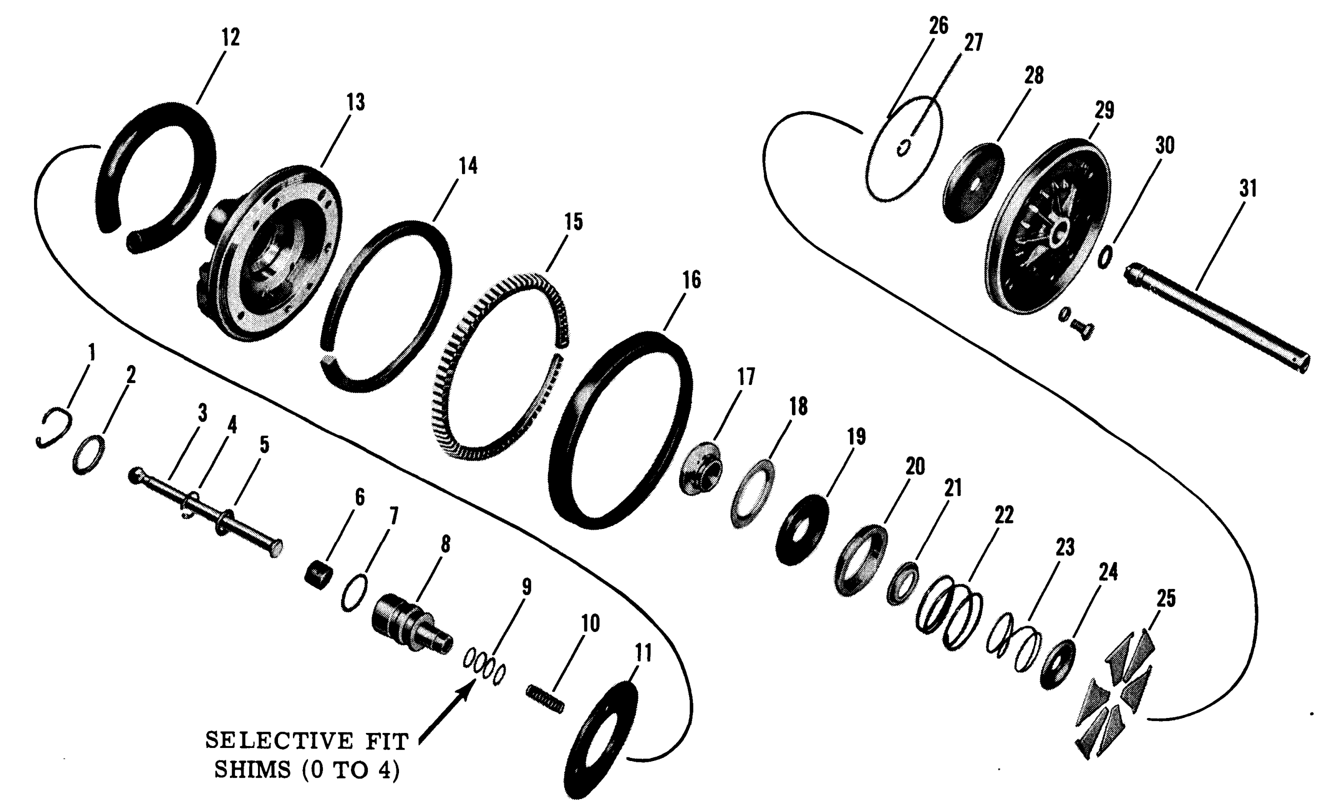
Fig. 7-24 Master Cylinder

holes. Install secondary cup washer and seat secondary cup with ribbed side up in cylinder plug.

5. Lubricate the cylinder plug "O" rings, secondary cup, and leather seal, with shock absorber fluid. Carefully install the cylinder plug assembly. Use special spanner wrench, Tool J-5794, for tightening cylinder plug. Torque 20 to 30 ft. lbs.
6. If vent pin was removed, replace in vent hole. The vent pin should protrude through bottom of vent hole. Bend protruding end to approximately 45^{o} to hold in place.
7. Align new power cylinder gasket on the master cylinder casting so that the vent passage is open. Observe alignment marks and install the power cylinder on the master cylinder plug. Attach power cylinder to master cylinder with four cap screws. Torque to 12 ft. lbs.

ASSEMBLY OF VACUUM PISTON (Fig. 7-25)

1. If floating valve was disassembled, proceed as follows:
   a. Fit the lip of the rubber diaphragm over the small diameter of the diaphragm retainer ring. (See Fig. 7-26)
   b. Hold the flat side of the diaphragm retainer plate against the diaphragm, then press the floating valve into place in the diaphragm.
   c. Press the valve spring retainer over the hub of the floating valve and the inner flange of the diaphragm.
2. Push the floating valve assembly into the vacuum piston as shown in Fig. 7-27.
3. Install the felt wick in the expander, then install the wick and expander assembly in the groove of the vacuum piston with the expander fingers



1. Lock ring
2. Washer
3. Push rod
4. Snap ring
5. Washer
6. Push rod bumper
7. "O" ring
8. Air valve
9. Selective shims
10. Air valve return spring
11. Vacuum piston stop bumper
12. Vacuum hose
13. Vacuum piston
14. Lubricating wick
15. Seal expander
16. Leather packing
17. Floating valve
18. Diaphragm retainer plate
19. Diaphragm
20. Diaphragm retainer ring
21. Valve spring retainer
22. Reaction spring
23. Floating valve spring
24. Valve reaction plate
25. Reaction levers
26. "O" ring
27. Snap ring
28. Reaction plate
29. Vacuum piston guide
30. "O" ring
31. Master cylinder plunger

Fig. 7-25 Vacuum Piston Assembly

pointing towards hub. If new wick is used, saturate with shock absorber fluid. While holding the wick and expander in place, install leather packing. (See Fig. 7-28)

NOTE: If new leather packing is installed, use cardboard cylindrical container to confine packing during installation.

d. Wipe outside diameter of floating valve assembly lightly with Dow Corning No. 4 Silicone Grease.

4. Snap floating valve diaphragm spring over valve spring retainer. Nest valve reaction plate over diaphragm spring. Seat reaction spring in recess of valve diaphragm retainer ring. (See Fig. 7-29)

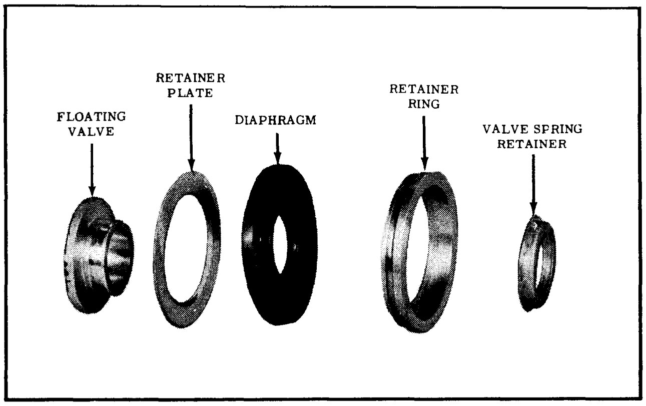


Fig. 7-26 Floating Valve

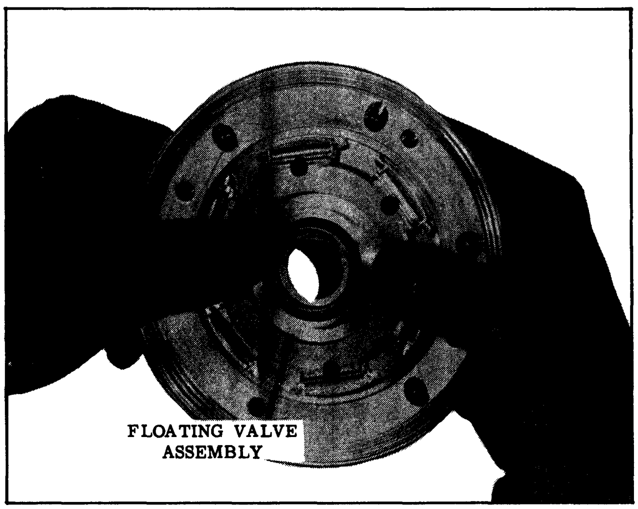


Fig. 7-27 Installing Floating Valve Assembly

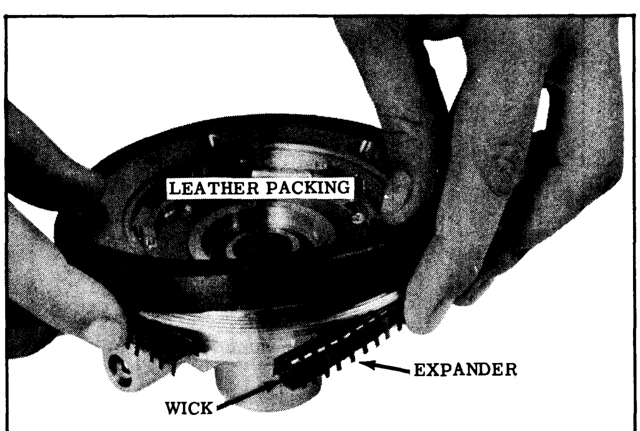


Fig. 7-28 Installing Leather Packing

5. Place reaction levers in vacuum piston. (See Fig. 7-30)
6. Install new "O" ring in groove in hydraulic plunger. If plunger reaction plate was removed, install on plunger with raised edge extending away from

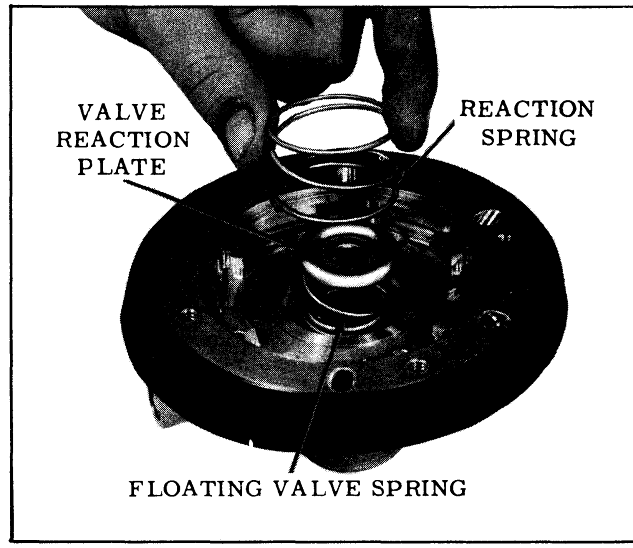


Fig. 7-29 Installing Reaction Spring

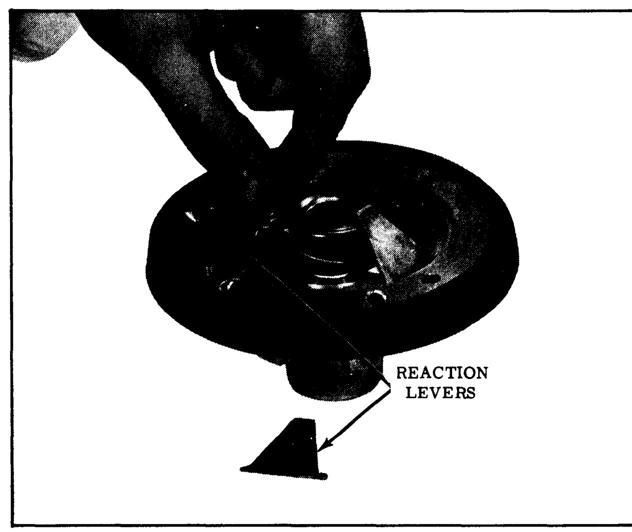


Fig. 7-30 Installing Reaction Levers

plunger using Truarc external No. 2 pliers (J-4880). (See Fig. 7-31)

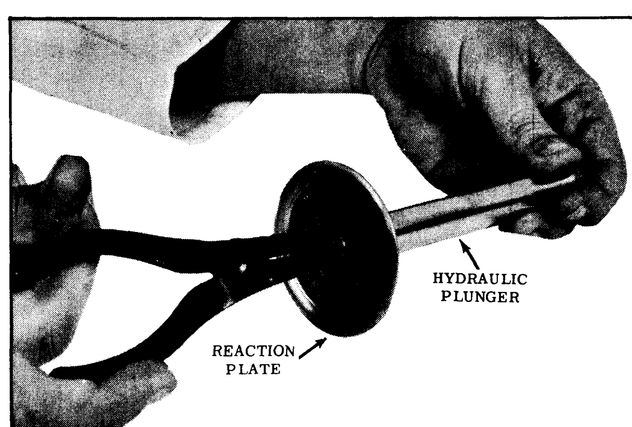


Fig. 7-31 Installing Reaction Plate

Fig. 7-32 Depressing Reaction Levers

7. Fit new "O" ring onto machined hub of vacuum piston guide.
8. Lightly lubricate plunger "O" ring and bore of vacuum piston guide with Dow Corning No. 4 Silicone Grease.
9. Seat the plunger and reaction plate assembly on the reaction levers, then press down quickly until the reaction levers are held in a flat position. (See Fig. 7-32) Be sure each lever is properly seated.
10. While holding the plunger in position, slide the piston guide down the plunger and into position on vacuum piston.
11. Align the raised holes in the piston guide with the threaded holes in the vacuum piston, then install the attaching screws. Torque 5 to 6 ft. lbs.
12. Install new rubber vacuum piston stop washer to hub flange of vacuum piston with Super Weatherstrip Adhesive.
13. If push rod was removed from air valve, position rubber bumper over end of push rod and insert assembly into air valve. Seat washer against push rod bumper and install snap ring with Truarc internal No. 1 pliers (J-5403).
14. Place new "O" ring in narrow groove on outside of the air valve. Coat "O" ring and outside diameter of air valve with light coat of Dow Corning No. 4 Silicone Grease.
15. Check to determine number of shims to be used as follows:

    NOTE: Visually check position of valve reaction plate in the vacuum piston. The hole in the reaction plate must be centered in relation to the bore in the piston hub.

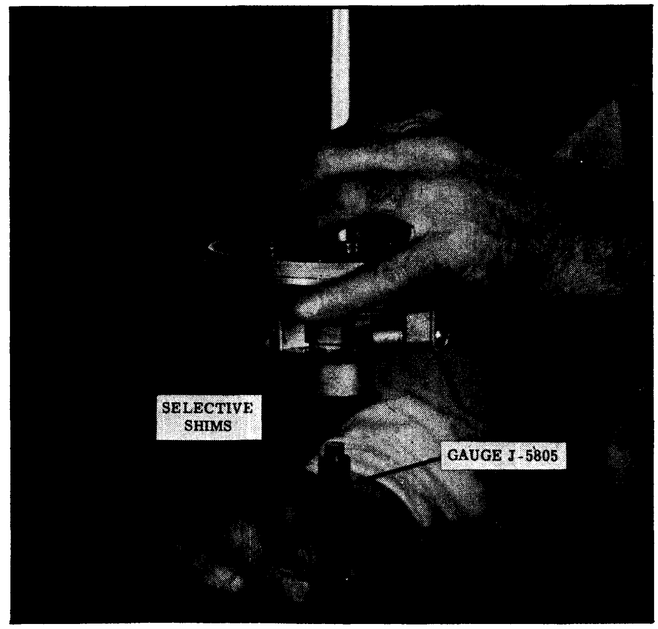


Fig. 7-33 Inserting Gauge J-5805

    a. Place shims and Tool J-5805 and insert gauge into bore of vacuum piston as shown in Fig. 7-33. The body of the gauge will rest on the valve reaction plate, and the pin will extend through the hole in the plate and contact the end of the hydraulic plunger.
    b. Turn the vacuum piston so the gauge is on the top and observe the position of the pin in the gauge body.
    c. If the pin is flush with or less than .010" above the body, no further adjusting is required. (See Fig. 7-34)
    d. If the pin is below the top of the gauge body, remove shims one at a time until the pin is flush or not more than .010" above gauge body.
    e. If pin is more than .010" above the top of gauge body, disassemble and inspect for bent reaction levers, reaction plate, or valve plate.
16. After proper number of shims has been determined, place the shims on small diameter of air valve, then insert valve return spring into small bore in air valve.
17. Holding the vacuum piston assembly with master cylinder plunger pointing

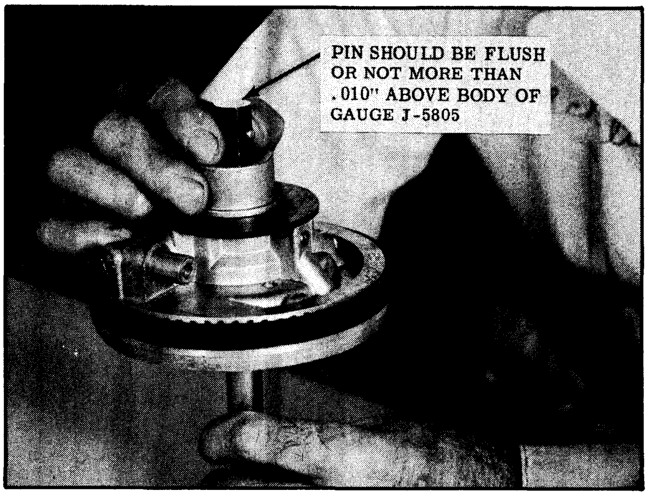


Fig. 7-34 Checking Pin Position of Gauge J-5805

upward, insert from below, the air valve, spring, and push rod assembly into the hub end of the vacuum piston. (See Fig. 7-35)

18. While holding push rod with air valve in vacuum piston, turn assembly over and install stop washer and triangular lock ring. The lock ring may be installed into groove by using a small screw driver as a pry bar. After being locked in place, the air valve will have approximately 1/32" travel against valve return spring before picking up floating valve load.

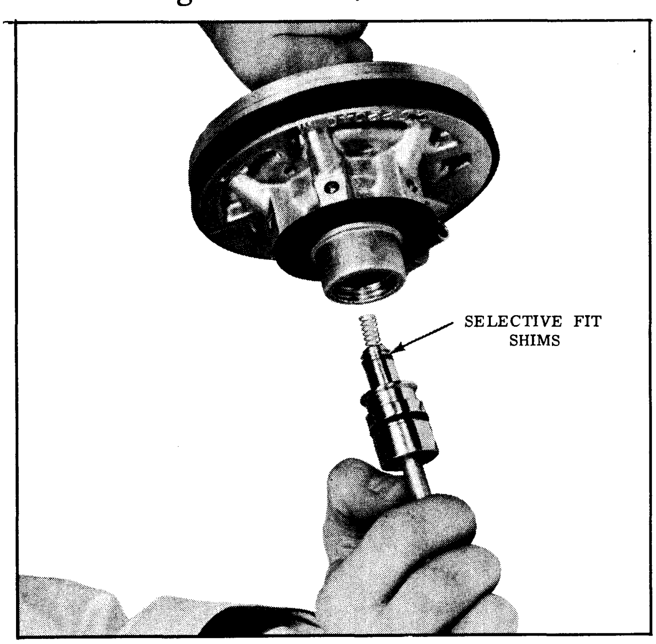


Fig. 7-35 Installing Air Valve

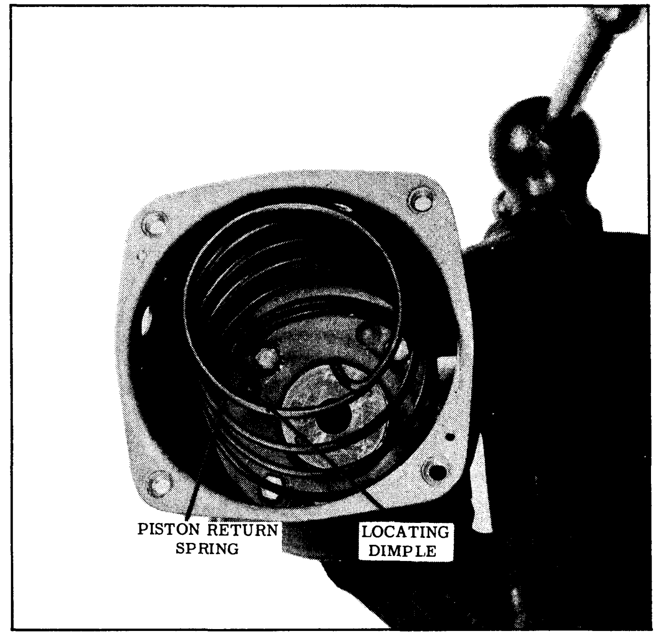


Fig. 7-36 Installing Piston Return Spring

VACUUM PISTON INSTALLATION

1. Lightly lubricate the power cylinder bore with shock absorber fluid.
2. Place the power cylinder and master cylinder assembly in holding fixture, or clamp the master cylinder in a vise with the power cylinder extending upward. Place the large coil return spring in power cylinder with the large diameter of spring at the bottom. The hook on the bottom of the coil spring should be placed in the narrow space between any one of the hex head bolts and closest locating dimple. (See Fig. 7-36)
3. Wipe lip of vacuum piston leather packing with light coating of shock absorber fluid.
4. Install vacuum hose to vacuum piston assembly with Super Weatherstrip Adhesive.
5. Position vacuum piston assembly on top of coil spring. (See Fig. 7-37)
6. Depress vacuum piston assembly into housing and attach vacuum inlet tube and gasket.
7. Slip hose onto inlet tube (approximately 5/8").
8. With the vacuum piston back against vacuum inlet tube, make sure that

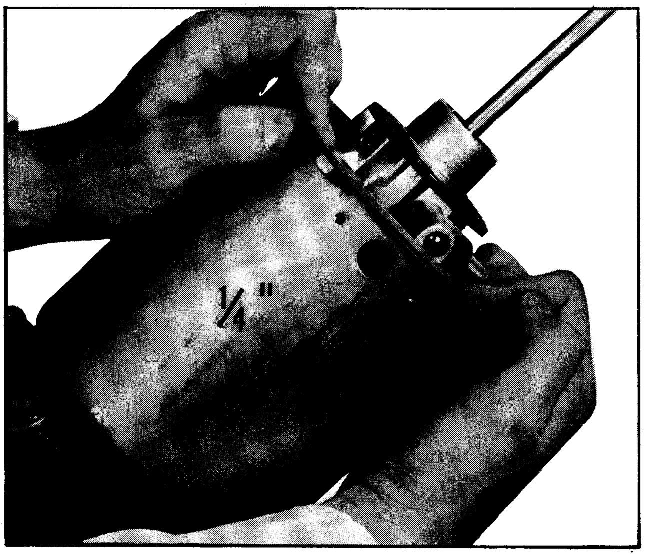


Fig. 7-37 Vacuum Piston Alignment

rubber hose lays flat against piston and does not rub sides of power cylinder.

9. Install power cylinder end plate and gasket.
10. With the felt washer in the second large convolution of boot, install felt washer and dust boot over push rod and fit boot snugly over flange on end plate.
11. Lay hairpin spring inside air cleaner cover and place new or clean filter element on top of hairpin spring. Place rubber gasket on filter element, depress spring and element so that the edges of the gasket can be fitted over the flanges of the air cleaner cover.
12. Insert cover screw with aluminum gasket through air cleaner assembly and attach to top of power cylinder.

BENDIX POWER BRAKE

PRINCIPLES OF OPERATION

Released Position (Fig. 7-38)

In the released position, both sides of the vacuum piston are open to atmospheric pressure; therefore, the piston is balanced in atmospheric pressure and is held in its

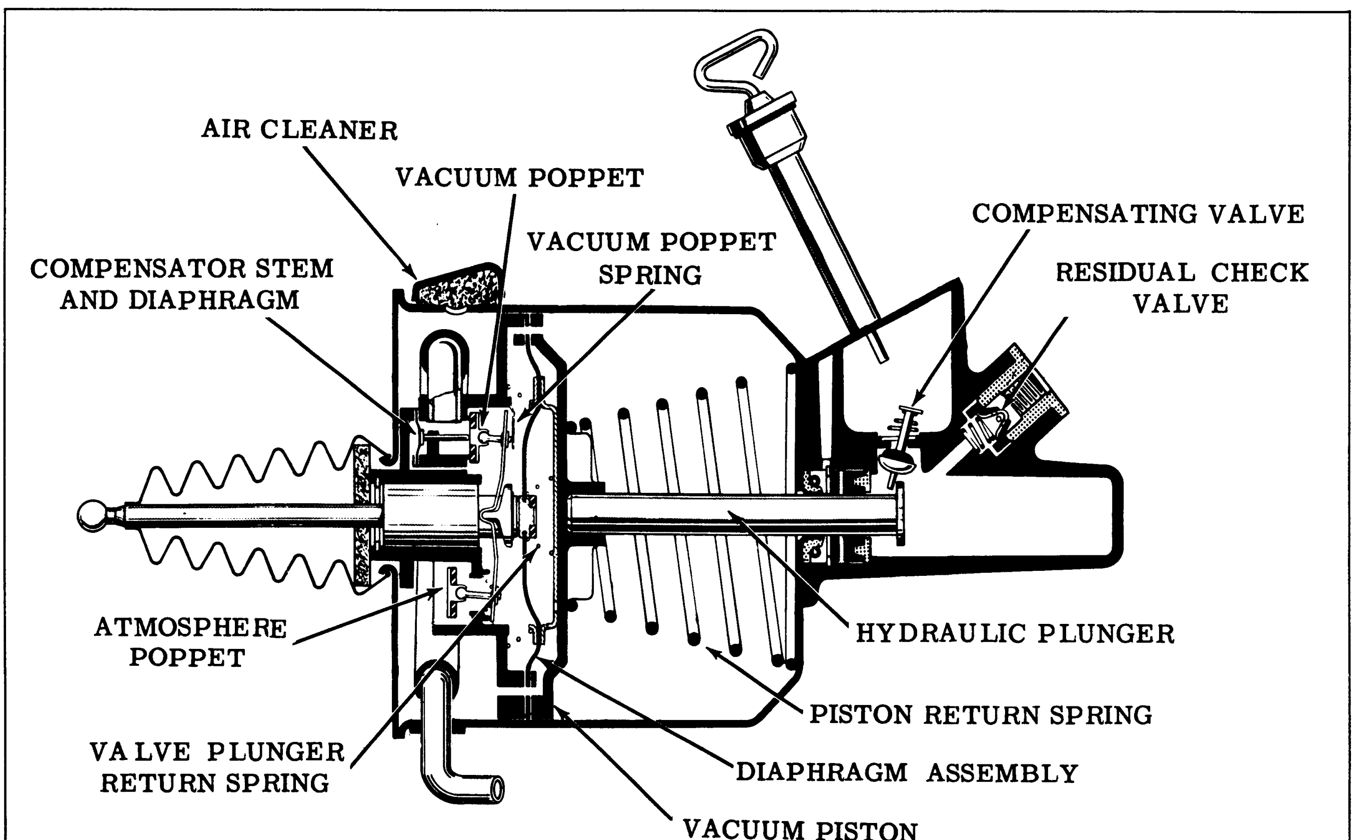


Fig. 7-38 Released Position

released position by the piston return spring. This condition is accomplished by the following:

Vacuum is shut off within the vacuum piston since the vacuum poppet is held on its seat by the valve plunger return spring. The valve return spring also holds the atmosphere poppet away from its seat, thus admitting atmospheric pressure through the air cleaner to the rear side of the vacuum piston. It then passes through the open atmosphere poppet to the forward side of the vacuum piston.

All sides of the reaction diaphragm are balanced in atmospheric pressure. Atmospheric pressure is also present at the rear side of the compensator diaphragm, exerting a slight force on the compensator stem, which opposes the vacuum poppet spring.

The hydraulic plunger is held in the released position by the piston return spring. In this position the compensating valve is held open and fluid can flow freely in either direction between the hydraulic cylinder and the fluid reservoir. This compensates for expansion, contraction, or leakage of fluid in the hydraulic system. The fluid in the lines to the wheel cylinders is trapped by the residual check valve, thus maintaining pressure in the lines as in a conventional braking system.

Applying Position (Fig. 7-39)

In the applying position, vacuum exists on the forward side of the vacuum piston and atmospheric pressure on the rear side of the vacuum piston overcoming the piston return spring and forcing the vacuum piston in the applying position. This condition is accomplished by the following:

Atmospheric pressure is blocked off from the forward side of the vacuum piston as the atmosphere poppet spring closes the atmosphere poppet. Further movement of the plunger permits the pivot arm to open the vacuum poppet. The "pre-loading" of

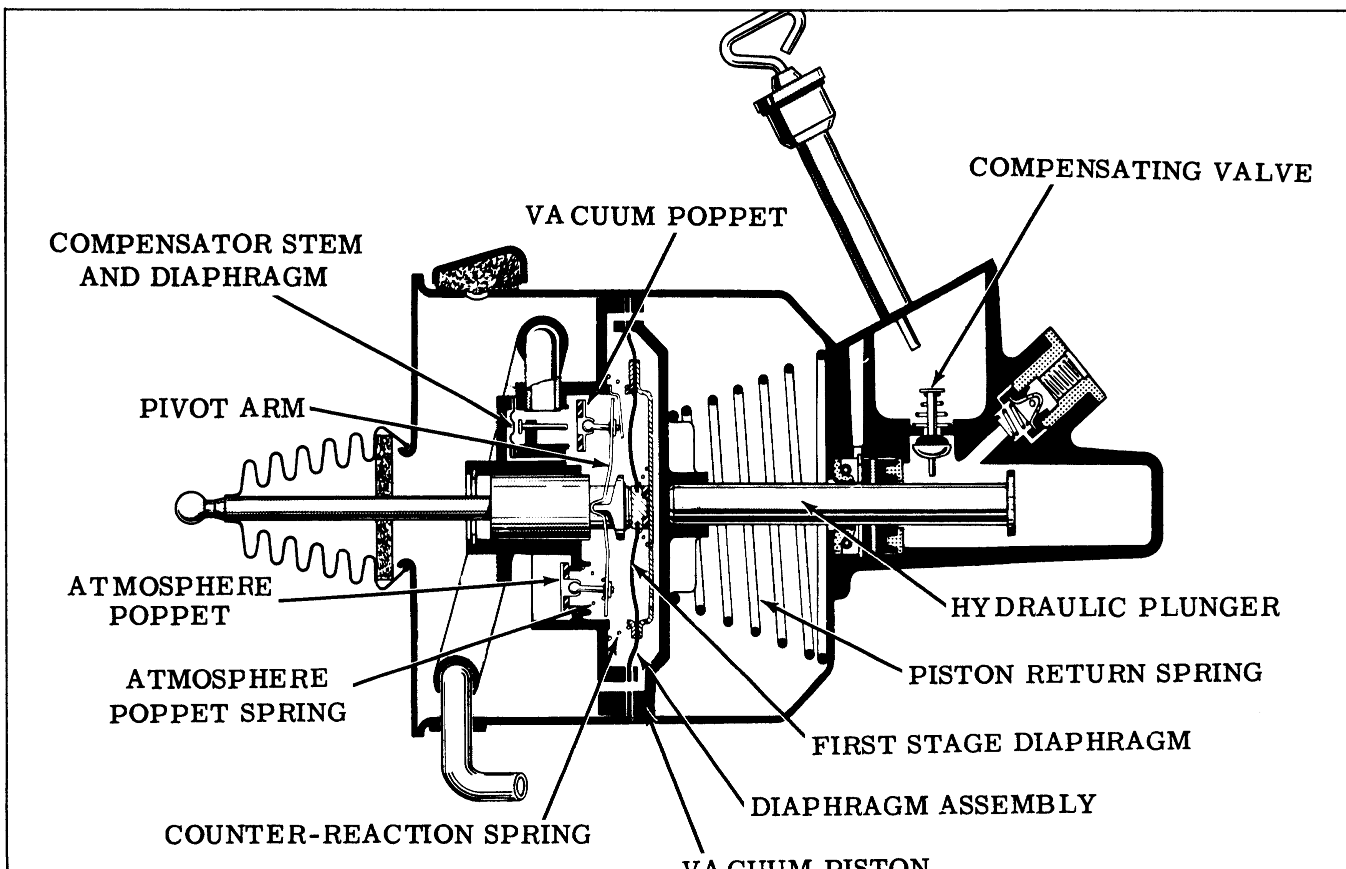


Fig. 7-39 Applying Position

the vacuum poppet by the compensator diaphragm and stem assists in lifting the vacuum poppet off its seat, thereby providing smoothness in the initial application of the power brake. Vacuum then passes through the open vacuum poppet to the rear side of the diaphragm assembly and to the forward side of the vacuum piston. Atmospheric pressure on the rear side of the vacuum piston moves the piston and the hydraulic plunger in the applied direction.

The initial movement of the hydraulic plunger in the applied direction closes the compensating valve, sealing off the fluid reservoir from the hydraulic cylinder. Further movement of the plunger in the applied direction forces fluid out of the master cylinder under pressure through the hydraulic lines into the wheel cylinders to apply the brakes.

With vacuum on the rear side of the diaphragm assembly and atmospheric pressure on the forward side, a reaction force is exerted against the push rod and plunger giving the driver brake "feel". This reaction force is obtained during initial application from the inner "first stage" diaphragm, and when the force of the counter-reaction spring is overcome, additional reaction force is obtained from the diaphragm assembly.

Holding Position (Fig. 7-40)

When the desired brake application has been reached, the driver stops increasing the brake pedal force, which in turn holds the push rod and valve plunger stationary. The vacuum piston will continue to move forward as in the applied position until

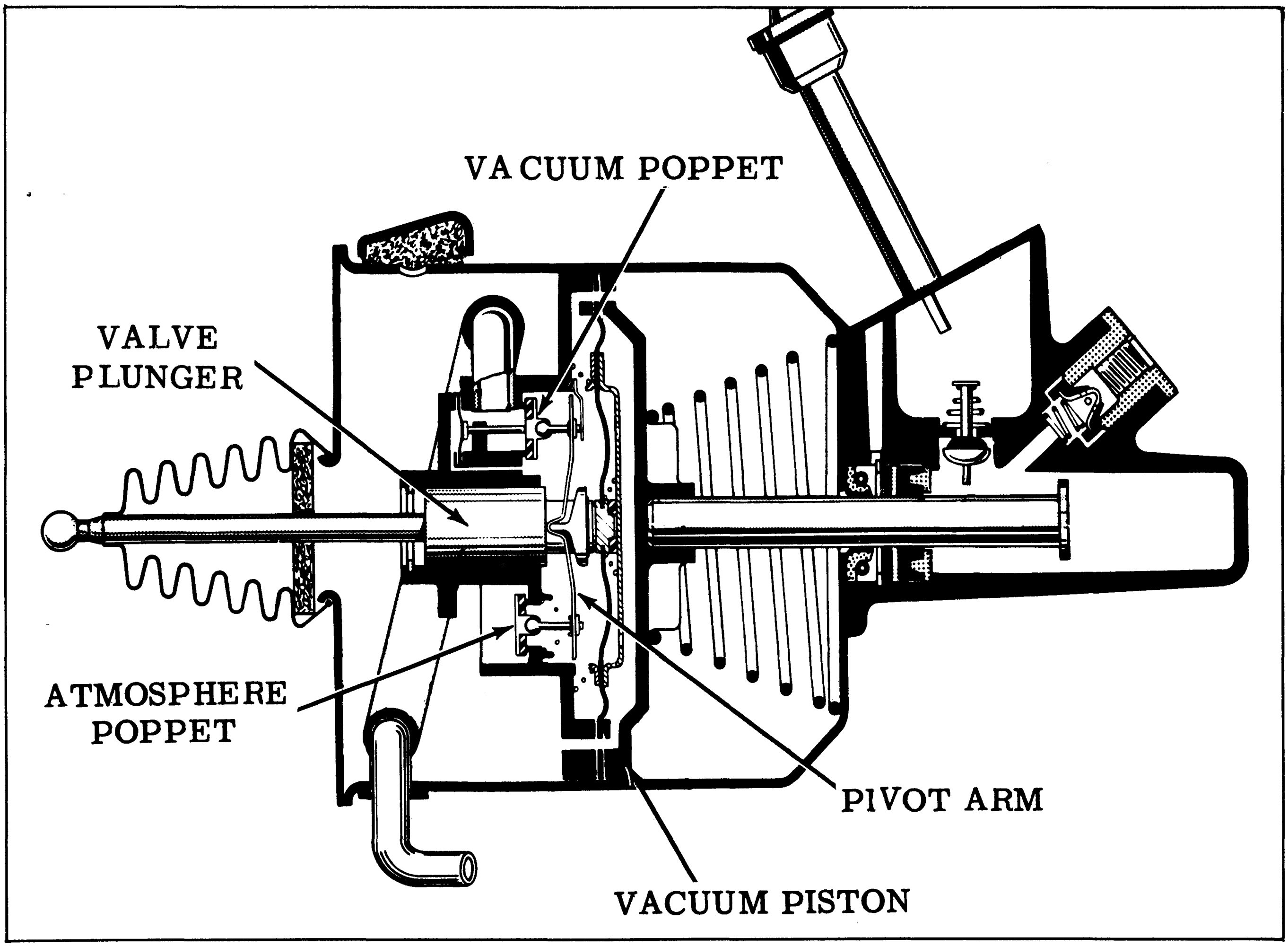


Fig. 7-40 Holding Position

the pivot arm allows the vacuum poppet to close. At this point, both the atmosphere and vacuum poppets are closed and no further movement takes place until the force on the pedal is either decreased or increased.

DISASSEMBLY OF BENDIX POWER BRAKE (Fig. 7-42)

NOTE: Use extreme care to keep mineral oil or grease from coming in contact with hydraulic parts.

1. Clean all dirt from the outside of the power brake unit. Remove dip-stick and gasket and empty brake fluid from master cylinder casting.
2. Mount unit in holding fixture J-5433, if available. (See Fig. 7-41) If holding fixture is not available, clamp master cylinder end of unit in a vise.

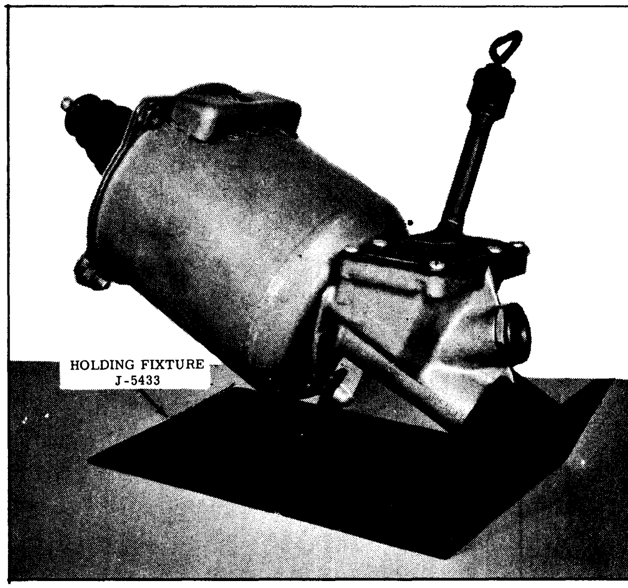


Fig. 7-41 Power Brake Holding Fixture

3. Remove boot and felt washer. Bend tabs on end plate, then remove end plate and gasket.

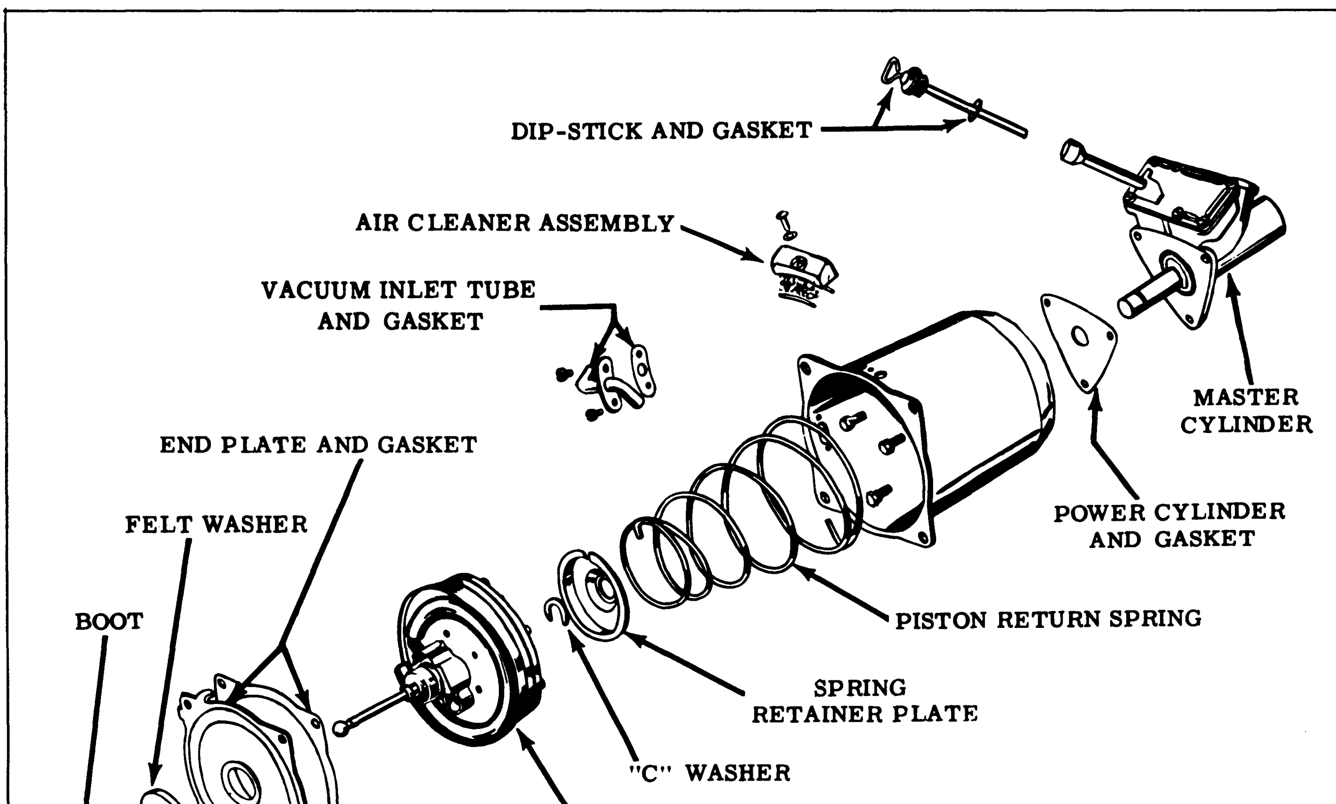


Fig. 7-42 Bendix Power Brake

4. Remove the screw attaching air cleaner unit to power cylinder. Remove any burr inside of cylinder at air cleaner screw hole to prevent damage to the packing during vacuum piston removal.
5. Slip rubber hose from vacuum inlet tube inside the power cylinder, then remove the inlet tube and gasket. Pull vacuum piston from power cylinder.
6. Push in on spring retainer plate to free "C" washer, then remove "C" washer, retainer plate, and vacuum piston return spring.
7. Scribe alignment marks across power cylinder and master cylinder casting. Remove screws from the inside of the power cylinder, then remove the power cylinder and gasket.

DISASSEMBLY OF VACUUM PISTON (Fig. 7-43)

1. Remove the vacuum hose and piston tube, then remove rubber seal from the vacuum piston.
2. Remove air valve seal, then remove rubber stop washer from steel stop washer on vacuum piston.
3. Remove two screws, then remove the steel stop washer.
4. Lift out the compensating stem diaphragm, then invert the piston assembly to allow the compensating stem to fall out.

CAUTION: Do not remove the stem guide.

5. Remove the diaphragm cover attaching screws, then remove the cover, gasket, diaphragm, and the counter-reaction spring.
6. Remove the vacuum poppet spring screw and spring from the piston. (See Fig. 7-44) Remove the atmosphere poppet retainer and poppet.
7. Pull the push rod, valve plunger, and

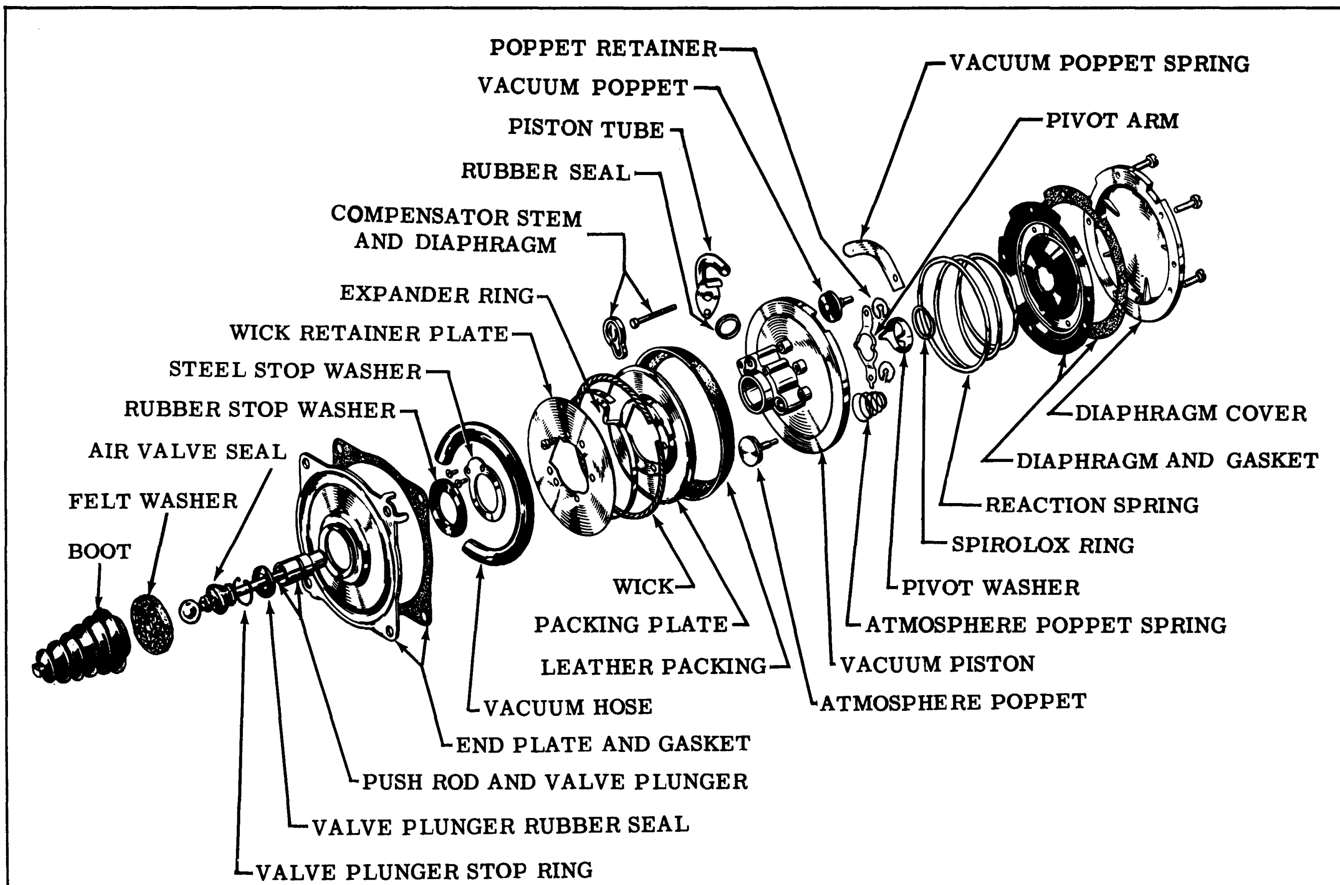


Fig. 7-43 Vacuum Piston Assembly

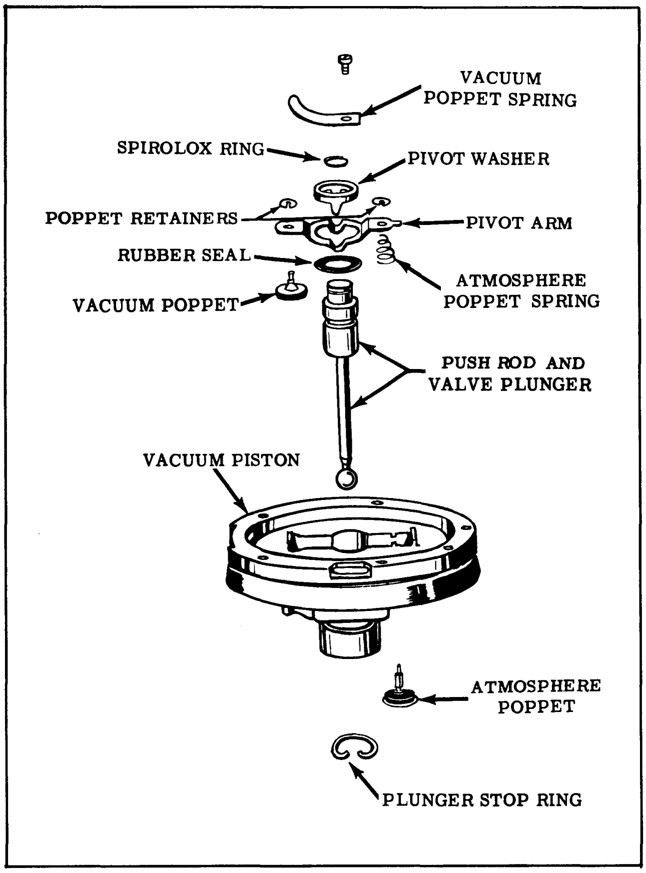


Fig. 7-44 Plunger & Puppet Assembly

vacuum poppet assembly from the piston. Remove the atmosphere poppet spring from the vacuum piston.

8. Use a sharp tool to remove the Spirolox ring from the groove at the end of the valve plunger. Remove the pivot washer and pivot arm from the valve plunger. Remove vacuum poppet from pivot arm. Remove rubber seal from valve plunger.
9. Remove valve plunger stop ring from groove in bore of vacuum piston.
10. Remove the six vacuum piston retainer plate screws, then remove the retainer plate.
11. Unhook expander ring and remove the cotton wicking, packing plate, and leather packing from the vacuum piston.

DISASSEMBLY OF MASTER CYLINDER (Fig. 7-45)

1. Scribe alignment marks across master cylinder casting and reservoir cover, then remove cover and gasket.
2. With a 1-1/8" thin walled socket, remove compensating valve assembly.
3. If necessary to disassemble compensating valve assembly, refer to Fig. 7-46.
4. Remove rubber ring seal from master cylinder bore.
5. Push in hydraulic plunger and then pull out to remove vacuum seal from recess in hydraulic cylinder.
6. Using Truarc No. 3 internal pliers (J-4245), remove retainer ring from bore of hydraulic cylinder.
7. Pull plunger out of master cylinder and remove steel and fiber washers, rubber cup, and cup retainer from plunger.
8. Remove hydraulic outlet fitting, residual check valve cup and retainer, and check valve spring from master cylinder.

CLEANING AND INSPECTION BENDIX POWER BRAKE

CLEANING

Thoroughly wash all parts in alcohol, blow out all passages, and air dry. Place clean parts on clean paper.

INSPECTION

In addition to parts contained in repair kits, inspection of parts should be made as directed below, and parts replaced as necessary.

Power Cylinder

Inspect for scoring, pitting, dents or nicks, or damaged threads. Small imperfections may be smoothed out with fine crocus cloth.

Master Cylinder Casting

Examine bore one inch down from open end. For hydraulic cup to seal properly,

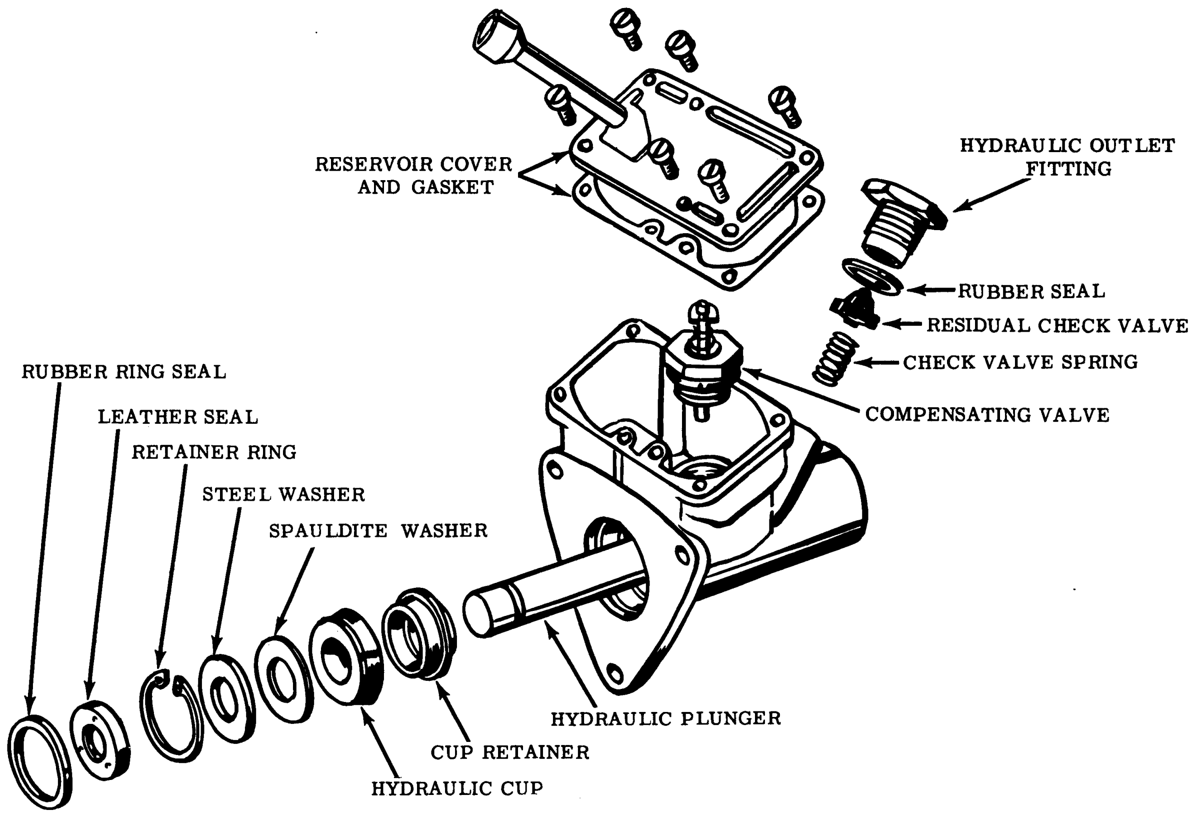


Fig. 7-45 Master Cylinder

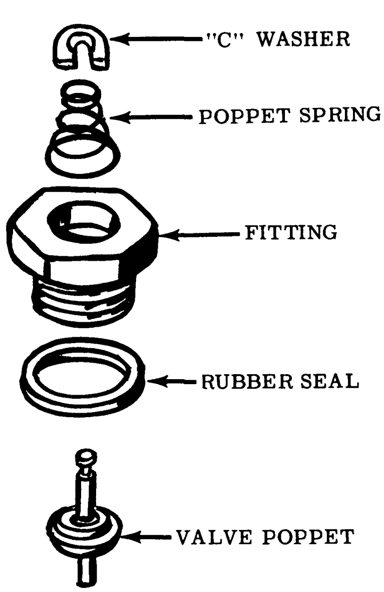


Fig. 7-46 Compensating Valve

this portion of bore must be free from scores, deep scratches, and corrosion. Gasket surfaces at reservoir cover, compensating port, and outlet fittings, must be free from scoring, pitting, dents, and nicked edges. Also check for cracks and damaged threads.

Hydraulic Outlet Fitting

Surface at small end of fitting must be free from scoring or corrosion which might prevent sealing with residual check valve rubber cup.

Compensating Valve Fitting

Surface at end of bore (inside threaded portion) must be free of scoring or corrosion which might prevent sealing with rubber poppet on compensating valve.

Vacuum Inlet Tube

Make sure braze is secure and tube plate is not distorted.

Hydraulic Plunger

Inspect plunger for scoring, pitting, or dents. DO NOT attempt to refinish plunger, as an undersize plunger may cause serious hydraulic leakage.

Valve Plunger and Push Rod Assembly

Push rod must pivot freely in valve plunger without noticeable end play. Replace if damaged.

Vacuum Cylinder End Plate

Examine end plate for distortion.

Vacuum Piston Casting

Inspect vacuum piston valve plunger bore and poppet seats for scratches and nicks.

ASSEMBLY OF BENDIX POWER BRAKE

ASSEMBLY OF MASTER CYLINDER (Fig. 7-47)

1. Coat the outlet fitting rubber seal with brake fluid and assemble over hydraulic outlet fitting, then assemble the residual check valve into fitting.
2. Hold the master cylinder casting upside down and insert the residual check valve assembly and outlet fitting into check valve bore. Tighten to 50 ft. lbs.
3. Insert the washer end of the hydraulic plunger into the master cylinder. Install the cup retainer on the plunger.
4. Coat the hydraulic cup with brake fluid

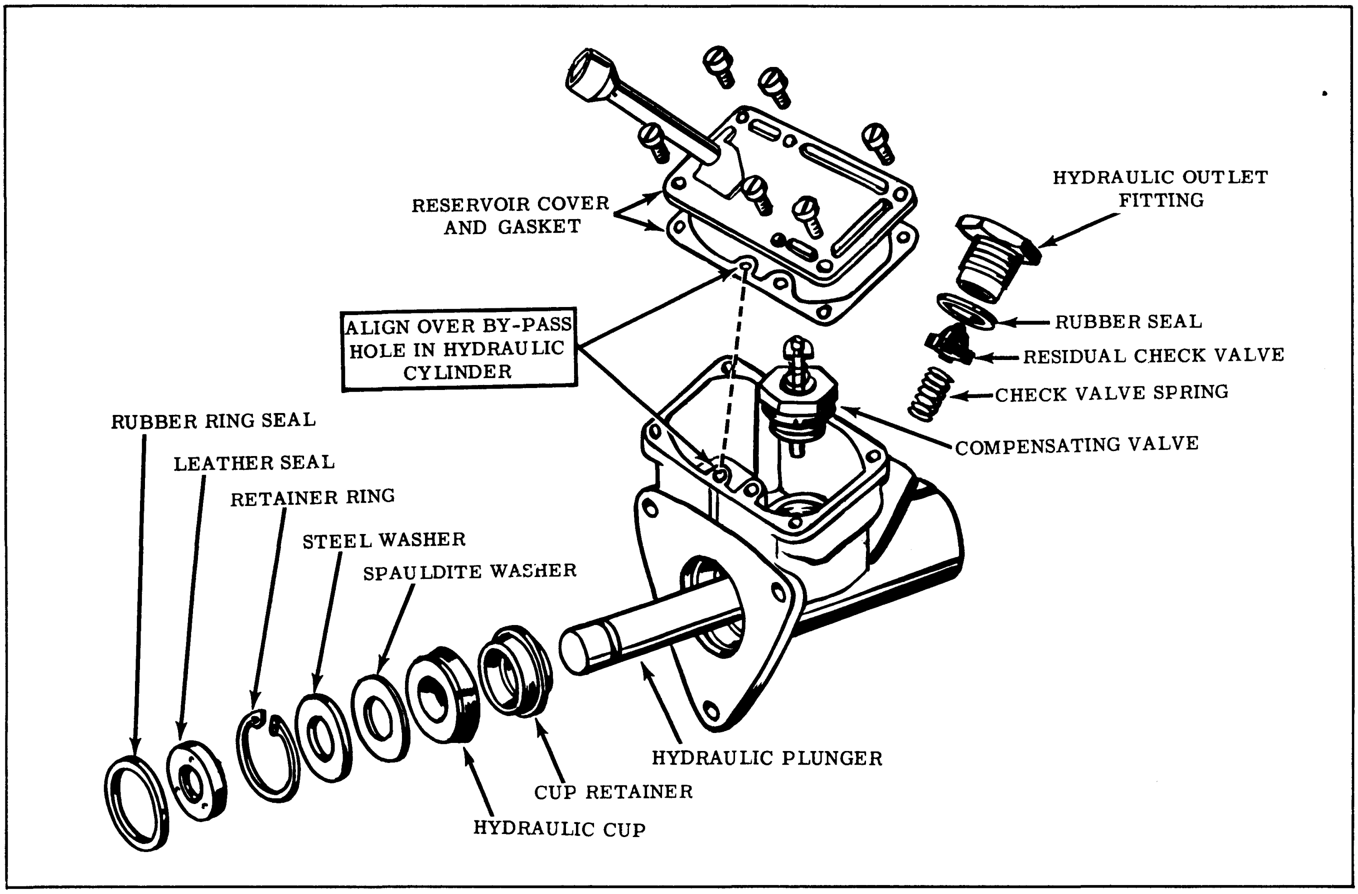


Fig. 7-47 Master Cylinder Assembly

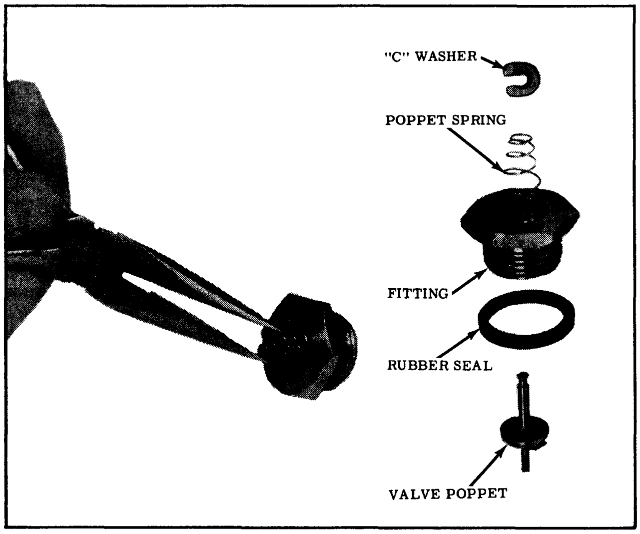


Fig. 7-48 Compensating Valve Assembly

and install with lips against cup retainer. Install Spauldite guide washer, then steel washer on plunger. Install snap ring in the master cylinder bore with Truarc No. 3 internal pliers (J-4245).

5. If the compensating valve was disassembled, assemble as shown in Fig. 7-48. Crimp "C" washer to retain in place.
6. Coat compensating valve rubber seal with brake fluid. Push hydraulic plunger into master cylinder, then install compensating valve assembly in bore. Torque to 15 ft. lbs. Pull back on the plunger to be sure the plunger washer tilts the compensating valve.
7. Install reservoir cover and new gasket. Note cover to reservoir casting alignment marks to insure filler tube is correctly located. Install dip-stick and gasket.
8. Install Seal Tool J-5405 on the plunger, then slide the leather seal over the tool with the seal lip facing hydraulic cylinder and position seal into recess of master cylinder. (See Fig. 7-49)
9. Place rubber seal into master cylinder counterbore around leather seal.
10. Install power cylinder and gasket on master cylinder casting. Note power cylinder to master cylinder casting alignment marks to insure that power cylinder is correctly located.

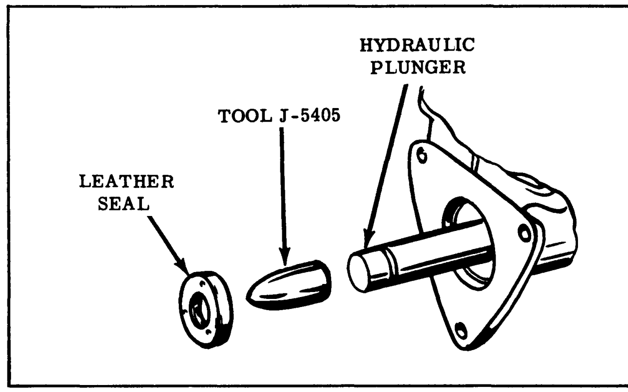


Fig. 7-49 Installing Leather Seal

ASSEMBLY OF VACUUM PISTON

1. Install rubber seal in recess of push rod plunger with lip of seal pointing toward push rod. (See Fig. 7-50) Coat plunger with Dow Corning No. 4 Silicone Grease and install push rod and plunger assembly into hub side of vacuum piston. Install plunger stop ring in hub of vacuum piston.
2. Place stem of vacuum poppet (poppet with short stem) in hole at rounded end of pivot arm and install poppet retainer over stem.

   NOTE: During assembly do not permit plunger seal to clear end of piston bore.

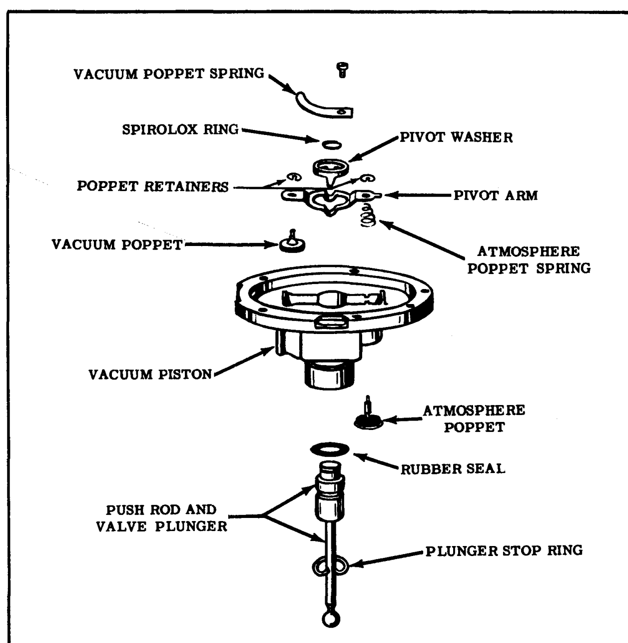


Fig. 7-50 Plunger and Poppet Assembly

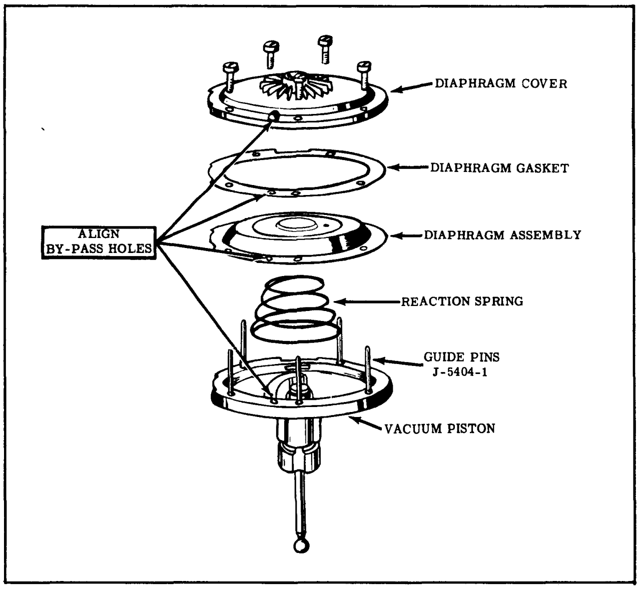


Fig. 7-51 Diaphragm Assembly

3. Place pivot arm over end of plunger with attached poppet over the piston port with the raised seat (vacuum port). Install pivot washer, then install Spirolox ring into groove at end of plunger. (Engage end of ring in groove and twist clockwise until ring is properly seated.)
4. Place vacuum poppet spring into recess of piston and install screw.
5. Position atmosphere poppet spring between pivot arm and piston with large coil of spring seated on piston. Insert atmosphere poppet from opposite side of piston and guide poppet stem through poppet spring and pivot arm. Secure poppet with retainer.
6. Install guide pins (J-5404-1) into vacuum piston and large coil of counter-reaction spring against piston.
7. Place diaphragm, gasket, and cover over guide pins as shown in Fig. 7-51. Center metal ring of diaphragm assembly over small coil of spring. Press down on the cover and install screws by removing one guide pin at a time. Tighten screws evenly.
8. Install special assembly ring Tool J-5406 over vacuum piston assembly. (See Fig. 7-52)
9. Place leather packing on piston with lip up. Place packing retainer plate with beveled edge of plate down on packing.

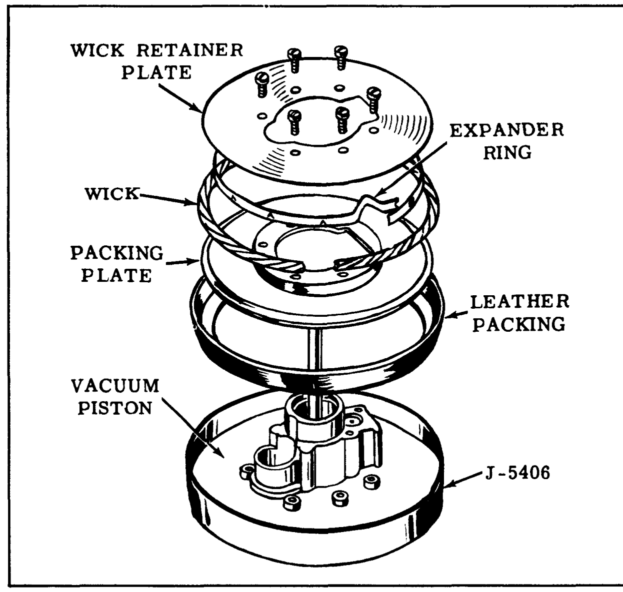


Fig. 7-52 Piston Packing Assembly

10. Coil wick inside lip of packing and cut wick to required length.
11. Saturate wick with shock absorber fluid and again coil wick against the lip of the leather packing.
12. Coil expander ring inside wick with barbs pointing up and into wick. Engage notch at loop end of ring with hook at opposite end. (See Fig. 7-53)

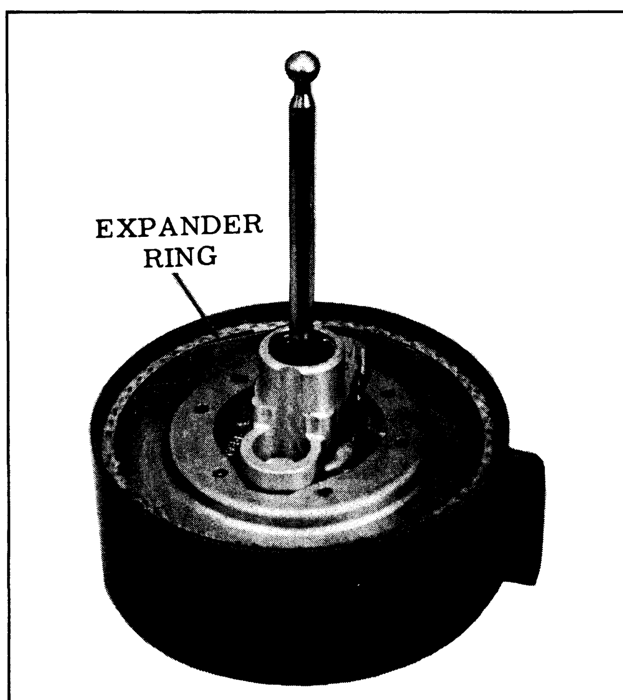


Fig. 7-53 Installing Expander Ring

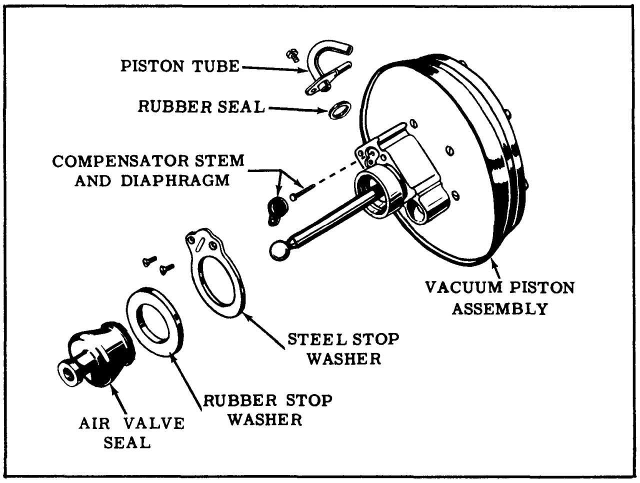


Fig. 7-54 Compensating Stem Installation

13. Install wick retainer plate with six screws and remove Tool J-5406.
14. Install compensating stem into the piston, then install stem diaphragm with the "by-pass" slot up. (See Fig. 7-54)
15. Install the steel stop washer on the piston hub.
16. Cement a new rubber stop washer on the steel washer with Super Weatherstrip Adhesive.
17. Install air valve seal, then install the piston tube rubber seal in the recess of the piston, then install vacuum hose and the piston tube.

VACUUM PISTON INSTALLATION (Fig. 7-55)

1. Apply a thin film of shock absorber fluid to the inside of the power cylinder. Pull hydraulic plunger out, then place vacuum piston return spring in power cylinder with the large diameter of spring at the bottom. The hook on the bottom of the coil spring should be placed in the narrow space between any one of the hex head bolts and nearest locating dimple.
2. Place the retainer plate on the spring so that the hook engages with notch in the plate. Compress the spring and

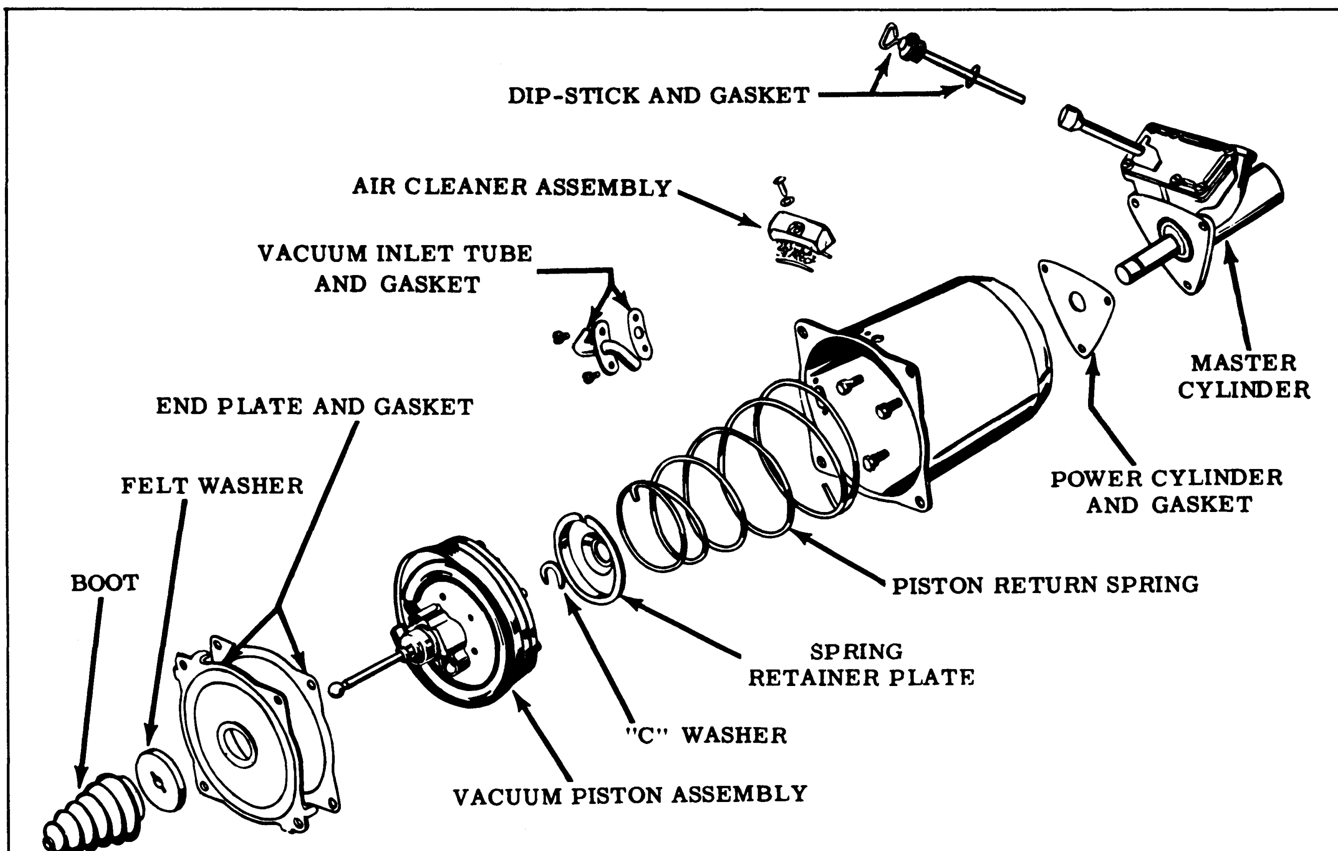


Fig. 7-55 Bendix Power Brake

install the "C" washer in the groove of the plunger.

3. Install the vacuum piston assembly in the cylinder so that the free end of the hose is in line with the center of the elongated hole in the cylinder.
4. Push the piston down in the cylinder until the piston engages the hook at the end of the return spring. Twist the piston 20-25 degrees in both directions, then move the piston through its full stroke several times to permit it to find its normal operating position.
5. Install the vacuum tube and gasket to the power cylinder and slip vacuum hose approximately 5/8" onto vacuum tube.
6. Operate piston by hand to make certain that the hose does not rub against the cylinder or piston. Should interference occur, remove piston and rotate to a position where interference does not occur.
7. Assemble air cleaner by placing two rubber seals on the bottom edges of air cleaner shell, then install air cleaner to power cylinder. Use a 6" steel scale or similar tool to push clean filter element into open spaces at each end of air cleaner shell.
8. Align end plate and gasket to power cylinder and bend tabs of end plate to secure plate and gasket to cylinder.
9. Assemble felt washer into first large convolution of rubber boot. Dip small end of boot in brake fluid and install boot over push rod and attach to "scallops" of end plate.

POWER BRAKE TESTING

Any time a power brake unit has been removed and replaced, or a new unit installed on a car, vacuum and hydraulic leakage tests as well as operational tests should be made to determine whether the unit is operating up to standard.

Road test the brakes by making a brake application at about 20 m.p.h. to determine if the vehicle stops evenly and quickly. If the pedal has a spongy feel when applying the brakes, air is present in the hydraulic system. Bleed the system at each wheel cylinder.

With the engine stopped and the transmission in neutral, apply the brake several times to exhaust all vacuum in the system. Depress the brake pedal, hold foot pressure on the pedal, and start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure, and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum system is not functioning.

Stop the engine and again exhaust all vacuum in the system. Without starting the engine, depress the brake pedal and hold foot pressure on the pedal. If the pedal gradually falls away under foot pressure, the hydraulic system is leaking.

If the brake pedal travels to within 1 inch of the toe board, the brake shoes require readjustment or relining.

A faulty vacuum check valve may be tested by shutting off engine and, after waiting a few minutes, applying the brakes; there should be sufficient vacuum reserve for several applications.

BRAKE DIAGNOSIS

The following diagnosis applies to both power brakes and standard brakes unless otherwise specified.

Brake troubles may be easily diagnosed if the complaint is understood. The trouble will always show up in one or more of the four ways listed below. Related parts of the power brake or standard brake system should be checked before dismantling the brake when a malfunctioning brake system is encountered.

1. Hard Pedal Feel May be Caused By:
   - A. Power brake vacuum failure due to:
     - a. Faulty vacuum check valve.
     - b. Collapsed vacuum hose.
     - c. Plugged or loose vacuum hose or fittings.
     - d. Leaking vacuum reservoir tank.
   - B. Bound up pedal mechanism.
   - C. Glazed linings.
   - D. Grease on brake drum or linings.
   - E. Power brake unit trouble due to:
     - a. Internal vacuum hose loose or restricted.

b. Vacuum leak in vacuum piston assembly or past leather piston packing.
c. Leak at power cylinder to master cylinder mounting face (Bendix).
d. Faulty vacuum seal (Moraine).
e. Restricted air cleaner,
f. Jammed push rod plunger (Bendix).
g. Jammed air valve (Moraine).
h. Broken counter-reaction spring (Bendix).
i. Leak past atmosphere poppet (Bendix).
j. Leak past floating control valve (Moraine).

2. "Grabby" or severe brakes caused by:
   A. Grease or brake fluid on linings.
   B. Scored drums.
   C. Anchor pins improperly adjusted (new linings).
   D. Power brake unit trouble due to:
      a. Vacuum leakage in reaction diaphragm.
      b. Sticking push rod plunger or air valve.
      c. Faulty pivot arm and vacuum poppet action (Bendix).
      d. Restricted diaphragm passage.
      e. Master cylinder plunger binding in vacuum piston guide (Moraine).
3. Pedal goes to floor (or almost to floor) caused by:
   A. Brakes require adjustment.
   B. Air in hydraulic system.
   C. Hydraulic leak in lines or at wheel cylinders.
   D. Fluid reservoir needs replenishing.
   E. Cracked drums.
   F. Power brake hydraulic leakage at:
      a. Compensating valve or seal.
      b. Hydraulic plunger seals.
      c. Outlet fitting.
      d. Sand hole or crack in master cylinder.
4. Brakes fail to release (or slow release) due to:
   A. Bound up brake pedal linkage.
   B. Weak brake shoe return springs, or rusty bosses on backing plate.
   C. Power brake unit troubles due to:
      a. Faulty residual check valve.
      b. Excessive hydraulic plunger seal friction.
      c. Faulty compensating valve (Bendix).
      d. Excessive piston packing friction.
      e. Restricted air passage in vacuum piston.
      f. Restricted air cleaner.
      g. Sticky push rod plunger (Bendix).
      h. Sticky air valve (Moraine).
      i. Broken piston return spring.
      j. Broken air valve return spring.
      k. Broken push rod plunger return spring (Bendix).

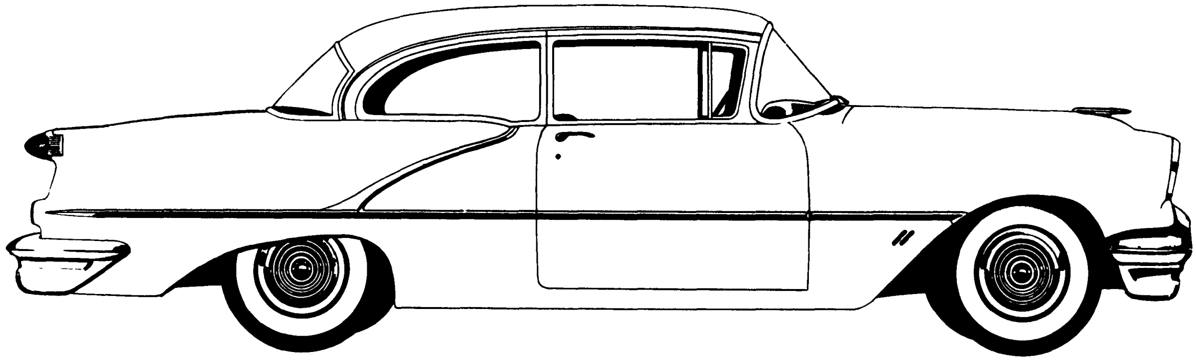
BRAKE SPECIFICATIONS

Subject and Remarks

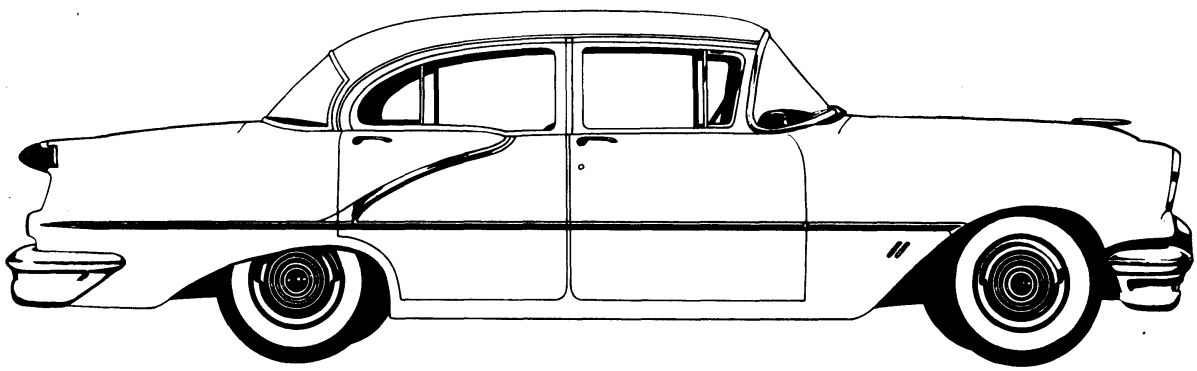
1. BRAKING AREA (FOOT BRAKES) . . . . 191.7 sq. in.
2. DRUMS
   a. Material-Braking Surface . . . . Cast Iron
   b. Inside Diameter . . . . 11"
   c. Maximum Out of Round . . . . .015"
   d. Clearance between Brake Lining and Drum
      (when new or newly adjusted) . . . . .015"
3. FLUID . . . . GM No. 11
4. LINING
   a. Length
      1. Front Primary (Forward Shoe) . . . . 9-3/8"
      2. Front Secondary (Rear Shoe) . . . . 12-1/32"
      3. Rear Primary (Forward Shoe) . . . . 9-3/8"
      4. Rear Secondary (Rear Shoe) . . . . 12-1/32"
   b. Width
      1. Front . . . . 2-1/2"
      2. Rear . . . . 2"
   c. Thickness
      1. Front . . . . 7/32"
      2. Rear . . . . 7/32"
5. RATIO (Percentage of Braking Effect)
   a. Front Brakes 56%
   b. Rear Brakes 44%
6. WHEEL CYLINDER BORE
   a. Front Wheel Cylinder . . . . 1-3/32"
   b. Rear Wheel Cylinder . . . . 31/32"
7. MASTER CYLINDER BORE (Standard Brake) . . . . 1"
8. PEDAL LASH (Standard Brake) . . . . 3/16"

BRAKE TORQUE TIGHTNESS CHART

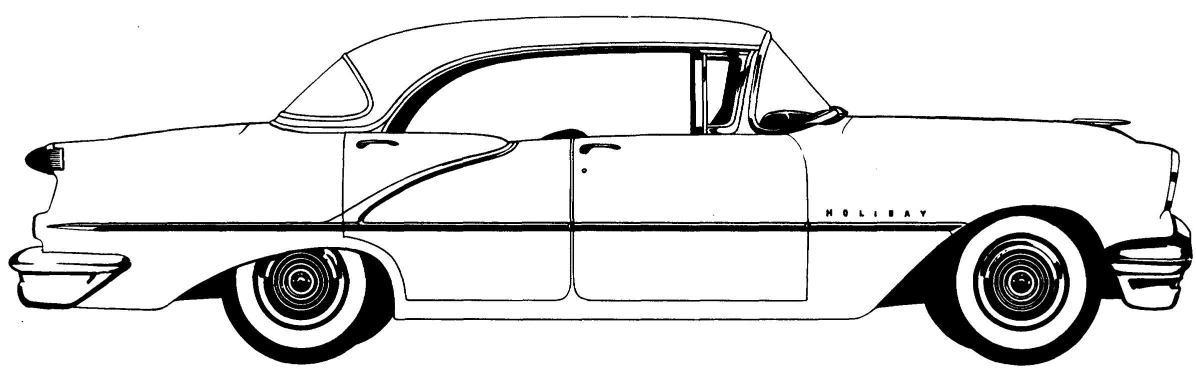
Application	Ft. Lbs.
1. Brake Line Fittings	8-12
2. Front Brake to Steering Knuckle Bolts & Nuts	35-40
3. Master Cylinder Filler Cap (Standard Brake)	20-35
4. Master Cylinder Filler Cap (Power Brake)	Finger Tight
5. Master Cylinder to Bracket Bolts & Nuts	55-60
6. Master Cylinder Bracket to Frame Bolts & Nuts	20-25
7. Power Brake to Cover Plate Bolts & Nuts	12-15
8. Rear Brake Backing Plate to Axle Housing Nuts	50-55
9. Rear Brake Cable Anchor to Backing Plate Bolts	10-12
10. Rear Brake Cable Support-Clamps to Frame Bolt & Nut	11-14
11. Pedal Rod Nut	20-25



88 2-DOOR SEDAN (K)



88 4-DOOR SEDAN (S)



88 HOLIDAY SEDAN (HS)

ENGINE

CONTENTS OF SECTION 8

The Rocket Engine is of the overhead valve type, having two banks of cylinders at a 90° angle. Pressure lubrication is supplied by a gear type oil pump driven off the lower end of the distributor shaft. The engine cooling system is of the pressure type employing a 7 lb. pressure radiator cap. The water pump is a centrifugal type, and circulation is controlled by a thermostat located in the water outlet on the intake manifold. Full length water jackets allow the engine coolant to completely surround all cylinders.

MANIFOLDS

The intake manifold for both banks of cylinders is of one casting, while each bank has a separate exhaust manifold.

Preheating of the gasoline mixture is obtained by the center exhaust gas passage which directly connects the two exhaust manifolds, allowing the hot exhaust gases to circulate around the intake manifold heater body.

Cast integral with the intake manifold at the front is a passage which returns the water from the two heads to the water outlet and the radiator core.

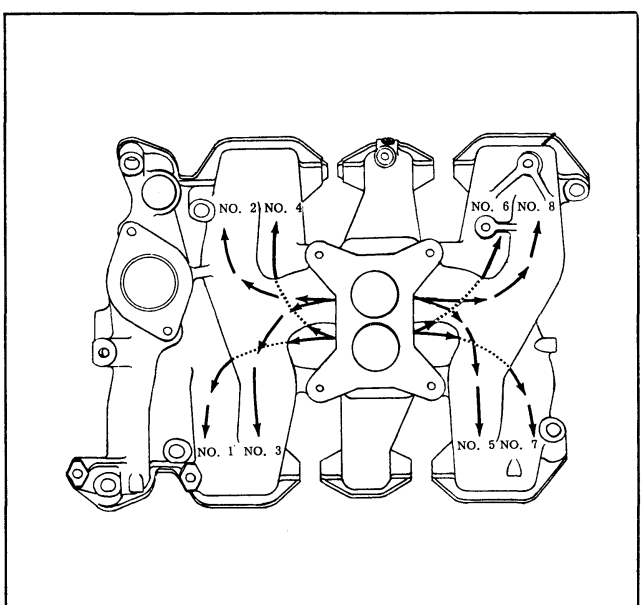


Fig. 8-1 Two Barrel Manifold

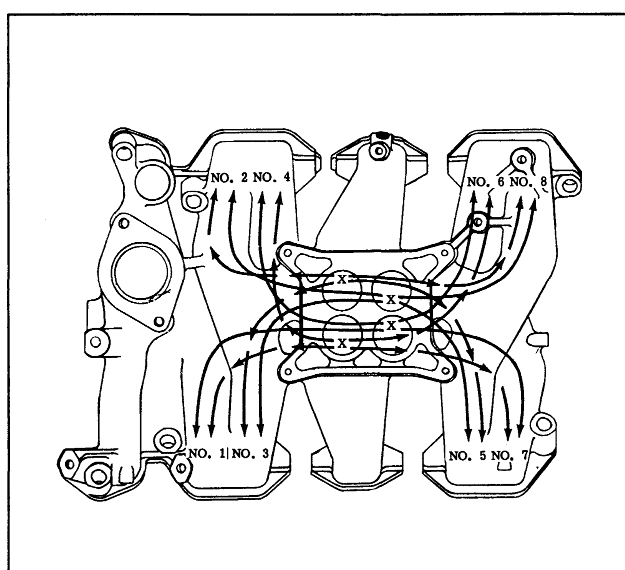


Fig. 8-2 Four Barrel Manifold

INTAKE MANIFOLD—REMOVE

1. Drain radiator, then disconnect upper radiator hose from water outlet.
2. Remove air cleaner.
3. Disconnect wires from spark plugs.
4. Disconnect spark plug wire supports from cylinder heads.
5. Remove distributor cap, then lift cap and high tension wire assembly (with supports) from engine.
6. Disconnect throttle linkage.
7. Remove carburetor fuel line and two vacuum lines.
8. If equipped with power brakes, disconnect brake vacuum line.
9. Disconnect primary wiring from coil.
10. If equipped with power steering, remove power steering pump and bracket as an assembly.
11. Remove intake manifold with coil and carburetor attached.
12. Clean cylinder head and manifold machined surfaces.

Choke Heater Tube—Remove and Install (Manifold Removed) FIG. 8-3

1. Remove pipe plug from right side of intake manifold just below manifold to carburetor pipe passage.
2. Apply penetrating oil to both ends of heat tube.
3. Using Tool BT-47, drive tube out through pipe plug hole.

To install choke heater tube:

1. Install tube through pipe plug hole, inserting the small necked end of tube first.
2. Using Tool BT-47, drive heat tube into place until large end of tube is either flush or protruding about 1/16" into manifold to carburetor pipe passage. If passage is blocked it will cause malfunction of the automatic choke.
3. Replace pipe plug in manifold.

INTAKE MANIFOLD—INSTALL

1. Reverse sequence of removal operations, using new graphite coated metal gaskets. Apply Permatex #3 sealer or equivalent around gasket water holes.
2. Dip threads of intake manifold bolts in C.P. No. 9 Sealer (Nat. Machine Prod. Co.).
3. If equipped with power steering, adjust belt tension. (30 ft. lbs. torque)

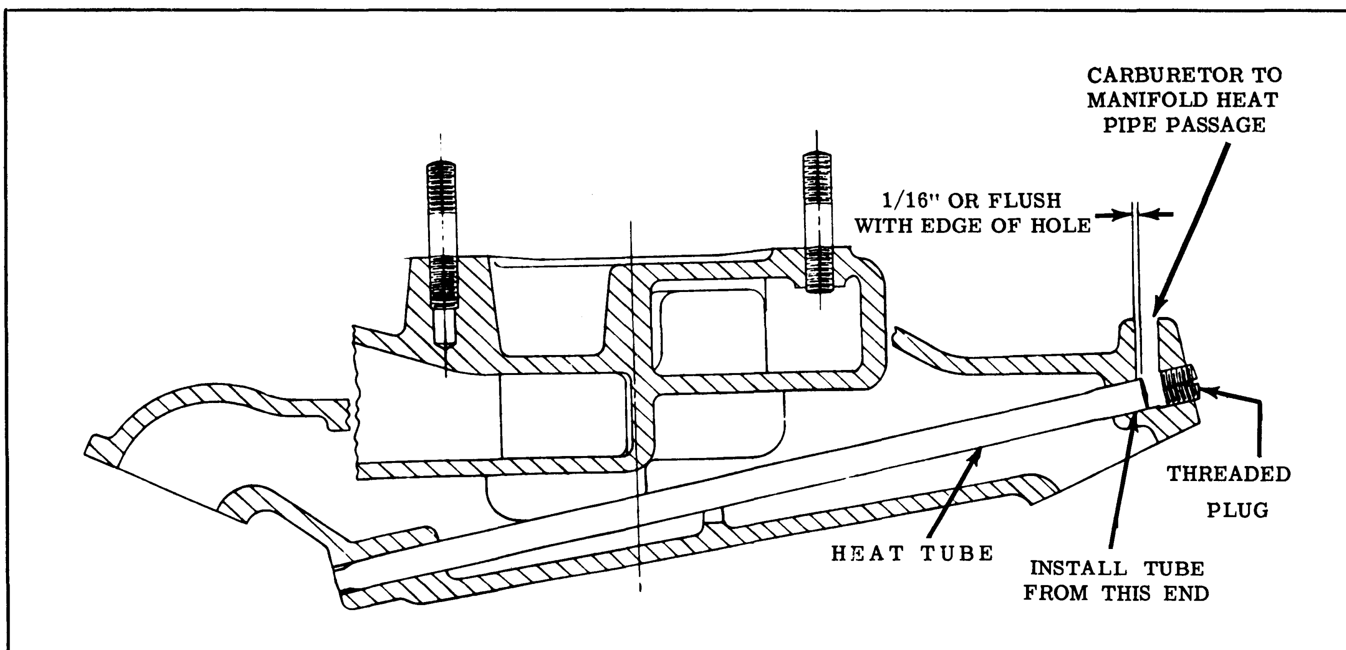


Fig. 8-3 Choke Heater Tube

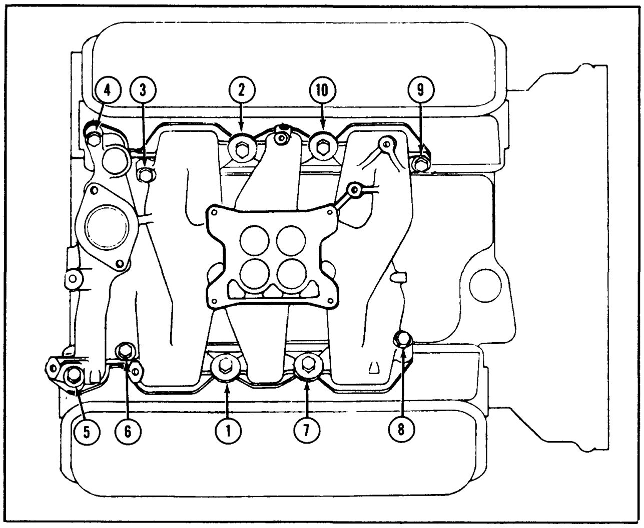


Fig. 8-4 Intake Manifold Torque Sequence

4. After installation of manifold is completed, adjust throttle linkage.

MANIFOLD HEAT CONTROL VALVE FIG. 8-5

The manifold heat control valve assembly is mounted on the left exhaust manifold. This automatically controlled valve regulates the amount of heat by-passed through the intake manifold so that a sufficient amount of heat is transferred to insure a uniform vaporization of the intake mixture under all operating conditions.

The offset valve, counterweight, and thermostat are calibrated to give proper intake manifold heat under all driving conditions.

Removal

The manifold heat control valve can be removed by disconnecting the crossover pipe to L.H. exhaust manifold attaching nuts (on cars with the single exhaust system) or by disconnecting the L.H. exhaust pipe to manifold (on cars with the dual exhaust systems). FOR CHECKS AND SERVICE PROCEDURES OF THE MANIFOLD HEAT CONTROL VALVE, REFER TO ENGINE TUNE-UP SECTION, STEP 11.

NOTE: Always use new gaskets and Seez-Pruf nuts when replacing the heat control valve. Torque exhaust pipe to manifold nuts 20-25 ft. lbs.

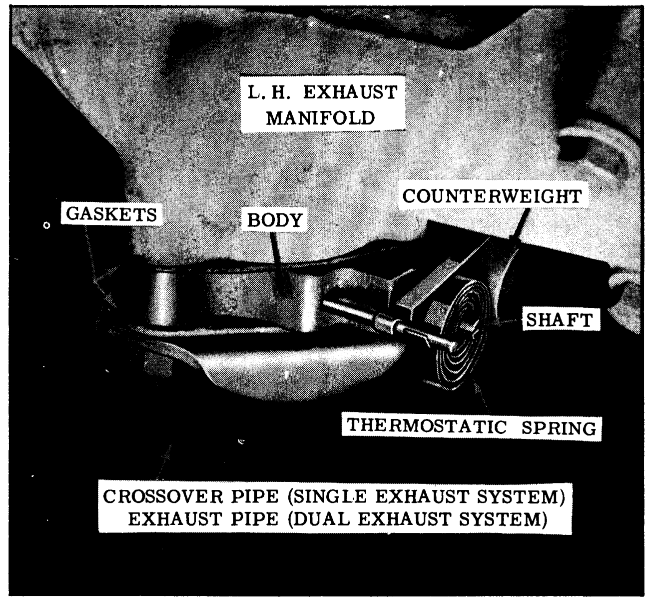


Fig. 8-5 Manifold Heat Control Valve

EXHAUST MANIFOLD AND/OR GASKETS—REMOVAL AND INSTALLATION (ON CAR)

1. Drain cylinder bank.
2. Disconnect exhaust pipes.
3. R.H. Manifold - Remove generator and bracket.
4. Remove manifold to head attaching nuts and bolts.
5. Remove manifold and gaskets from studs.
6. Clean manifold and cylinder head machined surfaces.

To replace, reverse the above procedure. If manifold studs show signs of coolant leakage, remove studs and apply C.P. No. 9 sealer (Nat. Machine Prod. Co.) to stud threads. Torque manifold to head bolts and nuts to 19-25 ft. lbs.

HEAD AND VALVE MECHANISM

VALVE SPRING REPLACEMENT (ON CAR) FIG. 8-6

To replace a worn or broken valve spring without removing the cylinder head, proceed as follows:

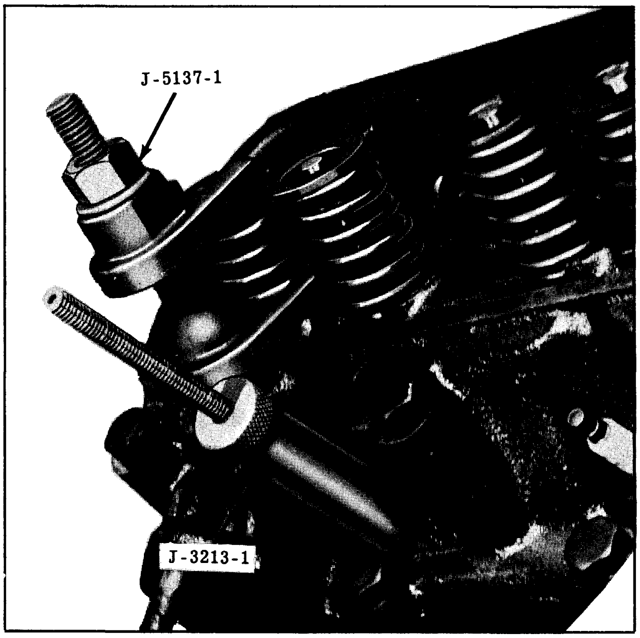


Fig. 8-6 Valve Spring Replacement (On Car)

1. Remove rocker arm shaft assembly.
2. Remove spark plug and install Tool J-3213-1 into the spark plug hole to hold the valve against its seat.
3. Using Tool J-5137-1, compress the valve spring until valve keys are accessible, then remove keys, spring retainer cup, and spring and damper assembly. (See Fig. 8-7)

   NOTE: When replacing spring, place closely wound coils toward cylinder head.

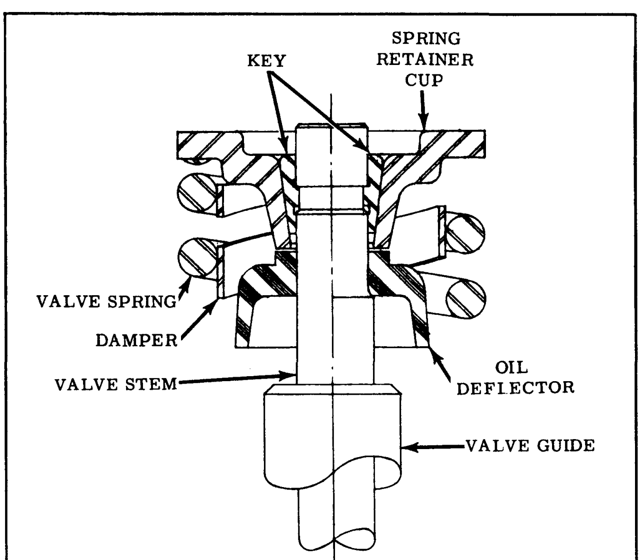


Fig. 8-7 Valve Assembly

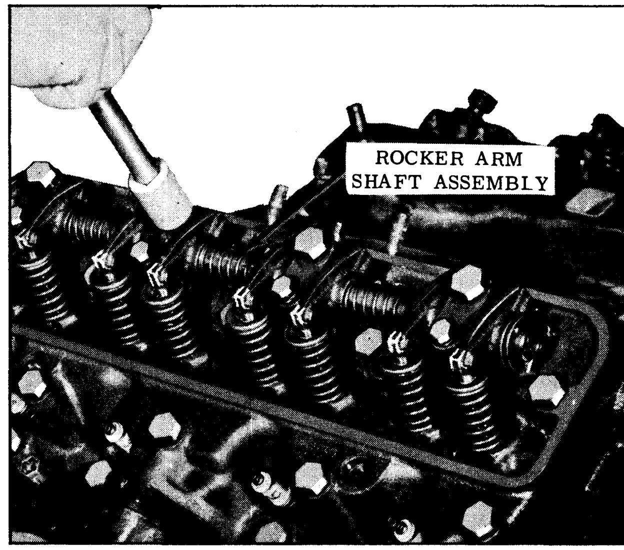


Fig. 8-8 Removing Rocker Arm Shaft Assembly

ROCKER ARM SHAFT ASSEMBLY
Removal and Installation

1. Remove valve cover.
2. Remove rocker arm and shaft assembly. (See Fig. 8-8)

When installing rocker arm and shaft assembly, tighten all bolts evenly. Before bolts are snug, align assembly, then torque small bolts 14-17 ft. lbs. Torque large bolts 65-70 ft. lbs.

Disassemble and Assemble

1. Remove cotter keys, flat washer, and wave washers.
2. Remove rocker arms, brackets, and springs from shaft.

   NOTE: One bracket is doweled to each shaft and should not be removed unless replacement is necessary.
3. Assemble rocker arm shaft assembly as shown in Fig. 8-9.

CYLINDER HEAD—REMOVE

1. Drain radiator and cylinder block.
2. Remove intake manifold.
3. Remove generator.
4. Disconnect exhaust pipes.
5. Remove valve cover.
6. Remove rocker arm shaft assembly.
7. Remove push rods and place in Engine Valve Parts Rack, Tool BT-27.

IMPORTANT: To assure satisfactory service, it is necessary that valve seat width be maintained within specifications. (Intake and exhaust .042"-.071"). A 15° cutter should be used to narrow the seat as necessary. Lapping in with grinding compound is not recommended.

Valve lifters should be disassembled and cleaned at time of valve reconditioning.

NOTE: 1956 intake and exhaust valves are longer than past model Rocket engine valves and identified by the part number forged under the head of the valve. The exhaust valve head diameter has been increased 1/8".

CYLINDER HEAD—ASSEMBLE

1. Install valves in their respective guides and place the holding plate (part of Tool BT-14) over valve heads to hold them in place.
2. Install new oil deflectors over valve stem. Force deflectors down as far as possible on valve stem. Note: The deflectors will correctly position themselves when the engine is started.
3. Place cylinder head in spring compressor and install valve springs and dampers.

   NOTE: Install closely wound spring coils toward cylinder head.
4. Install valve lock retainer cups, then compress springs.
5. Install valve stem keys.
6. Remove head from tool and check valve springs and keys to be sure they are properly seated.
7. Replace exhaust manifold using new gaskets.
8. Set spark plug gap to .030" and reinstall plugs.

CYLINDER HEAD—INSTALL

1. Install cylinder head guide studs, Tool No. J-3455, in cylinder head bolt holes at each end of block.
2. Apply a coat of P.O.B. No. 4 Gasket Sealer to both sides of gasket and place gasket over dowels.
3. Place cylinder head in position and install the center and lower row of attaching bolts finger tight, after removing guide studs.
4. Install push rods and rocker arm shaft assembly making sure that the push rods are properly seated in the rocker arms and valve lifters.
5. Tighten rocker arm shaft bracket and cylinder head attaching bolts in sequence as shown in Fig. 8-11. The cylinder head to block bolts should be torqued 65 to 70 ft. lbs. Tighten the rocker shaft bracket to cylinder head bolts 14 to 17 ft. lbs.

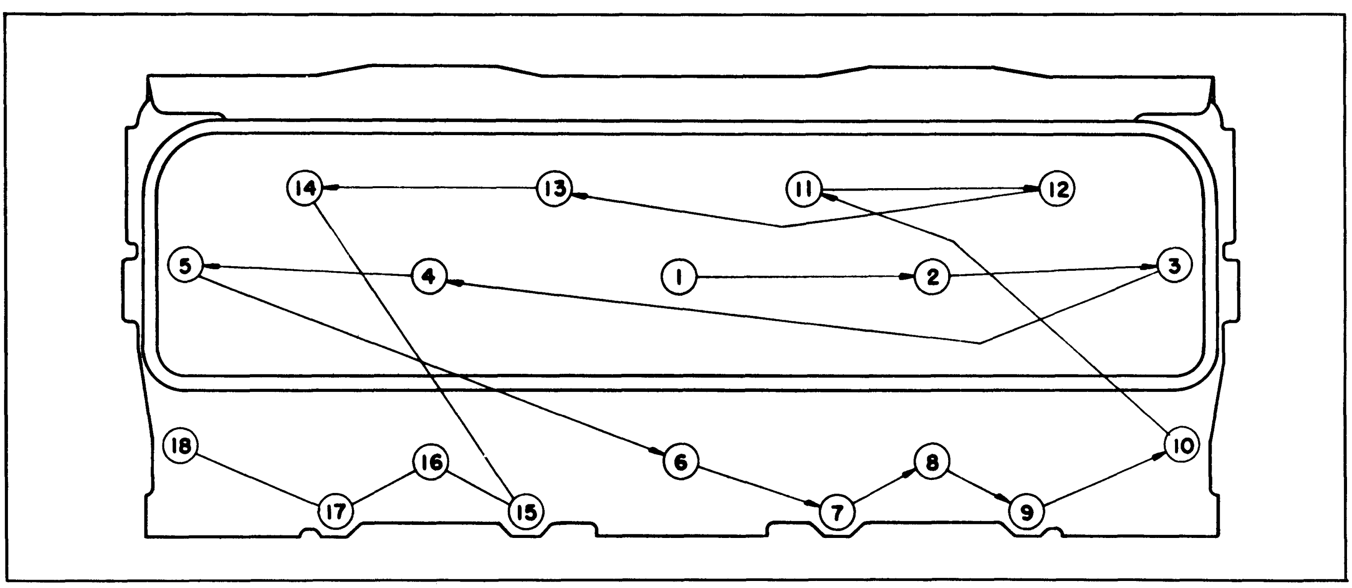


Fig. 8-11 Head Bolt Torque Sequence

6. Cement new gasket to valve cover, then install cover.
7. Connect exhaust pipes to exhaust manifold using new gaskets. (Torque 20 to 25 ft. lbs.)
8. Replace generator, and polarize after wires are connected. (See Polarizing Generator in ELECTRICAL SECTION.)
9. Install intake manifold as outlined under INTAKE MANIFOLD. (Torque 22-26 ft. lbs.)

VALVE LIFTER OPERATION FIG. 8-12

Oil is supplied to the lifter through the hole in the side of the lifter body which indexes with the hole in the lifter plunger. As force is applied to the push rod seat, little movement of the plunger takes place because the plunger can only be depressed very slowly. This is because the oil in the base of the lifter body holds the ball check valve against its seat, leaving only the small clearance between the plunger and the lifter body for the slow escape of the trapped oil. That is the action which takes place when the lifter rides up on the lobe of the cam to open a valve.

When force is removed from the push rod seat, the retainer spring quickly moves the plunger back (up) to its original position. This movement causes the ball check valve to open against the ball spring and oil from within the plunger is drawn into the base of the lifter.

Automatic adjustment of the hydraulic valve lifter takes place on every revolution of the cam. Each time the valve is opened, the lifter bleeds down slightly. This bleed-down is the result of the force of the valve spring which is exerted on the plunger through the rocker arm and push rod.

As the cam continues to turn, the lifter returns to the base circle and the valve closes, removing the force of the valve spring from the plunger. The retainer spring forces the plunger back up, and the ball check valve unseats and allows the base of the lifter to refill. This restores the lifter to zero lash.

NOTE: The 1956 valve lifters can be identified by a groove around the upper outside diameter of the lifter body.

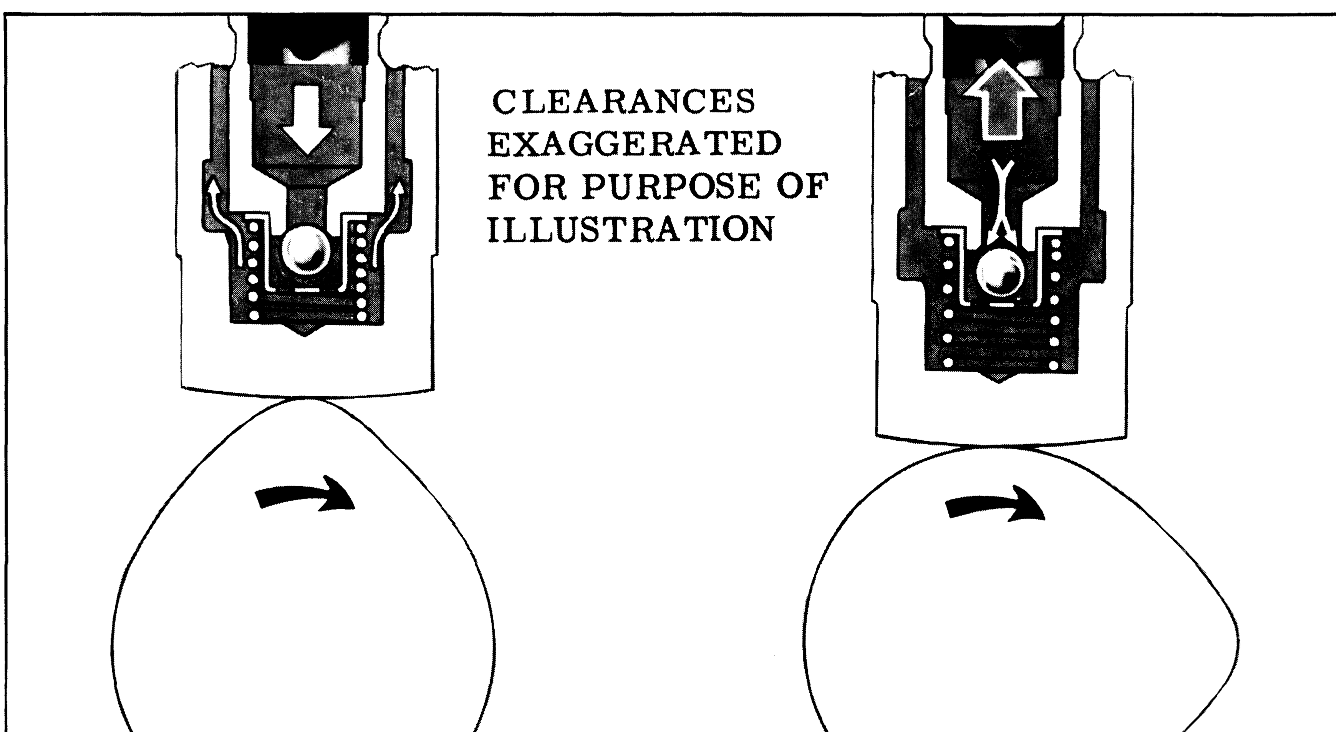


Fig. 8-12 Lifter Action On Cam

VALVE LIFTERS

Remove and Install

1. Remove intake manifold.
2. Remove engine top cover.
3. Remove valve covers.
4. Remove rocker arm shaft assemblies.
5. Remove push rods.
6. Remove valve lifters.

   IMPORTANT: Valve lifters and push rods should be placed in rack BT-27 in their proper sequence so they can be reinstalled in their same position in the cylinder block.

Reverse removal procedure for installation. Check lifters for free movement in the bore and to see that there is no perceptible side play.

Disassemble and Clean

1. Remove retainer spring with Tool BT-31.
2. Remove push rod seat.
3. Submerge lifter body in "D-Carb" solvent, using Tool BT-82 to unseat ball check.
4. Work plunger up and down with Tool BT-82. If plunger is stuck tight, allow lifter to soak in solvent for approximately 5 minutes, tapping on end of Tool BT-82 with a soft hammer if necessary. Tool BT-38 may be used if plunger does not fall out. (See Fig. 8-13)

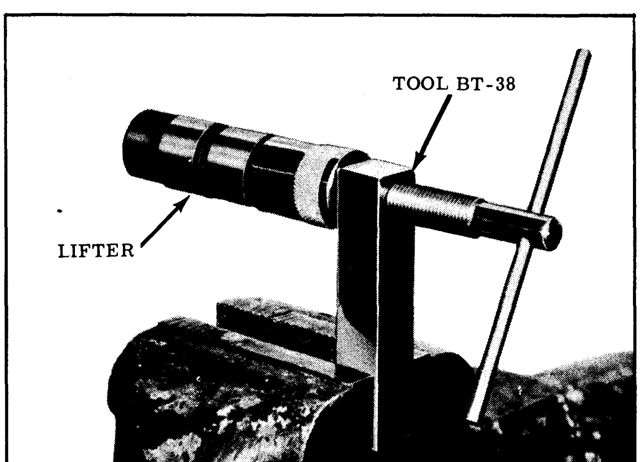


Fig. 8-13 Removing Plunger

   NOTE: "D-Carb" should be used in a well ventilated room. Avoid contact with skin and prolonged breathing of fumes.

5. After lifters are disassembled, all parts should be cleaned in clean solvent, using cleaning brush J-5099. A small particle of foreign material under the ball check valve will cause malfunctioning of the lifter. Close inspection should be made for nicks, burrs, or scoring of parts. Ball, ball retainer, springs, push rod seat, and snap ring are interchangeable and can be replaced individually. Body and plunger are selectively fitted at the factory for proper leak-down rate and must not be interchanged or replaced individually. If either the body or plunger is defective, replace with a new lifter assembly.

NOTE: Whenever lifters are removed, always check the lifter foot for wear as follows:

1. Place a straight edge across the lifter foot.
2. While holding the lifter at eye level, check for light between the straight edge and lifter foot.
3. If the light indicates a flat or concave surface of the lifter foot, the lifter should be replaced and the camshaft

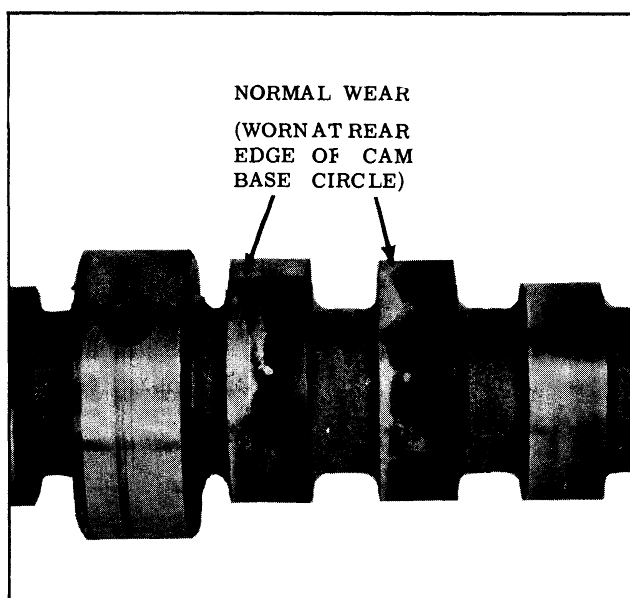


Fig. 8-14 Cam Shaft Wear

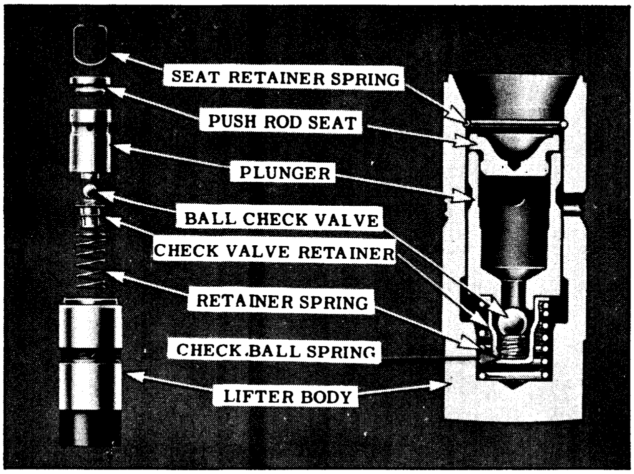


Fig. 8-15 Hydraulic Valve Lifter

inspected for wear. Wear at the REAR edge of the cam base circle is NORMAL. (See Fig. 8-14) The camshaft should be replaced ONLY when lobes are worn at FRONT edge of base circle.

Valve Lifter—Assemble

1. Place plunger over push rod seat.
2. Drop small spring and ball into check valve retainer. (See Fig. 8-15)
3. Hold check valve retainer as shown in Fig. 8-16, then lower plunger over ball so that it is seated properly.
4. Invert the assembly, then place check valve retainer spring over retainer.
5. Carefully assemble valve lifter body over the complete assembly.
6. Turn assembly over and tap gently on a wooden surface to make certain the plunger spring is in proper position in the bottom of the lifter body bore.

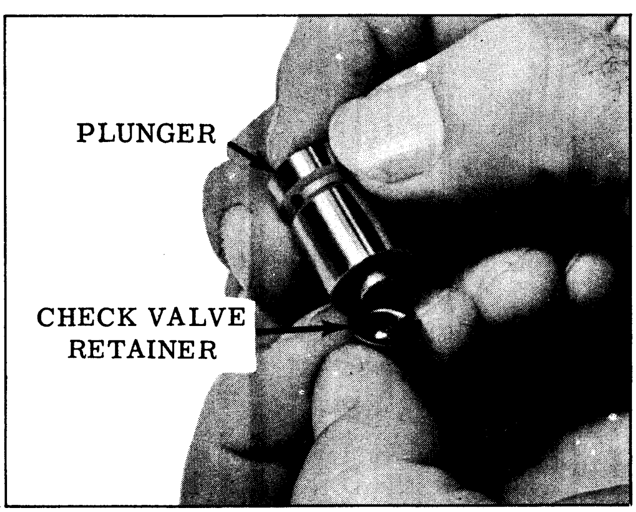


Fig. 8-16 Assembling Retainer and Plunger

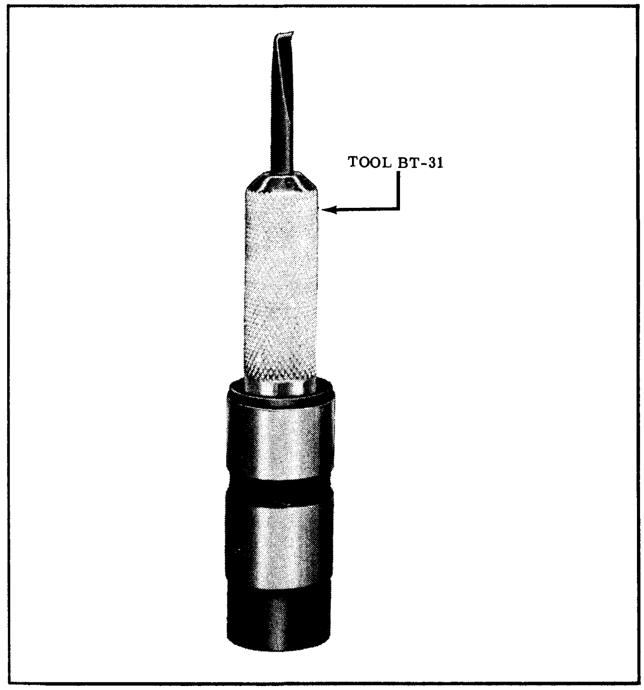


Fig. 8-17 Installing Lock Spring

7. Hold push rod seat down and install retaining lock spring, using Tool BT-31. (See Fig. 8-17)

Valve lifters in production engines may be one of five sizes: Standard, .001", .002", .003", or .005" oversize. It is important when replacing valve lifter assemblies that the proper size lifter be ordered. An identification numeral is etched on all lifter bodies except standard. The cylinder block is marked 1, 2, 3, or 5 for lifter size on the rail under the engine top cover. No mark indicates standard size lifter.

Valve Lifter Leak-Down

NOTE: Before checking leak-down, make sure that lifter is clean, dry, and free of varnish. Cleaning fluid or engine oil left in the lifter would affect leak-down rate through viscosity change of the testing fluid.

1. Fill fixture reservoir BT-60 with hydraulic lifter test fluid J-5268.

   CAUTION: Be sure fluid and reservoir are perfectly clean.
2. Place 1/4" steel ball into push rod seat of lifter.

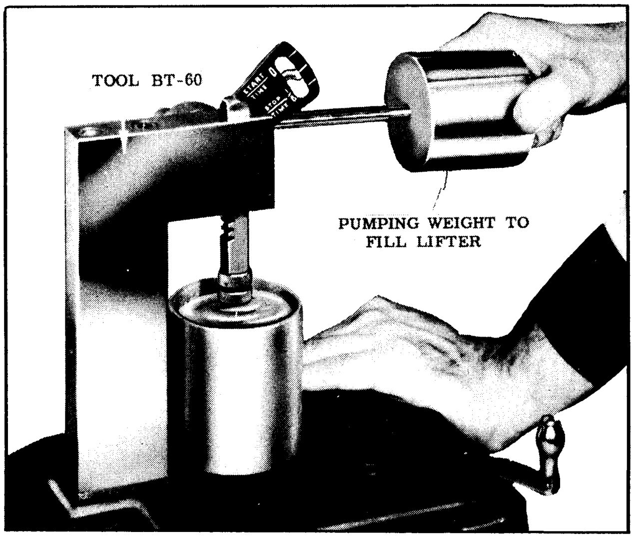


Fig. 8-18 Filling Lifter

3. Insert lifter into fixture reservoir. (Fluid should cover lifter at all times.)
4. Fill lifter by pumping until sponginess has disappeared and air bubbles have ceased. (See Fig. 8-18) If lifter will not pump up, it will be necessary to rebuild or replace lifter.
5. Start test by resting ram on steel ball. Rotate reservoir 1 revolution each 2 seconds and time the indicator from the start to the stop line. Allowable tolerance for leak-down rate is 12 to 55 seconds.

   NOTE: Leak-down tolerance for new lifters is 15 to 55 seconds. Part numbers of lifters to be used for 1956 replacement are as follows:

   5231380 (Standard Dia.)
   5231381 (.001" Oversize)
   5231382 (.002" Oversize)
   5231383 (.003" Oversize)
   5231385 (.005" Oversize)

VALVE LIFTER DIAGNOSIS

1. MOMENTARILY NOISY WHEN CAR IS STARTED:

   This condition is normal. Oil drains from the lifters holding the valves when the engine is not running. It will take several seconds for the lifter to fill after the engine is started.
2. INTERMITTENTLY NOISY ON IDLE ONLY, DISAPPEARING WHEN ENGINE SPEED IS INCREASED:

   Intermittent clicking can be caused by a worn rocker arm.

   Correction: Proceed as in step 3b.

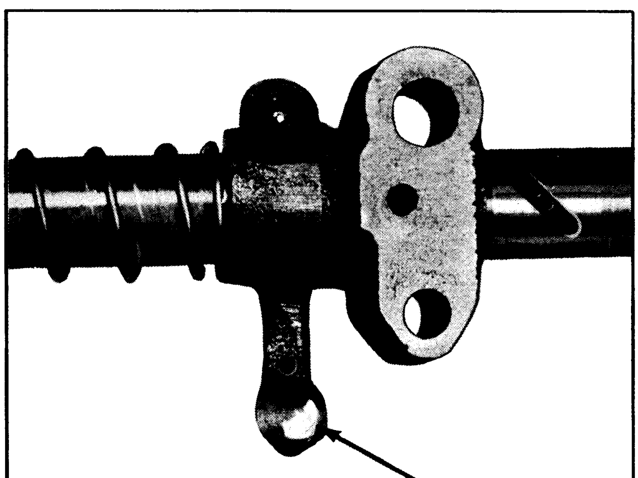
   Intermittent clicking is an indication of a bad ball.

   Correction: Clean the lifter or replace the ball.
3. NOISY AT IDLE AND LOW SPEED, QUIET ABOVE 35 M.P.H.:
   a. Insert a .015" feeler gauge between the rocker arm and valve stem. If noise momentarily disappears and then reappears after a few seconds with the feeler still inserted, it is an indication that the lifter "leak-down" rate" is too fast.

   Correction: The lifter must be replaced.

   b. Insert the .015" feeler between the rocker arm and the rocker arm bracket. If noise disappears, the rocker arm face is off-square or worn so that the arm alternately moves away from the bracket when the valve opens and then snaps back against it when the valve closes.

   Correction: The following procedure is recommended whenever it is suspected that rocker arms are causing excessive valve mechanism noise:



POSITION SIDE WITH HEAVY WEAR PATTERN TOWARD BRACKET

Fig. 8-19 Rocker Arm Wear Pattern

Remove rocker shaft assemblies and observe the appearance of the wear pattern on the arms where they contact the valve stems. If an "off-square" wear pattern is noted on one or more of the arms, and the heavy side of the pattern is AWAY from the adjacent rocker shaft bracket, move the arm to the opposite side of the bracket. (See Fig. 8-19)

NOTE: If the pad is badly worn, the arm should be replaced.

c. Noise can be caused by an "off-square" valve spring or a broken valve spring damper.

Correction: If noise can be stopped by pressing on side of spring with gloved hand, hold the valve stationary with Tool J-3213-1, then rotate the valve spring. If noise still exists, check for a broken damper.

4. NOISY AT HIGH CAR SPEEDS AND QUIET AT LOW SPEEDS:
   a. High oil level - Oil level above the "Full" mark allows crankshaft counterweights to churn the oil into foam. When foam is pumped into the lifters they will become noisy since a solid column of oil is required for proper operation.

   Correction: Drain oil until proper level is obtained. See LUBRICATION SECTION.

   b. Low oil level - Oil level below the "Add 2" mark allows the oil pump to pump air at high speeds which results in noisy lifters.

   Correction: Fill until proper oil level is obtained. See LUBRICATION SECTION.

5. VALVES NOISY REGARDLESS OF ENGINE SPEED:

   Correction: This condition can be caused by any of the following factors:

   a. With transmission in neutral and parking brake on, run the engine at a high speed. If a foreign particle in the lifter is restricting proper operation, this method sometimes proves successful in dislodging the particle. If this method does not quiet the lifter, strike the rocker arm above the push rod with a mallet while the engine is idling. This method of correction has proven successful for dislodging a foreign particle which is preventing the ball from seating properly.
   b. If the noise still persists, proceed as in Step 3b.
   c. Check for valve lash by turning engine so the piston in that cylinder is on T.D.C. of firing stroke. If valve lash is present, the push rod can be freely moved with the fingers up and down a certain amount with rocker arm held against valve.

   Valve lash indicates one of the following:

   1. Worn push rod.
   2. Worn rocker arm.
   3. Lifter stuck in down position (due to dirt or varnish.)
   4. Defective lifter.

Checking of the above four items.

Remove the rocker arm shaft assembly, then proceed as follows:

1. Observe upper end of push rod. Excessive wear of the spherical surface indicates one of the following conditions:
   a. Improper hardness of the push rod. The rod must be replaced.
   b. Improper lubrication to the push rod. The push rod and rocker arm must be replaced. The oiling system to the push rod should be checked.
2. If push rod appears in good condition and has been properly lubricated, replace rocker arm and recheck valve lash.

3 & 4. If valve lash exists and push rod and rocker arm are O.K., trouble is in lifters. Lifter should be rebuilt or replaced.

OIL PAN AND PUMP

REMOVE AND INSTALL

1. Loosen starting motor.
2. Remove exhaust crossover pipe.
3. Disconnect idler arm support from frame.

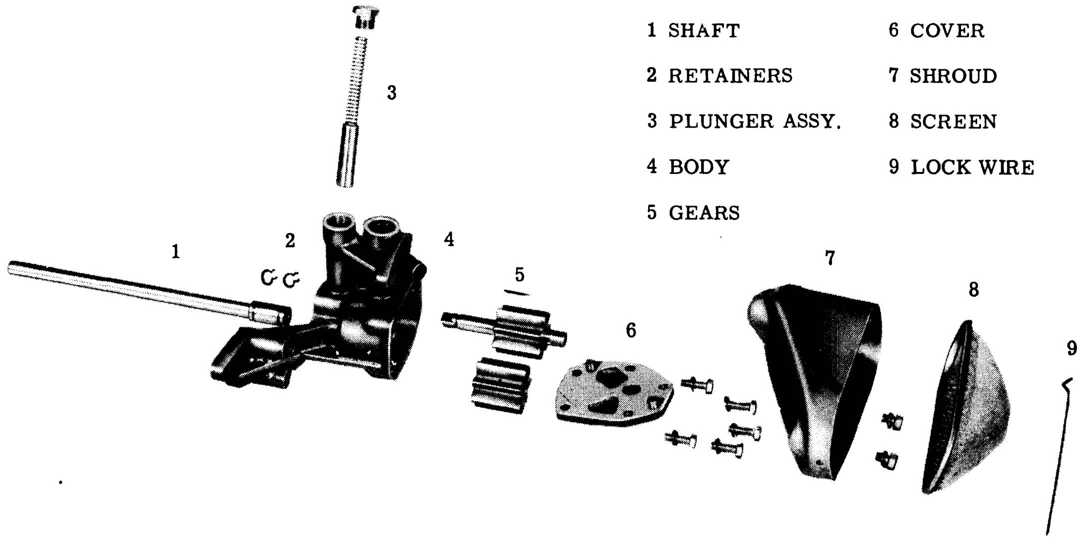


Fig. 8-20 Oil Pump Assembly Detail

4. Remove oil pan.
5. Clean oil pan.

When replacing the oil pan, always use new gaskets and new seals. The cork gaskets should be cemented to the pan and the front and rear synthetic rubber seals assembled to the pan. A coat of special lubricant #563598 should be put on the exposed surface of the seals to insure that the seals maintain their proper position in the pan and do not hang up on the front cover and rear main bearing sealing surfaces during oil pan installation. Oil pan bolts should be tightened evenly 9 to 11 ft. lbs. torque.

OIL PUMP

Whenever the oil pump is disassembled, the parts should be cleaned and inspected for wear or scoring. The pressure relief valve spring tension should be 10 lbs. 5 ozs. to 11 lbs. 5 ozs. at 2-7/16" length. Pressure relief valve clearance in bore should be .0025" to .005". Too much clearance can affect oil pressure at idle. (The oil pressure warning light on the instrument panel is calibrated to light when oil pressure is less than 3 lbs.) End clearance of gears should be .0025" to .0065".

OIL PUMP— DISASSEMBLE AND ASSEMBLE

1. Remove oil pan.
2. Remove oil pump.
3. Remove oil screen lockwire and screen. (See Fig. 8-20)
4. Remove oil screen shroud.
5. Remove extension shaft and coupling by removing lower snap ring from coupling.
6. Remove oil pump cover.
7. Remove oil pump gears.
8. Remove oil pump pressure regulator nut, spring, and valve.

To assemble oil pump, reverse the above procedure.

CONNECTING ROD AND PISTON ASSEMBLY

ROD AND PISTON ASSEMBLY—REMOVE

1. Remove cylinder head or heads.
2. Remove oil pan.

   IMPORTANT: If more than one piston and rod assembly is to be removed, the corresponding cylinder number should be stamped on the machined surfaces of the connecting rod and cap (on side opposite spit hole) for identification when reinstalling.

CAUTION: To prevent damage to the rods the stamping operation must be performed while the connecting rods are still attached to the crankshaft.

3. Remove the carbon ridge at the top of the cylinder bore before attempting to remove the piston and rod assembly.
4. Place guide Tool BT-22 over the threads of connecting rod bolts to prevent damaging the bearing journals, then tap rod and piston assembly up through the cylinder bore. (See Fig. 8-21) Pistons must always be removed from the top of the cylinder block.

RECONDITIONING CYLINDER BORE

Determine size of cylinder bore with inside micrometers.

Reconditioned cylinder bores should be held to not more than .001" out of round and .001" taper. (Larger at the bottom)

It is important that reconditioned cylinder bores be thoroughly washed with a large brush and a soap and water solution to remove all traces of abrasive material: otherwise rapid wear will result.

PISTON

Clean the pistons by scraping carbon off the top of the piston and immerse the pistons in a solvent. Deposits in the ring grooves should be removed by using a broken piston ring or a suitable groove cleaning tool.

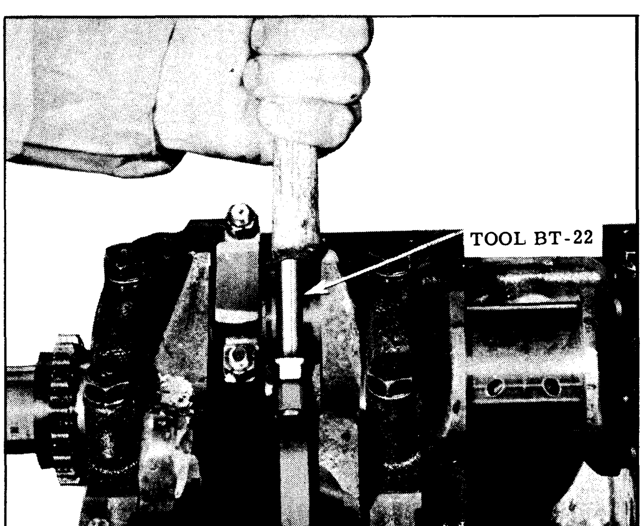


Fig. 8-21 Connecting Rod Bolt Guide

Fig. 8-22 Measuring Piston

Measuring Piston

When measuring pistons for size, the measurement must be made on the top and bottom of the skirt at 90^o to the piston pin hole (with the piston pin removed). (See Fig. 8-22) The largest reading must be at the bottom of the skirt. The allowable taper is .000"-.001".

Fitting Piston

NOTE: The piston and cylinder bore must be free of oil and at the same temperature.

1. Place a 1/2" x 12" x .0015" ribbon attached to scale HM-593-A against the upper side of the bore, at 90^o to the normal piston pin location. (See Fig. 8-23)
2. Insert piston (with pin and rings removed) into bore with head downward.
3. While holding the piston in the center of its normal travel, slowly pull the scale in a straight line and note the reading on the scale. The reading should be within 5 to 12 pounds.

Each piston should be fitted to its individual cylinder and marked for that cylinder.

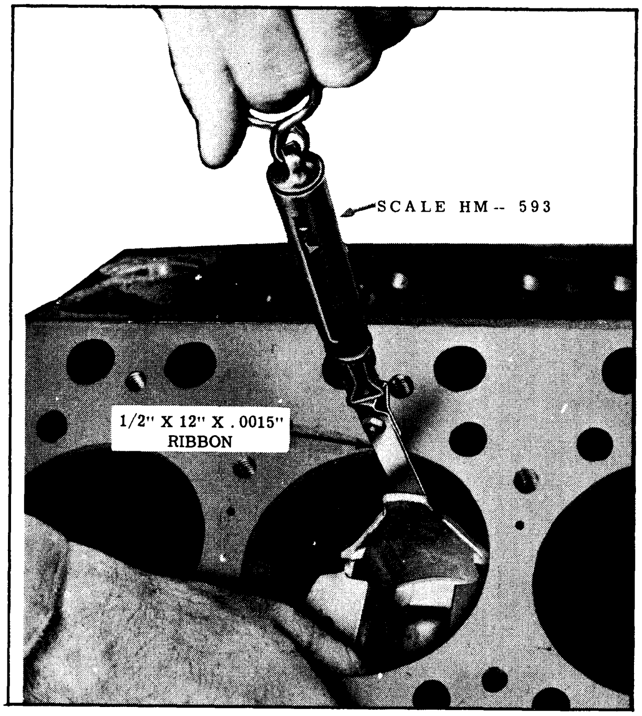


Fig. 8-23 Fitting Piston to Cylinder

PISTON PIN

Piston pins are available in three sizes - standard, .001", and .003" oversize. Honing of the piston pin hole for installation of oversize pins is the most satisfactory method of sizing.

The piston pin fit in the piston is .0000"-.0002" loose. If the clearance is to the high limit (.0002"), the pin can be inserted in the piston with very little hand pressure. The pin will not fall through the piston by its own weight. If the clearance is to the low limit (.0000"), considerable hand pressure will be required to insert the pin into the piston. By using a brass drift, the pin can be tapped into the piston. It is important that both the pin and piston pin hole be clean and free of oil (when checking pin fit), and that the piston pin hole is not more than .0005" out of round.

Whenever the replacement of a piston pin is necessary, the size pin required should be determined by trying standard, .001" or .003" oversize pin.

After the pin has been fitted to the piston, assemble the rod, piston, pin, and two new lock rings, then check the assembly for alignment.

CONNECTING ROD BUSHINGS

In rod bushing replacement, the bushing after having been pressed into the rod should be burnished and then finished to size with Rod Bushing Honing Tool KMO-754 or equivalent tool.

The fit of the piston pin in the connecting rod bushing should be .0003" to .0005" loose.

After new bushing is fitted with piston pin, the rod alignment should be checked and if outside of specifications, a new bushing must be installed. DO NOT attempt to correct alignment by bending rod.

CHECKING ROD ALIGNMENT

Check connecting rods on Connecting Rod Checking and Aligning Fixture, Tool J-3210 for alignment. The two points on the gauge must be square with the aligner face within .002" at both the top and side of pin in order for the rod to meet alignment specifications. (See Fig. 8-24) If rod is not properly aligned, a new rod must be used. NO ATTEMPT SHOULD BE MADE TO STRAIGHTEN THE ROD.

ROD AND PISTON—ASSEMBLE

All pistons have an "F" cast on the front side. There is also a notch cast in the top of the piston head at the front to facilitate checking for proper installation after assembly. The piston assemblies should always be installed with the notch toward the front of the engine.

The odd numbered piston assemblies

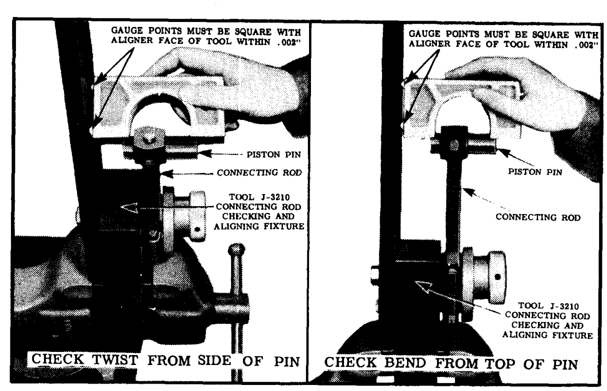


Fig. 8-24 Checking Rod Alignment

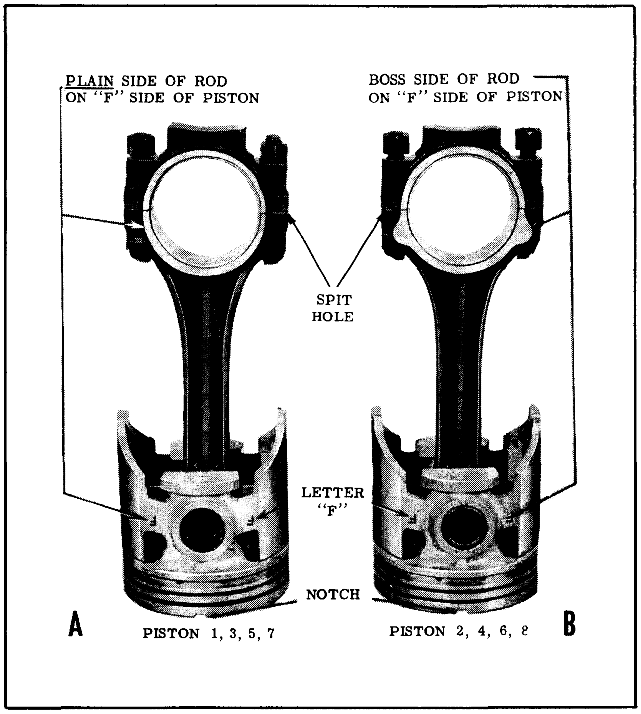


Fig. 8-25 Assembly of Rod to Piston

will always be installed in the left hand bank of cylinders, while the even numbered piston assemblies will always be installed in the right hand bank of cylinders.

One side of the connecting rod will have two machined bosses. (See Fig. 8-25) This side of the connecting rod and cap of two adjacent rods on each crankpin will always be facing each other.

This means that the machined bosses on the rod assemblies of the odd numbered piston assemblies will always be facing the rear of the engine, while the machined bosses of the even numbered piston assemblies will be facing the front of the engine.

RINGS

The pistons have three rings (two compression rings and one oil ring). Production rings are supplied from two sources and are of similar design. On both types of rings the outside diameter of top compression ring is chrome plated, the second compression ring is black, and the oil ring uses an expander.

To detei mine which make of production rings were installed in the engine, the following identification may be observed.

The Sealed Power compression rings have a chamfer on the inside of the ring. The Perfect Circle compression rings have a shoulder and a chamfer on the inside of the ring.

The following tolerances pertaining to production rings may aid in determining cause of malfunctioning rings.

Allowable Ring Gap

	Perfect Circle	Sealed Power
Oil Ring	.013"-.033"	.013"-.033"
Compression Ring	.010"-.020"	.008"-.016"

Allowable Side Clearance:

Oil Ring	.0023"-.0039"
Compression Rings	.001"-.003"

IMPORTANT: For service ring specifications and detailed installation instructions, refer to the instructions furnished with the parts package.

The following basic procedures apply to all ring installations regardless of make.

Piston Ring Gap

Each ring gap must be measured with the ring positioned squarely and at the bottom of the ring-travel area of the bore. (See Fig. 8-26)

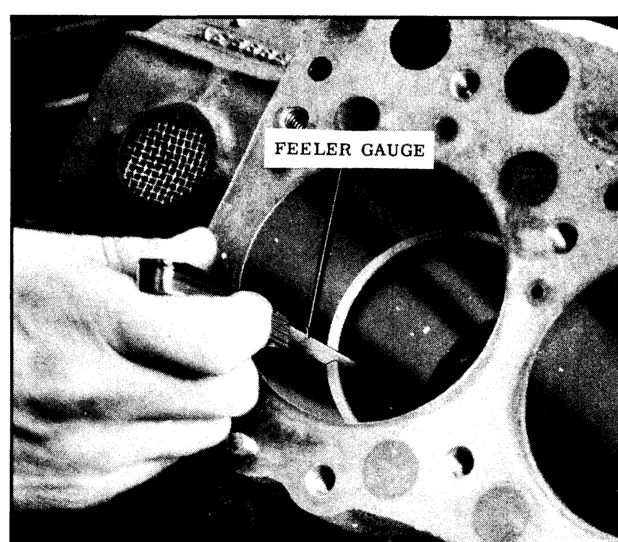


Fig. 8-26 Checking Ring Gap

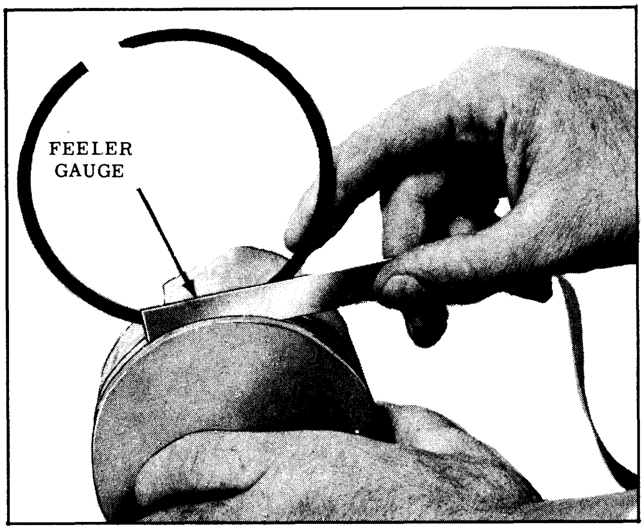


Fig. 8-27 Checking Side Clearance

If the gap measurement is less than specifications, file the ends of rings until the proper gap is obtained. Ends of rings must be filed square.

Side Clearance

Each ring must be checked for side clearance in its respective piston groove by inserting a feeler gauge between the ring and its upper land. (See Fig. 8-27) The piston grooves must be cleaned before checking ring for side clearance.

Installation

Rings can be installed on the piston without the danger of breaking the rings if Tool KMO-297-I is used for installation. (See Fig. 8-28) To install rings, proceed as follows:

1. Install oil ring expander in bottom groove with gap on opposite side of connecting rod spit hole.
2. Install oil ring in bottom groove with gap on same side of piston as rod spit hole. The oil ring has symetrical sections and can be installed with either side up.
3. Install compression ring (black) in middle groove with the side marked "TOP" facing up.
4. Install compression ring (chrome face) in top groove with the side marked "TOP" facing up.

Fig. 8-28 Ring Installing Tool KMO-297-I

After the rings are installed on the piston the oil ring gap should be approximately 180° opposite the expander gap. The oil ring and expander will remain in the assembled positions as a result of special design features.

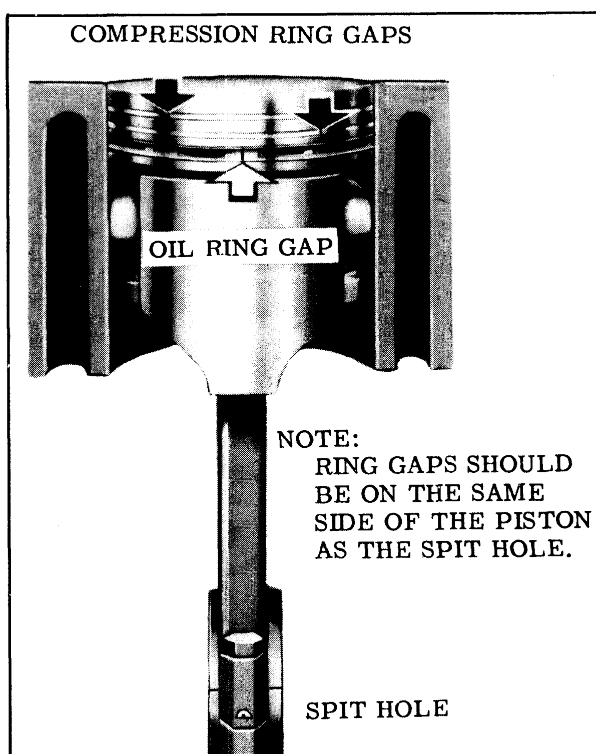


Fig. 8-29 Positioning Ring Gaps

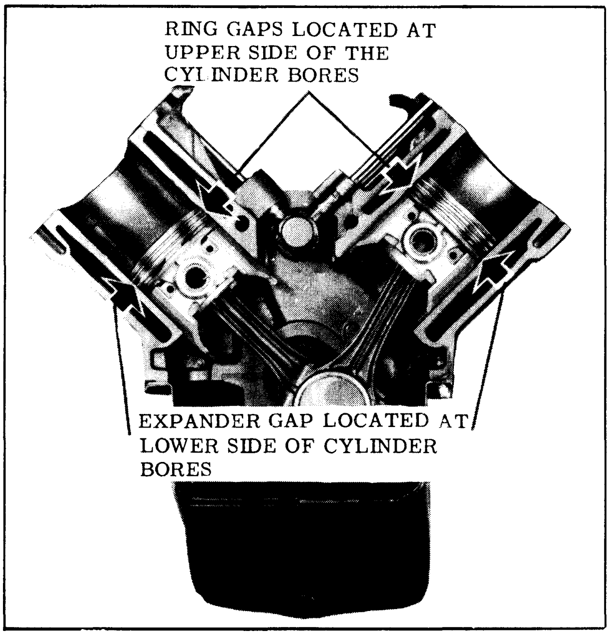


Fig. 8-30 Location of Ring and Expander Caps

Although compression rings rotate during normal operation, it is advisable to stagger the gaps as shown in Fig. 8-29. Thus, when the piston is installed in the engine all ring gaps will be located toward the upper side of the cylinder bores and the oil ring expander gap will be located at the lower side of the cylinder bore. (See Fig. 8-30)

ROD AND PISTON ASSEMBLY—INSTALL

When installing piston and connecting rod assemblies, connecting rod bolt guides, Tool BT-22 should be placed over connecting rod bolt threads to protect the crankshaft bearing surfaces.

IMPORTANT: The connecting rod caps must be properly installed; i.e., with the bearing index notches in rod and cap on the same side. The piston and ring assemblies can be installed in the piston bore without the danger of breaking the piston rings if Tool KMO-357 is used. (See Fig. 8-31)

NOTE: Apply SAE No. 20 oil to rings and piston immediately before installing rod and piston.

The notch cast in the top of each piston

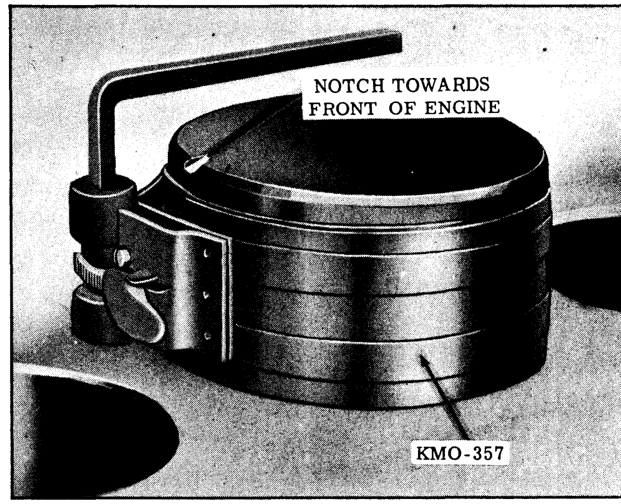


Fig. 8-31 Installing Piston Assembly

must be toward the front of the engine after installation.

The connecting rod cap attaching nuts should be snugged up only enough to keep each rod in position until all piston and rod assemblies have been installed. This will facilitate ease of installation of the remaining piston assemblies.

The clearance between the adjacent rods on each crankpin should be from .002" to .011" when checked with a feeler gauge.

Torque rod bearing cap nuts 45-50 ft. lbs.

CONNECTING ROD BEARINGS—REPLACE

The removable insert type connecting rod bearing shells are assembled with a slight projection above the rod and cap faces to insure a positive contact. Adjustment for wear, such as installing shims behind the shells should NEVER be practiced. WORN BEARINGS MUST BE REPLACED.

Connecting rod bearings can be replaced without removing the rod and piston assembly from the engine.

1. Remove oil pan.
2. With crankpin at approximately bottom dead center, remove both bearing caps.

   NOTE: Before removing bearing caps, stamp cylinder number on machined surfaces of connecting rod and cap for identification when reinstalling.

3. Using a micrometer, check crankpin journals for out-of-round.

4. Inspect crankpin journals for roughness and wear. Slight roundness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced or reground.

5. Clean oil from crankpin, bearing cap, connecting rod and outer and inner surfaces of bearing inserts.

6. Place a piece of "Plastigauge" in the center of lower bearing shell.

7. Reinstall bearing cap and torque 45 to 50 ft. lbs.

8. Remove bearing cap and determine bearing clearances by comparing the width of the flattened "Plastigauge" at its widest point with the graduation on the Plastigauge" container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (See Fig. 8-32) If this clearance is greater than .0045", replace the bearing.

NOTE: Lubricate bearing with SAE 20 oil before installation. Repeat steps 2 to 8 on remaining connecting rod bearings.

NOTE: All rods must be connected to their crankpins when rotating the crankshaft.

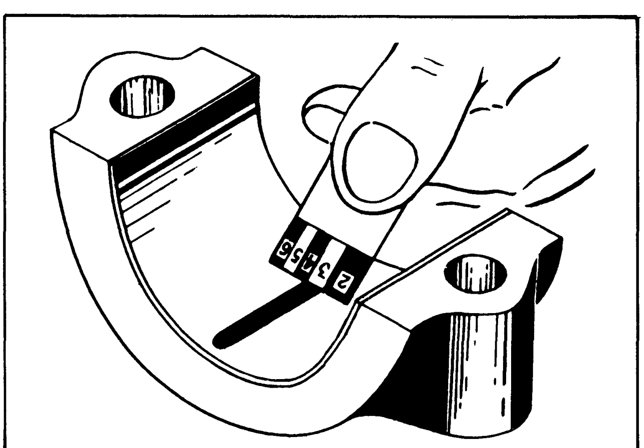


Fig. 8-32 Checking Bearing Clearance

MAIN BEARINGS

There are five replaceable main bearings. These steel backed babbitt inserts are indexed by small locating tangs on the edge of the bearing shells which fit in machined notches in the block and bearing caps.

The front four main bearings are alike. The rear bearing is flanged with integral thrust faces. (See Fig. 8-33)

The main bearing caps are offset, making improper installation impossible. The bearing caps, except the rear cap, are numbered consecutively one through four with number one at the front.

The main bearing locating notches in the caps are machined on the same side as the corresponding notches in the block.

The main bearing journals should be checked for roughness and wear. Slight roughness may be removed with a fine grit polishing cloth saturated with engine oil. Burrs may be removed with a fine oil stone. If the journals are scored or ridged, the crankshaft must be replaced or reground.

The journals can be measured for out-of-round (with the crankshaft installed) by using a crankshaft caliper and inside micrometer.

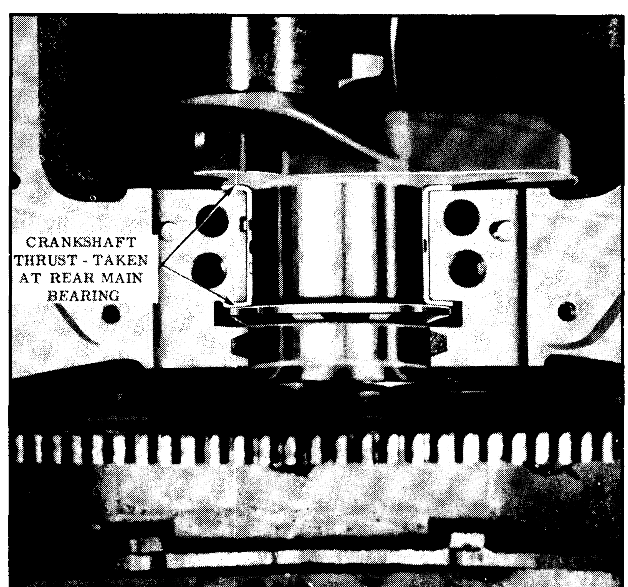


Fig. 8-33 Rear Main Bearing

NOTE: The upper bearing shell must be removed when measuring the crankshaft journals.

The lower flywheel housing and engine pan must be removed in order to remove the rear main bearing cap; however, bearing inserts can be replaced without removing the crankshaft.

CHECKING BEARING CLEARANCES

1. Remove bearing cap and wipe oil from crankshaft journal and outer and inner surfaces of bearing inserts.
2. Place a piece of "Plastigauge" in the center bearing.
3. Use a floor jack or other means to hold crankshaft against upper bearing shell. This is necessary to obtain accurate clearance readings when using "Plastigauge".
4. Reinstall bearing cap and bearing. Tighten to 100 ft. lbs. torque (rear bearing cap to be tightened to 140 ft. lbs. torque).
5. Remove bearing cap and determine bearing clearance by comparing the width of the flattened "Plastigauge" at its widest point with the graduation on the "Plastigauge" container. The number within the graduation on the envelope indicates the clearance in thousandths of an inch. (See Fig. 8-32) If this clearance is greater than .005", replace the bearing.

MAIN BEARINGS—REPLACE

Bearing adjustments are not recommended and shims are not to be used. Whenever a bearing failure occurs, a new bearing insert should be installed. Front main bearing inserts are selectively fitted and are furnished in "M" Medium and "H" Heavy in addition to the standard size which is also used for bearing numbers 2, 3, and 4. Medium and Heavy inserts are identified by "M" or "H" marking on the tang of the bearing insert. The diameter clearance for the front main bearing is .0005" to .002", and the diameter clearance for bearing number 2, 3, and 4 is .0005" to .003". The rear main bearing clearance is .002" to .0035" and is a selective fit. Rear main bearing inserts are furnished in three sizes; "M" Medium, "T" Thin, and "H" Heavy.

The tang of the rear main bearing is marked with a letter "M", "T", or "H". (See Fig. 8-34) When replacing rear main bearing inserts, the same size insert (determined by checking the tang marking) should be installed unless different thickness is required to obtain proper clearance.

1. Remove cap and take out worn shell.
2. Insert a flattened cotter pin in the oil passage hole, then rotate the crankshaft in direction opposite to cranking rotation. The cotter pin will contact the shell and force it out.
3. Place new upper half of main bearing on crankshaft journal with locating tang in correct position and rotate shaft to turn it into place.

   CAUTION: Always clean crankcase thoroughly before installing new main bearings.
4. Install new asbestos oil seal in bearing cap, assemble new bearing insert to cap, and install cap.

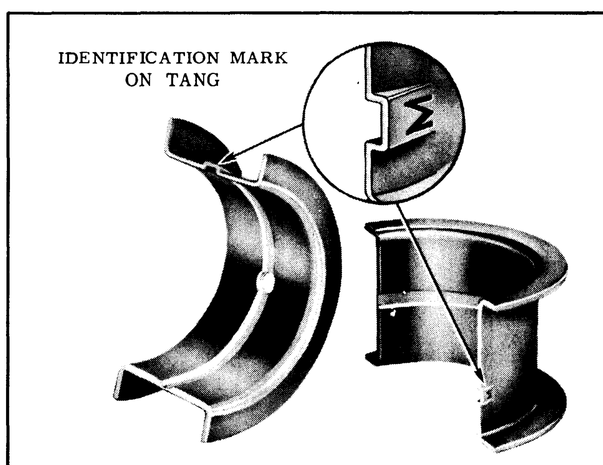


Fig. 8-34 Rear Main Bearing Size

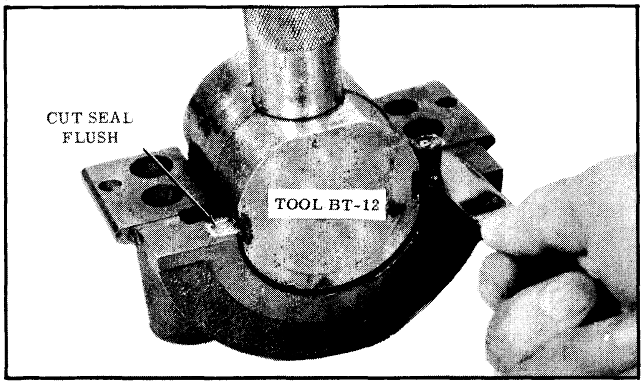


Fig. 8-35 Installing Oil Seal

REAR MAIN OIL SEAL—REPLACE

The rear main bearing is sealed against oil leaks by a special asbestos covered wiper seal; special care must be exercised when installing this seal.

Whenever the crankshaft is removed, a new seal coated with graphite grease should be installed. The seal, to be properly installed, should be crowded into the groove in the upper and lower half of the bearing by hand, then driven tightly into the groove by tapping Tool BT-12 with a hammer. (See Fig. 8-35)

After the seal has been seated in the bearing cap and while the tool is still resting in the bearing cap, the seal should be cut flush with the parting line between upper and lower bearing. The ends of the seal must be cut clean so no frayed ends will be clamped between the block and cap, and the seal must entirely fill the groove. (See Fig. 8-35)

CORK SEALS

After the rear main bearing cap has been installed, Dupont Cement #5402 should be wiped in grooves in block on both sides of bearing cap and the two cork seals pressed into place in the grooves. (See Fig. 8-36)

CRANKSHAFT PULLEY—REMOVE (WITH RADIATOR REMOVED)

1. Remove crankshaft pulley bolt and washer.
2. Using Tool J-6100, remove pulley from crankshaft.

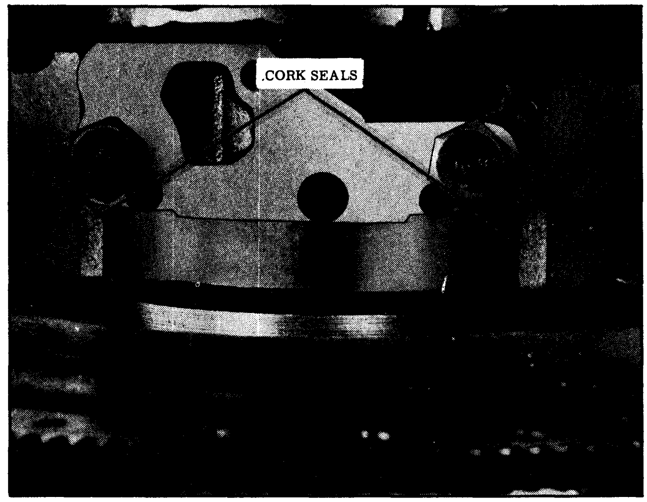


Fig. 8-36 Rear Main Bearing Cork Seals

When installing crankshaft pulley it is important to apply POB No. 3 Sealer to inside diameter of pulley and to crankshaft key to prevent possible oil leakage. Always use a new lockwasher on crankshaft pulley bolt and torque 45 to 50 ft. lbs.

CRANKSHAFT FRONT OIL SEAL—REMOVE AND INSTALL

The crankshaft front oil seal can be readily removed without removal of the engine front cover providing Tool J-4176 is used as follows:

1. Remove crankshaft pulley and replace large cap screw in crankshaft end.
2. Place fingers of Tool J-4176 over end of crankshaft turning the fingers so that the hooks will pass through clearance between the crankshaft end and the inside diameter of the oil seal. A few light taps on the tool center screw will force the fingers in behind the rubber ring of the oil seal. (See Fig. 8-37)
3. Using an end wrench on the fixed nuts rotate each finger outwardly 90 to engage the finger hooks with the inner surface of the oil seal.
4. Tighten the nuts on the outer surface of the puller plate to secure the fingers in position.
5. Turn the puller center screw to bear against the large crankshaft cap screw head to remove the oil seal.

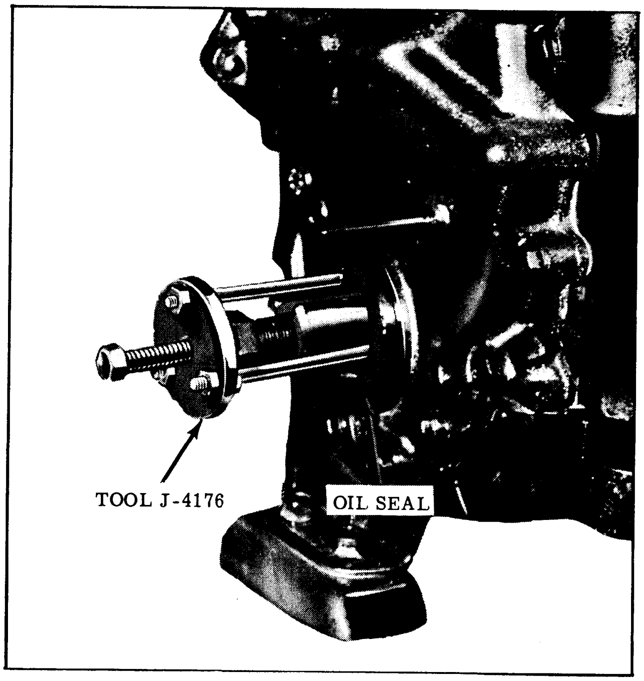


Fig. 8-37 Removing Front Oil Seal

The seal should be replaced in the front cover using Tool J-4177 as shown in Fig. 8-38. Coat the outside diameter of the seal with POB No. 3 Sealer and coat the sealing lip with special lubricant, Part No. 567196. Position the seal in the cover and assemble the adapter ring and driver as illustrated, so that the driver slot will clear the crankshaft key. The seal can then be installed in its proper position by driving tool until adapter bottoms on cover face.

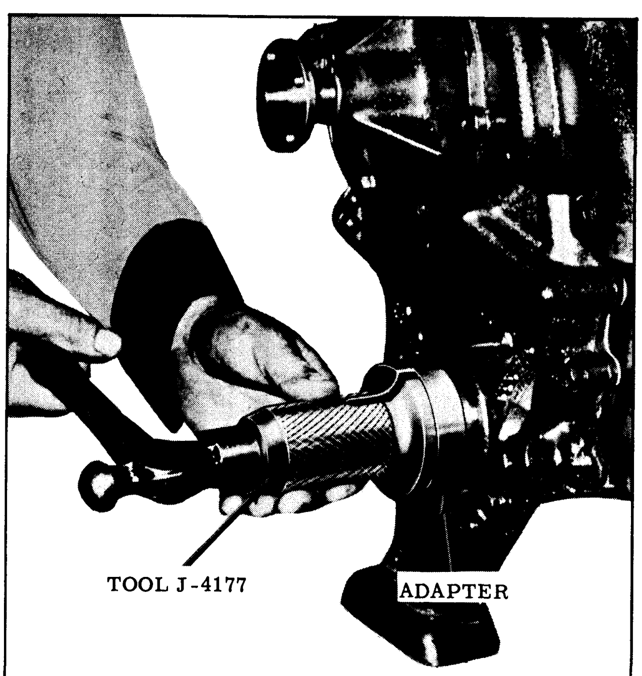


Fig. 8-38 Replacing Oil Seal

FRONT COVER— REMOVE AND INSTALL

1. Drain cooling system.
2. Disconnect lower radiator hose and heater hose from front cover.
3. Disconnect generator link at generator.
4. Remove oil pan.
5. Remove two bolts attaching front engine mount to frame.
6. Support engine with Special Tool Set BT-29. (Engine mount must clear frame cross member.)
7. Remove radiator assembly.
8. Remove fan blades and pulley.
9. Remove crankshaft pulley.
10. Remove fuel and vacuum pump assembly.
11. Remove front cover attaching bolts and front cover assembly.

To install, reverse sequence of operations.

NOTE: Always install a new front oil seal. Fuel pump operating arm pad should be coated with special lubricant, Part No. 567196.

The front cover attaching bolts should be dipped in POB No. 3 Sealer and torqued 30 to 35 ft. lbs. One side of the fuel and vacuum pump gasket should be coated with a gasket cement to hold gasket in place during installation of pump. (See Fig. 8-39)

TIMING CHAIN AND GEARS

The camshaft timing gear and the fuel

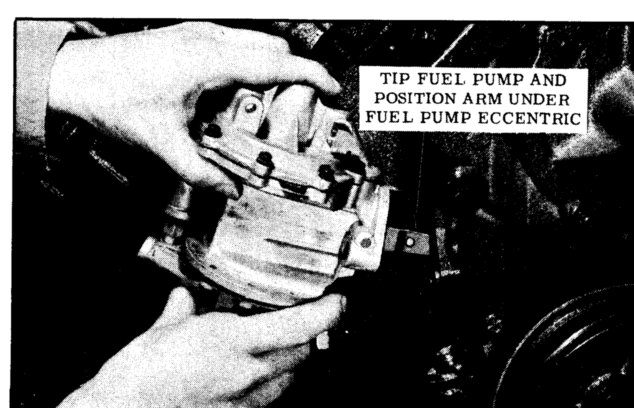


Fig. 8-39 Fuel Pump Installation

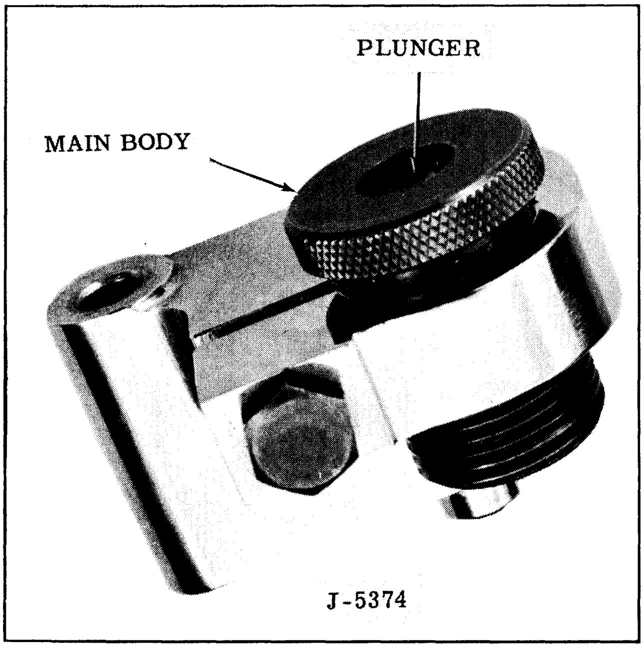


Fig. 8-40 Valve Timing Tool J-5374

pump eccentric are attached to the front of the camshaft. The camshaft gear has a slight counterbore which fits over the front of the camshaft. The crankshaft gear can be removed by tapping with a soft hammer or by using a universal gear puller if stuck tight. On reassembly, apply POB No. 3 Sealer to crankshaft key and slot.

When the camshaft gear, timing chain, or sprocket gear is replaced, the correct valve timing can be obtained by using Tool BT-11 as shown in Fig. 8-40.

When re-installing fuel pump eccentric, the side stamped with an "O" is to be positioned toward the front.

EXTERNAL METHOD OF CHECKING VALVE TIMING

1. Remove rocker shaft assembly on the left hand cylinder head.
2. Rotate engine so that piston No. 1 is on top dead center firing stroke. Distributor rotor will be pointing toward the front of the engine. Use the notch in the crankshaft pulley (trailing edge of notch) and timing pointer to obtain this set-up.
3. Install Tool J-5374 in place of rear rocker shaft bracket with step plunger over No. 7 cylinder exhaust push rod.

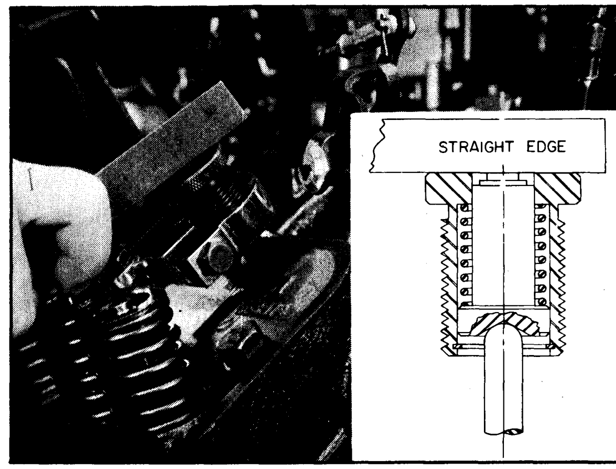


Fig. 8-41 Adjusting Tool J-5374

(Rear-most push rod). (See Fig. 8-41) The 7/16" diameter pilot at bottom of tool will fit into cylinder head bolt hole.
4. Screw main body of gauge down so the step plunger contacts the push rod and the small diameter of the step plunger is flush with the top of the main body as shown in Fig. 8-41. Tighten clamp bolt.
5. Rotate the engine one complete revolution so that cylinder No. 1 is again on top dead center (beginning of intake stroke). The distributor rotor should now be pointing toward the rear of the engine. If the timing chain is installed properly on the engine, the plunger

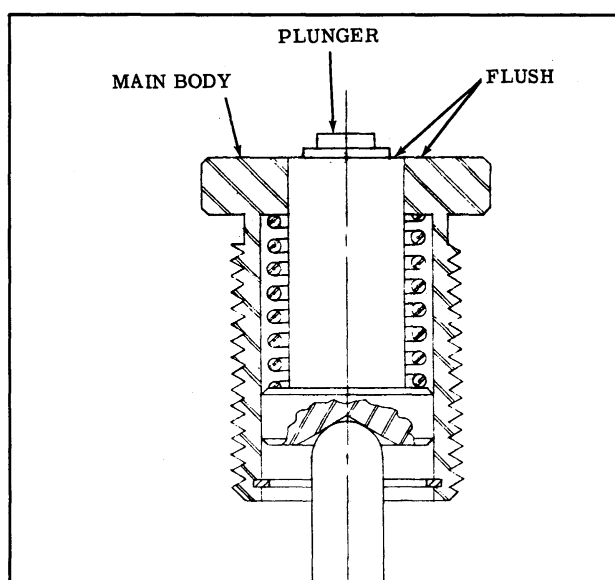


Fig. 8-42 Valve Timing Correct

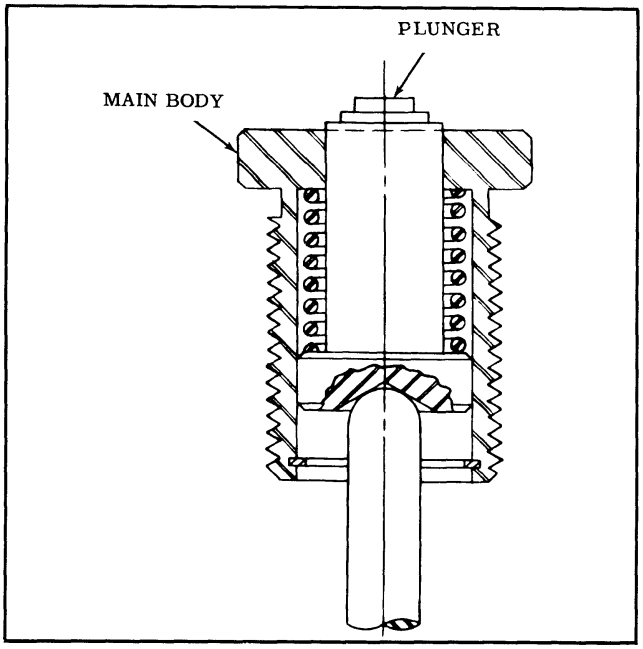


Fig. 8-43 Valve Timing Advanced

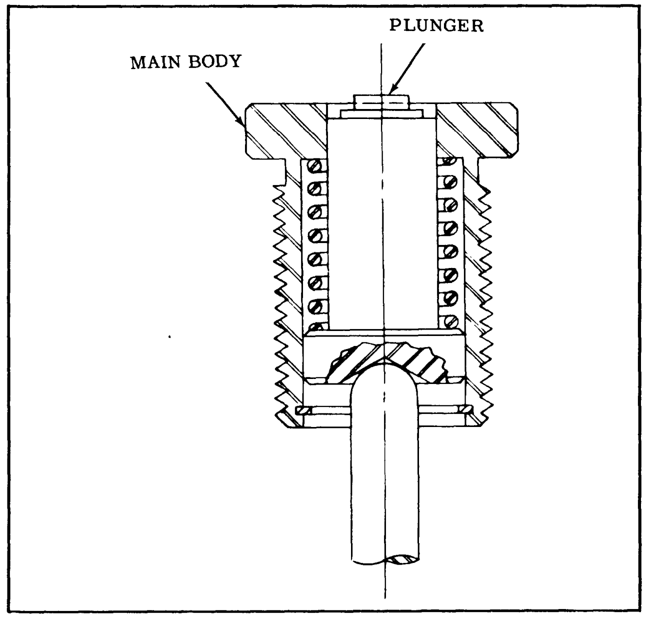


Fig. 8-44 Valve Timing Retarded

will rise so the third step is flush with the main body. (See Fig. 8-42) If camshaft is advanced one tooth, the third step will rise above the top of the main body as shown in Fig. 8-43. If camshaft is retarded one tooth, the second step will be below the top of the main body as shown in Fig. 8-44.

CAMSHAFT AND CAMSHAFT BEARINGS

Camshaft—Remove and Install

1. Remove valve lifters.
2. Remove distributor.
3. Remove engine front cover.
4. Remove fuel pump eccentric, camshaft sprocket and timing chain.
5. Remove camshaft by CAREFULLY sliding out from front of engine.

To replace, reverse sequence of operations, set valve timing, set ignition timing, adjust carburetor idle and check throttle linkage.

Camshaft Bearings—Remove

Camshaft bearings may be removed and replaced in the Rocket Engine with the use of Camshaft Bearing Remover and Replacer Tool J-4476. Whenever it is necessary to replace one bearing, ALL BEARINGS must be replaced. Service bearings do not require line reaming. Step by step procedure as shown in Fig. 8-45 must be followed.

Camshaft Bearings—Replace

CAUTION: Be sure step procedure as outlined in Fig. 8-46 is followed. If Tool J-4476-5 is mispositioned, it is possible to drive out the plug in rear of cylinder block. If the plug is loosened, flywheel removal will be required to install a new plug. The bearings are installed with the outside chamfer toward the rear of the engine. Start bearing so that the lower oil hole in bearing will align with the crankshaft to camshaft oil passage. Positioning the bearing seam toward top center of block will properly locate oil holes. After bearings are installed, check alignment of lower holes with a piece of wire and also check upper holes in No. 2 and 4 bearings which feed oil to rocker shafts.

CRANKSHAFT—PILOT BEARING

The pilot bearing is located in a bore in the rear end of the crankshaft, and is held in place by a sheet metal retainer pressed in the crankshaft. The same Durex bushing is used for the 88 Hydra-Matic and Syncro-Mesh equipped cars. (See Fig. 8-47)

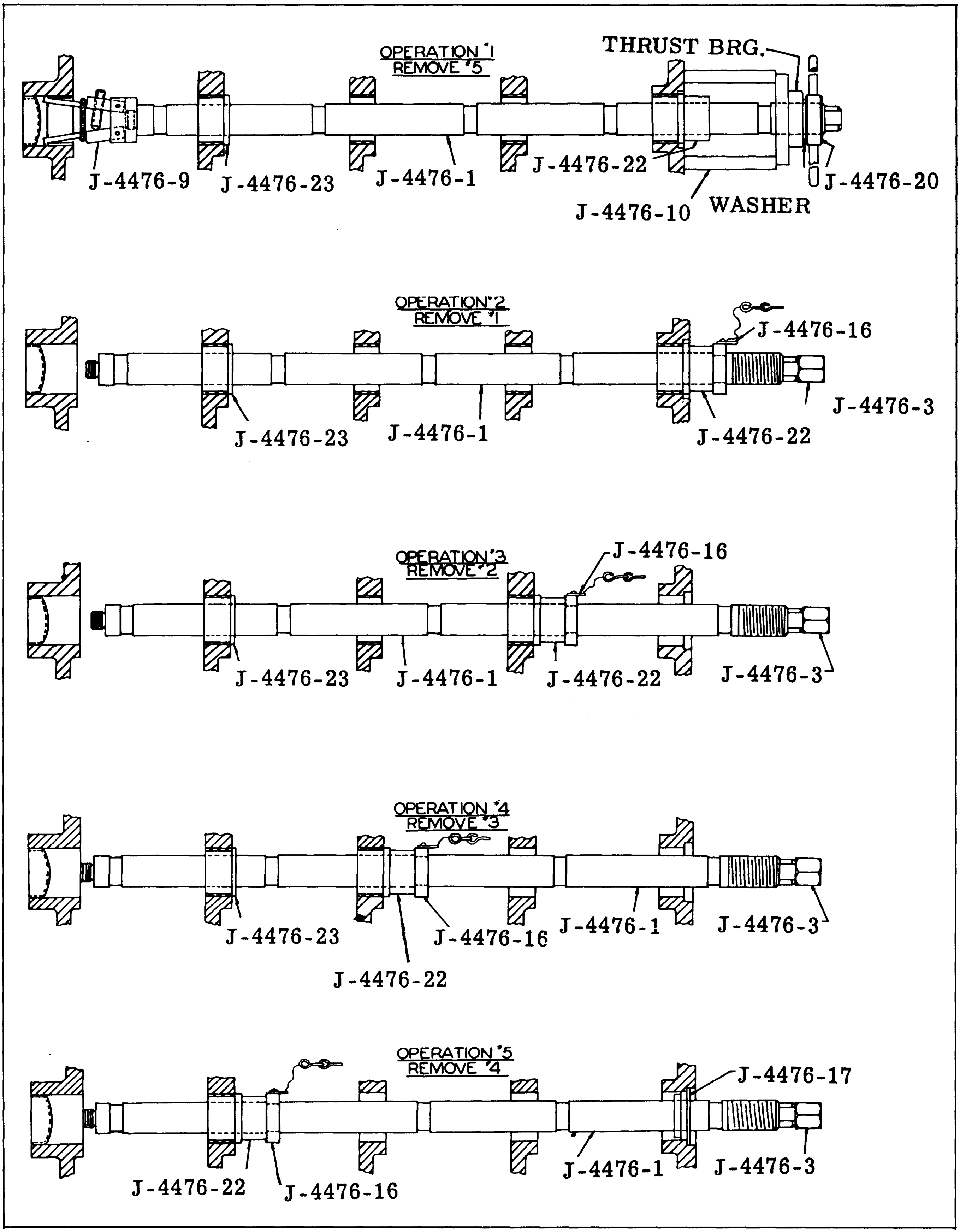


Fig. 8-45 Removal of Camshaft Bearings

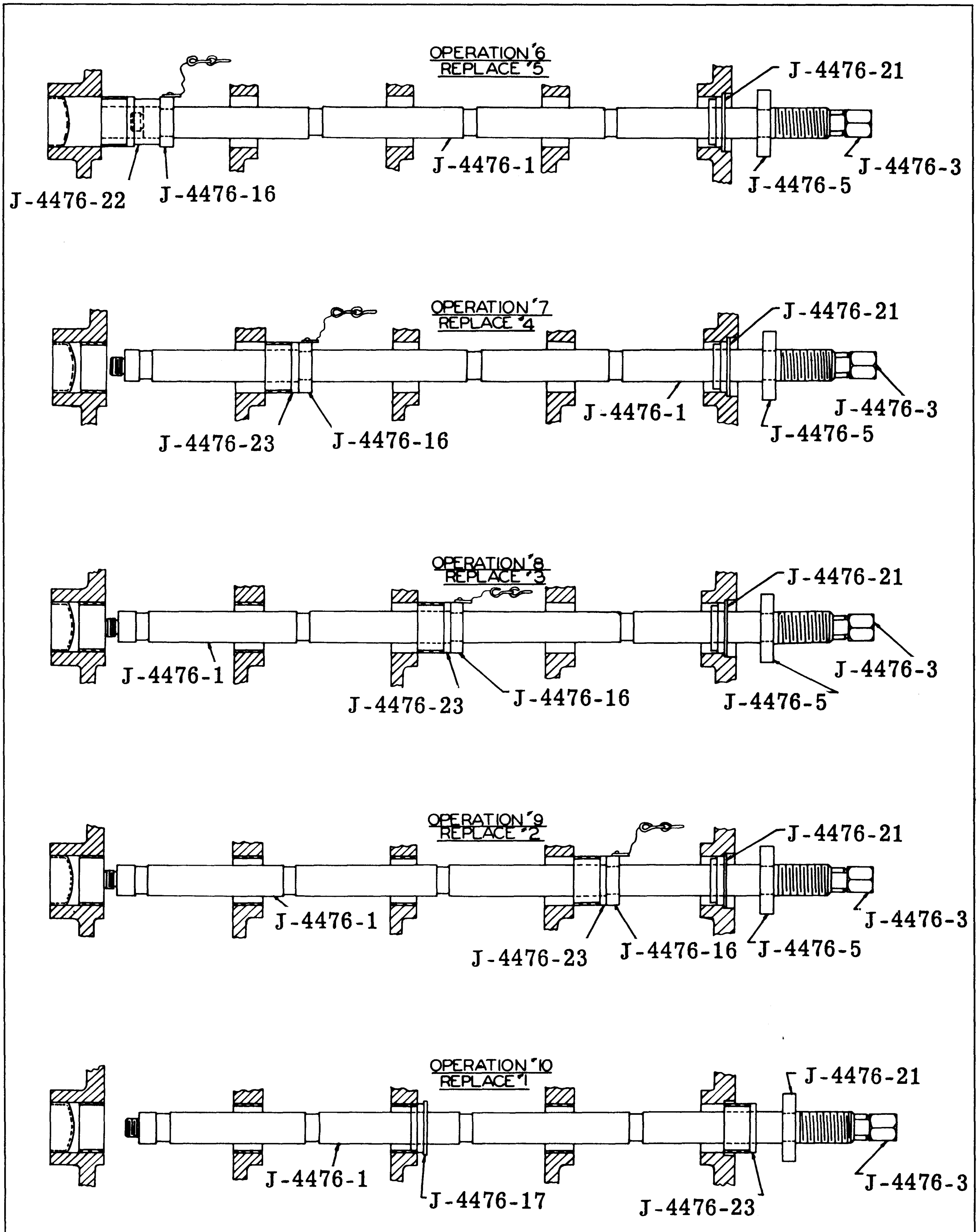


Fig. 8-46 Installation of Camshaft Bearings

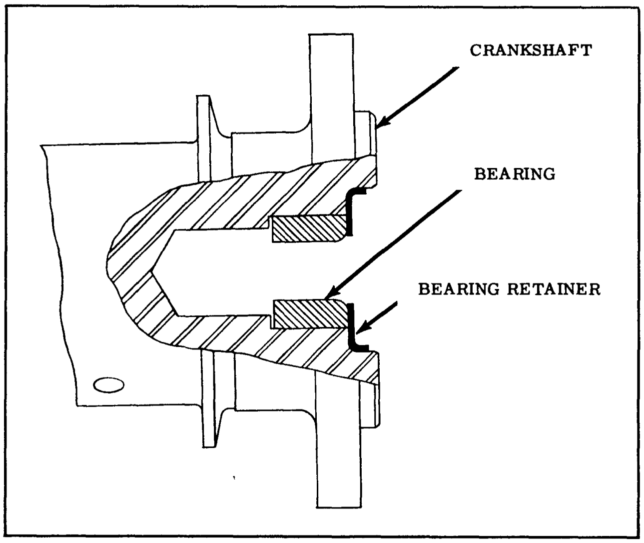


Fig. 8-47 Crankshaft Pilot Bearing

When replacing the pilot bearing on an engine equipped with Syncro-Mesh transmission, all old lubricant in the reservoir behind the bearing should be removed, and 1/4 ounce (level tablespoonful) of front wheel bearing grease should be placed in the reservoir. Do not fill the reservoir or use more lubricant than is specified above.

A slight trace of lubricant in the bore of the bearing will be sufficient for 88 Hydra-Matic models, as adequate lubrication is supplied as soon as oil is pumped to the torus members.

Whenever the transmission is removed (on models equipped with Jetaway Hydra-Matic) the pilot bore wick should be lubricated with Standard Oil Grease G-6466 or equivalent. (See Fig. 8-48)

When replacing the pilot bearing, first pry out the bearing retainer using a screwdriver; then remove the bearing with Pilot Bearing Puller J-1448. Install the new bearing using Pilot Bearing and Retainer Tool Set J-4530.

NOTE: On Syncro-Mesh equipped models apply a light coat of POB No. 3 Sealer to rim of retainer before installation.

FLYWHEEL AND FLEX PLATE

The flywheel in Jetaway Hydra-Matic equipped cars is of pressed steel, one piece construction with an integral ring gear. Power from the crankshaft is transmitted to the flywheel through a flex plate. (See Fig. 8-48) The Syncro-Mesh flywheel is of cast iron and has a hardened steel ring gear shrunk on its outside diameter. The flywheel is attached to the crankshaft.

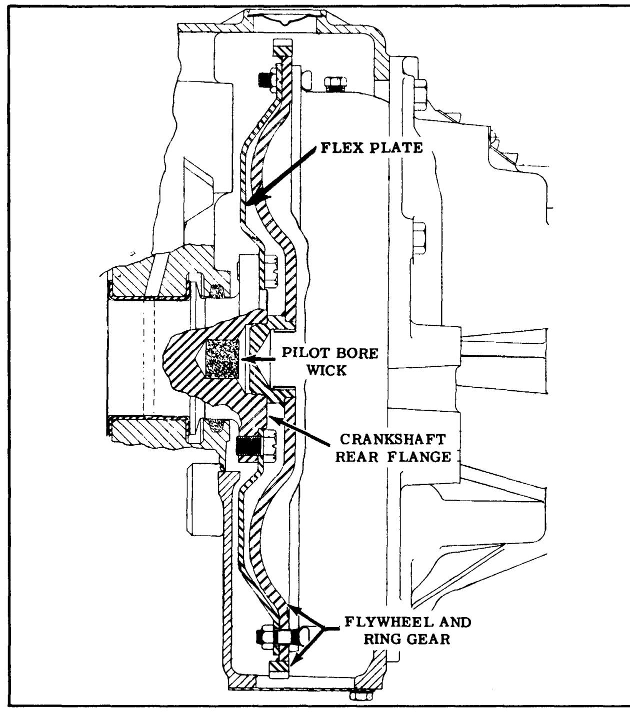


Fig. 8-48 Jetaway Flex Plate

One bolt hole in the Syncro-Mesh flywheel or the Hydra-Matic flex plate is offset so that either will fit on the crankshaft in only one position. The flywheel and flex plate mounting bolts, which are self locking, thread into the crankshaft rear flange. The mounting bolts for Syncro-Mesh flywheels are longer than the bolts used for Hydra-Matic.

It is unnecessary to ream the bolt holes when assembling a new flywheel to the crankshaft; however, a new gasket should always be used, and it is important that the flywheel to crankshaft bolts be tightened evenly 85 to 95 ft. lbs. torque.

After installing a new "88" Hydra-Matic flywheel, it should be checked for runout at the torus cover gasket surface. Runout should not exceed .005".

FLYWHEEL HOUSING ALIGNMENT

NOTE: Due to the design of the new Jetaway transmission, alignment factors of the bell housing are no longer critical, thus making it unnecessary to perform the following checks and adjustments. Therefore, THE FOLLOWING OPERATIONS PERTAIN ONLY TO CARS EQUIPPED WITH SYNCRO-MESH OR 88 MODELS EQUIPPED WITH HYDRA-MATIC.

It is necessary to check the alignment of the rear and lower flywheel housings to engine block whenever these parts are mismatched for any reason. This might occur upon replacement of a block assembly which is furnished without the REAR housing. The LOWER housing is furnished with a new block. However, in rare cases, it may become necessary to replace only a lower housing.

A misaligned housing may be indicated by one or more of the following conditions:

A. Chronic front seal failure (88 H.M.)
B. Excessive wear on torus cover hub. (88 H.M.)
C. Excessive wear on oil control ring. (88 H.M.)
D. Gear noise. (88 H.M. or S.M.)
E. Transmission jumps out of high gear. (S.M.)
F. Early bearing failure. (88 H.M. or S.M.)
G. Rapid wear on thrust washers. (88 H.M.)

CHECK AND ALIGN REAR FLYWHEEL HOUSING

(Engine in or out of car)

NOTE: It is not necessary to have lower housing in place during this check.

1. Install pilot mounting strap J-2548 on flywheel.
2. Install rear housing and tighten bolts.
3. Install pilot shaft and mount dial indicator as shown in Fig. 8-49.
4. Tap crankshaft to rear of engine.
5. Using large button on dial indicator, install indicator assembly so that button contacts face of housing with approximately .015" compression. This will allow button to pass over cavities in housing without damaging indicator.

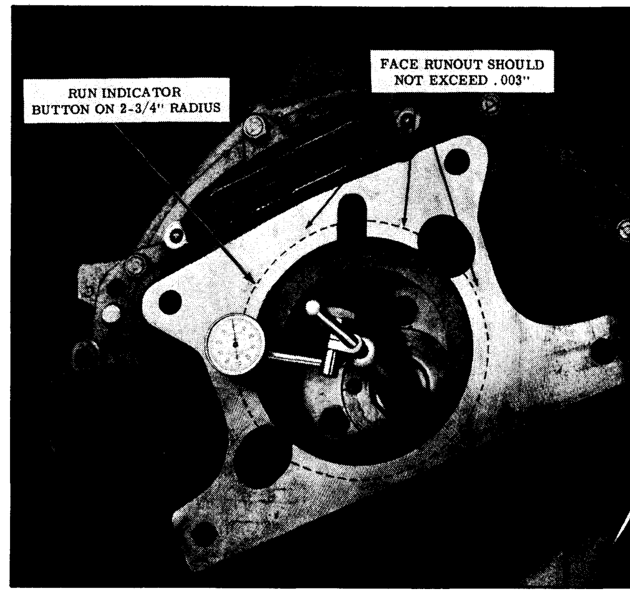


Fig. 8-49 Checking Housing Face Runout

6. With dial indicator positioned against rear face of housing at (2-3/4" radius 88 H.M.) (2-3/8" radius S.M.) from the centerline of the crankshaft, revolve flywheel 360° and note indicator reading. Limits for this reading are not to exceed .003" on indicator within 360°. If reading exceeds limits, shim as necessary between housing and engine block to bring within limits.

   NOTE: Flywheel may be turned with Tool J-972-A.
7. Assemble dial indicator to pilot shaft

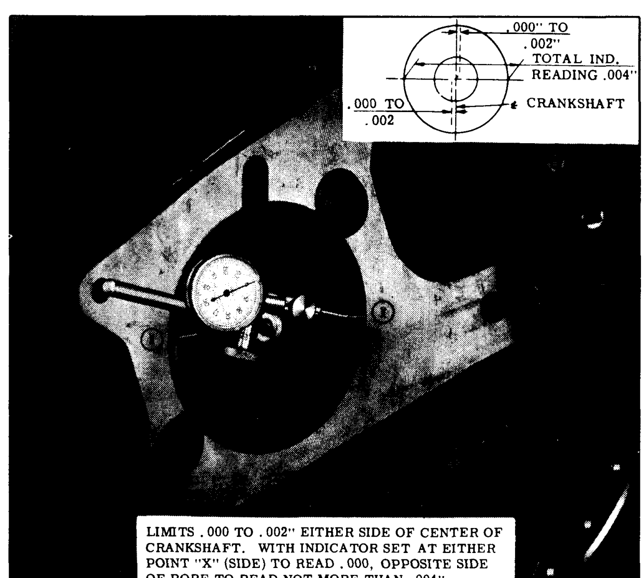


Fig. 8-50 Checking Housing Radial Runout

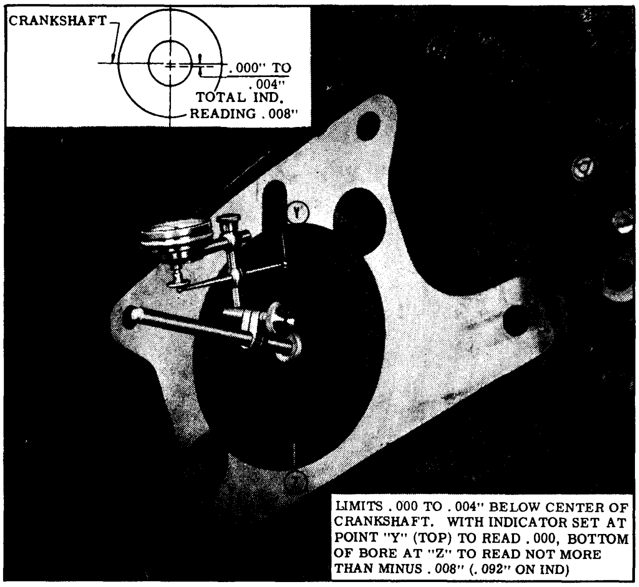


Fig. 8-51 Checking Housing Radial Runout

using the attachments as shown in Fig. 8-50 and 8-51, then check radial runout of the housing bore as follows:

A. Mark the flywheel housing with pencil or chalk to indicate the horizontal and vertical positions.

B. With indicator positioned at zero at either horizontal mark, rotate flywheel one-half turn (180). Indicator reading at this opposite side must not exceed .004" plus or minus.

C. With indicator positioned at zero at top mark (Y on illustration), rotate flywheel one-half turn (180°). Indicator reading at the bottom mark (Z on illustration) must be between 0.000 and minus .008".

8. If readings indicate misalignment, cap screws must be loosened slightly, dowel pins removed, and housing shifted with a lead hammer to bring within limits.

   NOTE: On Syncro-Mesh models it will be necessary to remove the rear housing and saw off the dowel pins close to the block before driving pins through; otherwise, the pins will strike the flywheel before clearing the dowel pin bores.

9. After aligning housing, again tighten housing attaching bolts and recheck radial runout.

10. Using reamer J-4832-3 (roughing reamer) and ratchet wrench J-808-6, ream the two engine block to rear housing dowel pin holes. Then finish ream using reamer J-4832-4 and install oversize dowel pins, Part No. 557754 (large chamfer end out).

    NOTE: The above reamers must be shortened to 4" over-all length in order to perform this operation with engine in car.

11. Clean all cuttings from housing.

12. Remove dial indicator setup and rear flywheel housing.

ALIGNMENT OF LOWER FLYWHEEL HOUSING

Lower flywheel housing alignment is rarely required; however, if a new lower housing is used, alignment should be checked.

Misalignment is evident as a "step" between the block and the lower housing resulting from the location of the housing too far forward or rearward on the block. (See Fig. 8-52) This condition can be corrected by elongating the dowel holes so as to allow lower housing to move to the rear or to the front as required.

NOTE: Do not remove dowel pins or enlarge dowel pin holes with an oversize drill, as correct sidewise location of lower housing must be maintained for proper engagement of starter pinion and ring gear.

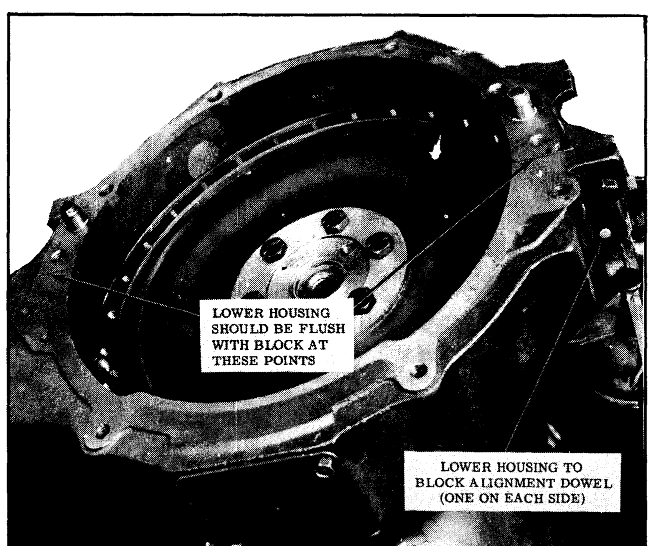


Fig. 8-52 Checking Lower Housing Alignment

FRONT ENGINE MOUNT

When installing a front engine mount, the engine bracket to mount attaching nuts should first be installed finger tight and then alternately tightened down one turn at a time. DO NOT TIGHTEN ONE SIDE INDEPENDENTLY OF THE OTHER. This is extremely important since the lower portion of the assembly would not seat evenly in the upper portion. (See Fig. 8-53) The front mounting must be properly positioned and tightened; otherwise, the mounting will bind and the engine will feel rough, particularly at idle.

To Replace Front Engine Mount:

1. From under the car remove mount to bracket nuts.

   NOTE: On cars equipped with power steering (single exhaust systems only) the exhaust crossover pipe must be removed for accessibility of the above nuts.
2. Remove the two engine mount to frame attaching nuts.
3. Raise the front of engine only sufficiently for removal of engine mount using Special Tool Set BT-29 or another suitable means and remove engine mount.
4. To install front engine mount, reverse above operations using new lockwashers

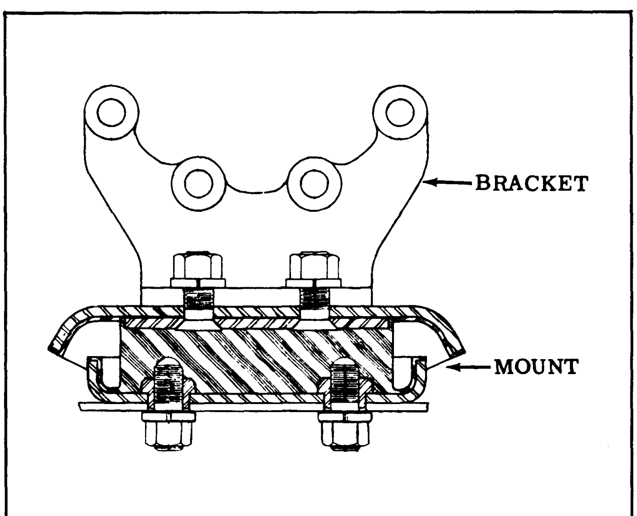


Fig. 8-53 Front Engine Mount

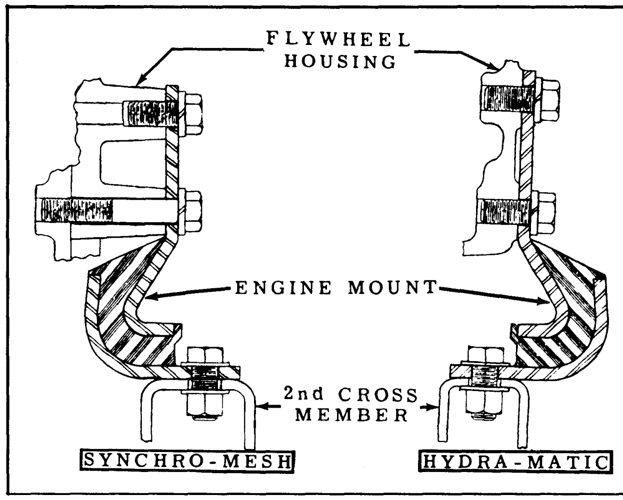


Fig. 8-54 Rear Engine Mounts

and being careful to tighten mount to bracket attaching nuts evenly 25 to 30 ft. lbs.

REAR ENGINE MOUNTS

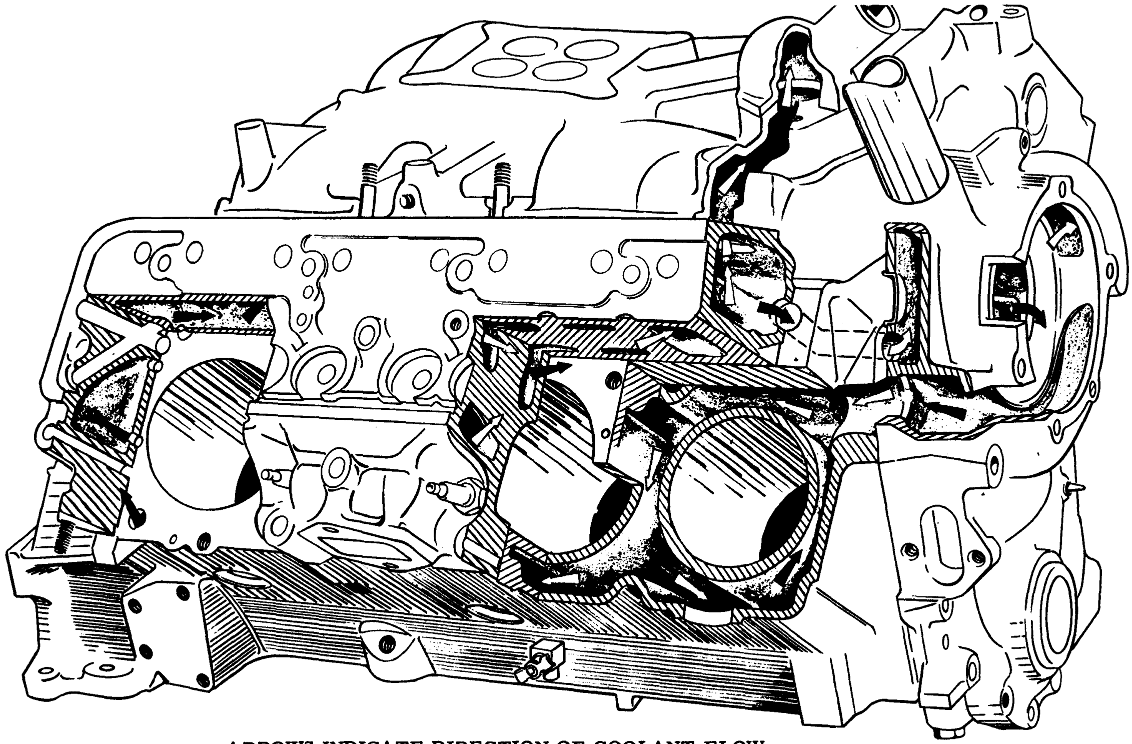
The rear engine mounts used on Hydra-Matic equipped models differ from mounts used on Syncro-Mesh equipped models. On Hydra-Matic models, the rear mount flange which bolts to the cross member faces the rear; whereas, on Syncro-Mesh models, the flange is toward the front. (See Fig. 8-54) When replacing mounts, the rear of the engine should be raised only enough to permit removal and installation of the mounts. After installing all bolts loosely, tighten the mount to rear cover bolts first; then lower the engine so the full weight is on the mounts and tighten the mount to cross member bolts.

COOLING SYSTEM

FIG. 8-55

The water pump discharges water through the front engine cover into both banks of the block. The water then flows through the full length water jackets in the block, up into the two cylinder heads, through the heads, and then flows from the front of each cylinder head through the intake manifold water passage to the water outlet and finally to the radiator.

When the thermostat is closed, all the



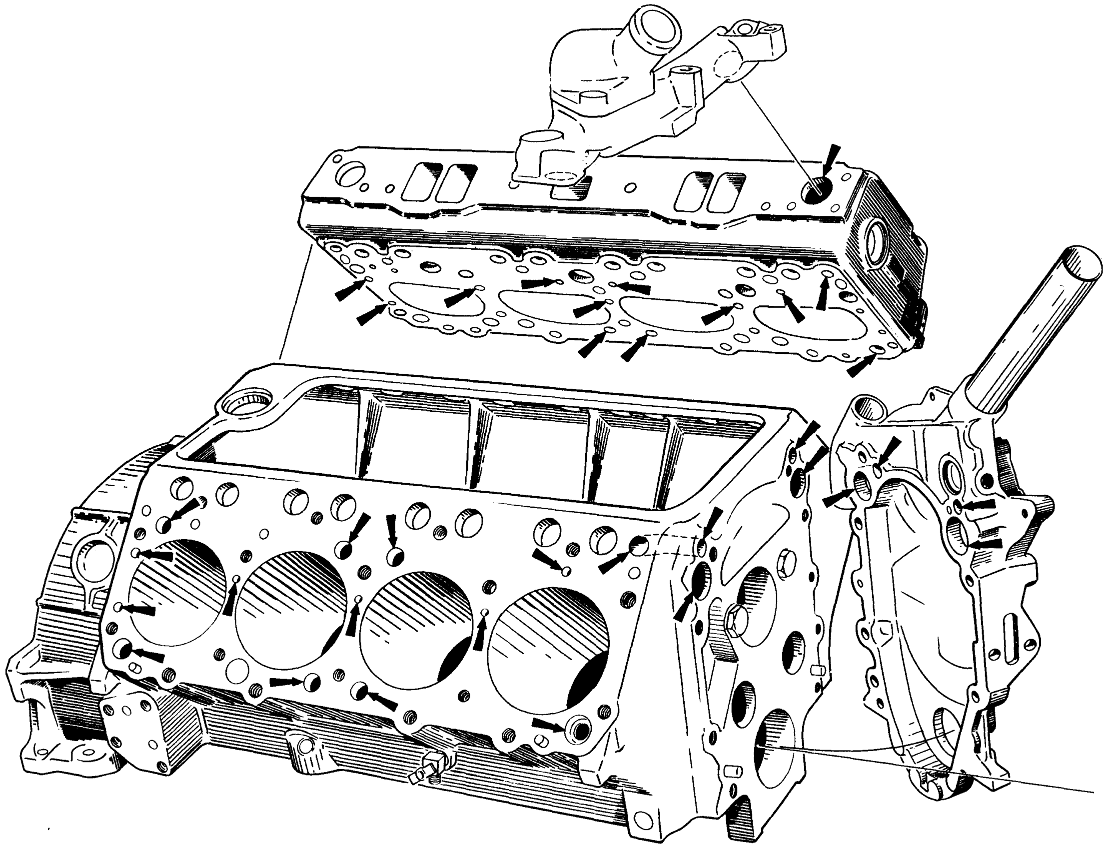


Fig. 8-55 Engine Cooling

water flows through the two internal by-passes to the inlet side of the water pump and back to the engine block.

No water distributor tube is used in the block since the size and location of the water distributor holes in the cylinder block and heads are designed for uniform coolant distribution.

The seven pound pressure radiator cap raises the boiling point of the water in the cooling system to approximately 230°F.

RUST PROOFING

Rust proofing of the cooling system can best be accomplished through the use of Rush Inhibitor, Part No. G.M. 986977.

All new Oldsmobiles have rust inhibitor added to the cooling system at the time of initial fill. The rust inhibiting compound is non-foaming and non-corrosive.

It is not necessary to add rust inhibitors to cars that have standard anti-freeze products containing proper corrosion preventing inhibitors.

It is recommended that 16 ounces of Rust Inhibitor be added to the cooling system each time it is drained and the coolant changed. In areas where temperatures do not require anti-freeze during the winter months and there is no occasion to drain the cooling system, 16 ounces of Rust Inhibitor should be added annually, preferably in the spring.

SERVICING

1. Inspect the cooling system and perform any necessary service to insure that it is clean, leak-tight, and in proper working order.
2. Completely drain the system by opening all drain valves.
3. If coolant drains out rusty, or if rust deposits are seen in the radiator, reverse flush the cooling system.
4. Determine the amount of anti-freeze to use from specification chart and mix with approximately 2 gallons of water.
5. Start engine and immediately pour the mixture of anti-freeze and water into the radiator with the engine idling and finish filling with water until level with center-line of inlet tube. This will allow room for thermal expansion without overflow.
6. Run the engine until it reaches driving temperature, covering the radiator if necessary in order to open the thermostat and establish complete circulation through the system before driving the car or exposing it to freezing temperature.

FAN AND PULLEY— REMOVE AND INSTALL

The fan blades and pulley can be removed without disturbing the water pump or radiator.

NOTE: If tension on belt is not released, the fan can be removed without disturbing the pulley by removing four attaching bolts. When the first two bolts are removed, replace with aligning studs. The tension of the belt will keep the pulley in position.

To remove the fan and pulley as an assembly proceed as follows:

1. Loosen generator and link adjusting bolt.
2. Remove four fan and pulley attaching bolts.

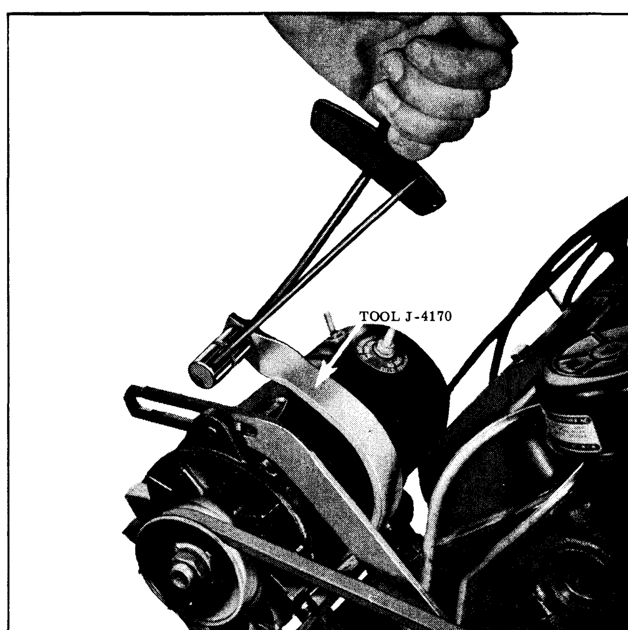


Fig. 8-56 Adjusting Fan and Generator Belt

3. Remove fan and pulley.

Reverse the above procedure for installing fan and pulley and adjust belt to proper tension.

FAN AND GENERATOR BELT ADJUSTMENT FIG. 8-56

The fan and generator belt is adjusted with Tool J-4170-B and a torque wrench as follows:

1. Loosen generator attaching bolts.
2. Place Tool J-4170-B under generator as shown in Fig. 8-56.
3. Using a torque wrench, adjust belt tension to 16 ft. lbs.
4. Tighten generator attaching bolts.

RADIATOR—REMOVE AND INSTALL FIG. 8-57

1. Drain cooling system.
2. Disconnect upper and lower radiator hoses.
3. Disconnect horn wires and remove horns.

   NOTE: If car is equipped with Jetaway transmission, disconnect and cap oil cooler lines. Disconnect radiator shroud and position away from radiator.
4. Remove upper radiator baffle.

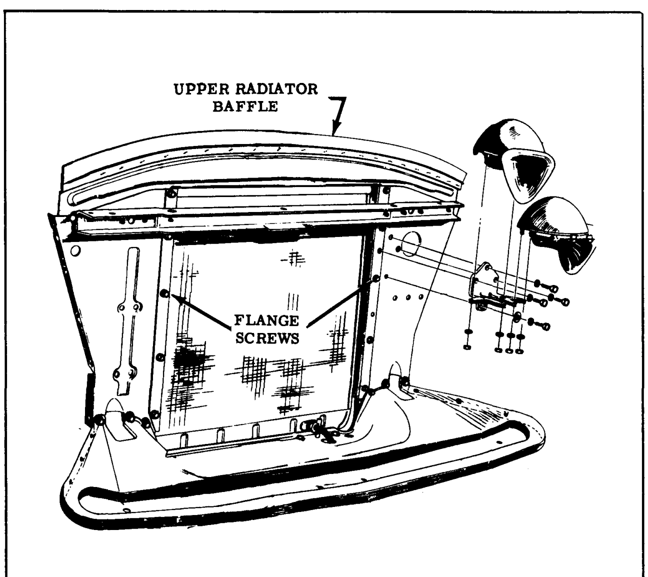


Fig. 8-57 Radiator Removal

5. Remove sheet metal screws from radiator flange. (Both sides)
6. Position fan blades to clear radiator lower outlet and remove radiator.

To replace radiator, reverse sequence of operations and refill to center-line of upper tank inlet tube. Check Jetaway Hydra-Matic fluid level.

REMOVE AND INSTALL WATER PUMP

1. Drain cooling system.
2. Remove fan and fan pulley.
3. Remove six water pump attaching bolts (four pump housing to front engine cover attaching bolts and two pump housing to block attaching bolts.
4. Remove water pump.

For installation, reverse the above procedure using a new gasket. One side of the water pump gasket should be coated with gasket cement. The threads of the water pump housing bolts should be dipped in C.P. No. 9 sealer.

WATER PUMP—DISASSEMBLE

1. Remove bearing retainer wire from front of housing.
2. Support outside surface of pump housing in arbor press and press shaft through impeller and housing, pressing

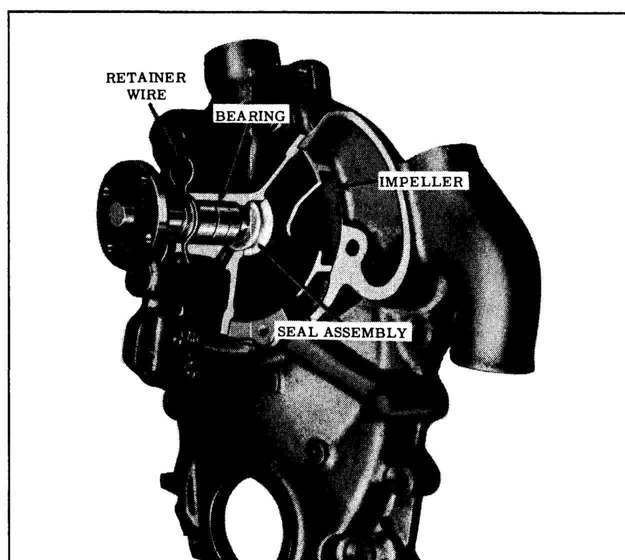


Fig. 8-58 Front Cover and Water Pump Assembly

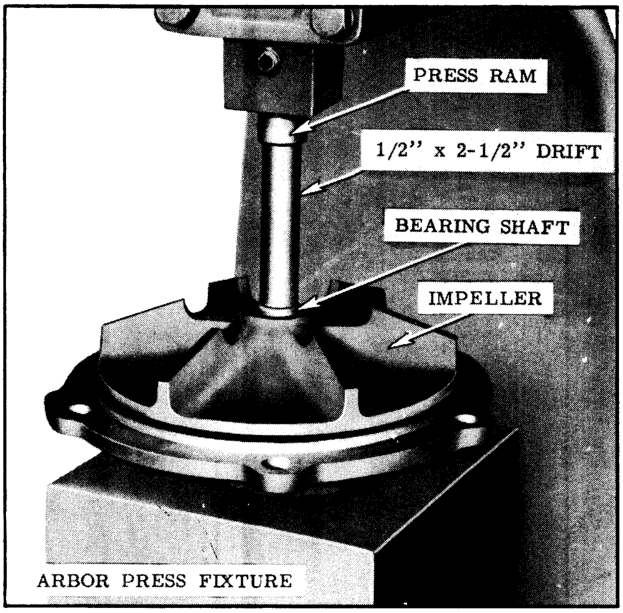


Fig. 8-59 Removing Impeller From Shaft

on impeller end of shaft toward front of housing. (See Fig. 8-59)

3. Remove seal assembly from housing by driving against inside face of seal with a drift.
4. Remove pulley drive flange. (Support flange and press shaft through flange.)
5. Clean all sealer material from pump housing and seal seat.

WATER PUMP ASSEMBLE

1. Coat the outer seating diameter of new seal with C.P. No. 9 Sealer and install seal, using Tool BT-16 as shown in

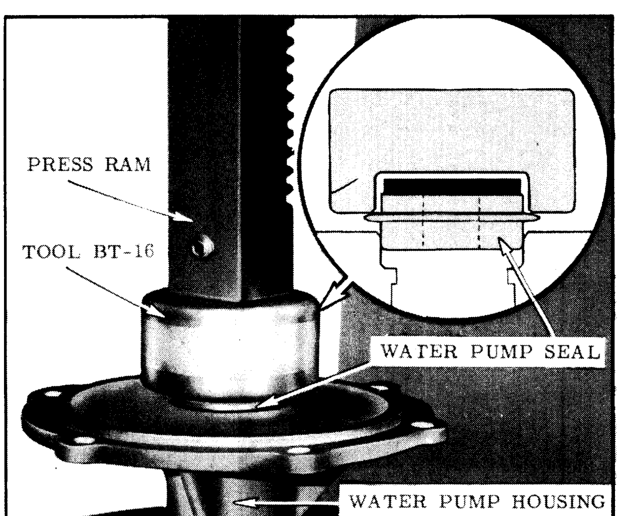


Fig. 8-60 Installing Water Pump Seal

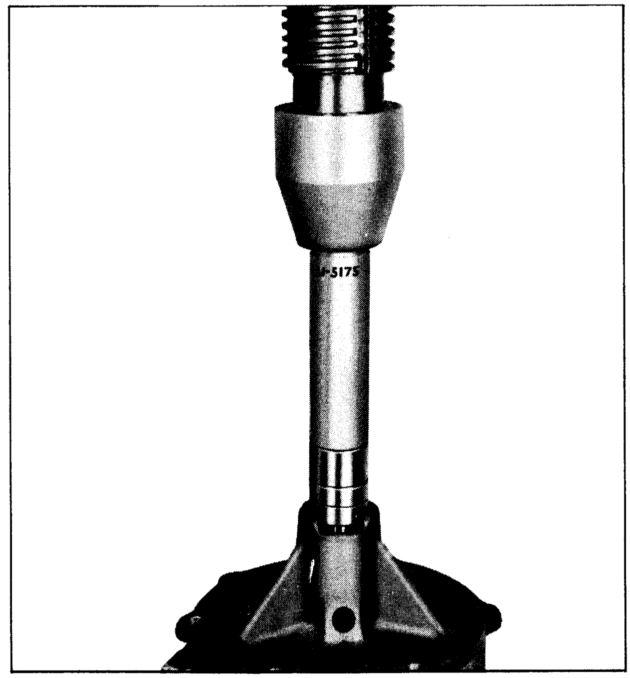


Fig. 8-61 Install Water Pump Bearing

Fig. 8-60. Support water pump housing during seal installation.

2. Assemble slinger to new bearing assembly.
3. Press bearing into the housing with Tool J-5175, Fig. 8-61, and install bearing retainer wire.
4. Install fan hub with Tool BT-16, Fig. 8-62. Assembly must be supported on bearing shaft; otherwise, damage to bearing will result.
5. Before assembling the impeller to the bearing shaft, dirt or other foreign particles should be removed from the

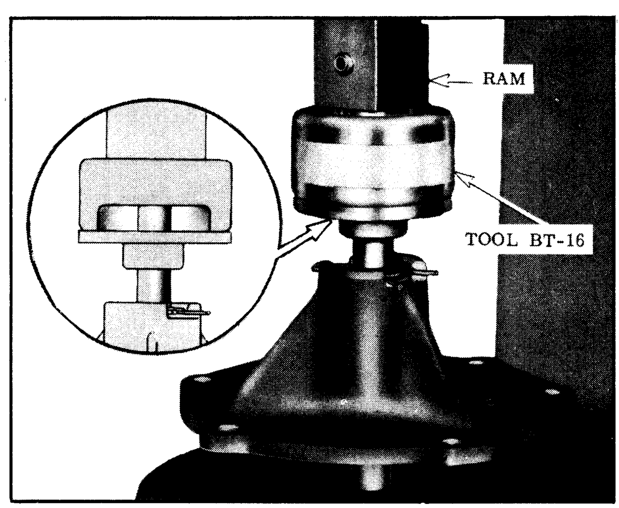


Fig. 8-62 Installing Fan Hub

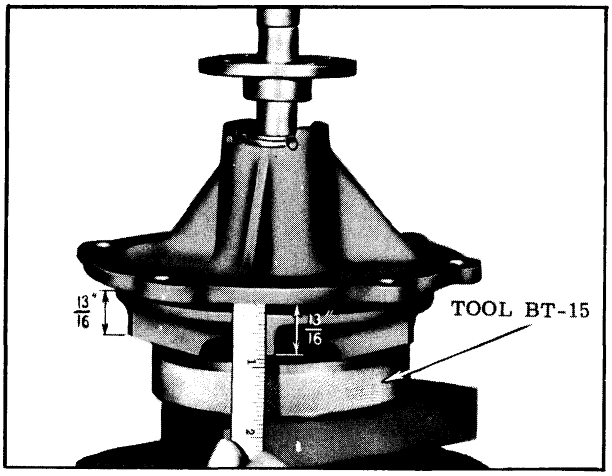


Fig. 8-63 Installing Impeller

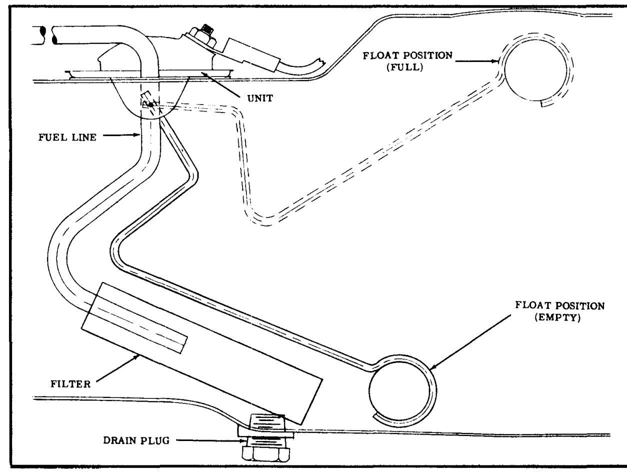


Fig. 8-64 Fuel Tank and Gauge Assembly

water pump seal and the corresponding surface of the impeller. The sealing face of the seal should be coated with special lubricant Part No. 567196 or equivalent.

6. Using Tool BT-15 to support impeller, Fig. 8-63, press bearing shaft through impeller until bottom edges of vanes are 13/16" from machined face at edge of housing.

FUEL SYSTEM

FUEL TANK AND GAS LINE

The fuel tank on all 1956 models has a capacity of 20 gallons. The filler tube is accessible through the left rear fender door. Venting of the fuel tank is provided by a groove on the filler tube flange where the cap seats. The tank is fitted with a tank gauge unit of which the suction pipe is an integral part. (See Fig. 8-64) A Saran fuel filter on the end of the suction pipe prevents entry of dirt or water into the fuel line. The filter is a push fit on the end of the pipe and should be pressed on approximately 1-11/16" so that the pipe bottoms on the shoulder inside the filter.

The fuel tank is mounted at the rear of the body under the rear compartment floor pan, and is removed by disconnecting the fuel line, gasoline gauge connection, and two gas tank support straps.

The gasoline line is located so as to reduce to a minimum the possibility of vapor lock. The main line is located on the outside of the left hand frame side rail and passes over to the fuel pump side of the engine, along the front side of the frame front cross member. In this way, the lines are exposed to outside air current along the side and front of the car frame.

CAUTION: If a car is to be stored for any appreciable length of time, the gasoline should be drained from the complete fuel system - including carburetor, fuel pump, all fuel lines, and fuel tank in order to prevent gum formations and resultant improper engine performance.

FUEL AND VACUUM PUMP

Description and Operation

The sealing of the pump against possible loss of oil through either the gas or vacuum sections has been provided for by seals at both diaphragm pull rods. With these seals, oil is allowed to lubricate the pump mechanism and is prevented from entering either the fuel or vacuum sections of the pump.

NOTE: Sediment and water sometimes become trapped within the fuel pump filtering bowl. To avoid difficulty, clean filter bowl and inspect paper filter element at least twice a year (Spring and Fall). The filter element and strainer gasket cannot be satisfactorily cleaned. If clogged, they must be replaced. When the filter bowl is replaced, use a new gasket.

The fuel diaphragm is moved downward

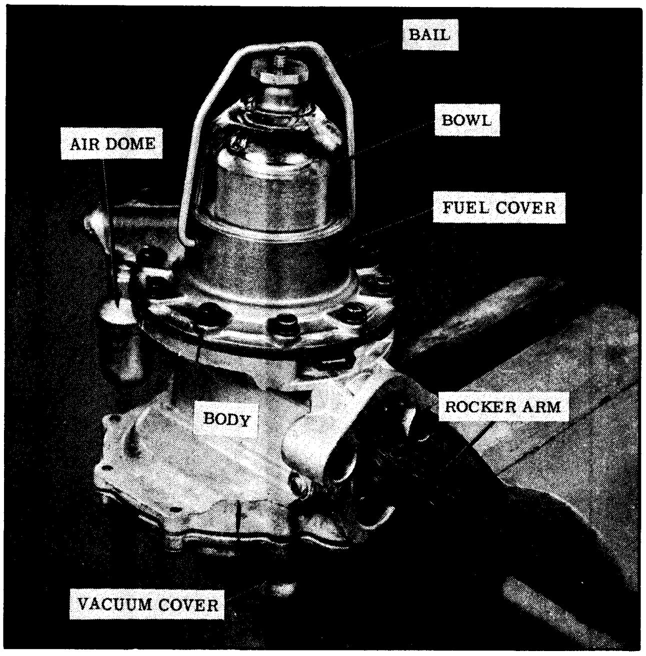


Fig. 8-65 Fuel Pump

only by the diaphragm spring. The pump delivers fuel to the carburetor only when the pressure in the outlet line is less than the pressure maintained by the diaphragm spring. Fuel is delivered to the carburetor only when the carburetor needle valve is open. When the needle valve is closed by pressure of fuel on the float, the pump builds up pressure in the space below the diaphragm and in the outlet tube until the diaphragm spring is compressed. The diaphragm remains in a stationary condition until more fuel is required. Normal diaphragm stroke is about 1/64".

The vacuum section acts as a booster when engine manifold vacuum is insufficient to operate the windshield wipers at adequate speed. This section is a double acting pump since air is displaced on both upward and downward movement of the diaphragm.

As the rocker arm is moved downward by pressure from the high point of the eccentric, it bears against the link which is also pivoted on the rocker arm pin bushing. The long end of the channel link is hooked to the diaphragm so the rocker arm movement results in upward motion of the vacuum diaphragm. The diaphragm movement compresses the diaphragm spring and exhausts air from the upper chamber to the intake manifold. With this same stroke the lower diaphragm chamber is enlarged, thus drawing air from the windshield wiper.

As the rotating eccentric permits the rocker arm to move away from contact with the link, the compressed diaphragm spring is free to move the diaphragm downward. This diaphragm stroke exhausts air from the lower chamber, through the valve that opens into the pump body, into the engine crankcase. This same stroke draws air from the windshield wiper into the expanded area above the diaphragm.

When the windshield wiper control valve is closed, or engine vacuum is sufficient to operate the wiper, vacuum holds the diaphragm near the center of its stroke so that very little movement occurs.

Fuel Pump Inspection and Test (Check the Pump While it is Mounted on the Engine)

Be sure there is gasoline in the tank. Note that the line from the tank to the pump is the suction side of the system and that the line from the pump to the carburetor is the pressure side of the system. Thus a leak is apparent on the pressure side by dripping fuel, but a leak on the suction side will not be apparent except in its effect or reducing volume of fuel on the pressure side. Tighten any loose line connections and look for bends or kinks in lines which reduce fuel flow. Tighten diaphragm flange screws. Disconnect fuel line at carburetor. Ground primary terminal of distributor with jumper lead so that engine can be cranked without firing. Place suitable container at end of fuel line and crank engine a few revolutions. If no gasoline, or only a little, flows from open end of line, then the fuel line is clogged or the pump is inoperative. Before removing pump, disconnect fuel lines at fuel pump and at gas tank, and blow through them with an air hose to make sure they are clear. Reconnect fuel lines to pump and gas tank, then retest flow while cranking engine. Even if fuel flows in good volume from line at carburetor, it is advisable to make a test of fuel delivery pressure to be certain that pump is operating within specified limits.

Attach a low reading pressure gauge to upper end of pump to carburetor line. Run engine at approximately 450 to 1000 R.P.M. on gasoline in carburetor bowl and note reading on pressure gauge. If pump is operating properly, the pressure will be 4 to 5-1/4 pounds and will remain constant at speeds between 450 and 1000 R.P.M. If pressure is too low or too high, or varies materially at different speeds, the pump should be removed for repair or replacement. Check strainer on tank pick-up tube if fuel flow is not improved after new pump installation.

Vacuum Section Inspection and Test

Test the vacuum section of the pump by fully opening the windshield wiper valve and observe wiper blade speed while alternately idling and accelerating the engine. Wiper blade speed should be fairly constant regardless of engine speed or throttle opening. NOTE THAT A DRY WINDSHIELD WILL SLOW WIPER SPEED. If windshield wiper does not operate properly, make the following inspection and test:

1. Make certain that wiper hoses are properly connected at pump, wiper motor and control on instrument panel, and that connections are air tight. Replace cracked or deteriorated hose.
2. If windshield wiper does not operate properly after all points of leakage have been corrected, detach both pipes at vacuum pump and join them with a piece of tubing. Slowly operate engine from idle to about 25 mph speed. The wiper should run at full speed, operating on engine vacuum only. If it does not, it can be assumed that the wiper motor or tubing is defective. The pump vacuum section is inoperative if the windshield wiper operates properly on engine vacuum but not on pump vacuum.
3. A further test of vacuum pump may be made by attaching a vacuum gauge to the inlet port (port connected to wiper motor) with outlet pipe disconnected.

   CAUTION: Always make this test of vacuum pump with outlet open.
4. With engine operating at equivalent of 20 mph road speed, the gauge should show 7 to 12 inches of vacuum. Less than 7 inches of vacuum indicates an inoperative vacuum pump.

PUMP ASSEMBLY
Remove and Install

The fuel pump is attached to the engine front cover by two bolts and lockwashers. Before removing the attaching bolts the vacuum and fuel lines should be disconnected. The flexible fuel line no longer has a swivel at the fuel pump end of the flex line. Therefore, whenever the fuel pump or flexible line is to be removed, it is necessary to disconnect the flex line from the fuel line before disconnecting the flex line at the pump. The line is retained on the frame by a bracket and a "C" type retaining clip.

When installing pump, the pump arm operating pad should be coated with special lubricant, Part No. 567196. The gasket should be cemented in place to aid installation. Torque pump to cover bolts 35-40 ft. lbs.

The flex line must be attached to the fuel pump before attaching the other end to the main fuel line.

Disassembly of Fuel Pump

NOTE: Before proceeding with the following operation, clean the outside of the unit. DO NOT SUBMERGE PUMP IN COMMERCIAL TYPE DEGREASER OR USE STEAM.

1. Clamp pump in vise by one ear of mounting flange with fuel side up.
2. Mark edges of fuel cover and body diaphragm flange with a file so the parts can be reassembled in the same relative position.
3. Remove fuel cover screws and lock washers evenly. Tap cover lightly to separate it from body if cover sticks.
4. Press down on fuel link as shown in Fig. 8-66 and push straight down on diaphragm, then tilt upward on side opposite lever to disengage pull rod from the fuel link, then remove diaphragm, spring, and spring seat.

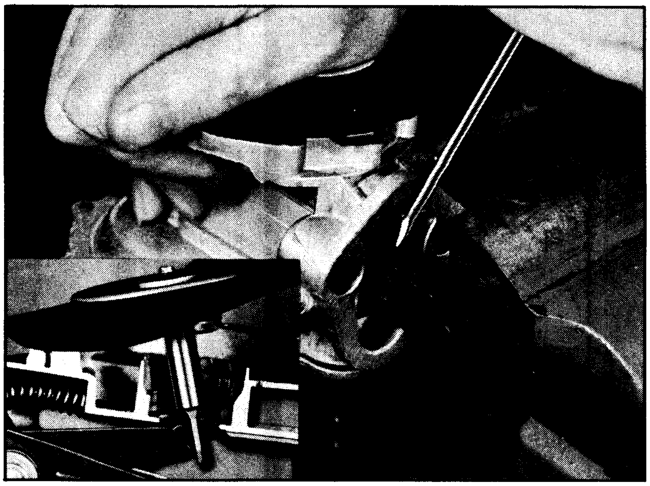


Fig. 8-66 Removing Fuel Diaphragm

5. Remove retainer screw from cover and lift out retainer, two valves, and two gaskets. (See Fig. 8-67)
6. Loosen bail nut and swing bail away from cover.
7. Remove glass bowl, fuel strainer, cork gasket, and strainer gasket.
8. Remove air dome from bowl cover. This is necessary to facilitate reassembly of cover to body.
9. Remove pull rod seal by removing staking, and pulling out seal retainer. (See Fig. 8-68)

   NOTE: The pull rod seal should be replaced whenever the fuel pump is disassembled.

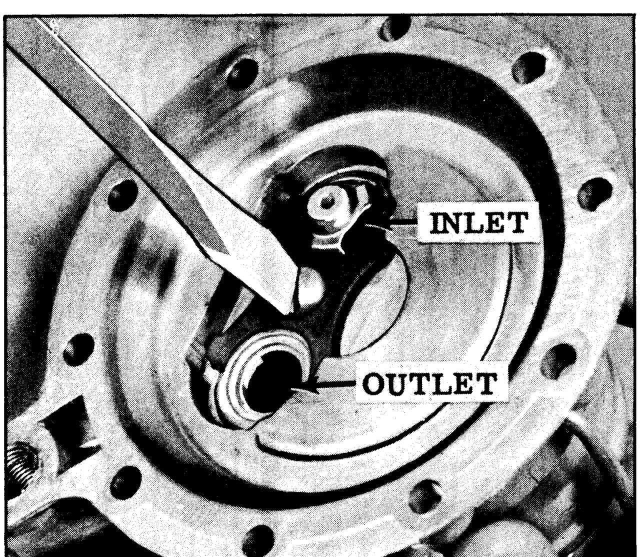


Fig. 8-67 Valves and Retainer

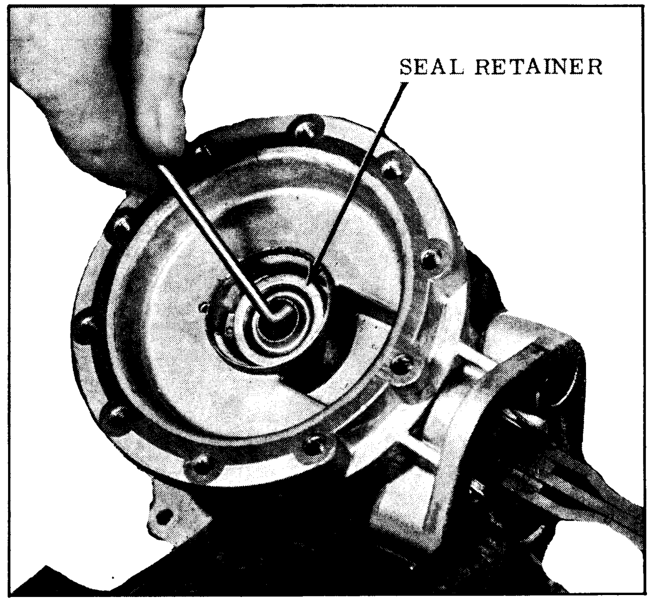


Fig. 8-68 Removing Fuel Seal Retainer

Disassembly of Vacuum Pump

1. With vacuum pump up, remove two opposite cover attaching screws and lock washers.
2. Install two #10-32 x 1-1/2" screws in place of screws just removed. Turn these screws all the way down and then remove the remaining six short screws. (See Fig. 8-69) This procedure is important to avoid damage to threads in body.
3. Alternately back off the two #10-32

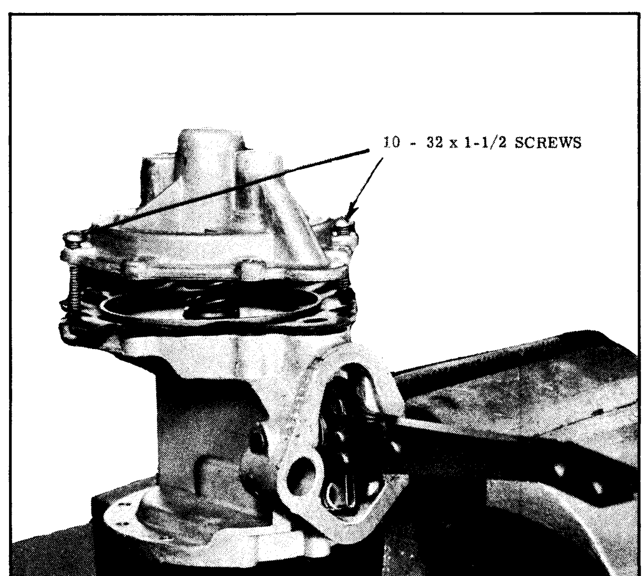


Fig. 8-69 Removing Vacuum Cover

screws a few turns at a time until the pressure of the heavy vacuum diaphragm spring is released. (See Fig. 8-69) Then remove both screws.

NOTE: Tap cover lightly to free it from body while removing the #10-32 screws if the cover tends to stick.

4. Remove cover with spring and spring seat.
5. Remove vacuum diaphragm by turning diaphragm 1/4 turn and pulling straight out.
6. Remove burrs produced by staking; then remove inlet and outlet valves from cover if they are to be replaced.

   NOTE: Valves need only to be replaced when they are defective.
7. Remove burrs produced by staking, then remove the outlet valve from the body by prying out with a screwdriver or a hook-shaped tool. The inlet valve adjacent to the rocker arm is not staked in place and it can be easily removed.
8. Remove pull rod seal by removing staking and prying out seal retainer (See Fig. 8-70)

   NOTE: The pull rod seal should be replaced whenever the vacuum pump is disassembled.

Inspection

1. Clean and rinse all metal parts in solvent. Blow out all passages with air hose.

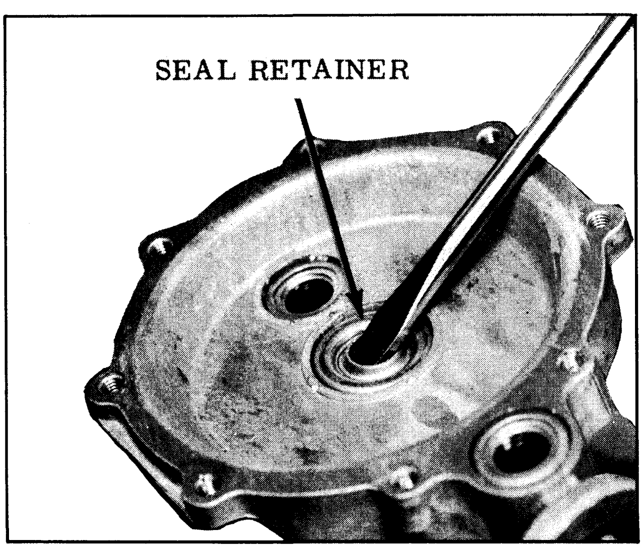


Fig. 8-70 Removing Vacuum Seal Retainer

2. Inspect pump body, fuel cover, and vacuum cover for cracks, breakage, and distorted flanges. Examine all screw holes for stripped or crossed threads. Replacement of pump assembly is advisable if one or more of the following conditions are found:
   a. Body or cover castings warped or damaged.
   b. Rocker arm worn at camshaft pad.
   c. Rocker arm bushing worn.
   d. Links worn excessively.

   NOTE: If flange facings are warped .010" or less, they can be trued up on surface plate and #400 grit sandpaper.

Assembly of Fuel Section

Installation of fuel diaphragm, valves and cover.

NOTE: Always assemble the fuel section of the pump before the vacuum section.

1. Install a new pull rod seal and retainer using a socket or a tube which will rest on the outer shoulder of the retainer.

   NOTE: It is not necessary to restake the seal retainer.
2. Soak diaphragm in clean kerosene or fuel oil, and oil diaphragm pull rod.
3. Place spring over seal, and spring seat on spring. With the fuel link up against the seal, hold the link in this position as shown in Fig. 8-71, then install the diaphragm by inserting the fuel pull rod through the spring seat, spring,

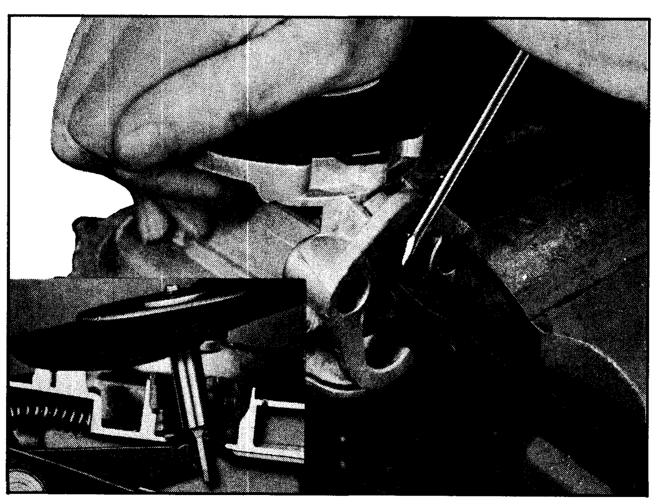


Fig. 8-71 Installing Fuel Diaphragm

and seal and with the flat of pull rod at a right angle to the fuel link, hook rod to link.

4. Place valve gaskets in recesses provided in fuel cover. Place valve assemblies on top of gaskets. Inlet valve must have spring cage facing out of cover, and the outlet valve must have the spring cage facing into cover. Secure valve assemblies with retainer and screws. (See Fig. 8-67)
5. With pump held in a vise, fuel pump up, using aligning pins as shown in Fig. 8-72, lift rocker arm until the diaphragm is flat across the body flange and install fuel cover on body, making sure that file marks on cover and body line up. While holding diaphragm flat, install cover screws and lock washers loosely until screws just engage lock washers. Remove aligning pins and install remaining screws with lock washers.

   NOTE: Diaphragm must be flexed by several full strokes of rocker arm before tightening cover screws, or pump pressure will be incorrect and diaphragm may be damaged.

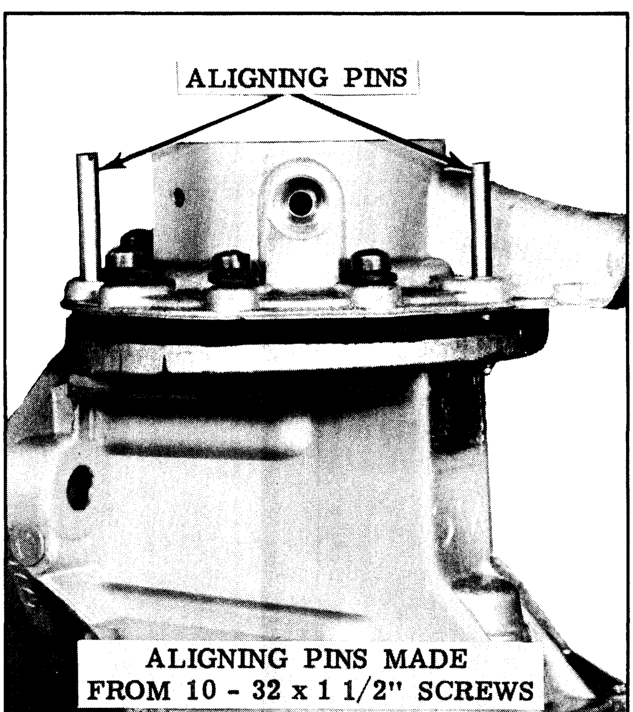


Fig. 8-72 Installing Fuel Cover

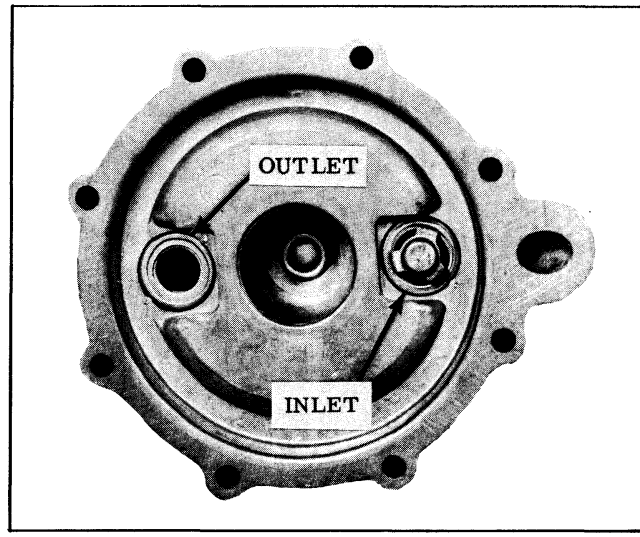


Fig. 8-73 Vacuum Valves

6. Tighten the cover screws alternately and securely.
7. Install fuel strainer gasket and strainer, bowl gasket and bowl. Swing bail over glass bowl and tighten nut finger tight.
8. Install air dome in fuel pump cover.

Assembly of Vacuum Pump

1. If valves were removed, place paper gaskets in recesses provided for valves in vacuum cover. Place valve assemblies on top of gaskets. (See Fig. 8-73)
2. Secure valve assemblies by staking.
3. Install a new pull rod seal and retainer assembly using a socket or a tube which will rest on the outer shoulder of the retainer.

   NOTE: It is necessary to stake the vacuum pull rod seal retainer.
4. Clamp pump in vise by one ear of mounting flange with vacuum pump up.
5. If removed, install composition gasket and valve assembly with spring cage down in seat farthest away from rocker arm; then lightly stake in place. Do not install the inlet valve adjacent to rocker arm at this time. (See Fig. 8-74)
6. Soak diaphragm in kerosene or fuel oil, and oil diaphragm pull rod.
7. Hold vacuum diaphragm so that the ear is 1/4 turn from rocker arm and gently insert pull rod down through seal.

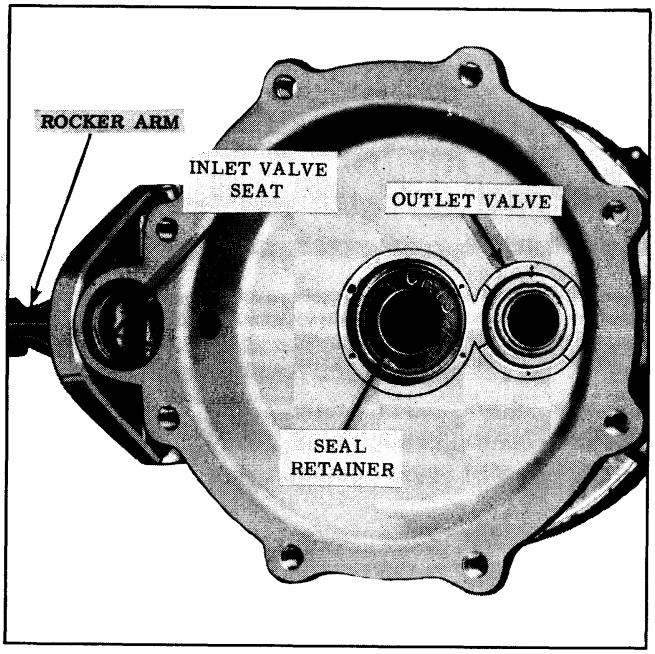


Fig. 8-74 Pump Body and Outlet Valve

8. Press rocker arm down to end of its travel and lift up on diaphragm approximately 1/8". This will align pull rod and link so that when the diaphragm is then turned 1/4 turn, the pull rod and the link will be engaged.
9. Depress rocker arm and insert hooked end of diaphragm Tool No. PT-8 (A-C) between rocker arm and the stop boss in body; then release rocker arm. (See Fig. 8-75)

   NOTE: If Tool PT-8 is not available, a piece of metal having a short bent end 3/32 inch thick may be used. See Fig. 8-76 for detail of tool.

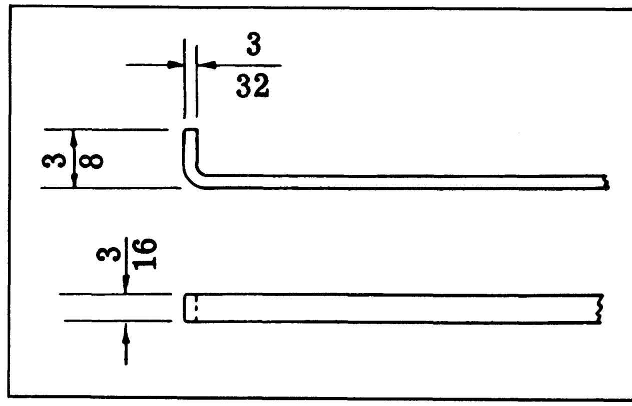


Fig. 8-76 Diaphragm Positioning Tool

10. Lift ear of diaphragm at rocker arm end and install gasket and valve in valve seat in body, with spring cage down. Do not stake this valve in place as it is retained by the diaphragm.
11. Place spring seat over the riveted end of diaphragm, and place the spring on the seat; then, place vacuum cover over the spring.
12. With projection of vacuum cover placed toward rocker arm, install two 10-32 x 1-1/2" screws in two opposite holes in cover flange. (See Fig. 8-77) Turn these long screws down alternately a few turns each, until regular screws can be installed. Insert regular screws

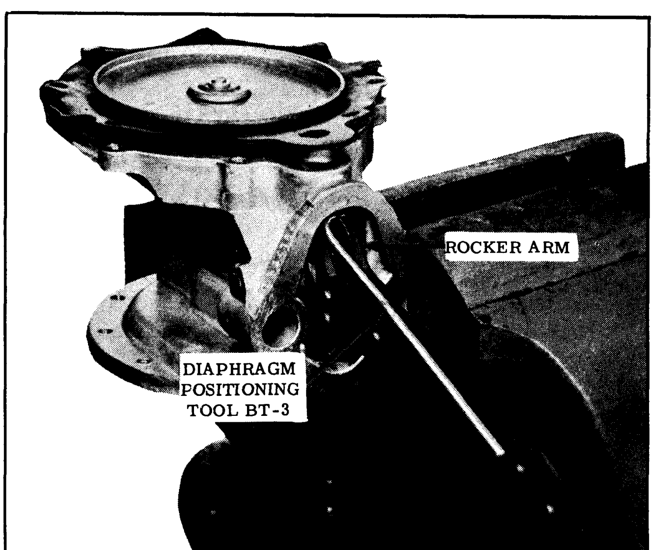


Fig. 8-75 Tool in Position

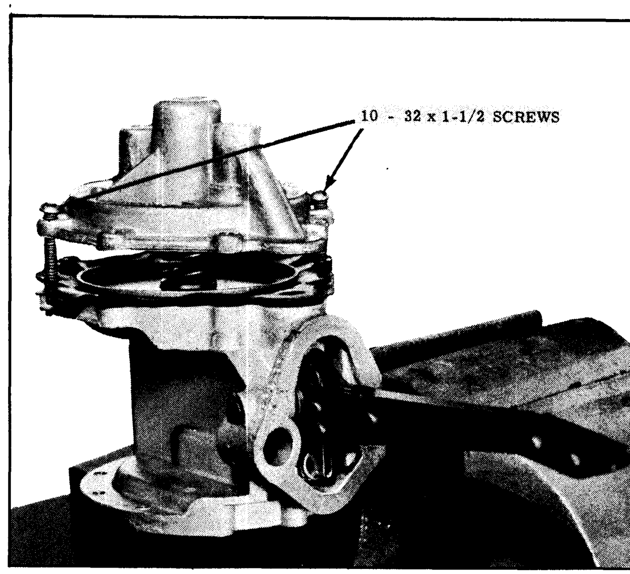


Fig. 8-77 Installing Vacuum Cover

with lock washers, and tighten evenly until screws just engage lock washers. Replace two long screws with regular screws and lock washers. Be sure that screws pass through holes in fabric of diaphragm without damage to material.
13. Remove 3/32 inch tool from rocker arm position. This allows the heavy vacuum spring to flex the diaphragm the correct amount.
14. Tighten all screws alternately on opposite sides.

EXHAUST SYSTEM

The single exhaust system consists of an exhaust pipe, crossover pipe, muffler, and tail pipe.

The dual exhaust system available for 1956 models consists of 2 exhaust pipes, mufflers, tail pipes, and tail pipe extensions. (See Fig. 8-78)

NOTE: To remove the L.H. exhaust pipe, it is necessary to disconnect the pitman arm from the pitman shaft. To remove the L.H. tail pipe, it is necessary to disconnect the lower end of the left shock absorber (98 models only).

MUFFLER

The muffler is a reverse flow type having an asbestos and steel outer shell to improve silencing characteristics. The muffler is supported at its front end by the exhaust pipe while the rear end is supported by a rubber insulated hanger which is part of the rear clamp.

NOTE: The muffler must be installed with the drain hole facing rearward.

When installing components of the exhaust system, observe the following:

1. To insure gas tight connections:
   a. Always use new gaskets.
   b. Apply Vibradamp #253 or equivalent to the outside diameter of the exhaust and tail pipes where they join the muffler.
   c. When tightening exhaust pipe flanges, tap the flanges with a hammer to insure the proper seating of the flanges and gaskets.
2. Before tightening any part of the exhaust system, align the exhaust and tail pipes to provide adequate clearance between the body and frame. Before tightening the muffler front clamp, the L.H. tail pipe must be positioned to provide a clearance of 1-3/4" to the rear axle housing. The tail pipe extensions must be positioned to provide 1" clearance to the rear bumper ornaments.

NOTE: ALLOW ENGINE TO REACH OPERATING TEMPERATURE BEFORE TORQUING ATTACHING NUTS.

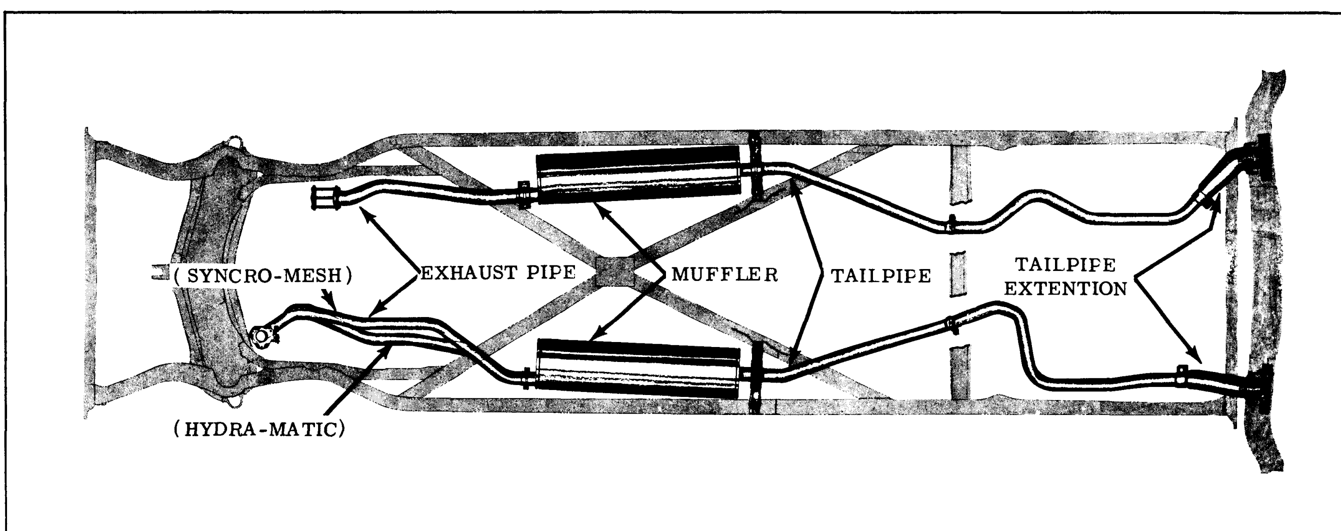


Fig. 8-78 Dual Exhaust System

ENGINE SPECIFICATIONS

Subject and Remarks

1. CYLINDER BLOCK
   - a. Engine Type . . . . 90° V-Type
   - b. Number of Cylinders 8
   - c. Bore and Stroke . . . . 3-7/8" x 3-7/16"
   - d. Piston Displacement . . . . 324 cu. in.
   - e. Compression Ratio . . . . .88, Super 88 & 98 - 9.25 to 1
   - f. Firing Order 1-8-7-3-6-5-4-2

2. CRANKSHAFT
   - a. Diameter - Main Bearing Journal
     - No. 1 . . . . 2.498" - 2.499"
     - No. 2 . . . . 2.498" - 2.499"
     - No. 3 . . . . 2.498" - 2.499"
     - No. 4 . . . . 2.498" - 2.499"
     - No. 5 . . . . 2.623" - 2.624"
   - b. Width - Main Bearing Journal, Including Fillets
     - No. 1 . . . . 1-3/32"
     - No. 2 . . . . 1-1/8"
     - No. 3 . . . . 1-1/8"
     - No. 4 . . . . 1-1/8"
     - No. 5 . . . . 1-7/8"
   - c. Diameter - Connecting Rod Bearing Journal . . . . 2.2488" - 2.2498"
   - d. Width - Connecting Rod Bearing, Including Fillets . . . . . . 1.997" - 2.000"
   - e. Length - Overall Crankshaft . . . . 26-1/8"
   - f. Weight - Crankshaft . . . . 59-1/4 lbs.
   - g. Diameter of Oil Holes in Crankshaft . . . . 1/4"
   - h. Number of Counterweights. 6
   - i. Clearance - Crankshaft End Thrust . . . . .004" - .008"

3. CRANKSHAFT SPROCKETS

	Link - Belt:	Morse
a. Width	.520"-.530"	.495"-.505"
b. Pitch	.500"	.375"
c. Number of Teeth	18	24

4. FLYWHEEL
   - a. No. of Teeth on Starter Gear 176
   - b. No. of Teeth on Starter Pinion 9

5. MAIN BEARINGS
   - a. Clearance - Crankshaft Radial on Front Bearing . . . . . . .0005" - .0020"
   - b. Clearance - Crankshaft Radial on Rear Bearing . . . . . . .0020" - .0035"
   - c. Clearance - Crankshaft Radial on Bearing #2, 3 & 4. . . . .0005" - .0030"
   - d. Length - Bearing Shell
     - No. 1 . . . . 15/16"
     - No. 2 . . . . 15/16"
     - No. 3 . . . . 15/16"
     - No. 4 . . . . 15/16"
     - No. 5 . . . . 1-11/16"

ENGINE SPECIFICATIONS—Continued

Subject and Remarks

6. PISTONS

a. Length Overall . . . . 4.050"
b. Length from top of Piston to Pin Center . . . . 1.895" - 1.898"
c. Clearance (at Thrust Surface) Selective . . . . .0005" - .0010"
d. Diameter - Nominal Outside . . . . 3-7/8"
e. Weight - Less Pins and Rings . . . . 22.0702 oz.

77. PISTON PINS

a. Diameter (Selective) . . . . .9803" - .9807"
b. Length Overall . . . . 3.126"
c. Radial Clearance (Selective) Plain Boss . . . . .000 to .0002" Loose

8. PISTON RINGS

a. Material . . . . Compression - C.I.
Oil - Spring Steel
b. Number Compression Rings 2
c. Width, Compression Rings . . . . .077" - .078"
d. Thickness, Compression Rings (Maximum). . . . . .189"
e. Gap Clearance, Compression Rings. . . . . .008" - .016" S.P.
.010" - .020" P.C.
f. Clearance in Groove, Compression Rings . . . . .001" - .003"
g. Number Oil Rings 1
h. Width Oil Ring . . . . .180" - .186" S.P. & P.C.
j. Thickness, Oil Ring (Maximum) . . . . .139" S.P. & P.C.
k. Gap Clearance, Oil Ring. . . . . .013" - .033" S.P. & P.C.
l. Clearance in Groove, Oil Rings. . . . . .0023" - .0039"

9. CONNECTING RODS

a. Length - Center to Center . . . . 6-5/8"
b. Length - Lower Bearing Shell . . . . .876" - .886"
c. Length - Upper Bearing . . . . 1.249" - 1.251"
d. Diameter - Lower Bearing Shell . . . . 2.2507" - 2.2512"
e. Diameter - Upper Bearing (Selective) . . . . .9807" - .9811"
f. Clearance - On Crankshaft (Vertical) . . . . .0009" - .0029"
g. Clearance - On Crankshaft (Horizontal) . . . . .0019" - .0039"
h. Clearance - Radial - On Piston Pin . . . . .0003" - .0005"
j. Clearance - End - On Crankshaft . . . . .002" - .011"
k. Diameter - Connecting Rod Bolt . . . . .389" - .390"

10. CAMSHAFT

a. Bearing Journal Diameters
No. 1 . . . . 1.997" - 1.9975"
No. 2 . . . . 1.997" - 1.9975"
No. 3 . . . . 1.997" - 1.9975"

ENGINE SPECIFICATIONS—Continued

Subject and Remarks

No. 4	1.997" - 1.9975"
No. 5	1.997" - 1.9975"
b. Width Including Chamfers	
No. 1	25/32"
No. 2	23/32"
No. 3	23/32"
No. 4	23/32"
No. 5	25/32"
c. Journal Clearance in Bushing	.0018" - .0038"
d. Diameter - Reamed Bushing	
No. 1	1.9995" - 2.001"
No. 2	1.9995" - 2.001"
No. 3	1.9995" - 2.001"
No. 4	1.9995" - 2.001"
No. 5	1.9995" - 2.001"
e. Length - Bushing	
No. 1	11/16"
No. 2	11/16"
No. 3	11/16"
No. 4	11/16"
No. 5	11/16"
f. End Thrust	Block and Spring Loaded Plunger

11. CAMSHAFT SPROCKET	Link - Belt:	Morse
a. Width	.520"-.530"	.500"
b. Pitch	.500"	.375"
c. Number of Teeth	36	48

12. TIMING CHAIN	Link - Belt:	Morse
a. Width	27/32"	7/8"
b. Length	24"	24"
c. Number of Links	48	64
d. Pitch	.500"	.375"

13. VALVES - INTAKE

a. Diameter - Head	1.745" - 1.755"
b. Diameter - Stem	.3417" - .3425"
c. Angle - Valve Seat	45°
d. Width - Seat	.042" - .071"
e. Length - Overall	4.989" - 5.009"
f. Lift	.418"
g. Clearance in Guide	.0017" - .0040"
h. Lash	Hydraulic

14. VALVES - EXHAUST

a. Diameter - Head	1.557" - 1.567"

ENGINE SPECIFICATIONS—Continued

Subject and Remarks

b. Diameter - Stem . . . . .3930" - .3938"
c. Angle - Valve Seat . . . . 45^o
d. Width - Seat . . . . .042" - .071"
e. Length - Overall . . . . 4.989" - 5.009"
f. Lift . . . . .418"
g. Clearance in Guide . . . . .0022" - .0045"
h. Lash . . . . Hydraulic

15. VALVE SPRINGS

a. Number of Coils 7-1/4
b. Number of Active Coils (Valve Closed) 3-3/4
c. Length - Free (Approx.) . . . . 2.38"
d. Diameter - Wire . . . . .184" - .187"
e. Diameter - Inside . . . . 1.070"
f. Diameter - Outside . . . . 1.441"
g. Pressure and Length
(1) Valve Open . . . . 183 - 197 lbs. 1.480"
(2) Valve Closed . . . . 95 - 105 lbs. 1.880"

16. VALVE LIFTERS

a. Diameter - Body . . . . .8424" - .8427"
b. Length - Overall . . . . 2"
c. Clearance in Boss (Selective) . . . . .0005" - .0018"

17. VALVE GUIDES

a. Height from Top of Head . . . . .787"
b. Diameter - Inside Ream Int. (At Assembly) . . . . .3442" - .3457"
c. Diameter - Inside Ream Exh. (At Assembly) . . . . .3960" - .3975"
d. Length - Overall . . . . 2.390"

18. LUBRICATION SYSTEM

a. Capacity - Engine Oil - Qts 5
b. Width - Pump Gears . . . . 1-1/2"

19. COOLING SYSTEM

a. Radiator - Make . . . . Harrison
b. Capacity - Qts.
Without Heater 20-1/2
With Heater 21-1/2
c. Thermostat - Degrees
For G.M. Anti-Freeze (Alcohol) . . . . 160^o
For G.M. Ethylene Glycol Anti-Freeze (Permanent) . . . . 180^o

ENGINE SPECIFICATIONS—Continued

ENGINE TORQUE TIGHTNESS CHART

Application	Ft. Lbs.
1. Air Cleaner to Carburetor Stud	3-5
2. Bearing Housing to Front Cover Bolts	14-22
3. Carburetor to Intake Manifold Nuts	11-14
4. Connecting Rod Nuts	40-50
5. Crankshaft Bearing Cap Bolts No. 1, 2, 3 & 4	100
6. Crankshaft Bearing Cap Bolts (Rear)	140
7. Push Rod Cover Bolts	2-3
8. Cylinder Head to Block Bolts	60-70
9. Exhaust Manifolds to Cylinder Head Nuts and Bolts	22-26
10. Fan Drive Pulley to Crankshaft Bolt	45-50
11. Fan to Fan Hub Bolts	11-14
12. Filter Assembly to Cylinder Block Bolts	30-35
13. Filter Housing to Base Bolt	40-45
14. Flywheel Lower Housing Cover Bolt (1/4)	4-7
15. Flywheel Lower Housing to Cylinder Block Bolt	50-55
16. Flywheel Cover Housing to Block and Flywheel Housing	50-55
17. Flywheel to Crankshaft Bolt (7/16)	85-95
18. Front Cover to Cylinder Block Bolts (3/8)	30-35
19. Front Cover to Cylinder Block Bolts (7/16)	30-35
20. Front Engine Mounting to Frame Bolts	45-50
21. Front Mounting Bracket to Front Cover Bolts	30-35
22. Fuel & Vacuum Pump to Front Cover Bolts	35-40
23. Gear and Eccentric to Camshaft Bolts	14-17
24. Intake Manifold to Cylinder Head Bolts and Nuts	22-26
25. Oil Filter Pad Cover Bolts	30-35
26. Oil Pan Bolts	9-11
27. Oil Pan Drain Plug	35-40
28. Oil Pump Cover to Pump Body Bolts	5-8
29. Oil Pump Relief Valve Plug	35-40
30. Pump Assembly to Bearing Cap Bolts	11-14
31. Radiator Center Mounting Nut	25-30
32. Rear Engine Support to Frame Bolts & Nuts	45-50
33. Rear Mounting Support Bolts	45-50
34. Rocker Shaft Brackets to Cylinder Head Bolts	14-17
35. Screen Cover to Oil Pump Body Bolts	4-7
36. Torus Cover to Flywheel Bolts	35-40
37. Transmission to Housing Bolts (1/2) S.M.T.	60-70
38. Valve Cover Bolts	2-3
39. Water Outlet Hole Cover Nuts	22-26
40. Water Outlet to Manifold Bolts	22-26

CARBURETION

CONTENTS

CARBURETION

The 1956 Oldsmobile "88" series is equipped with the Rochester Model 2GC dual downdraft carburetor, and the "Super 88" and "98" series are equipped with the Rochester Model 4GC carburetor.

Both carburetors are designed with split throttle levers which permit idle speed adjustments to be made without affecting the Hydra-Matic throttle linkage adjustment on Hydra-Matic equipped models.

ROCHESTER CARBURETOR
Model 4GC

The model 4GC carburetor is the same design as used in 1955, with the exception of two new features:

A. During low speed, wide open throttle operation, the velocity (manifold vacuum) through the four bores often becomes too low to allow good metering control. A pair of spring-loaded, velocity-operated auxiliary throttle valves, located in the secondary bores have been added to close the secondary bores during the above condition. Thus, more effective metering control is possible through a wider range of wide open throttle operation.

When air velocity is high, metering control is good and the auxiliary valves are held open.

B. A vacuum and spring operated throttle return check has been added to retard throttle closing sufficiently to prevent stalling (on cars equipped with the Jetaway Hydra-Matic).

The following description will consider and assume the carburetor as basically two dual carburetors incorporated as one complete unit. These theoretical two carburetors will be referred to as the Primary Side and the Secondary Side. The Primary Side completely controls the metering of fuel to the engine throughout the idle and part throttle range. The fuel delivered from the Primary Side is supplemented by fuel from the Secondary Side during the power or wide open throttle range.

Float System
Fig. 8-79

To aid in maintaining the correct fuel level under all conditions of operation, the Rochester 4GC carburetor employs the use of two sets of twin floats.

Both sides of the carburetor incorporate individual float systems for maintaining the proper fuel level in each float bowl. All fuel enters the carburetor on the primary side (1).

When the fuel on primary side drops, the twin floats (2), also drop, thus moving the inlet needle (3) from its seat (4).

Pressure from the fuel pump forces fuel through the filter screen (5) into the inlet passage (6), then through the small cylindrical filter screen (7) located on the projecting portion of the fuel valve seat and then into the float bowl. As the fuel level in the bowl rises, the floats rise and once again close off the inlet needle.

As fuel is drawn from the float bowl on

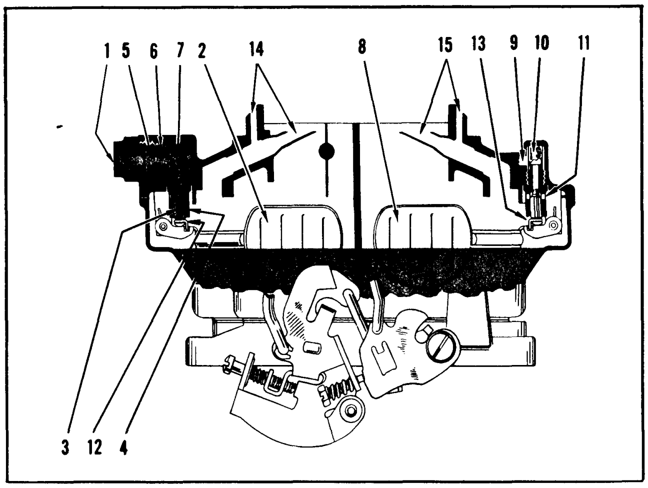


Fig. 8-79 Float System

the secondary side of the carburetor, the float action is identical with that on the primary side. When the twin floats (8) drop, pressure from the fuel pump forces fuel through the fuel inlet (1) and filter screen (5). This fuel then passes through a channel in the air horn and enters the inlet passage on the secondary side at (9). It then passes through the small filter screen (10), through the needle seat (11), and into the float bowl. As on the primary side, when fuel level rises, the floats rise and close the inlet needle valve.

Both float systems are provided with float needle pull-clips (12 & 13) which pull the inlet needles from their seats when opening. This is to prevent the possibility of gum deposits causing a sticking condition.

Both sides of the carburetor are individually and internally vented by the channels shown in (14 & 15). These vents transmit the air pressure from beneath the air cleaner to the fuel in the float bowl. The amount of fuel metered by the carburetor is dependent upon the air pressure in the float bowl causing fuel to flow. By locating the vents below the air cleaner, or internally, the carburetor automatically compensates for air cleaner restriction, since the same pressure causing air to flow will also be causing fuel to flow.

A passage in the float bowl, slightly above the normal fuel level, links the primary and secondary float bowl together. In this way, any abnormal rise in level on one side will be absorbed by the other and should not seriously disrupt the operation of the engine.

Idle System
Fig. 8-80

At small throttle openings, the vacuum created by the main venturi is not sufficient to cause fuel to flow from the nozzles. Therefore, an additional system has been provided to furnish the proper mixture ratios required throughout the low speed range.

An adjustable idle system is provided on the primary side of the carburetor and supplies the fuel required for normal curb idle as well as that required for operation in the off idle, low speed range. Idle fuel is drawn from the float bowl through the main metering jets (1) into the fuel well in the bottom of the float bowl. It then passes through the calibrated idle tubes (2). Air joins this fuel at the calibrated primary idle air bleeds (3). This mixture then passes through the idle restrictions (4) where it is "squeezed" together under high velocity, mixing the fuel and air. The mixture is further bled at the secondary idle air bleeds (5), then passes down through a vertical idle channel (6) where additional air is bled into the mixture through the lower idle air bleeds (7) and secondary idle discharge holes (8). The resultant mixture is then discharged into the throttle bore from the idle needle holes (9).

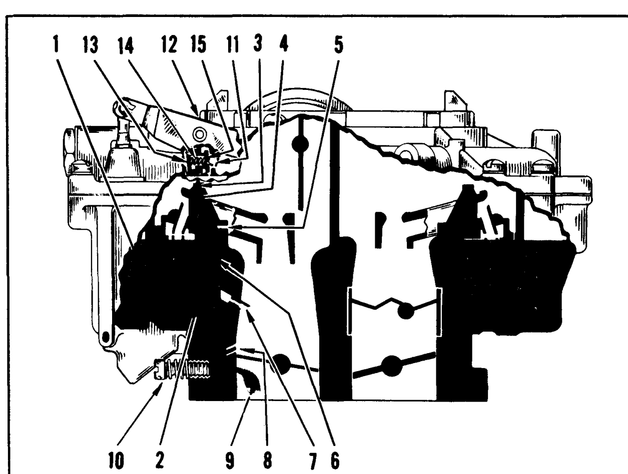


Fig. 8-80 Idle System

As the throttle valves are opened from the curb idle position, the air entering the secondary idle holes (8) gradually diminishes. When these holes become exposed to manifold vacuum they then become fuel discharge holes to meet the increased demand of the engine. Further opening of the throttle valves increases the air velocity through the carburetor sufficiently to cause the air to strike the end of the extended lower idle air bleed (7), thus creating a lower pressure within the bleed tube. As a result, fuel begins to discharge from this bleed tube and continues to do so throughout the part throttle and wide open throttle ranges, supplementing the nozzle delivery.

To adjust the idle mixture, a tapered needle (10) is used to vary the amount of manifold vacuum applied to the idle system. Turning the needle clockwise reduces the vacuum available to the system and the idle mixture becomes leaner.

In order to minimize difficult hot weather starting or rough idling due to fuel vapor formation, the Model 4GC carburetor incorporates an external vent which functions when the throttle valves are in the closed position. This external idle vent consists of an actuating lever (11) attached to the pump shaft and lever assembly (12), idle vent valve guide (13), idle vent valve spring (14), and idle vent valve (15). When the throttle valves are closed, the actuating lever contacts the spring loaded vent valve and holds it open, permitting vapors from the float bowl to vent themselves to the atmosphere. As the throttle valves are opened, the idle vent spring closes the vent valve, thus eliminating the atmospheric vent and returning the carburetor to an internal balance.

Part Throttle System
Fig. 8-81

As the throttle valves are opened to a greater degree and more air is drawn through the carburetor, it is necessary to provide means, other than the idle system, for supplying additional fuel to meet the engine requirements.

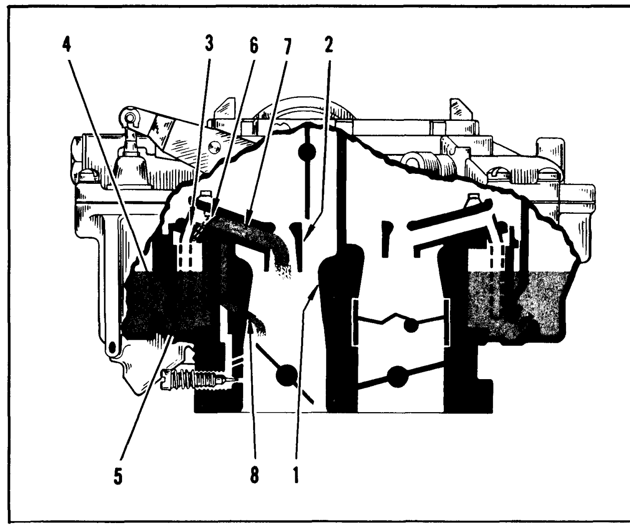


Fig. 8-81 Part Throttle System

The primary side of the carburetor meets this increased demand for fuel in the following manner: at a point of sufficient throttle opening, manifold vacuum, multiplied several times in the primary (1) and secondary venturi (2), is transmitted to the top of the main well tubes at main discharge nozzles (3). This vacuum draws fuel from the float bowl, through the calibrated main metering jets (4) and into the main well tubes (5). After passing through the main well tubes, air joins the mixture at the main well bleeds (6). The mixture then passes from the top of the nozzle through the mixture passage (7), to the secondary venturi (2) and on into the intake manifold. As the throttle opening is progressively increased and more fuel is drawn through the main well tubes, the fuel level in the main well drops. The calibrated holes in the main well tubes are proportionately exposed to the air in the upper well area and when this occurs, they become air bleeds, mixing progressively more air with the fuel passing through the main well tubes. Thus, although the nozzle suction is increased by increasing the throttle opening, the fuel mixture to the engine remains constant throughout the Part Throttle Range.

As mentioned in the idle system, when the throttle opening increases, the lower idle air bleeds (8) now become part throttle feed nozzles.

The throttle valves on the secondary side of the carburetor do not open until the primary linkage engages the secondary throttle shaft. They will open fully during the final few degrees of primary throttle travel. The secondary side, therefore, only supplies fuel in the power range. The part throttle or intermediate range is controlled completely by the primary side of the carburetor.

Power System
Fig. 8-82

To achieve the proper mixtures required when more power is desired or sustained high speed driving is to be maintained, the Model 4GC Carburetor employs the use of a vacuum operated power piston (1) in the air horn and a power valve (2) in the float bowl. This power system is located on the primary side of the carburetor.

The power piston vacuum channel (3) is exposed to manifold vacuum beneath the throttle valves. The vacuum in this channel varies directly with the manifold vacuum. In the idle and part throttle ranges, the manifold vacuum is normally quite high. This vacuum is sufficient to hold the power piston (1) in its extreme upward position. However, as the throttle valves are progressively opened, the vacuum drops. When the vacuum drops below approximately 7" Hg., the calibrated spring (4) forces the piston down. This situation occurs at very high speeds or on rapid acceleration. When the piston moves down, it unseats the spring loaded power valve (2). This permits additional fuel to flow from the float bowl through the holes in the main well tubes (5) and into the main wells. This additional fuel supplements that already flowing through the main metering jets (6) and main well tubes (7), (on the primary side) thus making the mixture being delivered to the manifold considerably richer than normal Part Throttle mixtures. This power mixture continues to be supplied as long as the manifold vacuum remains below approximately 7" Hg. When the manifold vacuum again increases sufficiently, the force of the power piston spring (4) is overcome and the piston is drawn up, returning the carburetor to the economical part throttle mixtures.

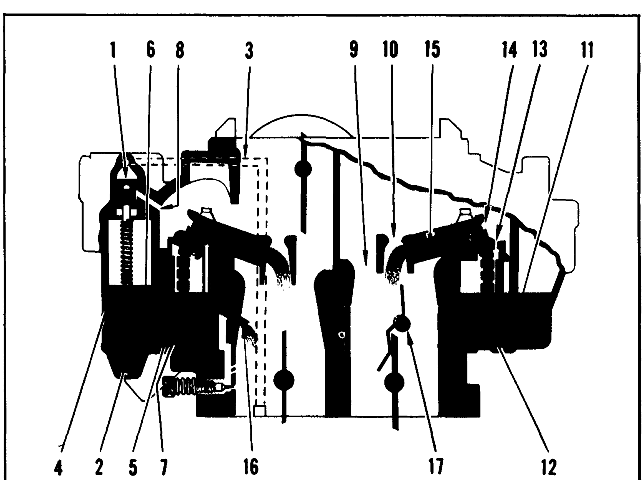


Fig. 8-82 Power System

It will be noted that the power piston cavity in the carburetor air horn is connected to the main air flow passage by a vacuum break hole (8). This hole prevents the transfer of vacuum acting on the piston from acting also on the top of the fuel in the float bowl. Any leakage of air past the upper grooves of the piston will be compensated for by this vacuum break hole and will not affect carburetor calibration.

It is also in this range that the secondary side of the carburetor provides additional air and fuel to the engine for increased power. For high speed operation beyond the part throttle range, the throttle linkages engage the secondary throttle valves and open them completely in the remaining few degrees of primary throttle travel.

In this range, manifold vacuum acting on the secondary side of the carburetor is multiplied at the primary (9) and secondary (10) venturi and draws fuel from the float bowl through the calibrated main metering jets (11) into the main wells. This fuel then passes through the main well tubes (12) and is bled in a manner similar to that described previously in the operation of the primary main well air bleeds. This mixture is bled further at the main well bleed (13) and is then drawn to the top of the main well tube (14). It then passes through the discharge nozzle (15) to the secondary venturi (10) and is discharged into the intake manifold.

The lower idle air bled (16) also supplies fuel throughout the power range in a manner similar to that described under the Part Throttle System.

The auxiliary valves (17) provide a means for controlling secondary bore opening according to air velocity at wide open throttle. High velocity allows good metering and also holds the valves open so that the secondary metering system can supply fuel-air mixture. Low velocity reduces metering efficiency. When this condition occurs, the spring tension overcomes the velocity and closes the valves. The mixture, which was passing through four bores, now passes through only two. Velocity is, therefore, twice as high and better metering control is extended over a wide range of low speed, wide open throttle operation.

Pump System
Fig. 8-83

When the throttle is opened rapidly the air flow and manifold vacuum change almost instantaneously, while the heavier fuel tends to lag behind causing a momentary leanness. The accelerating pump provides the fuel necessary for smooth operation during rapid acceleration.

It will be noted that since the throttle valves on the secondary side of the carburetor remain fully closed throughout part throttle operation, it is only necessary to have one accelerator pump, that being located on the primary side of the carburetor.

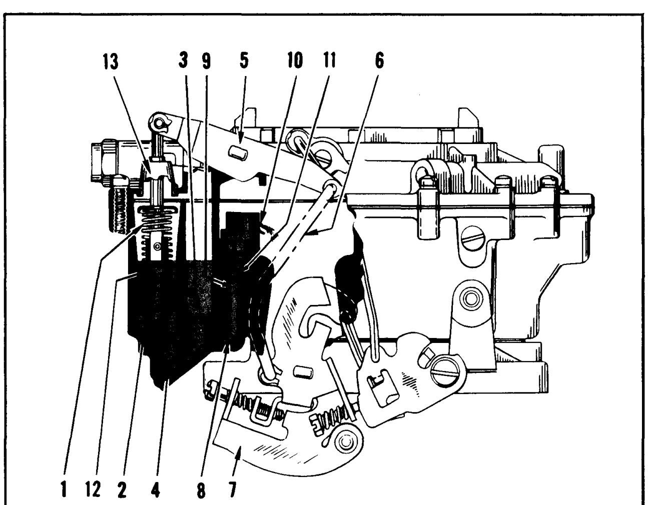


Fig. 8-83 Pump System

A double spring pump plunger is used on the Model 4GC Carburetor. The rates of compression of the top spring (1) versus the bottom spring (2) are calibrated to insure a smooth, sustained charge of fuel for acceleration.

On the pump intake or up-stroke of the plunger, fuel from the float bowl passes through the pump filter screen (3), unseats the aluminum inlet ball (4), and fills the pump well.

The accelerator pump is connected through the pump shaft and lever assembly (5), and pump rod (6), to the throttle lever (7). Upon acceleration or down stroke of the pump plunger, the force of fuel in the pump well seats the inlet ball (4). The fuel is then forced through the discharge channel (8), unseats the pump outlet ball (9), and then discharges through the pump jets (10) into the air stream. At the end of the discharge, the outlet ball is returned to its seat by the spring (11), which prevents air being drawn back into the fuel channel during the intake stroke.

The pump plunger head has been vented to minimize the effect of fuel percolation in the pump well. This has been accomplished by the design of a ball check and seat in the plunger head (12). In this manner any build-up of fuel vapors in the pump well will rise and by-pass the ball, thus venting themselves into the float bowl. Therefore, there is always a charge of solid fuel beneath the plunger head for rapid acceleration. Without this feature, any vapor pressure build-up would evacuate the charge of fuel in the pump system, causing poor initial acceleration as well as difficult hot weather starting.

The carburetor also makes use of a pump plunger shaft dust boot (13) which serves the dual purpose of preventing dirt and foreign material from entering the fuel bowl through the shaft opening on the top of the air horn; and providing the proper seal necessary to maintain the correct air horn vent pressure within the fuel bowl.

Choke System
Fig. 8-84

The Model 4GC Carburetor employs the use of a fully automatic choke to insure proper starting and driving during cold weather operation. Choking of the carburetor is necessary only on the primary side. This is due to the fact that the secondary throttle valves are locked in the closed position whenever the choke valve is even partially closed. This is accomplished by a secondary throttle shaft lock-out lever and a slot in the fast idle cam. Whenever the choke valve is closed the lock-out lever prevents opening of the secondary throttle valves. However, when the choke valve is wide cpen, the fast idle cam drops down so that the lock out lever clears the cam, thus permitting the secondary throttle valves to open.

The choke system is composed of a thermostatic coil (3), vacuum piston (4), offset choke valve, and fast idle cam. Its operation is controlled by a combination of intake manifold vacuum, the offset choke valve, atmospheric temperature, and exhaust manifold heat.

When the engine is cold the thermostatic coil is calibrated to hold the choke valve closed. As the engine is started, air

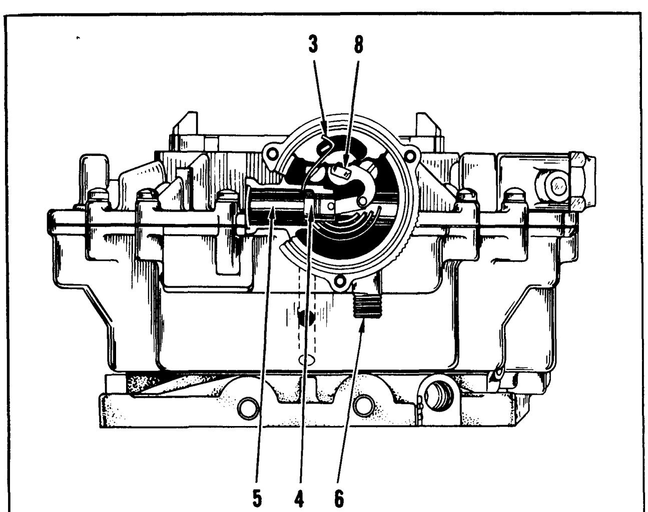


Fig. 8-84 Choke System

velocity against the offset choke valve causes it to open slightly against the torque of the thermostatic coil. In addition, intake manifold vacuum is applied to the vacuum piston (4) through the vacuum channel (5) which also tends to open the choke valve. Therefore, the choke valve assumes a position where the torque of the thermostatic coil is balanced against vacuum pull upon the choke piston and air velocity against the offset choke valve, thereby causing a regulated air flow into the carburetor which provides a richer mixture during the warm-up period.

During warm-up the vacuum piston (4) serves to modify the choking action to compensate for varying engine loads or acceleration. Any acceleration or increased load decreases the vacuum exerted on the choke piston. This allows the thermostatic coil torque to momentarily increase choke valve closure to provide the engine with a richer mixture for acceleration.

As the engine warms up, hot air from the exhaust manifold is drawn into the thermostatic coil housing (6). This hot air causes a rise in temperature which in turn causes the coil to slowly relax its tension. Thus the choke valve is allowed to move gradually to the full open position.

To prevent stalling during the warm-up period, it is necessary to run the engine at a slightly higher idle speed than for a warm engine. This is accomplished by the fast idle screw which rests on the steps of the fast idle cam. The fast idle cam is in turn linked to the choke valve shaft by the choke rod, choke trip lever and choke lever and collar assembly. This holds the throttle valves open sufficiently during the warm-up period to give the increased idle RPM until the choke valve moves to the full open position.

While the automatic choke is in operation, the driver may wish to advance the throttle to the full wide open position. Since this would decrease pull upon the vacuum piston (4), thereby closing the choke valve, it is necessary to provide increased carburetor air flow by opening the choke valve mechanically. To accomplish this, a tang on the fast idle cam is made to contact the throttle lever at wide open throttle position so as to sufficiently open the choke valve. This is also called a choke unloader and serves to dechoke a flooded carburetor during starting operation whenever the engine is cranked with the accelerator held fully depressed.

DISASSEMBLY OF THE MODEL 4GC CARBURETOR

Removal of Vacuum Return Check

1. Mount the carburetor on holding fixture BT-88 or J-5923B.
2. Remove the vacuum line at the throttle flange.
3. Remove vacuum return check to carburetor body attaching screw, then remove vacuum return check. (See Fig. 8-85)

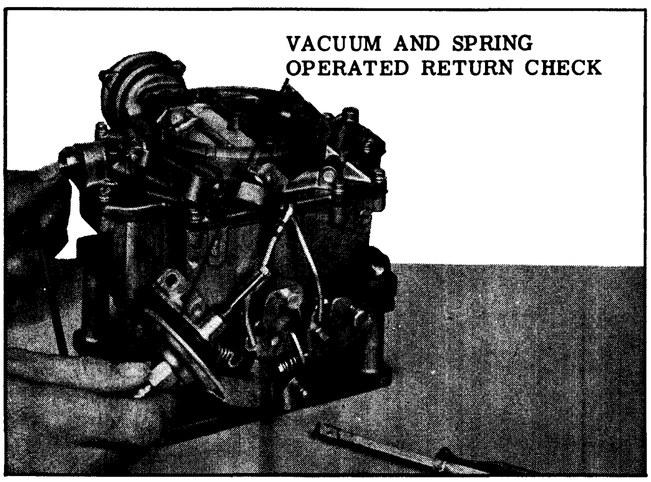


Fig. 8-85 Vacuum Return Check Removal

Disassembly of Air Horn

1. Remove gasoline inlet fitting and gasket, and remove filter screen from the air horn.
2. Remove the three choke cover attaching screws and retainers, and remove the choke cover and gasket.
3. Carefully lift the baffle plate from the choke housing. (See Fig. 8-86)
4. Unhook the spring clip from the upper end of the pump rod, and remove rod and clip from pump lever.

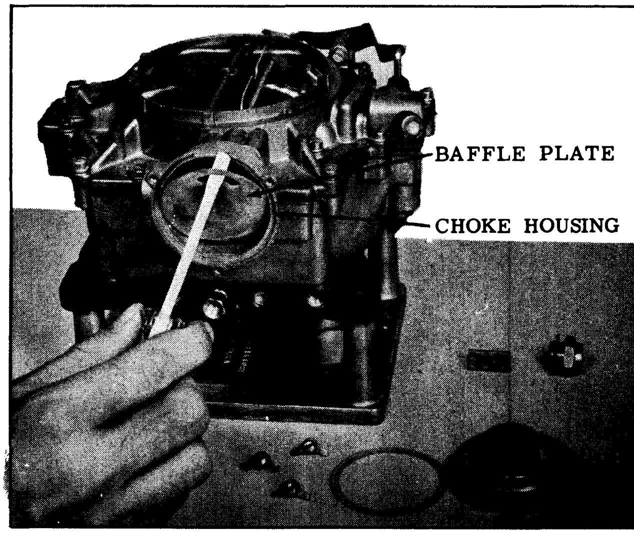


Fig. 8-86 Removing Baffle Plate

5. Remove the small horseshoe type retainer from lower end of the pump rod, and remove rod.
6. Remove the small retainer screw holding the trip lever to the choke shaft, then remove the trip lever. (See Fig. 8-87)
7. Remove the fast idle cam attaching screw. Remove the fast idle cam, choke rod and choke counterweight as an assembly. (See Fig. 8-88)
8. Remove the two small brass choke valve retaining screws and slide the choke valve from the shaft. Discard retaining screws.

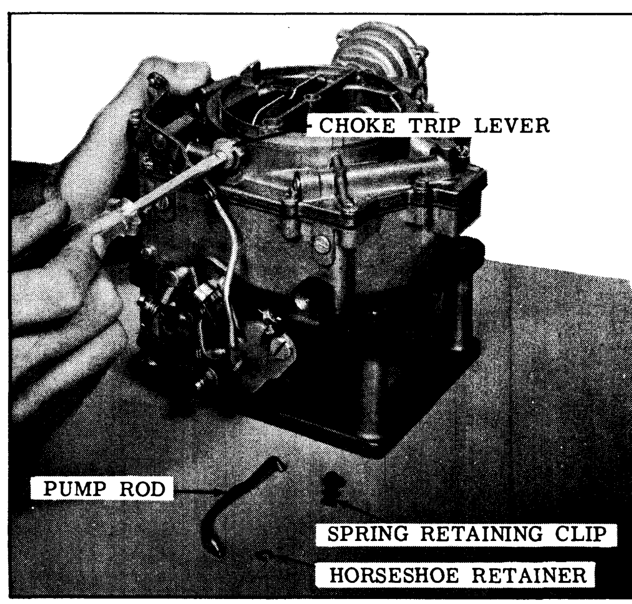


Fig. 8-87 Removing Trip Lever

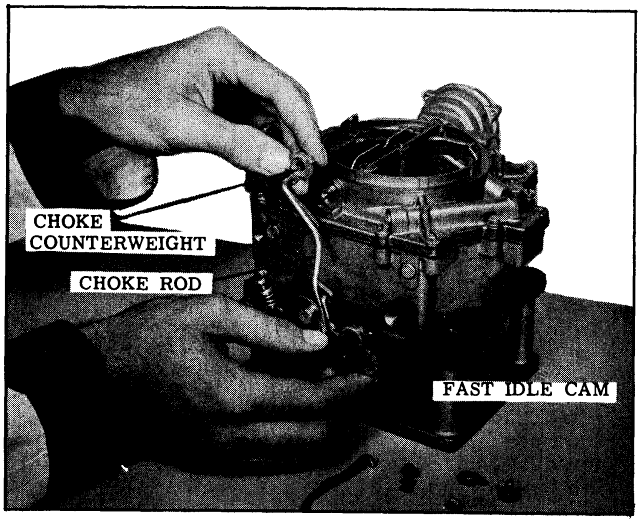


Fig. 8-88 Removing Fast Idle Cam

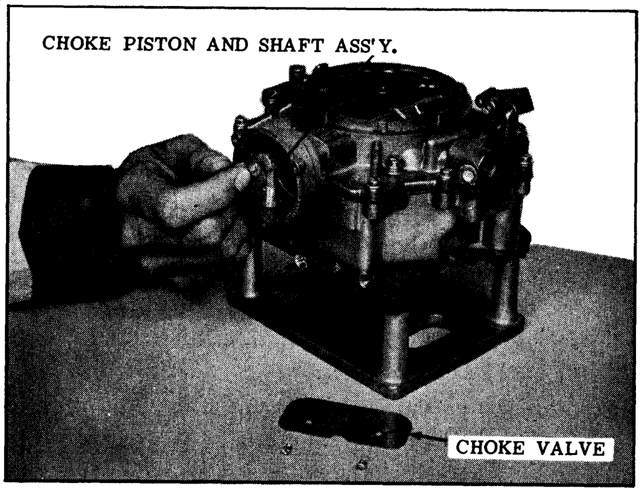


Fig. 8-89 Removing Choke Piston & Shaft

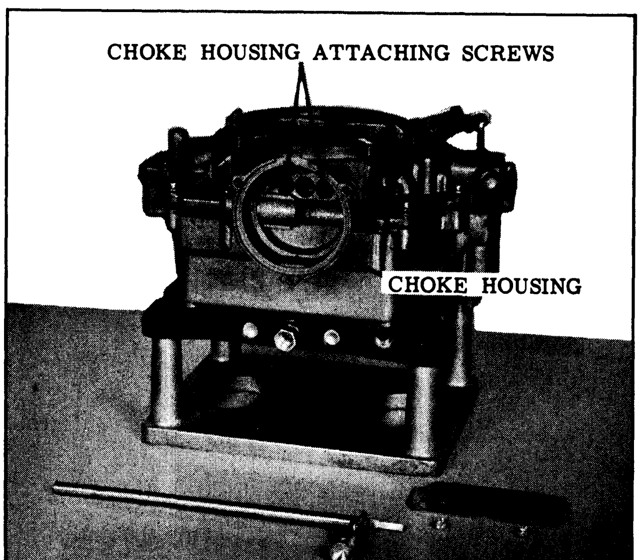


Fig. 8-90 Removing Choke Housing

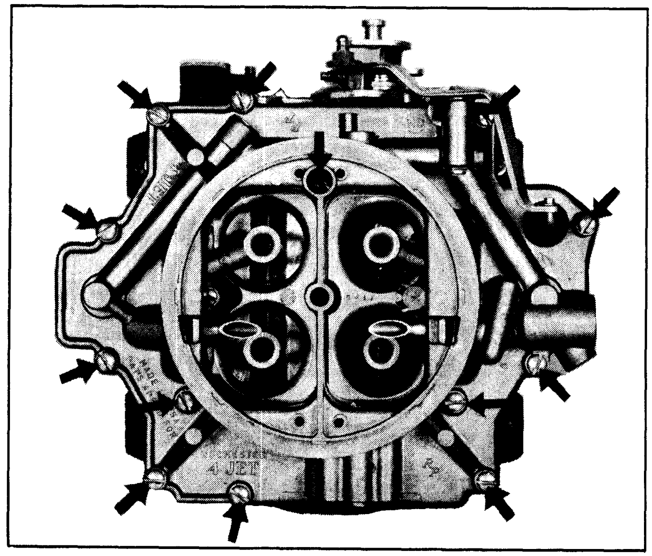


Fig. 8-91 Air Horn Attaching Screws

9. Rotate choke shaft counter-clockwise to free choke piston from housing, and remove piston and choke shaft assembly by sliding from air horn. (See Fig. 8-89)
10. Remove the choke housing attaching screws, and remove the choke housing and gasket from the air horn. (See Fig. 8-90)
11. Remove the 13 air horn to carburetor body attaching screws as follows: (See Fig. 8-91). First, remove the 1 air

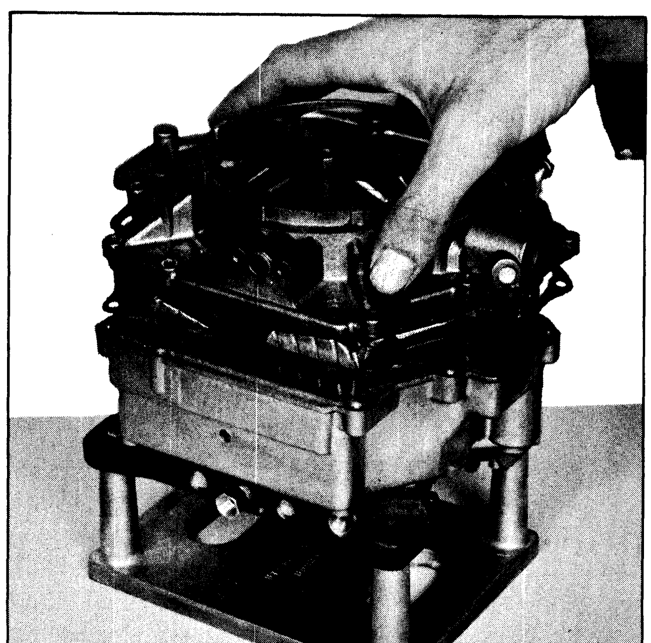


Fig. 8-92 Removing Air Horn

horn attaching screw recessed in the top of the air horn, then remove the remaining 12 attaching screws.

12. Carefully lift the air horn straight up until the float assembly is clear of the carburetor body. (See Fig. 8-92)
13. Remove the hinge pin from the primary float assembly, then lift the float and needle from the air horn. (See Fig. 8-93)
14. Remove the primary float needle seat using Tool BT-52. Remove gasket.
    NOTE: The float needle and seats are factory matched and must be installed in pairs. Never mix float needles and seats.

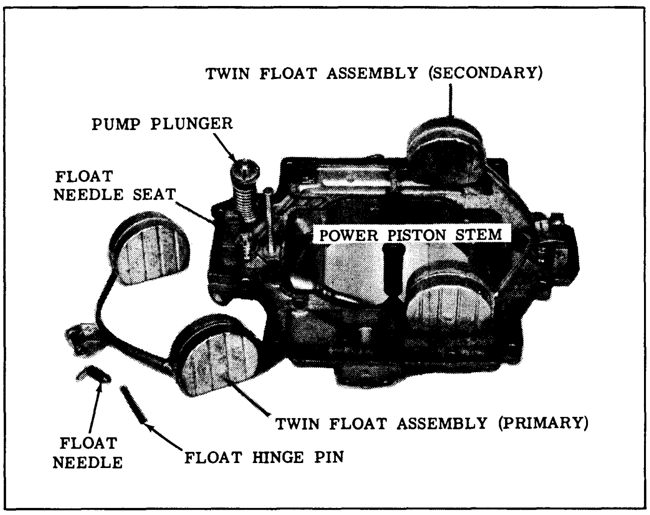


Fig. 8-93 Primary Float Assembly

15. Remove the hinge pin, float assembly, needle seat and gasket from the secondary side of air horn.
16. Remove air horn gasket.
    NOTE: It is not necessary to remove the small fuel filter screen in the float needle seat bore unless it is to be cleaned or replaced.
17. Remove the power piston assembly by depressing the stem and allowing it to snap into position again. (See Fig. 8-94)
18. Remove the horseshoe type retainer from the pump plunger shaft.
19. Remove pump plunger assembly by sliding the shaft through the rubber seal. Remove the rubber seal from the top side of the air horn casting.

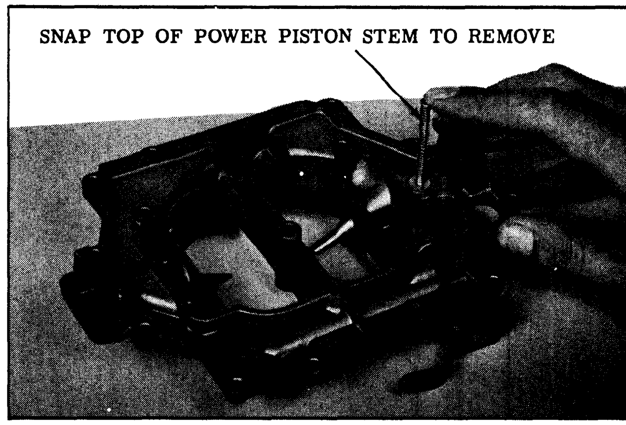


Fig. 8-94 Removing Power Piston

Disassembly of Carburetor Body

1. Remove the three attaching screws and lockwashers from venturi cluster on the primary side, and carefully remove cluster and gasket. (See Fig. 8-95)
2. Remove the three attaching screws and lockwashers from venturi cluster on the secondary side. Carefully remove the cluster and gasket.
3. Remove both metering jets from the primary (pump) side of the carburetor body. (See Fig. 8-96)
   NOTE: Never mix the metering jets.

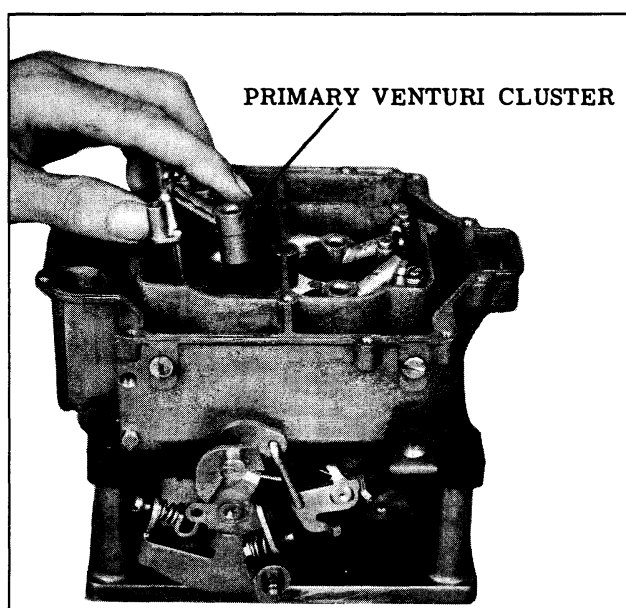


Fig. 8-95 Primary Venturi Cluster

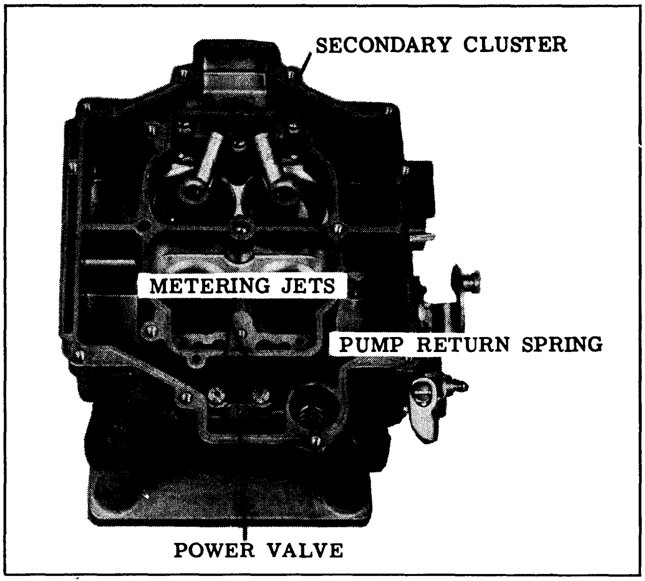


Fig. 8-96 Primary Metering Jets

4. Remove the power valve and gasket.
5. Remove both metering jets from the secondary side of carburetor body. Keep in separate group.
6. Remove the pump return spring from the pump well, and turn the carburetor over to remove the pump inlet aluminum ball.
7. Remove the small "T" shaped pump discharge spring guide, then remove the small spring and steel ball. (See Fig. 8-97)

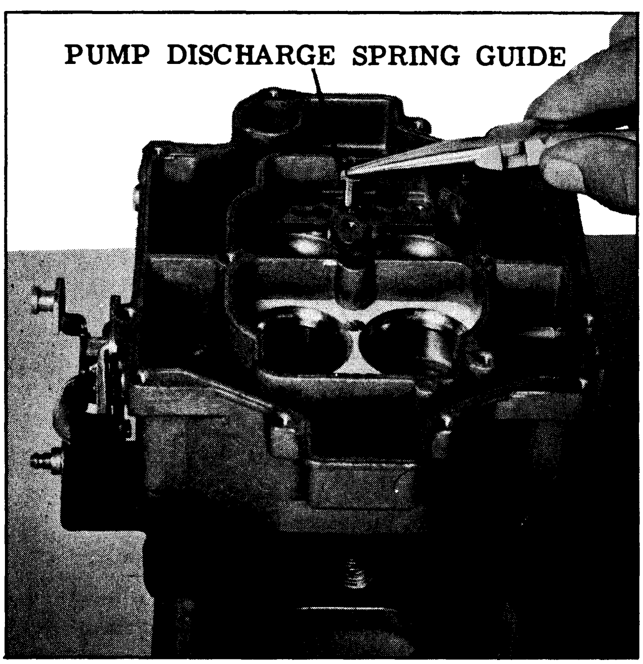


Fig. 8-97 Pump Discharge Valve

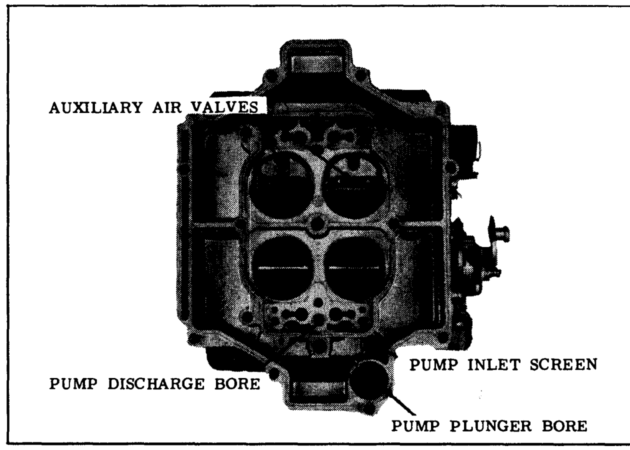


Fig. 8-98 Pump Inlet Screen

8. If necessary to clean or replace the small screen in the bottom of the fuel inlet cylinder, remove retainer ring and screen. (See Fig. 8-98)
9. Remove the four throttle flange to carburetor body attaching screws. (See Fig. 8-99) Then remove throttle flange gasket and carburetor body.
10. Remove the secondary auxiliary throttle valve assembly from the carburetor body as shown in Fig. 8-100.

NOTE: No attempt should be made to remove the throttle valves or shafts from the throttle flange as it may be impossible to again assemble the throttle valves correctly in relation

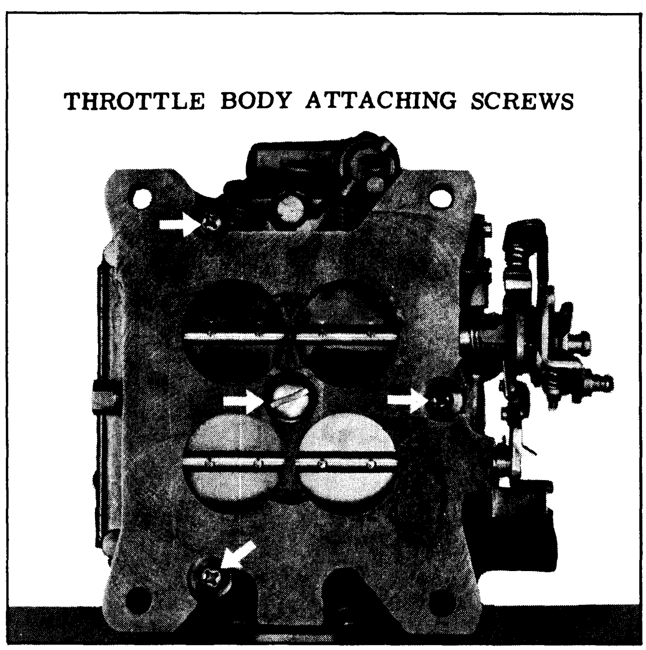


Fig. 8-99 Throttle Flange Attaching Screws

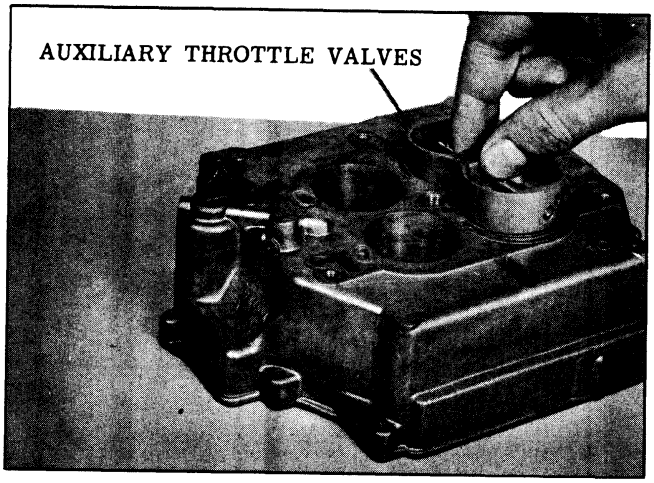


Fig. 8-100 Auxiliary Throttle Valve Assembly

to the vacuum advance and idle discharge orifices.

11. The idle mixture needle screws may be removed for cleaning or replacement. The slow and fast idle speed screws and springs can be replaced if necessary.

CLEANING AND INSPECTION

Cleaning

The carburetor should not be cleaned in any solution other than a cold immersion type cleaner.

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.

   CAUTION: The choke coil, housing and pump plunger should not be immersed in solvent. Clean pump plunger in clean gasoline only.
2. Blow out all passages in casting and dry with compressed air. DO NOT PASS DRILLS THROUGH JETS OR PASSAGES.
3. Clean filter screens of any foreign material. If the filter screens are distorted or plugged, they should be replaced.

Inspection

1. Check floats for dents or excessive wear at hinge pin holes.
2. Shake floats to check for leaks.
3. Examine float needle and seat. If grooved, replace with a factory matched assembly.
4. Inspect the idle mixture adjusting needles for burrs or ridges.
5. Inspect the upper and lower surfaces of the carburetor body to see that the small sealing beads are not damaged. Damaged beading may result in air or fuel leaks at that point.
6. Inspect holes in pump rocker arm, fast idle cam, and throttle shaft lever. If holes are worn excessively or out of round to the extent of improper operation of the carburetor, the worn parts should be replaced.
7. Inspect the steps on the fast idle cam for excessive wear. If excessive wear is noted, it should be replaced to assure proper engine operation during the warm-up and choking periods.
8. Inspect the pump plunger leather for cracks or creases. If the pump plunger leather is damaged, replace the pump plunger as a complete assembly.
9. Inspect the throttle flange assembly. If the throttle valves, levers or shafts are worn excessively or damaged, a complete throttle flange assembly is required.

CARBURETOR ASSEMBLY

1. Place the carburetor body on the holding stand in an inverted position.
2. Install the auxiliary throttle valve assembly (with the calibrated spring operating pin) down into the base of the carburetor body.
3. Position the throttle flange gasket on the carburetor body so that all holes are properly aligned.
4. Place the throttle flange on the carburetor body and install four attaching screws, then tighten the 3/8" x 24 center screw 9 to 10 ft. lbs. and the 12 x 28 outer screws 3 to 4 ft. lbs. torque.
5. Install the idle mixture screws and springs if they were removed from the throttle flange.
6. Place the carburetor upright on the holding stand and install the pump

outlet steel ball, spring, and "T" shaped spring guide.

7. Install the pump outlet aluminum ball, then the pump return spring in the pump plunger cylinder.

   NOTE: The spring must be all the way down and seated over the ball.
8. Install the two primary main metering jets and then the power valve and gasket.
9. Install the two secondary main metering jets.
10. Install the secondary venturi cluster and gasket with three attaching screws and lockwashers. (The secondary venturi does not carry the idle tubes or pump discharge nozzles).
11. Install the primary venturi cluster and gasket using three attaching screws and lockwashers.

ASSEMBLY OF THE CARBURETOR AIR HORN

1. Install the power piston into air horn and stake very lightly to hold piston in place.
2. Install the pump plunger rubber seal in the air horn by inserting the small end through from the bottom. The lips of the seal must be sealed on both sides of the cover.
3. Position the gasket on the air horn.
4. Install both small filter screens in the air horn if they were removed for cleaning or replacement.
5. Install needle seat gaskets, then install both float needle seats using Tool BT-52.

   NOTE: Needle seats must be installed on the same sides they were removed from to match their respective float needle.
6. Install both float and needle assemblies on the air horn, retaining in place with the hinge pin.

FLOAT LEVEL AND FLOAT DROP ADJUSTMENTS

NOTE: The float level and float drop adjustments are made independent of each other and must be made at this stage of the assembly procedure. All other adjustments are made after the assembly of the carburetor has been completed.

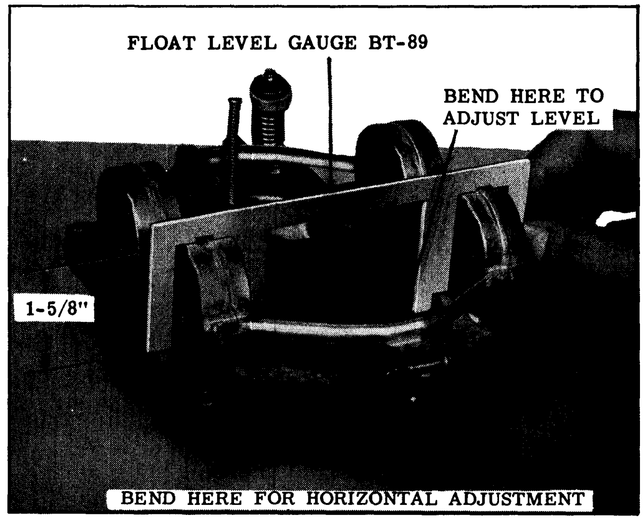


Fig. 8-101 Float Level Adjustment

Float Level Adjustment

The float level adjustment is made with the air horn gasket in place on the air horn.

1. Place gauge BT-89 in position as shown in Fig. 8-101. Be sure the gauge is in line with center of floats.
2. Bend float arm at center as shown in Fig. 8-101, to raise or lower floats. Adjustment is correct when the bottom of the float just touches the bottom of the float gauge BT-89 (height 1-5/8" from face of gasket).
3. With gauge BT-89 in place, visually check floats to see if they are centered between the legs of the gauge. If required, bend float arms until floats are centered. (See Fig. 8-101)

Float Drop Adjustment

1. Holding a six inch scale against the air horn gasket, measure the float drop as shown in Fig. 8-102. The distances should be 2-1/4".
2. If adjustment if required, bend the small brass tang.

COMPLETION OF CARBURETOR ASSEMBLY

1. Carefully guide air horn assembly on

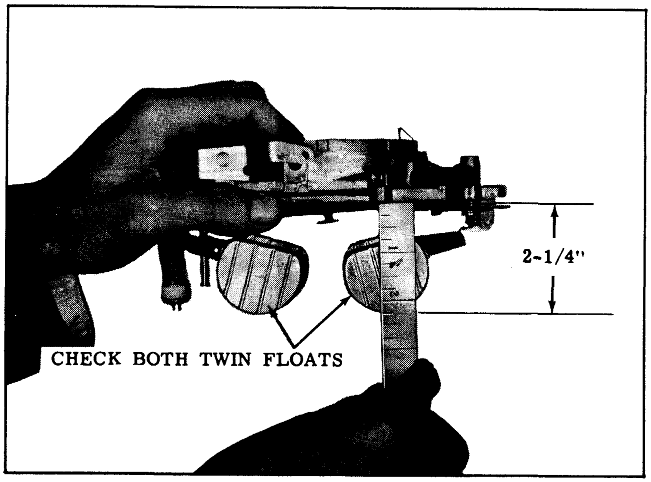


Fig. 8-102 Float Drop Adjustment

carburetor body so the pump plunger, power valve stem and floats will not be damaged.

2. Align the holes in the air horn, gasket and body and START the 13 air horn attaching screws.
3. Tighten evenly and securely the inner attaching screws (including the screw through the inner wall), then tighten the remaining outside attaching screws in the same manner.
4. Assemble the choke housing and gasket to the air horn and tighten with two attaching screws. (See Fig. 8-103)
5. Install the choke shaft and piston assembly by carefully sliding the shaft through its bores. Then carefully fit the piston into the bore of the housing.

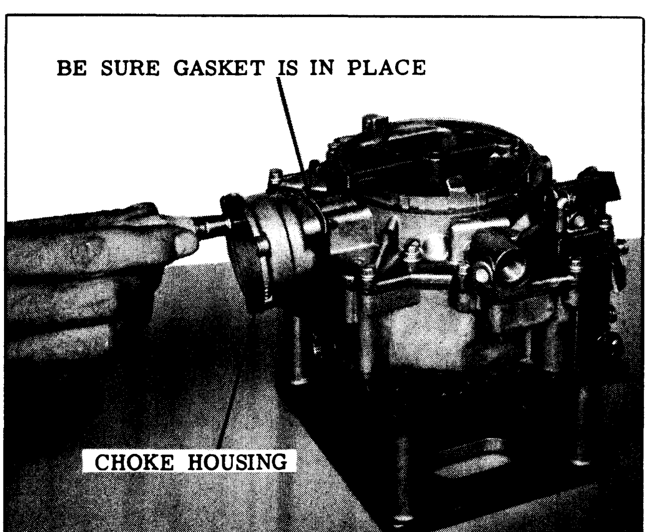


Fig. 8-103 Assembly of Choke Housing

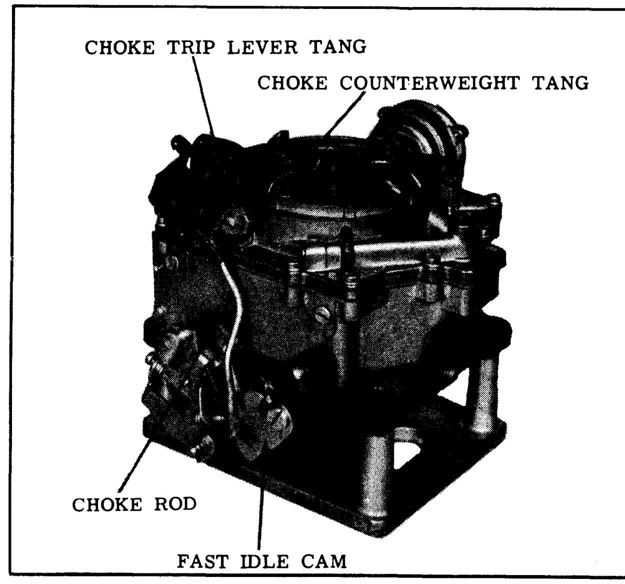


Fig. 8-104 Installing Choke Counterweight

6. Rotate the choke shaft clockwise to check for free movement of the shaft and piston.
7. Slide the choke valve through shaft so the letters "R. P." on the valve are facing up when valve is closed.
8. START the two small brass choke valve to shaft attaching screws. DO NOT TIGHTEN.
9. Position the choke counterweight over the choke shaft. Do not install the choke trip lever. (See Fig. 8-104)
10. Install the fast idle cam attaching screw.
11. Position the choke trip lever over the end of choke shaft. Be sure the small tab of the trip lever is above the choke counterweight tang. (See Fig. 8-104) Tighten securely.
12. To provide correct fit of the choke valve in air horn, push slightly on the end of choke shaft to obtain a minimum clearance of .020" between the trip lever and choke counterweight as shown in Fig. 8-105.
13. While holding the choke shaft as mentioned above, tighten choke shaft retaining screws. Check for free operation of choke valve in air horn.
14. Place baffle plate in position in choke housing.
15. Install thermostat cover and coil assembly, gasket and retaining screws

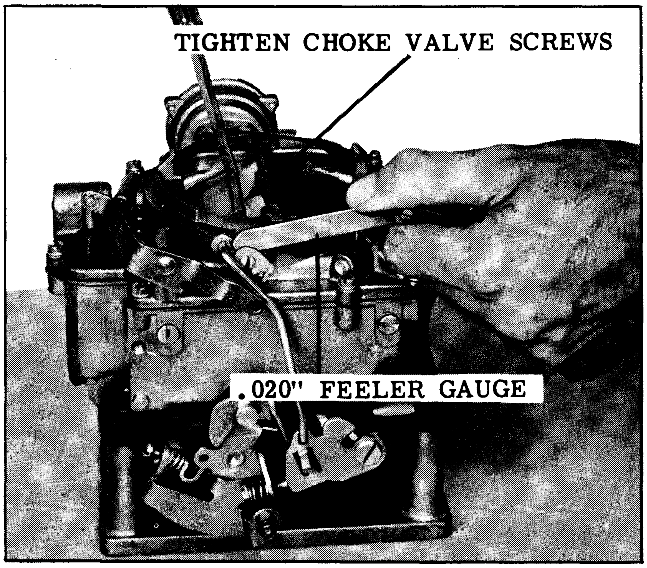


Fig. 8-105 Trip Lever Clearance

(with retainers). Leave housing cover retaining screws loose enough to permit rotating of cover.

16. Rotate cover counter-clockwise until coil engages the tang.
17. Set the cover at the "INDEX" scribe mark for Hydra-Matic equipped cars and one notch "LEAN" for Syncro-Mesh transmission equipped cars. (See Fig. 8-106) Tighten coil cover retaining screws.
18. Insert grooved end of pump rod through hole in throttle lever, then install small horseshoe type retainer.
19. Install the upper end of pump rod (with spring retaining clip) on the pump lever.

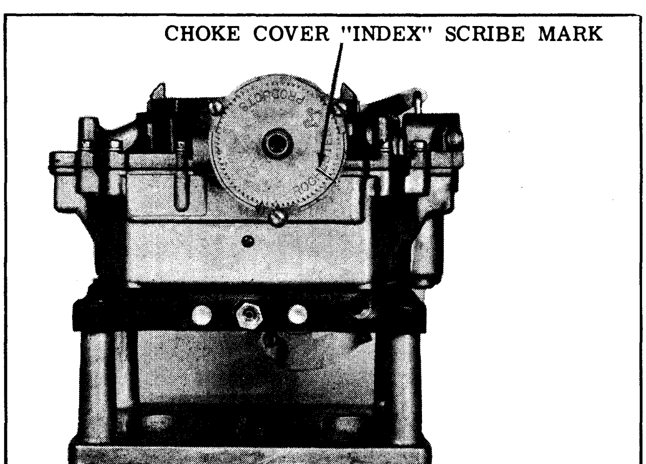


Fig. 8-106 Thermostatic Control Setting

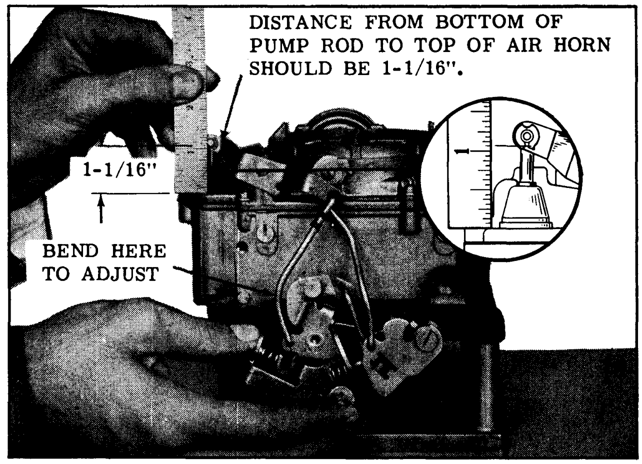


Fig. 8-107 Pump Rod Adjustment

ADJUSTMENTS (ON OR OFF THE CAR)

PUMP ROD ADJUSTMENT

1. Back off the idle speed screw and fast idle screw so the throttle valves can be held in their fully closed position.
2. Hold the throttle lever in this position and measure the distance from the top of air horn casting to the bottom edge of pump plunger shaft. (See Fig. 8-107)
   NOTE: With the throttle valve held in the closed position the distance should be 1-1/16".
3. Bend the pump rod to obtain the correct dimensions with Tool BT-18. (See Fig. 8-107)
4. Operate the pump shaft several times to be sure movement is free.

CHOKE ROD ADJUSTMENT

1. Turn the fast idle screw in until it just contacts the intermediate step (middle step) of the fast idle cam.
2. Hold the fast idle cam in the closed position so the shoulder of the highest step is against the fast idle screw. (See Fig. 8-108)
   NOTE: Be sure choke trip lever is in contact with choke counterweight.
3. With the shoulder of the highest step of the fast idle cam held against the fast idle screw, bend choke rod to obtain a clearance of .053" between

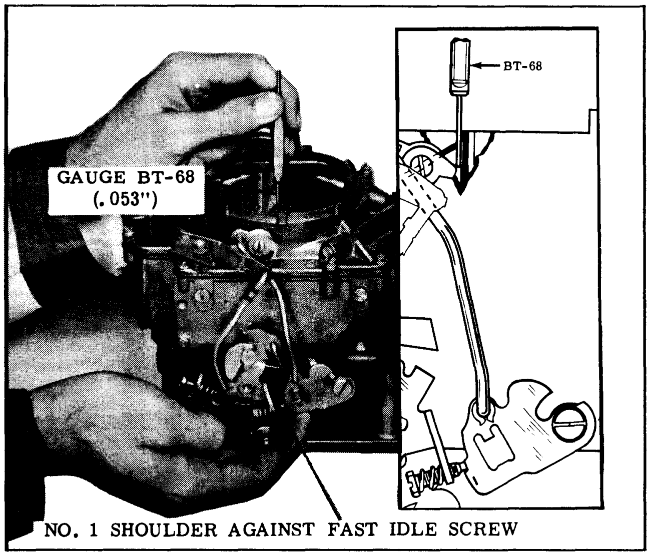


Fig. 8-108 Choke Rod Adjustment

the top edge of choke valve and the dividing wall (using small end of gauge BT-68). (See Fig. 8-108)

UNLOADER ADJUSTMENT

1. Be sure the thermostat is properly set ("INDEX" for Hydra-Matic equipped cars, one notch "LEAN" for Syncro-Mesh equipped cars) and the trip lever is in contact with the choke counter-weight.
2. While holding the throttle lever to the full open position, check the clearance between the top edge of the choke valve and dividing wall with gauge BT-90. (See Fig. 8-109) The clearance should be .115".
3. If necessary to adjust, bend the small tang on the fast idle cam with Tool BT-91 to obtain the correct dimension.

SECONDARY THROTTLE LOCK-OUT ADJUSTMENT

1. Hold choke valve partially closed so secondary lock-out tang is in line with the top of slot in the fast idle cam. (See Fig. 8-110)
2. Measure the clearance between lock-out tang and top edge of slot in fast idle cam. (See Fig. 8-110) Using Tool BT-18, bend tang sideways until a clearance of .015" is obtained.

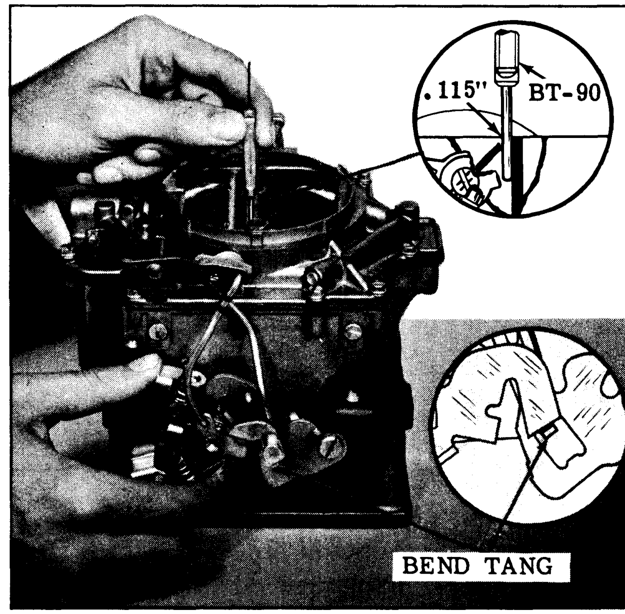


Fig. 8-109 Unloader Adjustment

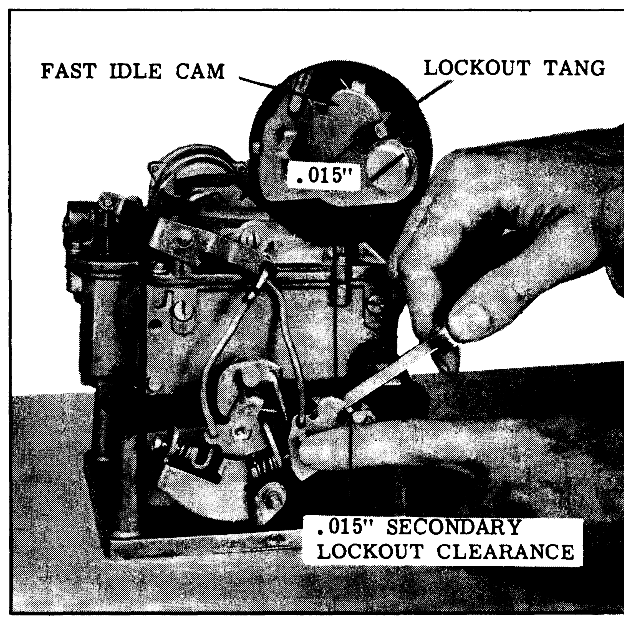


Fig. 8-110 Secondary Lockout Adjustment

SECONDARY THROTTLE CONTROL CLEARANCE ADJUSTMENT

1. Hold choke valve in the wide open position so the secondary lock-out tang is positioned over the fast idle cam. (See Fig. 8-111)
2. Measure the clearance between the tang and fast idle cam. (See Fig. 8-111) The clearance should be .035".
3. If adjustment is necessary, allow choke

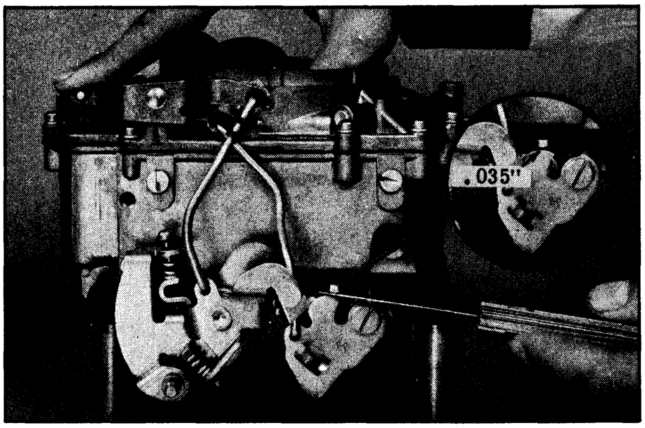


Fig. 8-111 Secondary Throttle Clearance

to close so tang is again in slot of fast idle cam, then use Tool BT-91 to bend tang straight up or down as required for proper clearance.

FAST IDLE ADJUSTMENT

1. Apply hand brake and start engine. Allow engine to reach operating temperature.
2. Set fast idle screw on high step of fast idle cam. (See Fig. 8-112)
3. With the transmission in neutral, adjust fast idle screw to obtain an engine speed of 1400 to 1500 R.P.M.

VACUUM OPERATED RETURN CHECK ADJUSTMENT

NOTE: The slow or fast idle adjustments must be correct before attempting to perform the following adjustment.

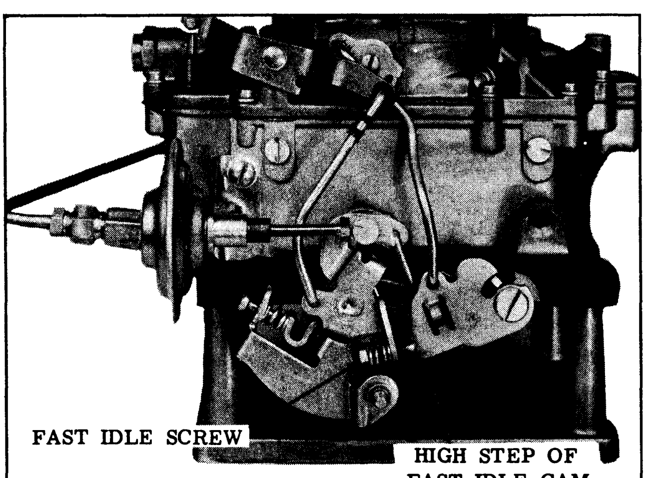


Fig. 8-112 Fast Idle Adjustment

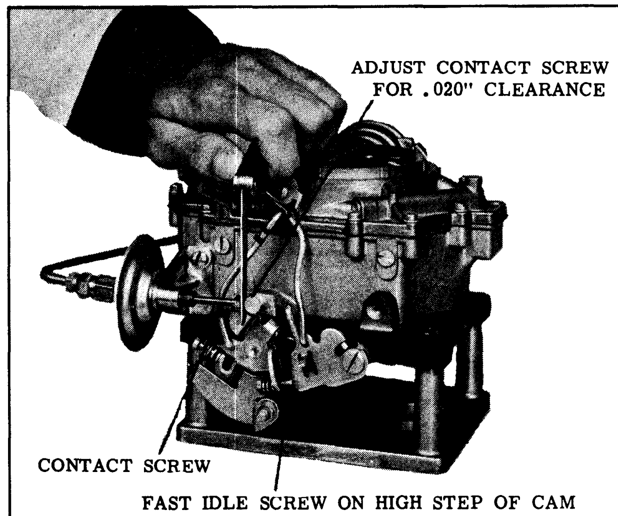


Fig. 8-113 Return Check Adjustment

1. With the engine not running, rotate the fast idle cam so the fast idle screw rests on the highest step of the fast idle cam. (See Fig. 8-113)
2. Measure the clearance between the contact screw and contact on throttle lever. The clearance should be .020".
3. If adjustment is necessary, loosen contact screw lock nut and adjust.

   NOTE: To prevent damage to diapragm, use two wrenches when adjusting lock nut. Any time the slow or fast idle is changed it will be necessary to readjust the throttle return check.

ATMOSPHERIC IDLE VENT ADJUSTMENT

NOTE: Be sure fast idle adjustment is set so engine is operating between 1400 and 1500 R.P.M.

1. While holding the throttle so the fast idle screw is on top of the highest step of the fast idle cam, check the opening of the atmospheric idle vent valve in the air horn. The valve should be opened approximately 1/32".
2. If necessary to adjust, use Tool BT-67 to bend the tang on the pump arm as shown in Fig. 8-114.

IDLE MIXTURE ADJUSTMENT

NOTE: To obtain proper operation adjust

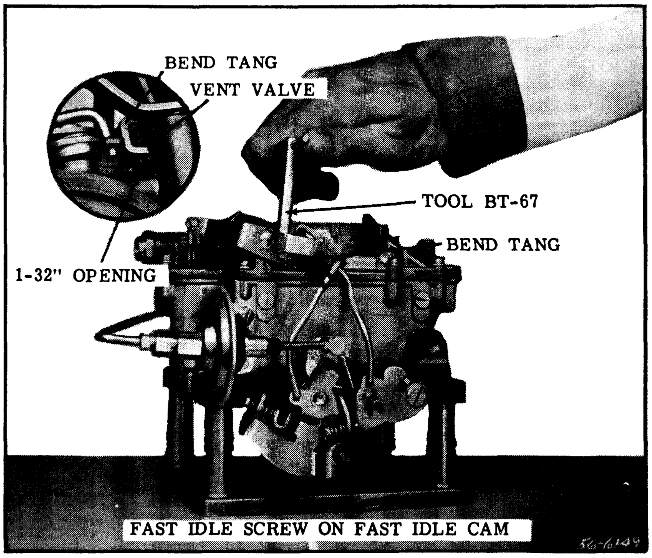


Fig. 8-114 Idle Vent Adjustment

idle mixture and speed only as specified in ENGINE TUNE-UP SECTION (Step 17).

ROCHESTER CARBURETOR
MODEL 2GC

The new "Power-Jet" carburetor for the 1956 Oldsmobile "88" is very similar in operation to the 1955 2GC, the principal difference being the concentric bowl design of the 1956 model. By concentric bowl design, the metering jets are placed near the center of the carburetor, with fuel surrounding them on all sides. Thus, fuel is always available at the jets even during the most severe driving conditions.

Under normal operating conditions, the carburetor is "internally balanced" because the fuel chamber is vented to the air horn just beneath the air cleaner. Thus the pressure of air AFTER passing through the air cleaner acts on both the fuel and air being metered. In this way, air cleaner restriction will not change fuel-air ratios, since both fuel and air are supplied under the same pressure. At idle speeds, an "atmospheric idle vent" is opened by a tang on the pump lever, to allow the escape of hot vapors to the atmosphere. The new model 2GC concentric carburetor functions conventionally, using the standard six systems of carburetion: Float, Idle, Part Throttle, Power, Pump, and Choke. The

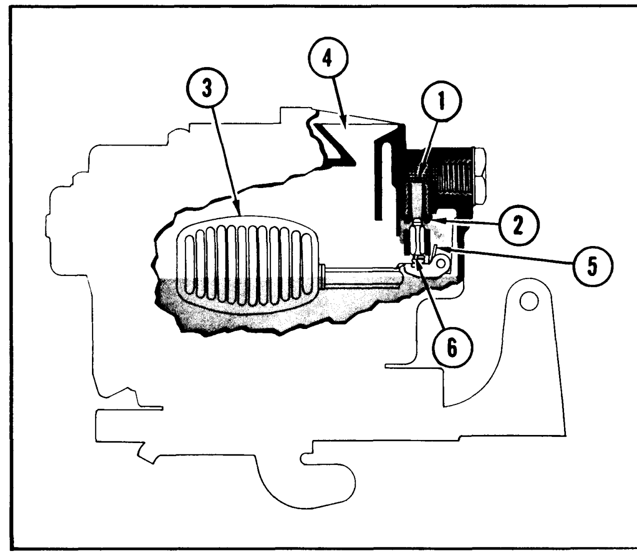


Fig. 8-115 Float System

following is a complete description of the operation of each of the six systems.

PRINCIPLES OF OPERATION

FLOAT SYSTEM
Fig. 8-115

The float system controls the level of fuel in the carburetor bowl. Fuel entering the carburetor travels through the inlet strainer (1) through the needle and seat (2) and into the carburetor bowl. Flow continues until the rising liquid level raises the float (3) to a position where the valve is closed. The fuel chamber is open to the air horn by a vent (4) so that air and fuel are supplied under the same pressure. The float tang (5) prevents the float from traveling too far downward. A float needle pull clip (6) connecting the float arm to the needle valve keeps the needle from sticking closed in the seat.

IDLE SYSTEM
Fig. 8-116

The idle system consists of the idle tubes (3), idle passages, idle air bleeds, idle adjustment needles (8), idle discharge holes (6) and the idle needle adjusting hole (2). In the low idle speed position, the throttle valve (1) is slightly open allowing a small amount of air to pass between the

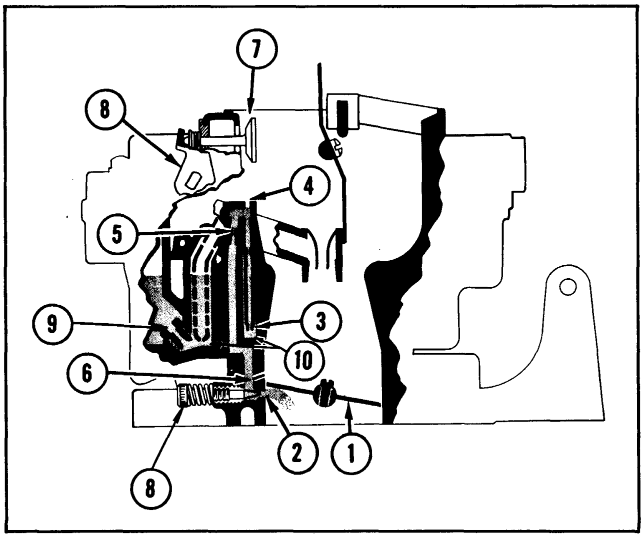


Fig. 8-116 Idle System

wall of the carburetor bore and the edge of the throttle valve. The idle needle hole (2) is in the high vacuum area below the throttle valve but the fuel is vented to atmospheric pressure. The idle vent valve (7) is opened at idle throttle position by the pump lever (8).

Fuel is drawn from the bowl through the main metering jets (9) into the main well (10). It is then metered by the idle fuel metering orifice at the lower tip of the idle tube (3) and travels up the idle tube. When the fuel reaches the top of the idle tube, it mixes with air drawn through the idle air bleed (4) and the mixture then passes through the horizontal idle passage. The mixture is then drawn through the restriction (5) and down the vertical passage to the discharge holes (6) where more air is added to the mixture, then out the idle needle hole (2) and into the bore of the carburetor.

In addition to this mixture of fuel and air, air is also entering the bore of the carburetor through the slightly opened throttle valves (1). For smooth operation, the air from the bore and the air-fuel mixture from the idle needle hole must combine to form the correct final mixture for low idle engine speed. The position of the idle adjusting needle (8) governs the amount of air-fuel mixture admitted to the carburetor bore. Except for this variable at the idle adjustment needle, the idle

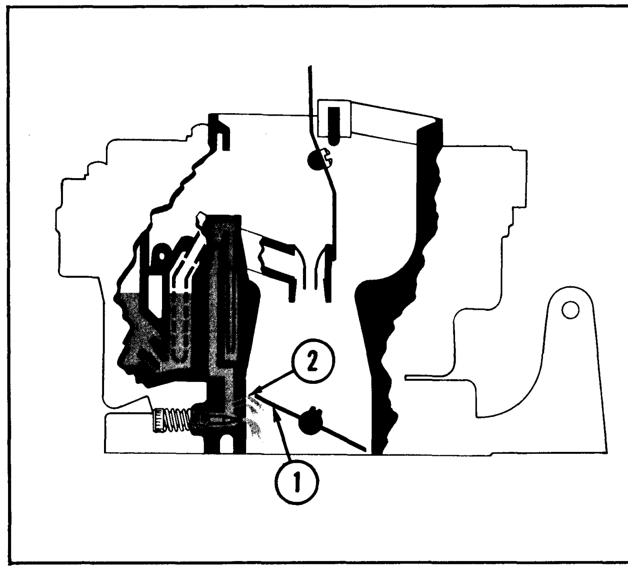


Fig. 8-117 Off Idle Operation

system is specifically calibrated for idle and low engine speeds.

OFF-IDLE OPERATION
Fig. 8-117

As the throttle valve (1) is opened, there is a change in pressure differential points. Opening of the valve progressively exposes the idle discharge holes (2) to manifold vacuum and the air stream with the result that they deliver additional air-fuel mixture for fast idle engine requirements.

PART THROTTLE
Fig. 8-118

Further opening of the throttle valve (1) increases the speed of the air stream passing through the venturi system, thus lowering the pressure (raising the vacuum) in the

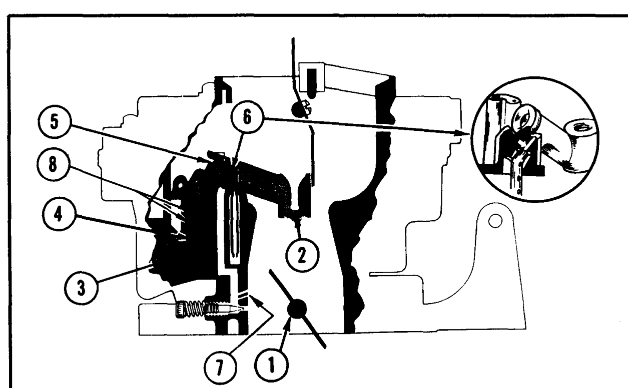


Fig. 8-118 Part Throttle

small venturi (2) area of the carburetor bore. At the same time, the edge of the throttle valve is moved away from the wall of the bore progressively reducing the vacuum and thus the mixture at the idle discharge holes (7).

Since the low pressure point is now in the small venturi area (2), air-fuel mixture will be drawn from the fuel bowl through the main metering system to the venturi as follows:

The fuel passes through the main metering jets (3) into the main well where it rises in the main well tube (4). Air entering through the main well air bleeds (6) in the cluster is mixed with fuel through the main well vents (8). The mixture continues up the main well tube through the nozzle (5) where more air is needed. The mixture flows through the high speed passage to the small venturi (2) where it mixes with additional air and moves on to the bore of the carburetor, through the intake manifold, and into the cylinders as a final mixture for part throttle operation. Permanent jets and air bleeds calibrate the main metering system for efficient part throttle operation.

POWER SYSTEM
Fig. 8-119

The power system provides additional fuel for heavy load and high speed engine requirements.

A spring loaded power piston (2) controlled by vacuum, regulates the power valve (3) to supply additional fuel according to speed and load.

The power piston vacuum channel (5) is open to manifold vacuum beneath the throttle valves, thus the vacuum in the channel rises and falls with engine manifold vacuum.

During idle and part throttle operation, the vacuum in the channel (5) is normally high enough to hold the power piston (2) in the fully raised position against the tension of the power valve spring (7). As the manifold vacuum drops with load, the calibrated spring (7) forces the piston down against the power valve (3). The power valve is opened by this method and it allows additional fuel to flow through the calibrated power restrictions (4) into the main wells. The power valve (3) allows a gradual increase in fuel flow as the power valve is fully opened to permit a maximum calibrated fuel flow from the power system.

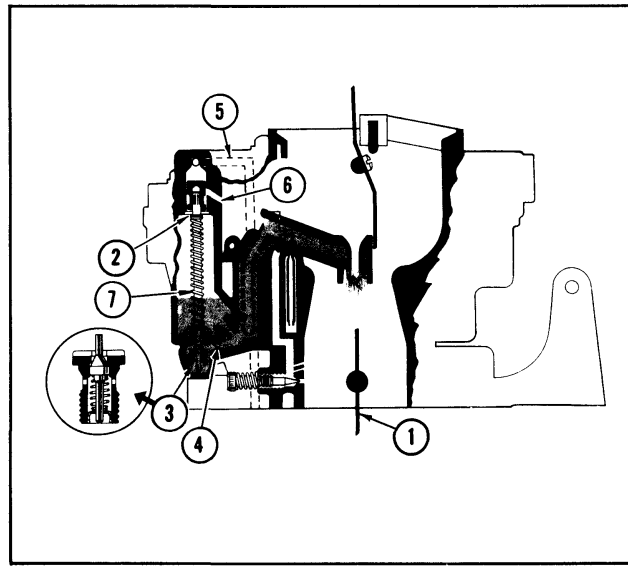


Fig. 8-119 Power System

As the load decreases, manifold vacuum increases. The increasing vacuum pull on the piston (2) gradually overcomes the spring tension of the power valve spring and the power piston returns to its original raised position; then, the valve (3) is fully closed.

The "vacuum break" passage (6) vents any vacuum leak to the air horn, preventing the application of any vacuum to the fuel chamber which would raise the fuel level above normal and upset the calibration of the carburetor.

PUMP SYSTEM
Fig. 8-120

Extra fuel for smooth quick acceleration is supplied by a double spring pump plunger (1). The combination of the top and bottom springs (6) and (7) is calibrated to move the plunger in such a manner that a smooth sustained charge of fuel is delivered for acceleration.

The fuel is drawn past the ball check (2) and between the plunger and wall into the pump well on the intake stroke of the

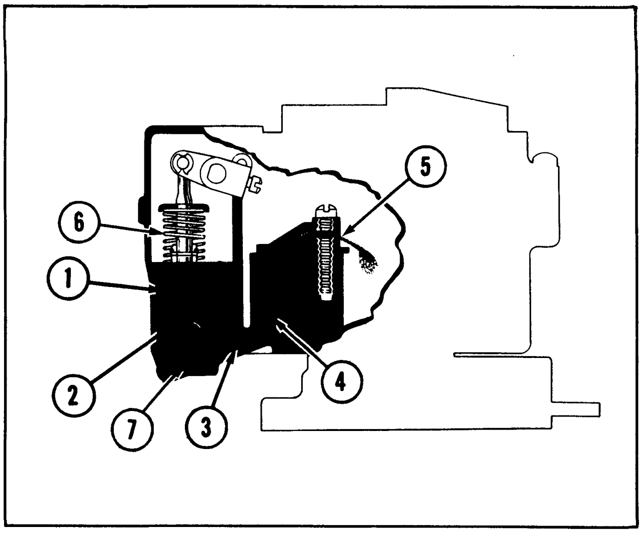


Fig. 8-120 Pump System

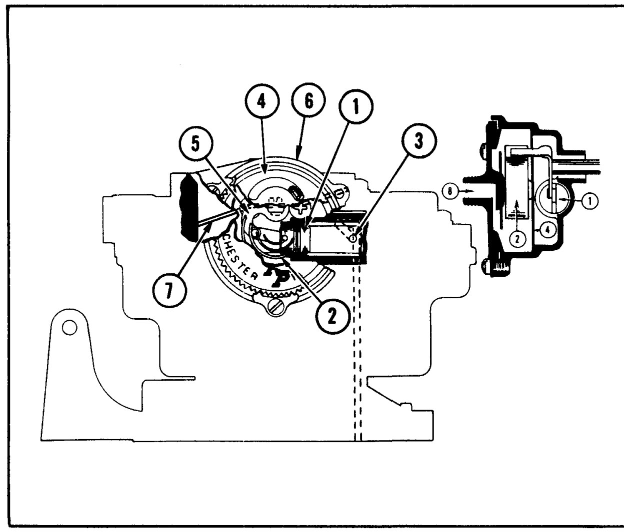


Fig. 8-121 Choke System

plunger. When the plunger is pushed down for acceleration, the force of the stroke seals the ball check (2) to prevent flow to the fuel bowl and the fuel is forced up the pump discharge passage (3).

The pressure of the fuel lifts the pump outlet ball check (4) from its seat and the fuel passes on through the pump jets (5) in the cluster where it is sprayed into the venturi and delivered to the engine.

In the pump plunger head, the ball check (2) and seat, is also designed to eliminate any fuel percolation problems in the pump system. When the engine is idling or not operating, excessive fuel vapors in the pump well rise through the plunger head and bypass the ball, then circulate into the fuel bowl which is vented to the atmosphere.

Without this feature, vapor pressure in the pump system might force fuel through the pump passage and into the engine causing hard (hot) starting because of excess fuel in the manifold, or vapor pressures might cause poor initial acceleration due to insufficient fuel in the pump system.

CHOKE SYSTEM
Fig. 8-121

For cold engine operation, a rich mixture at the carburetor is required so that a combustible mixture remains in the manifold system to be drawn into the cylinders after condensation of much of the fuel vapor on the cold engine parts. The function of the choke system is to subject all fuel outlets in the bore of the carburetor to high vacuum while restricting the intake of air, thus drawing into the engine the required rich mixture.

The choke system includes a thermostatic coil (2), housing (6), and choke piston (1), all of which are interconnected with the choke valve (7) and linkage. (The linkage is not shown in the schematic drawing.)

The choke is controlled by a combination of intake manifold vacuum, air velocity against the offset choke valve, atmospheric temperature, and induced heat from the exhaust manifold system.

When the temperature in the climatic control drops, the bi-metal thermostatic coil (2) expands and closes the choke valve. As soon as the engine is started, two forces within the carburetor start the de-choking operation. Engine manifold vacuum exerts a pulling action on the choke piston through the vacuum passage (3). Hot fresh air passes through the choke stove and carburetor heat tube, through the center of the choke cover (8), and begins to warm the thermostatic coil (2). The choke valve is offset; therefore, the speed and volume of the air stream through the air horn of the carburetor will proportionately affect the movement of the choke valve. Engine manifold vacuum continues to pull hot air through the heat tube and over the baffle plate (4) through the vacuum passage (3) at a speed and volume calibrated to effect maximum efficiency from the entire system.

This operation continues until the thermostatic coil is completely relaxed; at this point, the choke valve is vertical in the carburetor air horn and has no effect on the operation of the unit.

The operation of the choke system will recycle when the engine is stopped and allowed to become cold and the same sequence of events will take place when it is started again and goes through the warm-up period.

The fast idle cam and linkage maintains sufficient throttle opening for cold starting and keeps the engine running at a sufficient speed to prevent stalling during the warm-up period.

The mechanical unloader eliminates the possibility of the choke closing during heavy loads and acceleration by cracking the choke valve at wide open throttle.

DISASSEMBLY OF THE MODEL 2GC CARBURETOR

CHOKE ASSEMBLY

1. Mount carburetor on a suitable holding fixture, such as holding fixture BT-88 or J-5923B.

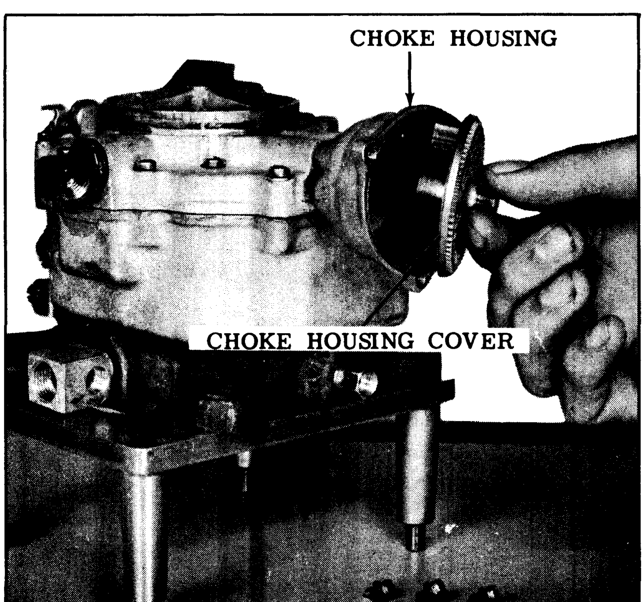


Fig. 8-122 Removing Choke Cover

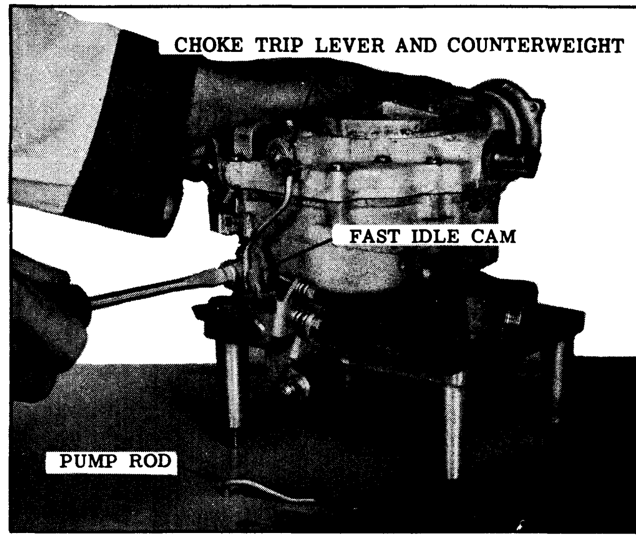


Fig. 8-123 Fast Idle Cam

2. Remove the three choke cover attaching screws and retainers, and remove choke cover, gasket, and coil assembly from carburetor. (See Fig. 8-122)
3. Remove baffle plate from choke housing.
4. Remove pump rod by disconnecting from throttle lever and rotating until it clears the pump lever.
5. Remove fast idle cam retaining screw. (See Fig. 8-123)
6. Remove retaining screw at end of choke shaft and carefully remove choke trip lever, counterweight, choke rod and fast idle cam.

   NOTE: Fast idle cam and choke counterweight can be removed from choke rod by turning until slots pass over tangs on rod.
7. File off staked ends of choke valve screws and remove screws and choke valve.
8. Rotate choke shaft clockwise to free choke piston from housing, then pull piston and choke shaft from carburetor. (See Fig. 8-124)
9. Remove choke piston from shaft by lightly tapping assembly, with piston pin downward. Pin should fall out.
10. Remove two choke housing attaching screws, then remove choke housing and gaskets from air horn.

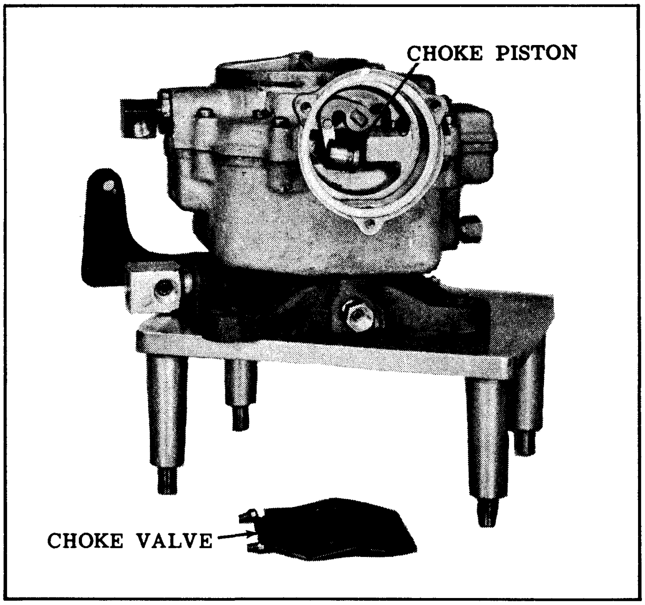


Fig. 8-124 Choke Piston

AIR HORN DISASSEMBLY

1. Remove filter screen retainer nut and gasket, then remove filter screen.
2. Remove the horseshoe type clip and spring from the idle vent valve shaft, then remove the valve. Caution: Do not damage the small spring. (See Fig. 8-125)
3. Remove eleven cover screws and lift air horn assembly from carburetor body. (See Fig. 8-126)
4. Invert air horn on a flat surface. Remove float hinge pin and lift float assembly from cover. (See Fig. 8-127). Float needle may now be removed from float.
5. Remove float needle seat using Tool BT-52. Remove gasket.
6. Carefully remove power piston by depressing shaft and allowing spring to snap back until retainer washer works free of light staking in casting.

   NOTE: If power piston shaft is bent or otherwise damaged, it will be necessary to replace the piston assembly.
7. Remove retainer from pump plunger shaft and remove plunger assembly from pump arm.
8. Remove the pump lever and shaft by

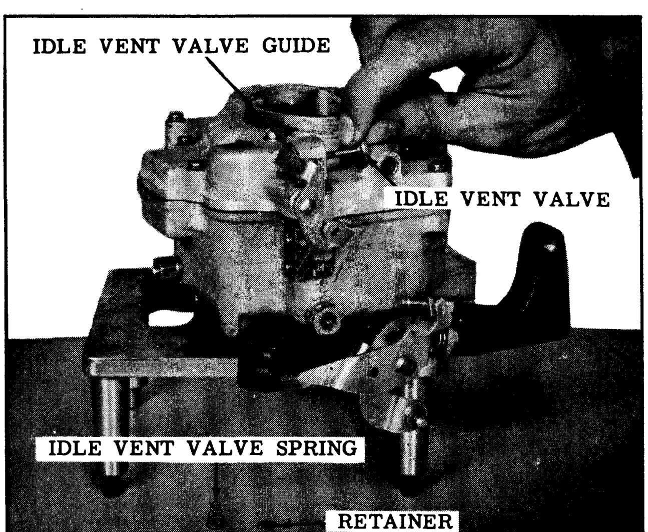


Fig. 8-125 Idle Vent Valve

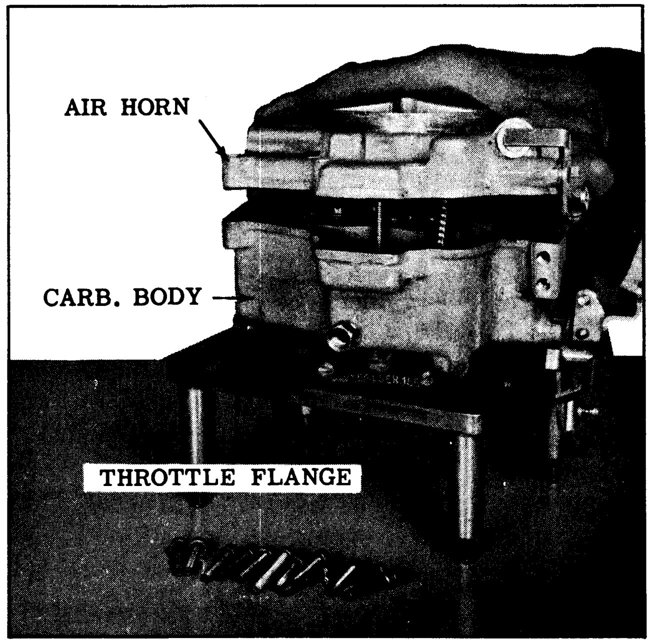


Fig. 8-126 Removing Air Horn Assembly

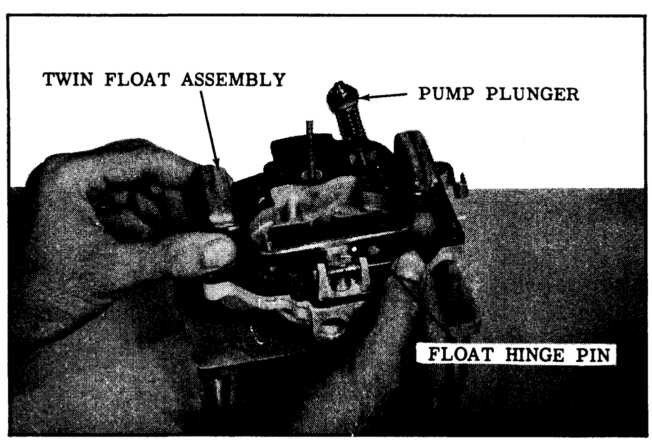


Fig. 8-127 Removing Float Assembly

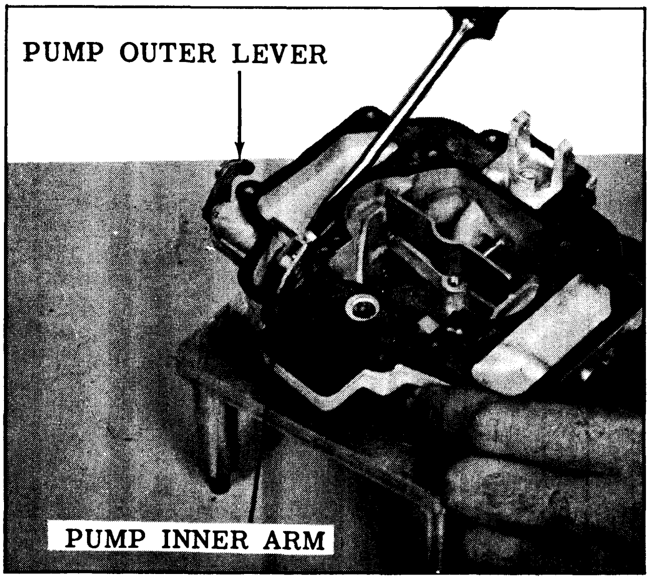


Fig. 8-128 Pump Lever and Shaft Removal

loosening set screw on inner arm and removing outer lever and shaft. (See Fig. 8-128)

9. Remove air horn gasket.

CARBURETOR BODY DISASSEMBLY

1. Remove pump plunger return spring from bore in body.
2. Remove main metering jets and power valve.
3. Remove three screws on top of cluster, then remove cluster and gasket.
4. Remove the pump discharge spring guide, (See Fig. 8-129) then remove the spring and steel ball check.

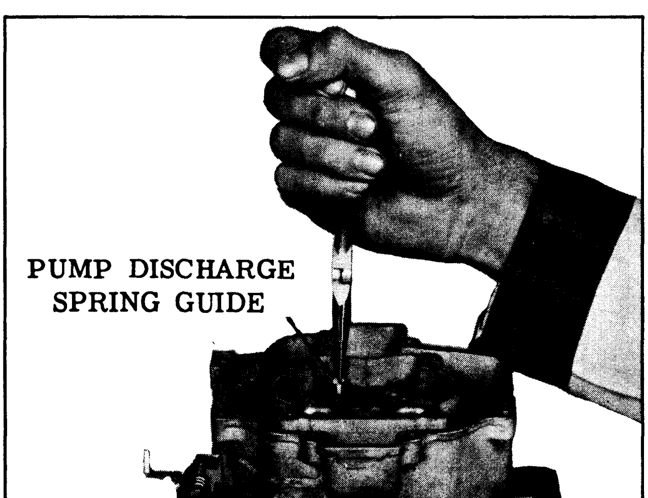


Fig. 8-129 Pump Discharge Spring Guide

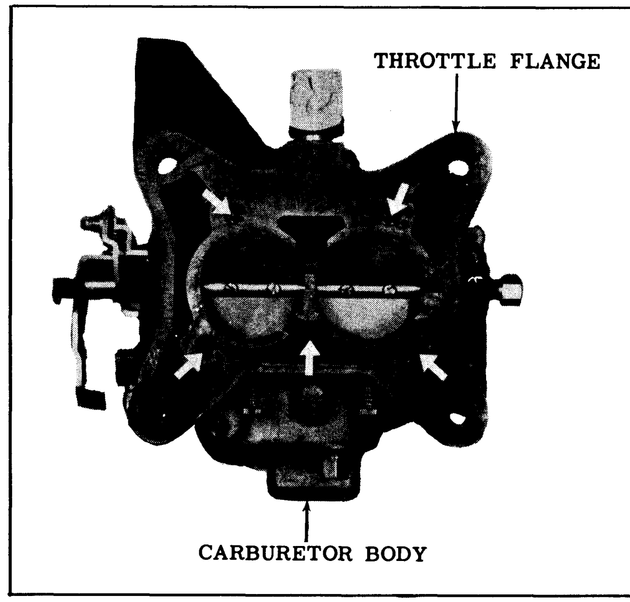


Fig. 8-130 Throttle Body Attaching Screws

5. Invert carburetor and remove the bowl to throttle body attaching screws. (See Fig. 8-130) Remove throttle flange and gasket.

DISASSEMBLY OF THE THROTTLE FLANGE

Remove idle adjusting needles and springs from throttle flange.

NOTE: No attempt should be made to remove the throttle valves or shafts from the carburetor throttle flange. The throttle flange is serviced as a unit with the throttle levers.

CLEANING AND INSPECTION

Cleaning

NOTE: Carburetor should not be cleaned in any solution other than a cold immersion type cleaner. Hot type cleaners may affect the sealing properties of dichromate coating. Do not soak air horn as an assembly in cleaner or solvent.

1. Thoroughly clean carburetor castings and metal parts in carburetor cleaning solvent.
2. Rinse parts in a clear rinsing solution.
3. Clean pump plunger in clean gasoline only.

4. Blow out all passages in castings and dry with compressed air.
   CAUTION: Do not pass drills or wires through calibrated jets or passages as this may enlarge orifices and seriously affect carburetor calibration.
5. Clean filter screens of dirt or lint. If they are distorted or plugged, replace.

Inspection

1. Check float for dents or wear at hinge pin holes.
2. Shake float to check for leaks.
3. Examine float needle and seat. If needle is grooved replace with a factory matched assembly.
4. Inspect idle adjusting needles for burrs or ridges.
5. Check body upper and lower surfaces to see that sealing beads are not damaged. Damaged beading may result in air leakage at that point.
6. Examine threads in main metering jet power valve and spark take-off passages to see that they are not damaged. Check with air, smoke, or liquid to be sure passages are open.
7. Check passages in the throttle flange in the same manner as above.
   NOTE: Due to the close tolerance fit of the throttle valves and the fact that the idle discharge holes are drilled in relation to proper fitting valves, the throttle flange and valve assembly should be replaced as a complete assembly if worn or damaged.
8. Inspect holes in pump rocker arm, fast idle cam and throttle shaft lever. If holes are worn excessively, the worn parts should be replaced.
9. If excessive wear is noted on the steps of the fast idle cam, it should be replaced to assure proper engine operation during warm-up.
10. Inspect pump plunger leather, replace the pump plunger as an assembly if leather is creased or cracked.

CARBURETOR ASSEMBLY

THROTTLE FLANGE ASSEMBLY

1. Install idle adjusting needles with springs finger tight. Back out needles 1-1/2 turns as a preliminary idle adjustment.
2. Invert carburetor body, place new throttle flange gasket in position and attach throttle flange. Tighten screws evenly and securely.

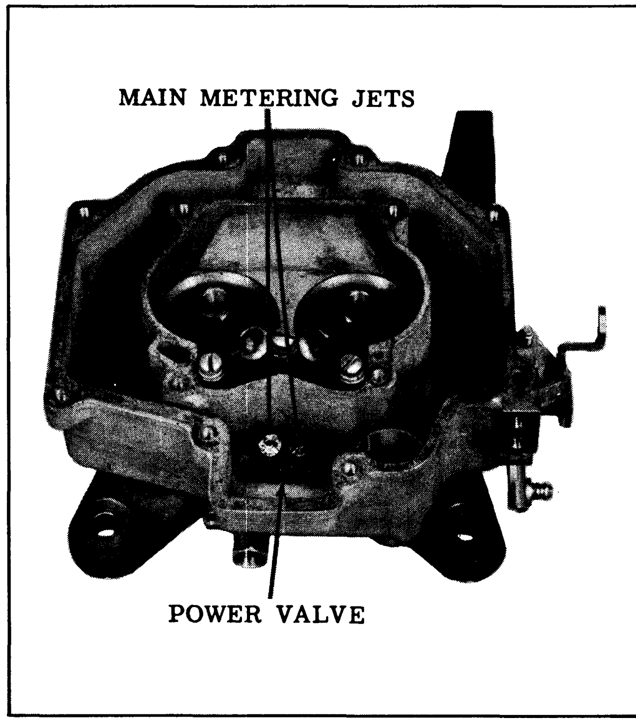


Fig. 8-131 Power Valve

CARBURETOR BODY ASSEMBLY

1. Install main metering jets.
2. Install power valve and gasket. (See Fig. 8-131)

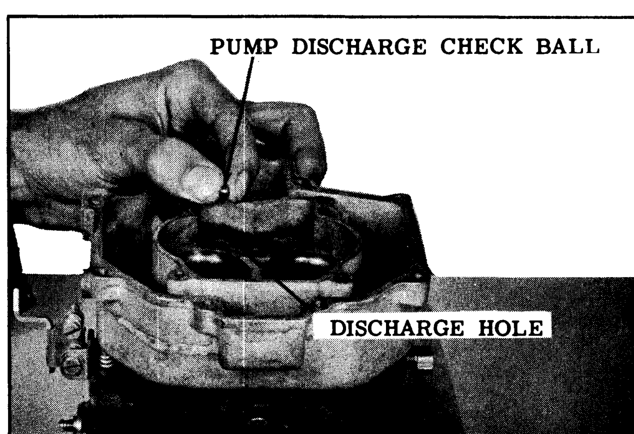


Fig. 8-132 Installing Check Ball

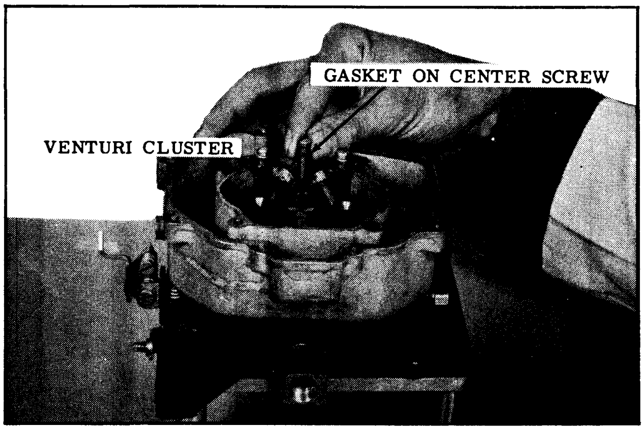


Fig. 8-133 Installing Venturi Cluster

3. Drop steel pump discharge check ball into discharge hole (See Fig. 8-132), and replace spring and "T" shaped guide.
4. Replace cluster and gasket, tightening screws evenly and securely. Make sure center screw is fitted with gasket to prevent pump leakage. (See Fig. 8-133)
5. Install pump return spring, pressing with finger to center it in counterbore of pump well.

AIR HORN ASSEMBLY

1. Assemble the outer pump lever and inner arm to air horn as shown in Fig. 8-134, then tighten set screw securely. Check to be sure shaft can rotate freely.

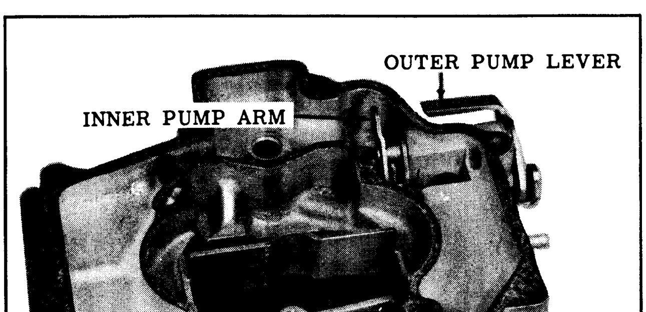


Fig. 8-134 Arm and Lever Installation

2. Attach pump plunger assembly to inner arm with pump shaft pointing outward, install retainer.
3. Install float needle seat and gasket and tighten securely.
4. Install power piston assembly in air horn and stake lightly in place opposite gasket sealing surface. Be sure piston moves freely.
5. Install cover gasket.
6. Attach needle to float, carefully position float and insert float hinge pin.

FLOAT LEVEL ADJUSTMENT (Setting 1 7/16")

The float setting is made with the air horn gasket in place.

1. Place gauge J-6337 so it rests over the floats and against the curvature of the air horn. (See Fig. 8-135)
2. Bend float arm as shown until float just touches bottom of gauge. To center floats between gauge legs, bend float arms at point shown.

FLOAT DROP ADJUSTMENT (Setting 2")

1. Bend float tang toward float needle seat to lessen drop and away from seat to increase float drop. The float drop is correct when the distance from the air horn gasket to the bottom of the float

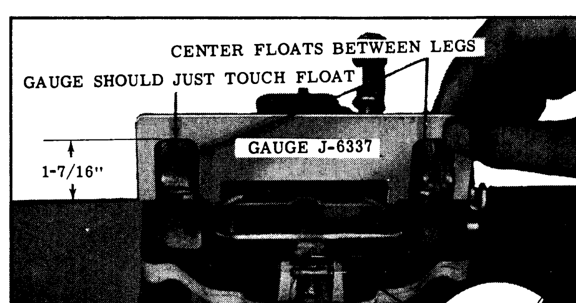


Fig. 8-135 Float Level Adjustment

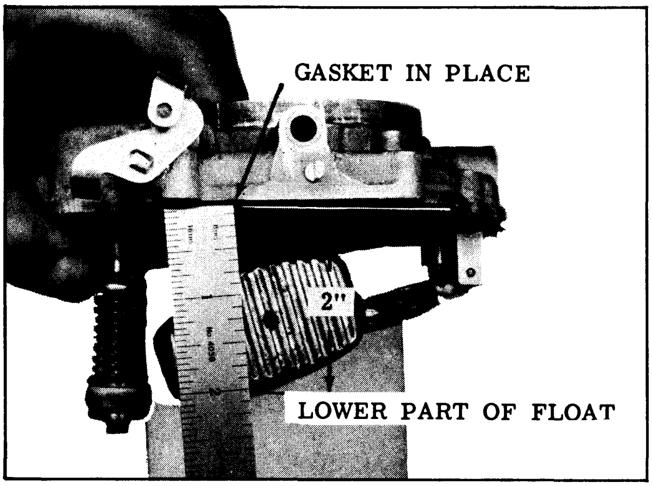


Fig. 8-136 Float Drop Adjustment

is 2", when measured with a scale (See Fig. 8-136)

COMPLETION OF ASSEMBLY AND ADJUSTMENTS

1. Install air horn assembly on body, being careful to guide pump plunger in well and not to bend float assembly. Check for free movement of pump plunger.
2. Install and tighten eleven cover screws evenly and securely. Note that long screw goes in raised area of air horn casting.
3. Install atmospheric vent valve assembly, spring and retainer. (See Fig. 8-137)
4. With strainer screen in strainer nut, install nut, screen and gasket assembly in air horn.

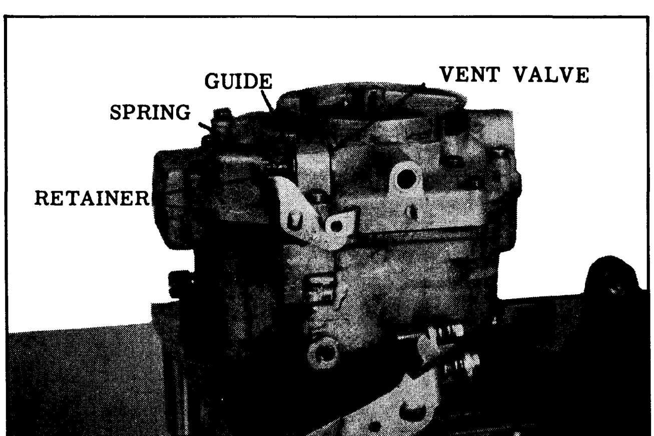


Fig. 8-137 Vent Assembly

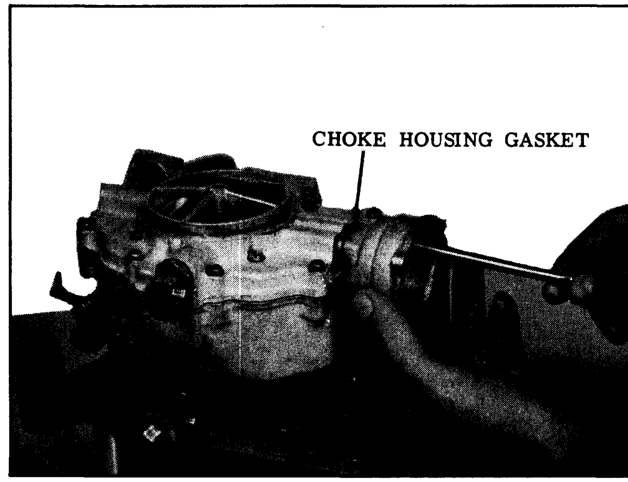


Fig. 8-138 Installing Choke Housing

5. Place new gasket in position and attach choke housing to air horn, tighten screws securely. (See Fig. 8-138)
6. Assemble choke piston to shaft with pin. Install choke shaft and piston in air horn assembly.
7. Install choke valve on choke shaft and install screws loosely.
8. Assemble fast idle cam and choke counterweight to choke rod.
9. Install fast idle cam, choke rod and counterweight as an assembly with the counterweight tang facing outward. (See Fig. 8-139) Attach choke trip lever so that tang of trip lever is under tang of choke counterweight, and install retaining screw.
10. Hold choke valve in closed position and center choke shaft for end play, then

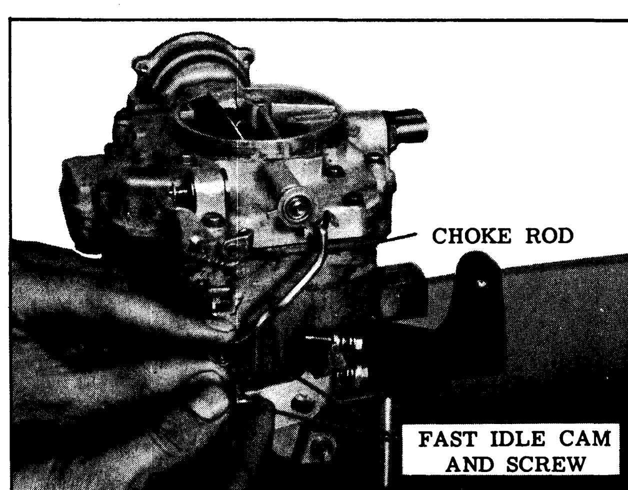


Fig. 8-139 Fast Idle Assembly

tighten choke valve screws. Check choke valve operation for freeness.

11. Place choke baffle plate into position and install choke coil cover and gasket. Rotate cover clockwise until the coil picks up the choke shaft tang, and index marks on cover and housing are aligned. Attach three retainers to housing and tighten securely.

    NOTE: Choke valve should be lightly closed at room temperature (75°F.) when index mark on cover and housing are aligned.
12. Install pump rod and retainer.

EXTERNAL ADJUSTMENTS (ON OR OFF THE CAR)

The float adjustments were made during assembly of the carburetor air horn. The remaining adjustments should be made in order as follows:

1. Pump rod adjustment.
2. Atmospheric idle vent adjustment.
3. Choke rod adjustment.
4. Unloader adjustment.

PUMP ROD ADJUSTMENT (Setting 3/16")

1. Back off idle speed adjustment screw and fast idle screw until throttle valves are completely closed.
2. Hold throttle valves closed. Check distance from top of air horn to top of pump rod with gauge J-6336. (See Fig. 8-140)

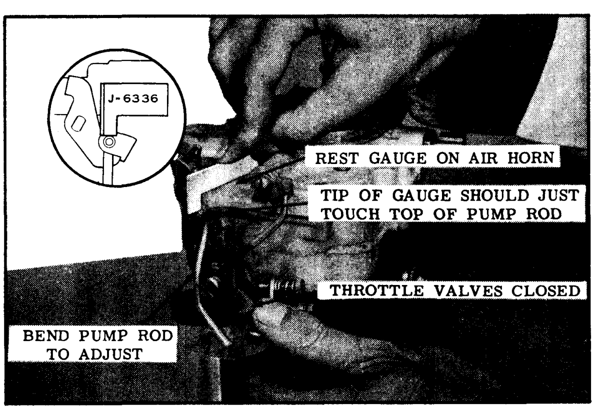


Fig. 8-140 Pump Rod Adjustment

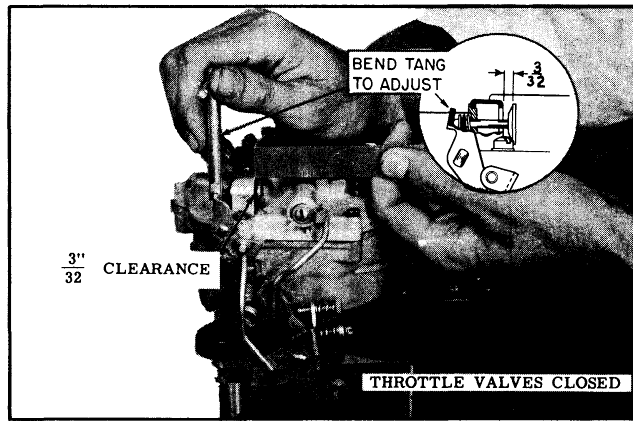


Fig. 8-141 Idle Vent Adjustment

3. Using BT-18 or similar bending tool, bend lower section of pump rod at point shown to obtain proper adjustment.

ATMOSPHERIC IDLE VENT ADJUSTMENT (Setting 3/32")

1. With the throttle valves completely closed, measure the distance from the air horn casting to the leading edge of the idle vent valve. (See Fig. 8-141)
2. Bend the tang on the pump lever with Tool BT-69 as necessary to obtain the proper setting.

CHOKE ROD ADJUSTMENT (Setting .073")

1. Turn the fast idle screw in until it just contacts the second step of the fast idle cam.
2. Hold the fast idle cam so the shoulder of the highest step is against the fast idle screw. (See Fig. 8-142)

    NOTE: Be sure choke trip lever is in contact with the choke counterweight.
3. Using BT-69 or similar tool bend counterweight tang to obtain .073" between upper edge of choke valve and air horn wall using small end of gauge J-6338 as shown.

UNLOADER ADJUSTMENT (Setting .115")

NOTE: Due to the split throttle lever

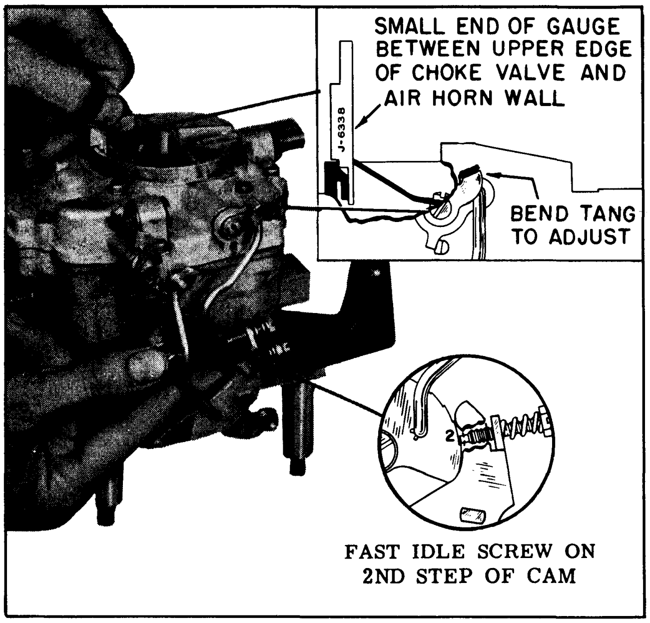


Fig. 8-142 Choke Rod Adjustment

arrangement, it is very important that the throttle levers be properly set before checking the unloader adjustment. The levers should be set as follows:

1. Back out the fast idle screw sufficiently so it will not rest or touch the fast idle cam when the idle speed screw is backed out.
2. Back out the idle speed screw until the throttle valves are completely closed.
3. Turn the idle speed screw in until throttle valves just begin to open, then turn the idle speed screw in one full turn from this setting. This is equal to approximately 400 engine R.P.M.

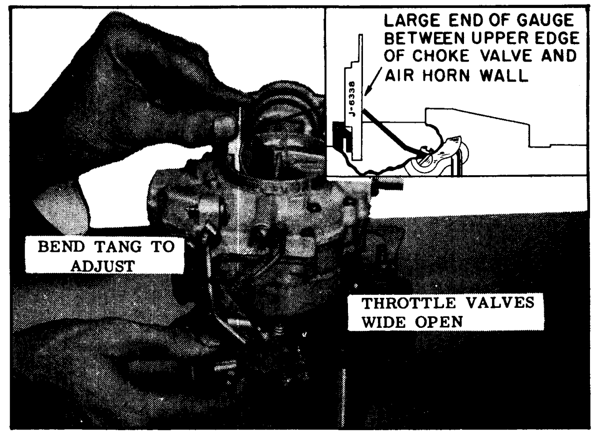


Fig. 8-143 Unloader Adjustment

NOTE: With the thermostat set at specifications and choke trip lever in contact with choke counterweight, proceed as follows to check and/or make unloader adjustment.

4. Hold throttle lever in full open position.
5. Using Tool No. J-6338 check clearance between top of choke valve and inner wall of air horn. (See Fig. 8-143)
6. Using BT-69 or similar tool, bent tang of throttle lever to obtain correct setting.

FAST IDLE ADJUSTMENT

1. With engine warm rotate fast idle cam so the fast idle screw is resting on the high step of the cam.
2. With the use of a tachometer adjust fast idle screw to obtain an engine speed of 1600 to 1700 R.P.M.

ENGINE TUNE-UP

CONTENTS OF SECTION 9

TUNE-UP PROCEDURE

1. CLEAN BATTERY AND TEST SPECIFIC GRAVITY.

   Clean battery as outlined in the Electrical Section. A warm battery reading below 1.225 should be recharged before tune-up is attempted. If there is a variation of more than .025 between cells, a load test of the battery should be made. If battery is low, cause should be located and corrected.

2. TIGHTEN ALL BATTERY, STARTER, GENERATOR, VOLTAGE REGULATOR, AND COIL PRIMARY CONNECTIONS.

   Loose connections cause high resistance and low voltage. Today's engines require maximum voltage for proper ignition. The generator must keep the battery in condition to meet these voltage requirements.

3. CLEAN FUEL PUMP BOWL AND FILTER AND CARBURETOR INLET SCREENS.

   A strainer gasket is located in the pump above the flange of the regular paper filter; if the gasket and filter become dirty, they should be replaced. No attempt should be made to clean gasket or filter. Always install a new bowl gasket. If water is present in fuel bowl, the fuel lines and tank should be cleaned.

4. TIGHTEN ALL FUEL, VACUUM, CHOKE AND POWER BRAKE CONNECTIONS ON THE CARBURETOR, FUEL PUMP, AND DISTRIBUTOR.

   As in the case of manifold gaskets, air leaks cause lean mixture and poor idle performance. A leak in the gas line between the gas tank and fuel pump will cause a high speed miss and/or failure to start; whereas, a leak between the fuel pump and carburetor will create a fire hazard.

5. TORQUE ALL INTAKE MANIFOLD BOLTS AND TIGHTEN CARBURETOR ATTACHING NUTS.

   Intake Manifold bolt torque - 22-26 ft. lbs.

   Air leaks at intake manifold cause rough idle and poor low speed performance due to lean mixture. If leak is suspected, test by squirting gasoline around intake manifold at cylinder heads, then observe combustion analyzer for richening of mixture.

   NOTE: Remove choke heat pipe while making this test to prevent gasoline from entering through the heat pipe, which would richen the mixture. Be cautious of fire.

   Torque Exhaust Manifolds and Tighten Exhaust System Connections.

   Exhaust manifold torque - 22-26 ft. lbs.

   Exhaust leaks are not only annoying, they are hazardous. A good tune-up eliminates this hazard and the possibility of early gasket failure.

6. CHECK CHOKE FOR PROPER SETTING, TIGHTEN COVER ATTACHING SCREWS, CHECK FOR FREENESS OF CHOKE VALVE AND SHAFT. TIGHTEN HEAT TUBE FITTING TO CHOKE HOUSING.

The automatic choke functions by heat and vacuum. The thermostatic spring should close the choke valve (engine off) at room temperature 75° F.) with choke set at index. When engine is started, vacuum tends to open the choke and also draws warm air to the thermostatic spring through the manifold heat tube. Malfunctioning of the choke could be caused by a split heat tube in the intake manifold or by a defective choke cover gasket.

7. SERVICE AND INSTALL THE AIR CLEANER. RECHECK CHOKE VALVE FOR FREENESS.

Service the air cleaner in accordance with instructions outlined in the Lubrication Section. Remember, this unit not only protects the engine from harmful abrasives, it also can be responsible for rich mixture when it is restricted with dirt or too full of oil.

NOTE: To be sure that tightening the air cleaner to carburetor has not caused the choke valve to bind, hold throttle partially open and see that choke turns freely.

8. CLEAN SPARK PLUGS, FILE END OF CENTER ELECTRODE FLAT - SET GAP AT .030".

The spark plug must be clean and properly adjusted to fire the mixture in today's high compression engines. Sand blasting alone does not completely service the plug. In addition to blasting, the end of the center electrode must be filed flat. Correct plug gap insures good performance under all operating conditions. Always be sure to properly gap new or used plugs .030".

9. INSTALL SPARK PLUGS TO 25 FT. LBS. TORQUE USING NEW GASKETS.

Loose spark plugs mean loss of compression. Installing plugs too tight will damage plugs or threads. In tightening plugs, be sure that the top end of the socket wrench is supported to avoid cocking the socket against insulator as this may crack the plug. Always remove dirt, paint, and other foreign material from insulator. Be sure insulating sleeves are in good condition and installed to cover the resistance type cable terminals and spark plug insulators.

10. ADJUST FAN AND GENERATOR BELT, COMPRESSOR AND HYDRAULIC STEERING BELT TENSION TO TORQUE SPECIFICATIONS. INSPECT BELTS AND REPLACE IF THEY ARE FRAYED OR OIL SOAKED.

A. Fan and Generator Belts:

Without Air Conditioning	16 ft. lbs.
With Air Conditioning	20 ft. lbs.

B. Hydraulic Steering Belt: 30 ft. lbs.

Loose fan and generator belt means improper engine operating temperature and an improperly charged battery. Engine temperatures and battery voltage affect performance and economy. Tight belts may damage water pump or generator bearings and cause rapid fan belt wear.

11. CHECK MANIFOLD HEAT CONTROL VALVE FOR FREENESS AND PROPER OPERATION.

Proper operation of the heat valve is essential to good performance and economy. A heat valve stuck in the open position means poor warm-up and rich carburetion. A valve stuck closed means poor high speed operation. Make sure that the thermostatic spring is installed properly. The thermostatic spring is designed to close the valve as it cools. As the spring warms and the engine speed increases, the counterweight and exhaust gas pressure opens the valve. Be sure the valve is free and operates in this manner. If the shaft is tight it may be freed-up by rotating the counterweight and applying a graphite base lubricant to the bearing surfaces.

CAUTION: Never oil the bearing surfaces as carbon may form and "freeze" the counterweight shaft.

Following is a quick test: With cool

exhaust manifold, start engine and flash the throttle quickly. Heat valve should open and return to closed position. If valve does not open in the above check, and the counterweight shaft is free, it indicates that the valve is loose on the shaft or the shaft could be broken; in either case the heat control valve should be replaced. A rattling or "buzzing" noise audible during the above test, indicates that the shaft bushings are worn. Valve opens when weight rotates downward.

12. BE SURE CONDENSER LEAD WIRE AND BREAKER PLATE GROUND WIRE IN DISTRIBUTOR ARE PROPERLY TIGHTENED.

13. FILE DISTRIBUTOR POINTS. BE SURE TO REMOVE ANY METAL BUILD-UP ON EITHER POINT. REPLACE EXCESSIVELY BURNED OR PITTED POINTS.

14. START ENGINE, BRING UP TO NORMAL OPERATING TEMPERATURE AND CHECK CAM DWELL.

This is done in preparation for setting the ignition timing. The cam dwell can be checked and/or adjusted as the engine is being warmed up.

CHECK CAM DWELL - 26° - 33°

If the cam dwell is outside of the above limits, adjust to 29° as outlined in the Electrical Section.

Flash throttle and observe dwell indicator for variance. Allowable variance 2°. If dwell indicator is erratic, primary wiring and distributor should be checked. If dwell is erratic and other conditions are O.K., check dwell meter.

15. ADJUST IGNITION TIMING.

The timing marks are located on the rim of the crankshaft pulley. The leading edge of the notch is 5° before top dead center. The trailing edge of the notch is top dead center. Midway between is $2\text{-}1/2^{\circ}$ before top dead center.

The correct method of setting timing is as follows:

A. Disconnect distributor vacuum advance line at the carburetor and close fitting with a piece of tape.
B. Set engine to run at 850 R.P.M.
C. Set timing at 5° before top dead center. This is normal setting.

   NOTE: If a tuned engine detonates with this setting, the cause is low octane fuel or carbon build-up in the combustion chambers. If these factors are not corrected, the timing should be set at $2\text{-}1/2^{\circ}$ before top dead center at 850 R.P.M. In some cases where fuel octane is good or the engine is clean or the car is operated at high altitudes, the timing can be set at $7\text{-}1/2^{\circ}$ before top dead center at 850 R.P.M. without detonation and with some advantage in performance and economy.
D. Remove tape, connect distributor vacuum advance line, and reset slow idle.

16. MAKE MILLIAMP TEST AT SPARK PLUGS.

Spark plug wires are not used in 1956 production; instead, · resistance type cables are used which no longer require the use of suppressors. Since the suppressors were always removed before making a milliamp test on past model cars, a different indicator reading will be noted, due to the new resistance type cables. When making a milliamp test, the indicated reading values, furnished by the testing equipment manufacturer, should be used.

A. Push all cables down tight in distributor cap.
B. CAREFULLY examine the rotor segment and distributor cap electrodes for excessive burning.
C. Be certain spring contact button contacts carbon brush in distributor cap.
D. Check breaker point spring tension - may be weak.
E. Remove cable from distributor cap on any cylinder that has a low

reading and thoroughly clean the connection in cap and on the cable terminals with a wire brush.

F. Check terminals on both ends of resistance type cable being certain that the terminals are secure, and the staples make contact with the terminals and pierce the center of the insulation. Wire is not used in the new cables; therefore, if terminals are loose or the staples are not making contact, the cable assembly should be replaced.

NOTE: All production and service replacement resistor type cables are made to specified lengths and no attempt should be made to shorten, rework, or repair the cable assemblies.

G. Carefully examine the low reading cable for possible breakdown of insulation; also, look for oil soaked cable, cracks, or small pin holes. Examine insulation carefully where it might be touching metal.

NOTE: If the milliamp reading is still unsatisfactory, carefully check the distributor cap and rotor for leakage or cracks. Test the coil, condenser, and primary circuit, including starter solenoid connections, ignition switch and terminals, as well as the coil and distributor terminals.

17. ADJUST CARBURETOR IDLE.

Engine must be at operating temperature:

H.M.T. in "Dr" - 400 R.P.M.

S.M.T. in "Neutral" - 425 R.P.M.

After the idle R.P.M. is stabilized, turn in or out each idle adjusting needle screw until the smoothest possible idle is obtained. This normally is accompanied by a higher manifold vacuum reading and/or an increase of idle R.P.M. Then, turn out (rich) each needle 1/4 turn, at which time both the idle vacuum and R.P.M. will drop off slightly. This adjustment will prove to be correct for all normal idle requirements.

A final check of the foregoing adjustment can be made by slowly opening the throttle until approximately 1000 R.P.M. is reached and then allowing the throttle to snap closed rapidly. The engine should return to normal idle with no indication of rolling due to richness. If a slight rich roll is experienced, turn each idle needle in (lean) no more than 1/8 turn, which should provide the stable idle desired.

NOTE: The carburetor throttle return check must be disconnected while making the above check.

18. ADJUST FAST IDLE TO SPECIFICATIONS WITH ENGINE WARM.

Correct fast idle adjustment prevents stalling when the engine is cold. This setting must be correct to insure proper performance: High Step - 1400-1500 R.P.M. (4GC); 1600-1700 R.P.M. (2GC).

ROAD TEST AND DIAGNOSIS

Road Test Car Thoroughly

Check the engine performance at HIGH SPEED, LOW SPEED and IDLE. If a tune-up has been performed as outlined, the car should perform to standard. If it does not, additional work and tests will be required. Although it would be difficult to point out the specific cause for improper engine performance after the recommended Rocket Engine tune-up has been performed, we are listing some of the additional possible causes to assist you, by grouping under separate subheads.

NOTE: AFTER ROAD TEST, INSPECT ENGINE FOR OIL AND WATER LEAKS.

Engine Performance Poor or Misses.

Probable cause is in the -

A. Ignition System
B. Fuel System
C. Valve System
D. Miscellaneous Causes

There are numerous possible causes of trouble in the ignition system that can cause the engine to miss at High or Low speed, most of which have been covered in the tune-up procedure. Additional items to check are listed below:

A. Ignition System.
   1. Be sure the cable terminal fits tight on spark plug terminal.
   2. Reinspect spark plug for lead deposits on insulator.
   3. Check spark plug for an insulator crack under plug body shell.
   4. Recheck milliamp out-put at spark plug cable terminal.
   5. Check all primary ignition wiring and connections.
   6. Check distributor cap for cracks.

B. Fuel System.
   1. Carburetor float level adjusted too LOW or too HIGH or leaky needle seat.
   2. Dirt and/or corrosion in carburetor fuel or air passages.
   3. Low capacity fuel pump.
   4. Punctured vacuum diaphragm in pump assembly.

   Careful examination of the carburetor and fuel system should reveal defects if present. Always be ACCURATE with the carburetor adjustments when overhauling a carburetor.

C. Valve System.
   1. Sticking valve due to carbon and/or varnish deposits.
   2. Broken or weak valve spring.
   3. Warped, cracked, or burned valve.
   4. Valve not seating correctly.
   5. Faulty operating hydraulic valve lifter.
   6. Bent push rod, push rod worn excessively, or push rod seat worn in rocker arm.

   To determine if the valves are at fault, a test should be made to determine the cylinder compression pressure. This is done in the same manner as when testing for worn pistons or rings. When checking cylinder compression, the throttle and choke should be open, all spark plugs removed, and the battery at or near full charge. The lowest reading cylinder should not be less than 80% of the highest, and no cylinder reading should be less than 100 pounds.

D. Miscellaneous Causes:
   1. Clogged muffler.
   2. Incorrect valve timing.
   3. Pre-ignition, due to sharp carbon deposits in the combustion chamber.
   4. Poor ground connection between engine and frame or body.

Engine Rough on Idle -
May Miss on One Cylinder

An engine may perform at High speed and Low speed driving, but will idle rough or even miss on one or more cylinders when permitted to idle a normal short period. This condition may be due to:

1. Spark plug has incorrect specification number (heat range).
2. Leak in intake manifold, gasket, crack, etc.
3. Varnish or carbon deposits around carburetor throttle valves and body.
4. Leak in floats causing flooding condition.
5. Idle jets clogged.
6. Worn or bent idle adjusting screw.
7. Sticking, poorly seated, or burned engine valve.

Restricted movement of front engine mount due to being oil soaked, misaligned or insufficient clearance between inner and outer mount will cause the idle to feel rough.

Engine Stalls on Idle.

Correct engine idle speed is important to assure good engine idle operation. An engine that idles slower than standard specifications will contribute to stalling.

Check the following.

1. Flooding of carburetor.
2. Clogged climatic control passage in choke housing.
3. Cracked heat tube in manifold. (Indicated by choke piston excessively carboned.)

Engine Surges or Cuts Out.

At times a surge or cut out of the engine may be noticeable. This is usually noticeable at moderately fast driving when the accelerator is held in a steady position.

Surging or cutting out can be due to:

1. Stopped up fuel line.
2. Stopped up gas tank cover vent.
3. Air leak at fuel pump filter bowl.
4. Leak in fuel line between gas tank and fuel pump.

Poor Acceleration.

Performance (acceleration) is dependent on the proper amount of fuel to satisfy the engine's demand when the throttle is opened rapidly. Also, the correct heat must be applied to the manifold.

Poor acceleration can be caused by:

1. Incorrect setting of the accelerator pump.
2. Worn throttle linkage or carburetor linkage.
3. Manifold heat valve sticking.
4. Clogged heat passage in climatic control housing.
5. Heat tube in manifold cracked.
6. Inoperative distributor advance.

The interval at which major service work is required to the carburetor, distributor, valve mechanism, etc., will vary with operating conditions. Prescribe this work only when a thorough diagnosis indicates the need. For instance -

Accumulation of carbon on the combustion chambers causes loss of power and performance and may result in detonation or "Spark Ping."

The rate and type of carbon accumulation is dependent upon the fuels and engine oils used, operating conditions, and driver habits. However, when it is known that recommended fuels are being used and the engine detonates with correct spark setting, the owner should be sold a carbon removal job as an engine tune-up alone will do little good, if any, to satisfy the owner. The carbon can be removed in a very short time with the Head-On Carbon Blaster and the owner will be gratified with the results.

CLUTCH

CONTENTS OF SECTION 10

The clutch consists of a single, dry cushioned, driven clutch disc and a pressure plate assembly which uses a needle bearing lever mount. Under normal conditions no adjustment is necessary and the release lever positions which have been factory located should not be disturbed unless instructions for servicing are followed in detail.

The clutch oil guard is integral with the clutch driven plate assembly.

Each clutch release lever is mounted to a yoke which, in turn, is bolted to the cover plate.

Nine pressure springs are used for maintaining the proper pressure on the driven plate. Forged integral with the release levers are weights which, through centrifugal force, add to the spring pressure exerted on the driven disk, thereby increasing the clutch torque capacity at higher speeds.

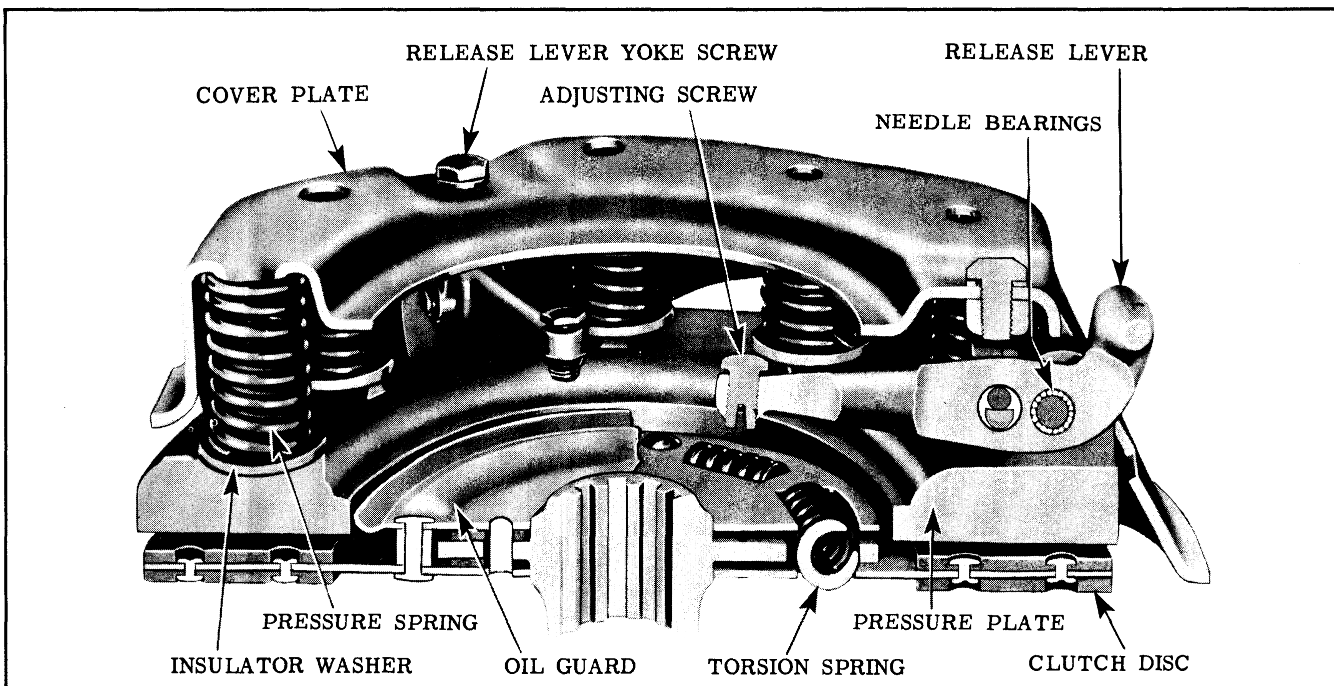


Fig. 10-1 Clutch Assembly Detail

CLUTCH DRIVEN PLATE

The clutch driven plate is of cushioned spring construction with grooved facings on both sides.

Balance is obtained by means of narrow sheet metal strips crimped around the webs of the driven disk; grinding of the edges should NOT be attempted as a means of balancing.

CLUTCH THROWOUT AUXILIARY SHAFT ASSEMBLY AND PEDAL ADJUSTMENT

The clutch throwout auxiliary shaft assembly is so designed as to permit engagement and disengagement of the clutch without being affected by engine movement on its flexible mountings.

The assembly consists of a stamped steel auxiliary shaft with a pivot pin at each end, three integral arms, a combination clutch pedal pressure reducer and return spring.

Two clutch auxiliary shaft felt washers impregnated with oil are used; one around each pivot pin.

The auxiliary shaft floats in both of its two supporting brackets and endwise shaft movement is kept within reasonable bounds by the felt washers.

Connection between the clutch pedal and one arm on the auxiliary shaft is furnished by a plain push rod. The adjustable link furnishes a connection between one arm of the auxiliary shaft and the clutch release yoke. Adjustment for clutch pedal lash is made on this link.

The third auxiliary shaft arm furnishes a connection for the combination pressure reducer and return spring, the anchored end of which is attached to the second frame cross member.

Lubrication of the auxiliary shaft assembly is provided by means of the felt washers at each end of the shaft. Engine oil should be applied to the felt washers at regular lubrication intervals.

A high pressure lubrication fitting is provided on the underside of both the clutch and brake pedals for their lubrication. Two bronze bushings are pressed into the lower ends of both pedals.

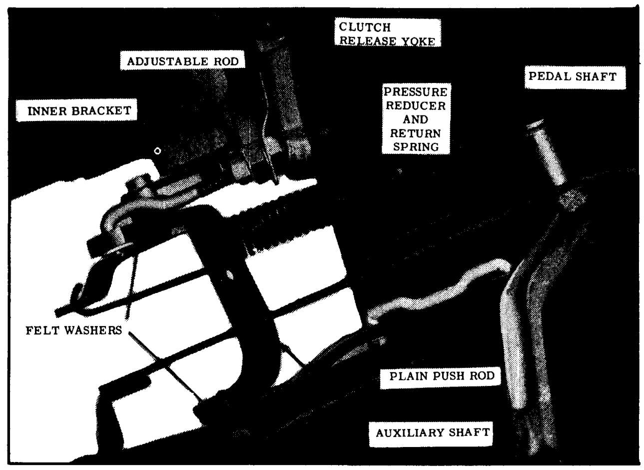


Fig. 10-2 Clutch Auxiliary Shaft Assembly

CLUTCH REMOVAL AND REPLACEMENT (Transmission Removed)

1. Remove bearing retainer sleeve.
2. Remove clutch return spring and disconnect clutch linkage at yoke connecting link.
3. Remove left hand engine filler plate, engine breather pipe, and the right and left rear lower flywheel housing bolts.
4. Install Engine Rear Support Tool BT-28, piloting supports in the bolt holes from which bolts were removed in Operation #3 above.
5. Remove engine rear mount bolts at clutch housing, and remove frame cross-member by removing three bolts at each end.
6. Remove eight bolts securing clutch housing to flywheel housing, and remove clutch housing.
7. Remove six clutch assembly to flywheel bolts, and remove clutch.

   Mark flywheel and clutch cover for correct positioning at reassembly.

To install, reverse sequence of operations, lubricating clutch shaft pilot bearing and bearing surface of release levers with Special lubricant #563598. Adjust transmission shift linkage, and adjust clutch pedal free lash to 1-1/8" to 1-3/8".

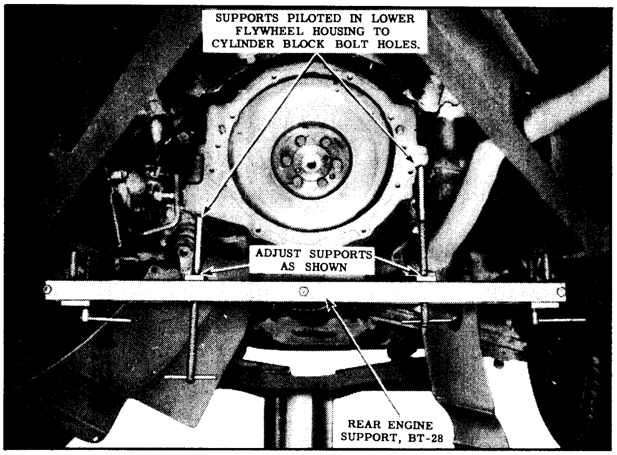


Fig. 10-3 Support Bar in Place At Rear of Rocket Engine for Clutch Removal

DISASSEMBLY AND INPSECTION OF PRESSURE PLATE

1. After removing clutch from engine, mark the cover and pressure plate with a punch if these are both to be reused, so that the two parts may be reassembled in the same relative position.
2. Place the clutch assembly on an arbor press with the pressure plate resting on a block so that cover plate is free to move downward without obstruction. Place a bar or block across the top of the cover, resting on the spring bosses. (See Fig. 10-4)
3. Lower the ram of the press and, holding it under compression, remove the release lever yoke screws and slowly release the pressure to prevent the springs from flying out.

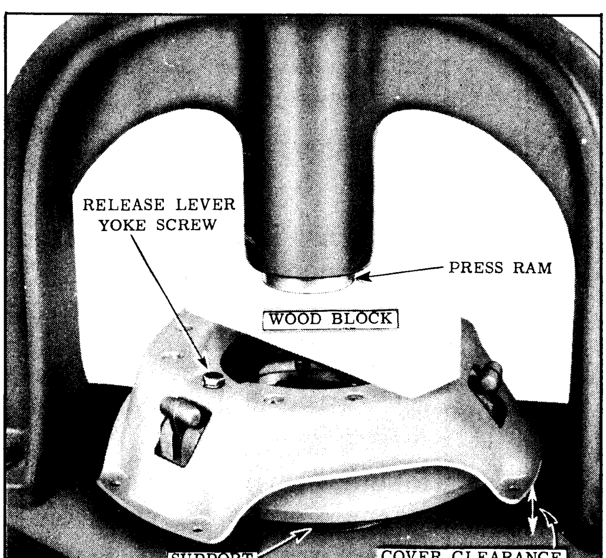


Fig. 10-4 Disassembly of Pressure Plate

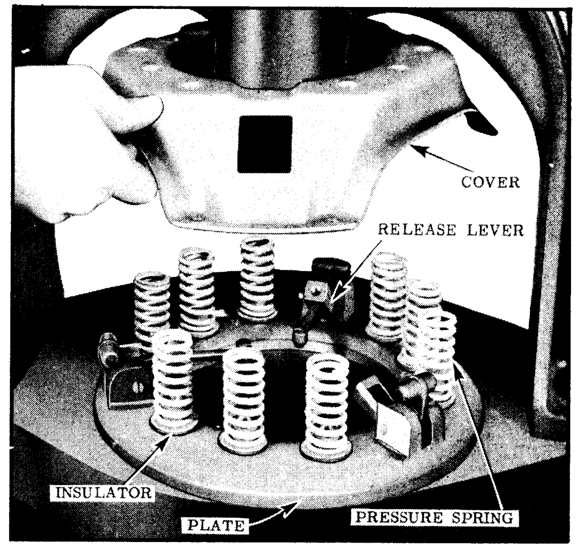


Fig. 10-5 Removing Cover and Springs

4. The cover can then be lifted off and all parts will be available for inspection. (See Fig. 10-5) Release levers can be removed from the pressure plate and yokes from the release levers by carefully hack-sawing the large upset ends off the pins holding these pieces together. A dummy pin the width of the lever should be used for removal of the old pins. In this way the needle bearings can be kept from falling from the lever during removal of the pin. (See Fig. 10-6)
5. Inspect the pressure plate springs and replace in complete sets if they show signs of overheating due to clutch slipping. If the springs have been overheated, the paint will be burned off or they will show a pronounced blue color, indicating the temper has been drawn.
6. Inspect the driven plate and replace if the facings are worn nearly to the rivet heads.
7. Inspect cushion in clutch driven plate for weakness, cracks, or fatigue failure and replace plate assembly if any of these conditions are found.

NOTE: Installation of clutch driven plate facings is not recommended, as it is difficult to obtain balance and flat parallel faces.

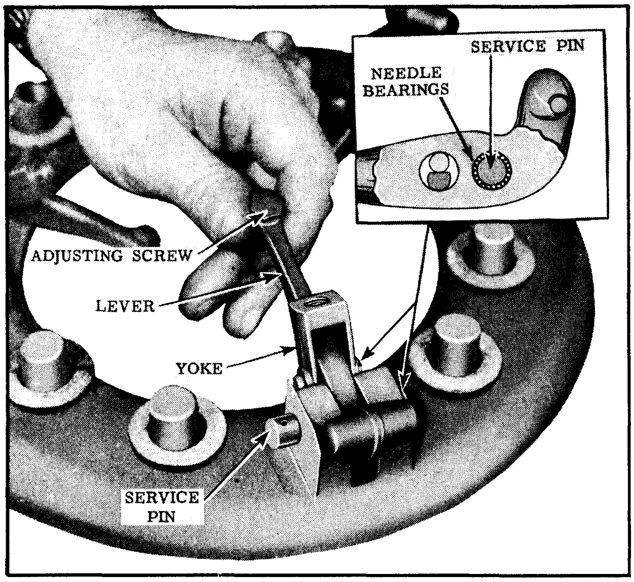


Fig. 10-6 Assembly of Lever to Plate

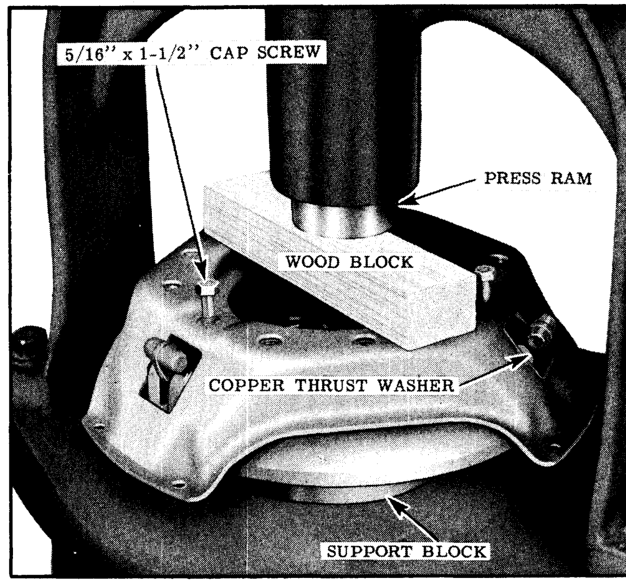


Fig. 10-7 Compressing Pressure Plate

ASSEMBLY OF PRESSURE PLATE

1. Mount the yoke on each clutch release lever, and all levers to the pressure plate using new pins to replace those hack-sawed off in the disassembly operation. New copper thrust washers should be installed on lugs at time of lever replacement. Be sure that pivot pins and driving shims are properly installed as shown in Fig. 10-7. The service replacement pins are like original pins except that they are drilled for cotter pins, eliminating the need for upsetting. A short length of pin cut to the width of the release lever will be used to hold the needle bearings in place while the new pin is installed.
2. Place pressure plate in arbor press and set clutch springs on it in a vertical position, seating them on the insulators resting on the small pressure plate bosses.
3. Place a small amount of lubriplate on driving lugs.
4. Place cover on top of assembled parts taking care that clutch levers are in position and that tops of pressure plate springs are properly seated in cover.
5. Position each yoke with respect to the cover and place a small pin through hole in cover into hole in yoke so that yoke does not drop out of position as cover is depressed.
6. Lay a bar across cover and slowly compress assembly, taking particular care to assure that pressure plate lugs are properly guided without bind through the holes in cover.
7. Remove the small pins used to hold release lever yokes in position and install cap screws, being sure to hold clevis square while tightening.
8. Release and apply pressure on assembly several times so that all moving parts will settle to their correct working position.
9. Remove pressure plate assembly from press; check, and if necessary adjust the clutch release levers.

MINOR ADJUSTMENT OF CLUTCH RELEASE LEVERS

1. Before adjustment of clutch release levers is attempted, levers must be worked several times to center the bearings.
2. Place Gauge J-4389 on flywheel in the position normally occupied by the driven plate.
3. Mount pressure plate assembly to flywheel, alternately tightening attaching screws one or two turns at a time so as not to distort pressure plate assembly cover.

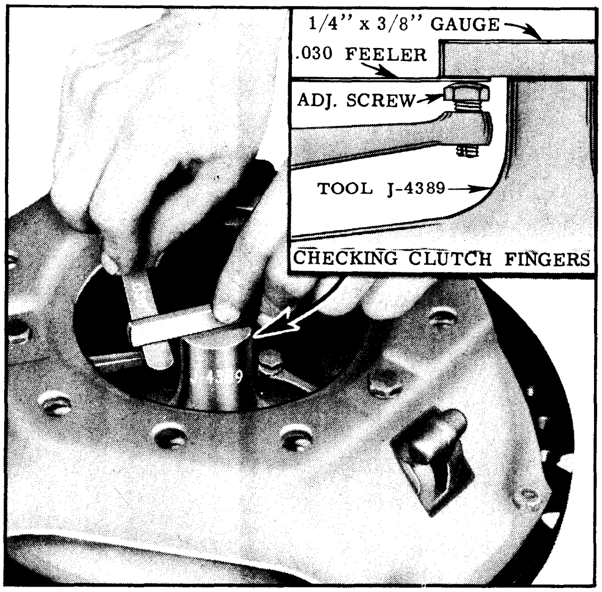


Fig. 10-8 Adjusting Clutch Levers

4. Lay a short straightedge across the center boss of the gauge as a guide for positioning clutch levers. (See Fig. 10-8)
5. The level of bearing surfaces on all levers should be from .0000" to .0625" below the level of the gauge center boss, and each lever should lie within .015" of the other two levers.
6. If the levers are not more than .025" out of plane, adjustment can be made by lightly tapping the clevis mounting screw heads, using an 8 ounce hammer, in order to bend the pressure plate cover a small amount until all levers are in the same plane within .015".

   If the levers are more than .025" out of plane or do not lie within the .0000" to .0625" dimension below the center boss, it will be necessary to adjust the release lever screws as follows:

MAJOR ADJUSTMENT OF CLUTCH RELEASE LEVERS

1. Using a standard hack-saw blade, remove the original stakes from the required release lever adjusting screws.
2. Adjust screw (or screws) until all levers are within .015" of each other and lie not more than .0625" below the level of the gauge center boss.
3. With head of screw resting on a solid block use a blunt chisel to restake the screw to the lever. A lever can be restaked only once because of the limited stock around the adjusting screw, and it will be necessary to replace the lever if the first restaking is incorrectly located.
4. Recheck release lever adjustment as outlined in steps 1 through 5 under MINOR ADJUSTMENT OF CLUTCH RELEASE LEVERS.

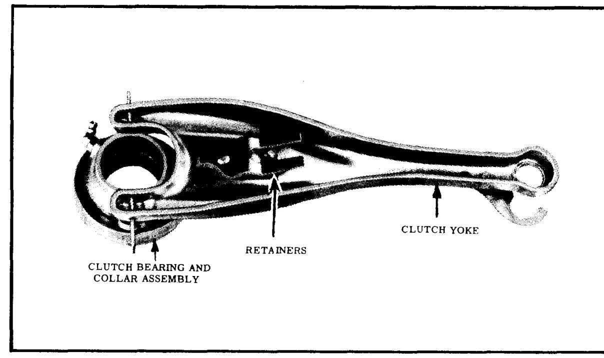


Fig. 10-9 Clutch Yolk Assembly

REMOVE AND REPLACE CLUTCH THROWOUT YOKE

To remove the clutch throwout yoke, proceed as follows:

1. Remove transmission and bearing retainer sleeve.
2. Disconnect adjusting link from yoke.
3. Remove the clutch housing.
4. Snap yoke off ball stud by pushing in on end of yoke.
5. Remove yoke. (See Fig. 10-9)

To replace, reverse sequence of removal operations.

REMOVE AND REPLACE CLUTCH AUXILIARY SHAFT

To remove the clutch auxiliary shaft proceed as follows:

1. Disconnect adjustable link and then plain link from clutch auxiliary shaft.
2. Disconnect pressure reducer spring by revolving auxiliary shaft backwards, holding the auxiliary shaft firmly while revolving.
3. Remove the inner auxiliary shaft bracket.

4. Slide shaft out of frame bracket.

To replace, reverse sequence of operations, lubricating each end of shaft and making sure that all parts are free.

PROVISION FOR LUBRICATION OF CLUTCH THROWOUT BEARING

The clutch throwout bearing is a prepacked ball bearing assembly and normally will not require attention except when the clutch is overhauled. Under abnormal service, the clutch throwout bearing should be lubricated sparingly as required. A lubrication fitting is provided on the throwout bearing retainer and is accessible by removing the access hole cover in the lower center area of the clutch housing.

CAUTION: Extreme care must be exercised to assure that no grease or oil reaches the clutch facings, as this will result in clutch slippage and chatter.

At each lubrication interval the felt washers at each end of the clutch auxiliary bell-crank should be saturated with SAE 20 oil, and the clutch pedal bushing should be lubricated through the grease fitting provided.

GREASE LEAKAGE INTO CLUTCH

(See Section on Syncro-Mesh Transmission)

CLUTCH SPECIFICATIONS

1. TYPE	11CF
2. CLEARANCE BETWEEN	
Hub and Splines on Clutch Shaft	.00175" - .005"
3. DISC FACINGS	
a. Area - Total Square Inches	56.5
b. Diameter - Inside	7"
c. Diameter - Outside	11"
d. Number Used	2
e. Thickness	.136"
4. DRIVEN DISC ASSEMBLY	
a. Number Used	1
b. Overall Thickness (Clutch Engaged)	.315"
5. PEDAL FREE MOVEMENT	1-1/8" to 1-3/8"
6. PRESSURE SPRINGS	
a. Number Used	9
b. Compression Pressure - lbs. (Standard Springs)	147-1/2 at 1-9/16"
1. Color	Yellow
c. Compression Pressure - lbs. (Heavy Duty Springs)	175 at 1-9/16"
1. Color	Orange
7. RELEASE BEARING	
a. Thickness	.665"
b. Type	Ball
8. TORQUE APPLICATION	Ft. Lbs.
a. Clutch to Flywheel Bolts	14-17
b. Clutch Release Ball Stud	35-40
c. Clutch Housing to Block Bolts	50-55

SYNCRO-MESH

CONTENTS OF SECTION 11

SYNCRO-MESH TRANSMISSION

The 1956 Syncro-Mesh Transmission is identical with the 1955 transmission in method of disassembly, assembly and adjustments.

SHIFT LEVER ADJUSTMENT

The syncro-mesh transmission requires two shift linkage adjustments to properly position the hand control lever with respect to the steering wheel.

To adjust the shift rods, proceed as follows:

1. Set the transmission outer shift lever "A", Fig. 11-1, in neutral position.
2. Adjust clevis at "B", to obtain a dimension of 2-11/16" (horizontal) from the steering wheel center line to the center line of the shift lever knob, Fig. 11-2.
3. With transmission outer selector lever "C", Fig. 11-1, against rear stop, and hand control lever knob resting in neutral position, adjust clevis "D" so that clevis pin will easily enter hole in lever "E" while holding lever forward to take up lash.
4. Remove clevis pin connecting clevis "D" to lever "E", lengthen clevis by 3 full turns, and replace pin. This gives the proper vertical adjustment between the steering wheel and the hand control lever knob.

THROTTLE CONTROL ADJUSTMENT—MODELS WITH 2 BARREL OR 4 BARREL CARBURETORS

1. Adjust engine idle to 425 R.P.M.

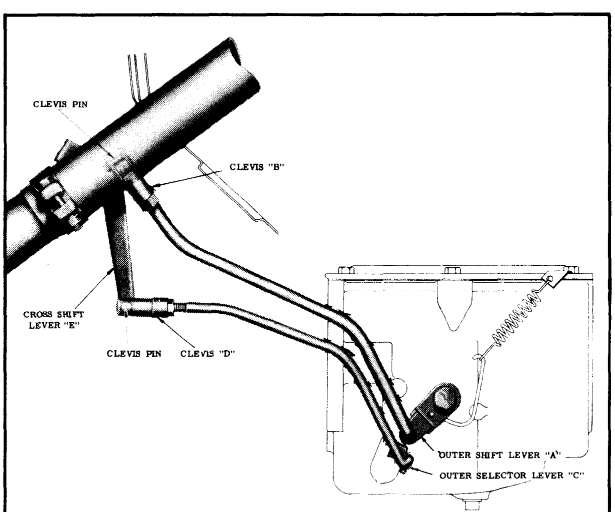


Fig. 11-1 Shift Lever Adjustment

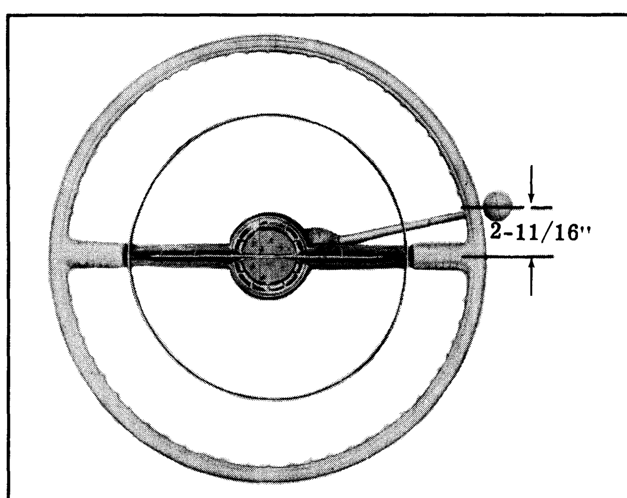


Fig. 11-2 Position of Shift Lever in Neutral

2. Adjust rod "A" to give 11/32" to 13/32" clearance between dash depression and bellcrank assembly "B".
   NOTE: On 2 bbl. models, rod end faces in.
   On 4 bbl. models, rod end faces out.
3. Adjust rod assembly "D" to give 3-7/8" clearance between the accelerator pedal and the floor mat. Assemble return spring and tighten jam nuts.
   NOTE: Open end on rod assembly "D" faces out on all models.

TRANSMISSION REMOVAL AND REPLACEMENT

1. Drain transmission and disconnect manual control rods and speedometer cable at transmission.
2. Remove propeller shaft.
3. Remove the bolts holding the transmission to the clutch housing, and remove the transmission by moving rearward until main drive gear clears clutch assembly.

To replace, first apply "Lubriplate" on end of main shaft and spline, (do not apply "Lubriplate" on splines 1" rearward of splined end); then reverse sequence of operations, and adjust transmission shift linkage.

DISASSEMBLY OF TRANSMISSION

1. Thoroughly clean all dirt from exterior of transmission to avoid getting dirt into bearings when transmission is opened.

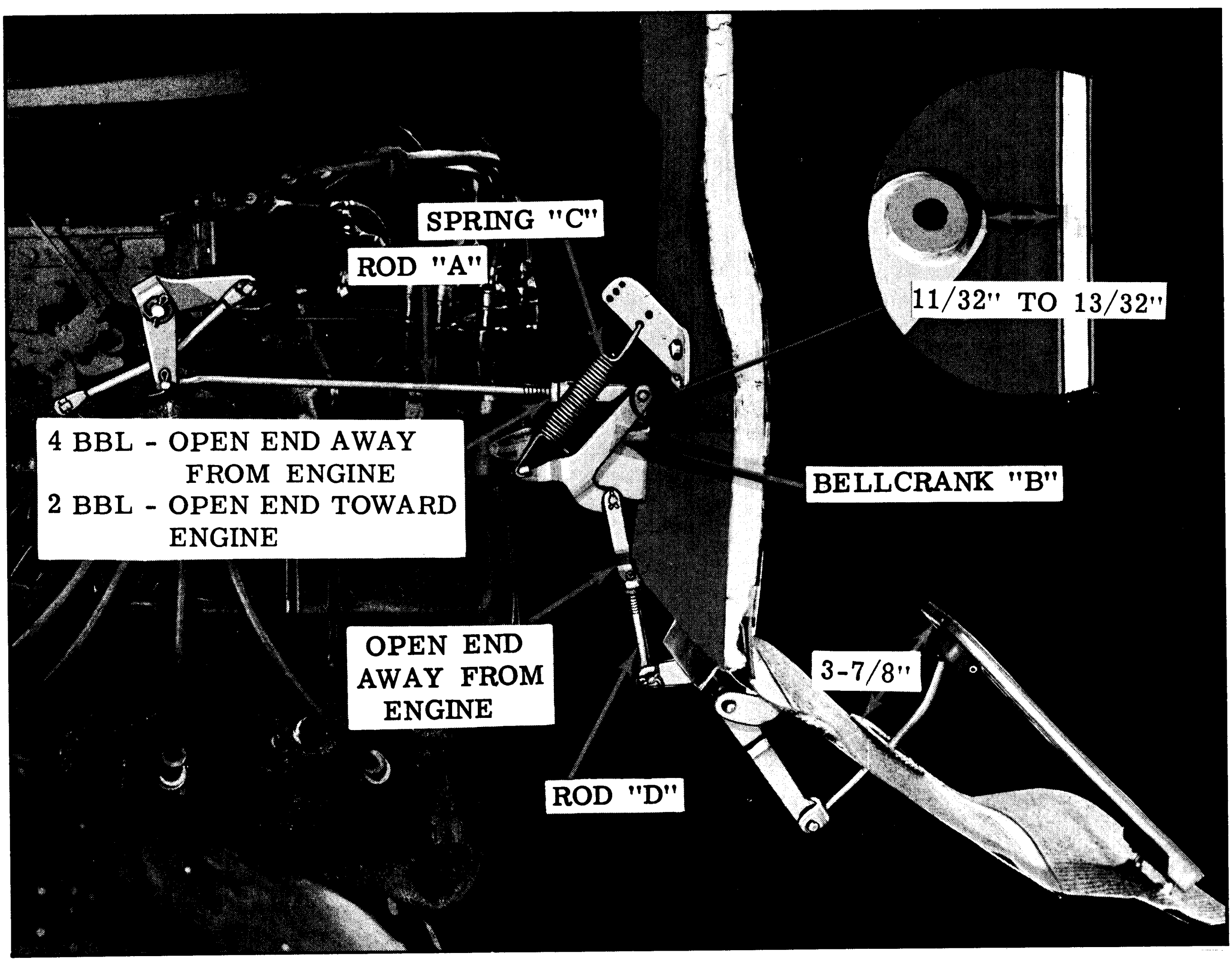


Fig. 11-3 Throttle Control Adjustments

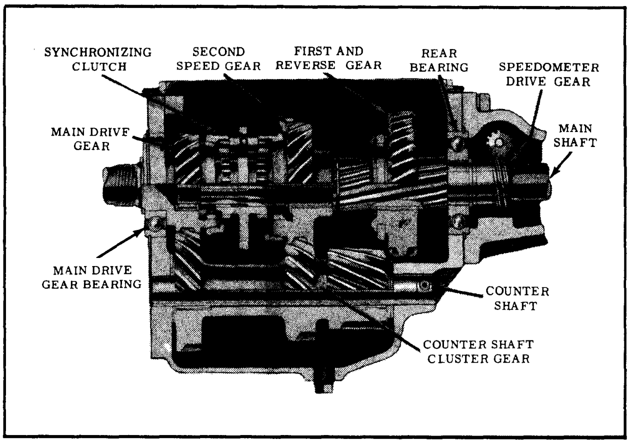


Fig. 11-4 Transmission Assembly

2. Remove transmission cover and gasket, toggle spring, spring clip and spring extension. (See Fig. 11-5 and 11-7)
3. Remove speedometer driven gear, then remove rear bearing retainer and gasket from transmission case.
4. Place transmission in second gear, move main shaft back until rear bearing is clear of case, and disengage shifter yoke from synchronizer. Then lift front end of main shaft enough to remove synchronizer from shaft. (See Fig. 11-6)

   Note that the counterbored end of synchronizer must face the second speed gear when replaced.
5. Remove snap ring holding second speed gear to main shaft. Remove thrust washer, after lining up small wire spacer ring installed in bottom of snap ring groove with thrust washer key, then remove second speed gear from main shaft. (See Figs. 11-8 and 11-9)
6. Remove snap ring holding low and

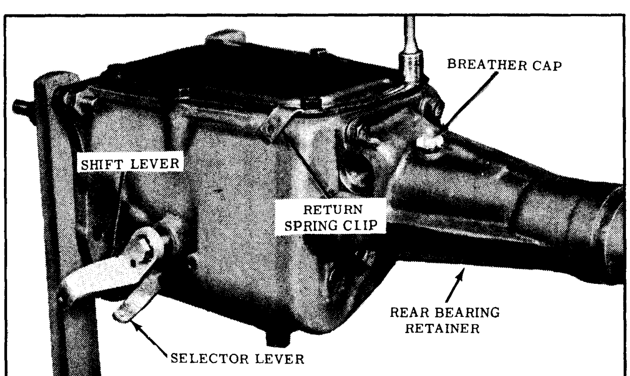


Fig. 11-5 Disassembly of Transmission

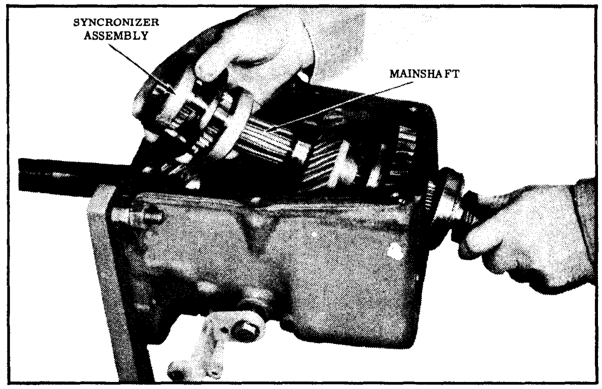


Fig. 11-6 Removing Synchronizing Drum

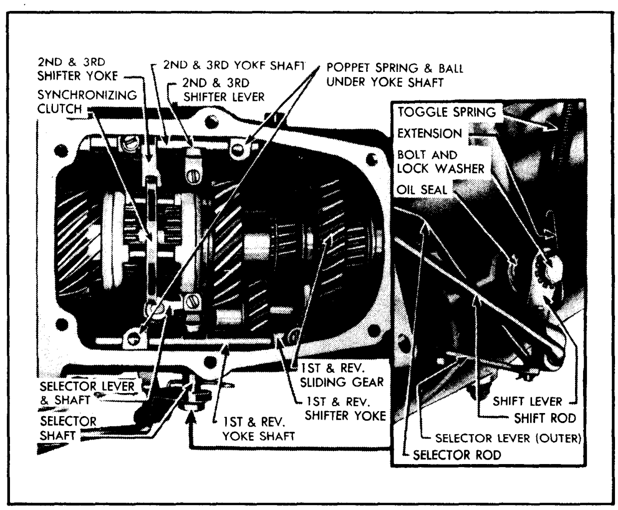


Fig. 11-7 Shift Mechanism

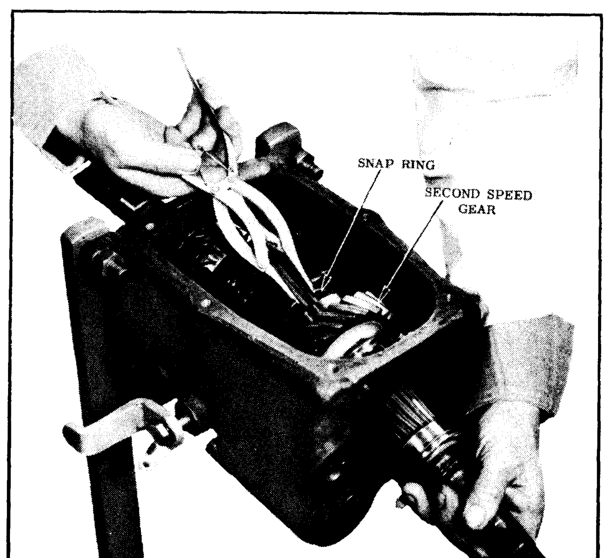


Fig. 11-8 Removing Second Speed Gear

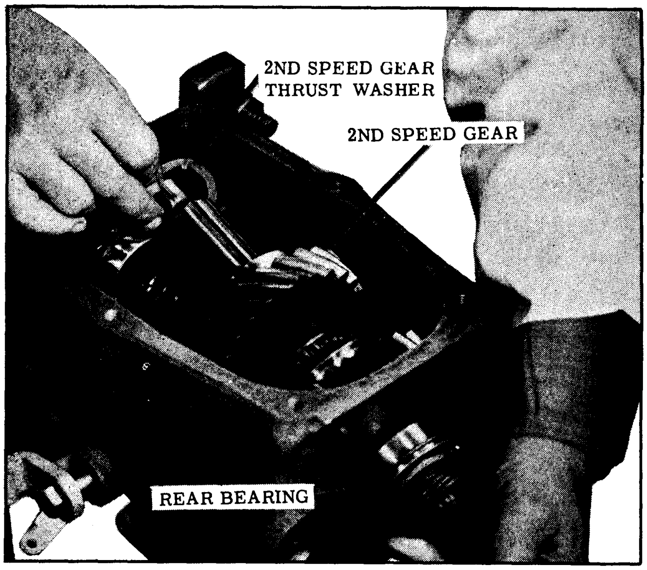


Fig. 11-9 Removing Second Speed Gear Thrust Washer

reverse gear to main shaft. (See Fig. 11-10)

7. Slide low and reverse gear off main shaft while pulling shaft out through rear of transmission case. (See Fig. 11-11)
8. Place transmission levers in neutral and remove set screws holding shifter yokes and shifter levers to their respective shafts. (See Fig. 11-12)

   NOTE: Each yoke shaft is in neutral position when the notch for the shifter lever is directly above the selector shaft.
9. Slide shifter lever and interlock away

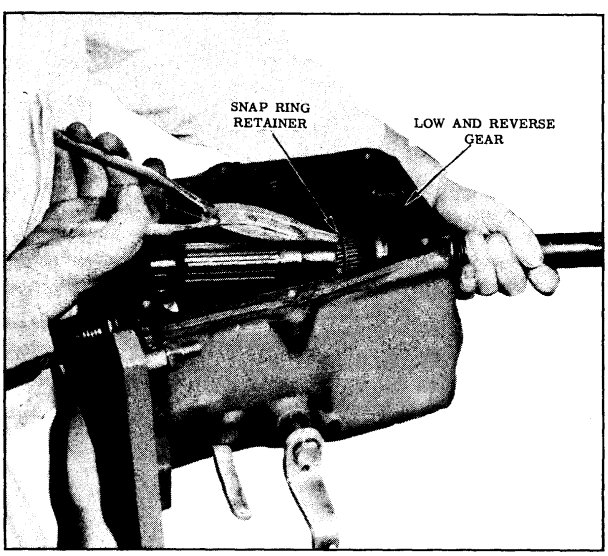


Fig. 11-10 Low and Reverse Gear Retainer

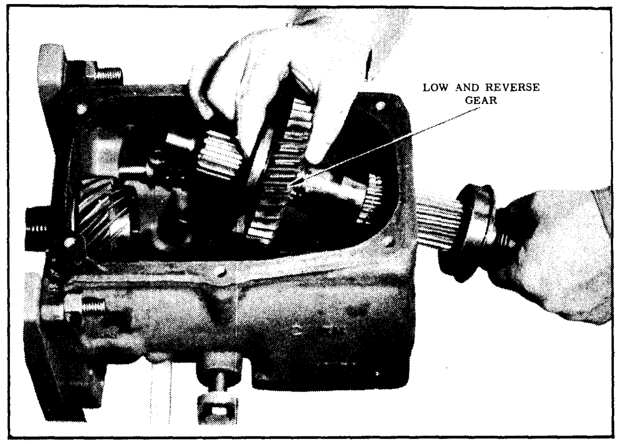


Fig. 11-11 Removing Horn and Reverse Gear

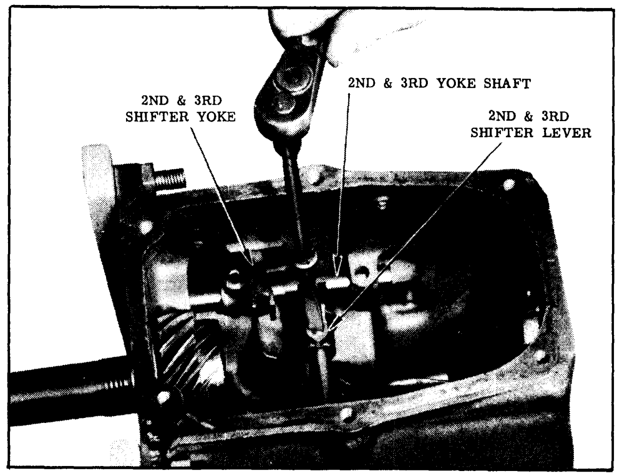


Fig. 11-12 Removing Shift Lever Set Screw

from second and third speed yoke shaft, then remove interlock retainer from groove in right end of selector shaft. (See Fig. 11-13)

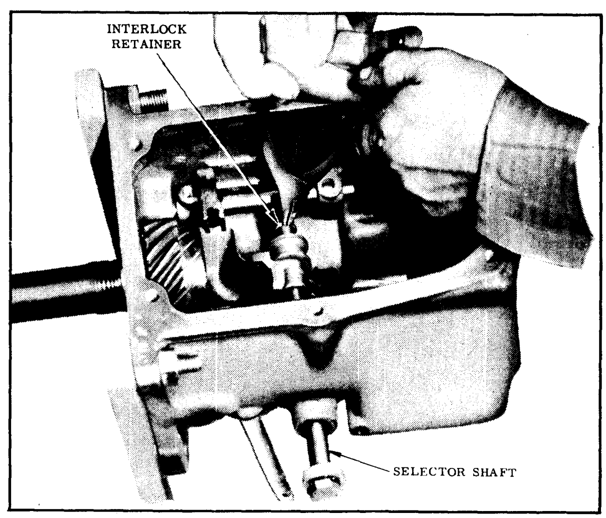


Fig. 11-13 Removing Interlock Retainer From Selector Shaft

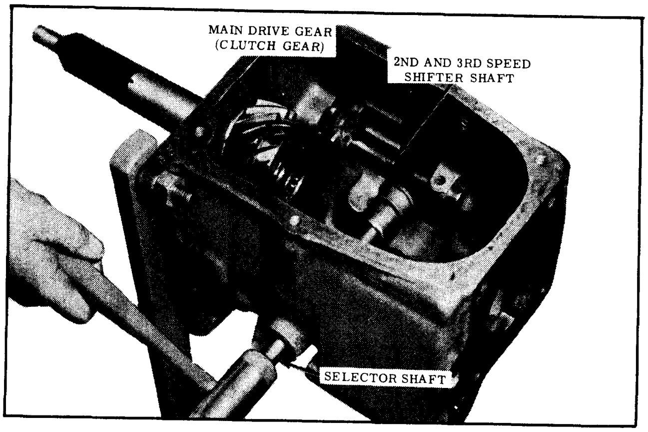


Fig. 1 -14 Driving Selector Shaft From Case

10. Remove outer shift lever and lock-washer from left end of selector shaft and, after making sure transmission is still in neutral, depress inner selector lever and drive the shaft out through right side of transmission case using a soft hammer. (See Fig. 11-14) The welch plug in right side of case will be driven out by shaft. Do not allow shifter levers and interlock to drop into case.

    CAUTION: When replacing selector shaft, be sure to install from left side of case toward right, in order to avoid damaging the oil seal.
11. Push second and third speed yoke shaft out through front of transmission case, taking care to prevent poppet ball and spring from flying out. Remove shifter yoke, ball, and spring.
12. Taking care to prevent poppet ball and spring from flying out, push low and reverse yoke shaft out through rear of transmission case. (See Fig. 11-15) Remove poppet ball, spring, and low and reverse interlock pin.

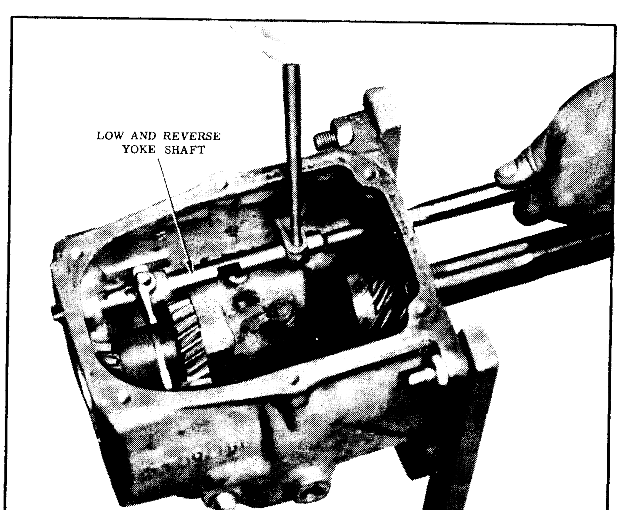


Fig. 11-15 Removing Yoke Shaft From Case

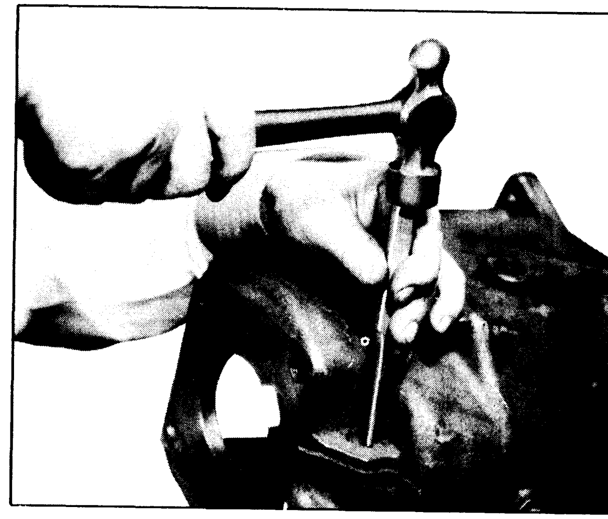


Fig. 11-16 Driving Lock Pin Into Shaft

13. Drive counter gear shaft lock pin into the shaft, then drive shaft out through rear end of transmission case using Bearing Loader Tool J-1001 and soft hammer. (See Figs. 11-16 and 11-17) Make sure that bearing loader follows the shaft closely so that counter gear bearings and thrust washers will be held in place. Allow counter gear to rest on bottom of case.

When assembling transmission use a new lock pin coated with sealing compound to prevent leaks. Drive pin flush with surface of transmission case.

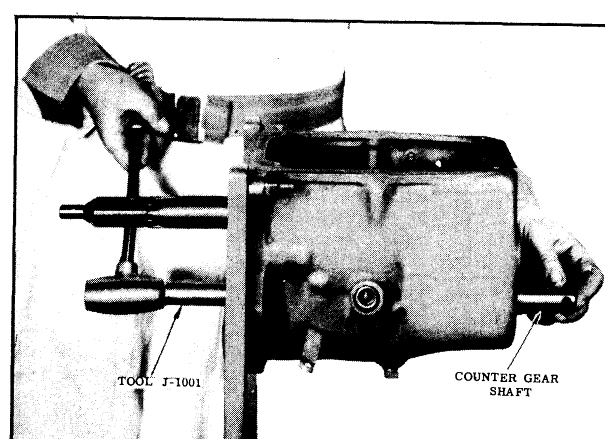


Fig. 11-17 Removing Counter Gear From Case

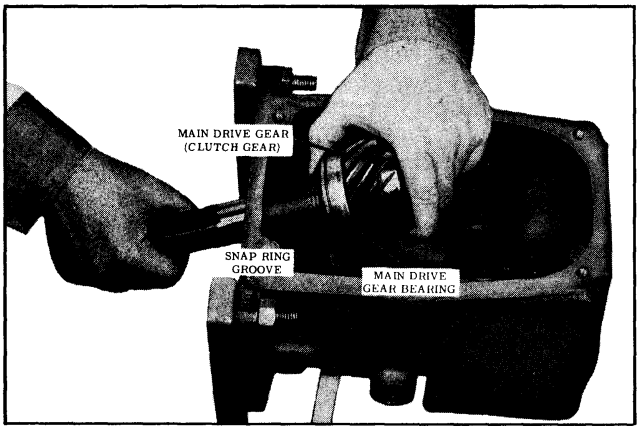


Fig. 11-18 Removing Main Shaft Drive Gear

14. Remove the snap ring from main drive gear bearing and tap drive gear and bearing assembly toward rear of transmission to remove. (See Fig. 11-18)
15. Carefully raise counter gear out of case so that bearing loader, bearings, and bearing retainer washers do not fall out. Remove all thrust washers. Note that a bronze and a steel washer are used at the rear (with bronze washer next to the gear), and a larger bronze washer, only, is used at the front. (See Fig. 11-19)
16. Remove transmission outer selector lever, lockwasher and nut; then remove inner lever and shaft, spring washer, flat washer, and oil seal from transmission case. Apply Lubriplate to shaft before installation.

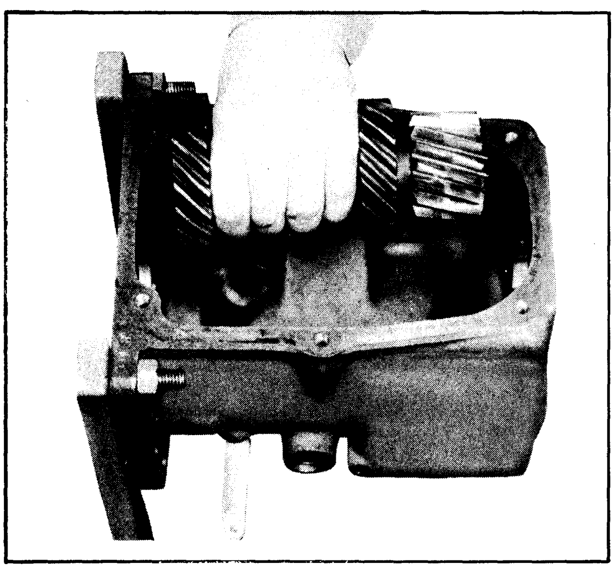


Fig. 11-19 Removing Counter Gear

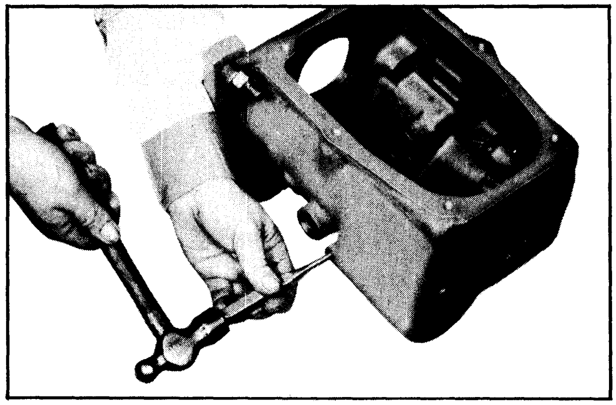


Fig. 11-20 Driving Lock Pin Into Idler Shaft

17. Drive reverse idler gear shaft lock pin into the shaft, then remove shaft, idler gear, and thrust washers. (See Figs. 11-20 and 11-21)

   Note that chamfered set of teeth on reverse idler gear should be at the rear when replaced.

   When assembling transmission, use a new lock pin coated with sealing compound to prevent leaks. Drive lock 1" below surface of boss on case.

SERVICING INDIVIDUAL UNITS

Servicing Countershaft Assembly (Fig. 11-22)

1. If for any reason it should become necessary to replace the countershaft and needle bearings, always place the countershaft Tool J-1001 into cluster gear to hold needle bearings in place.

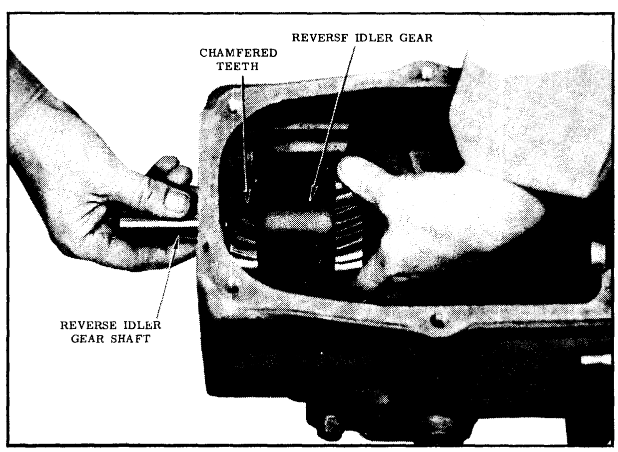


Fig. 11-21 Removing Reverse Idler Gear Shaft

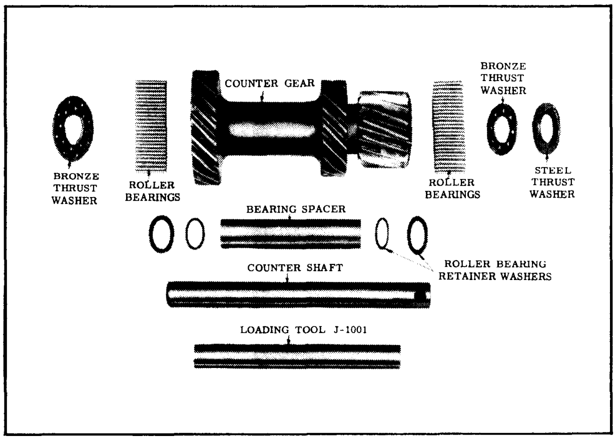


Fig. 11-22 Counter Gear Assembly

2. Assemble bearing spacer tube and bearing inner retainer washers over Tool J-1001.
3. Assemble a sufficient number of bearings under end of tool so it is evenly spaced in bore of gear.
4. Finish assembling a total of 26 bearings at each end of gear.
5. Leave Tool J-1001 in place until gear is assembled into transmission case.

Servicing Main Drive Gear (Fig. 11-23)

1. Remove snap ring and washer holding main drive gear bearing to gear.
2. Remove bearing by jarring shaft on block of wood.
3. Remove wire lock ring, washer and 14 roller bearings from counterbore in gear.

To replace, reverse sequence of removal operations.

CAUTION: Press on inner race of bearing when installing.

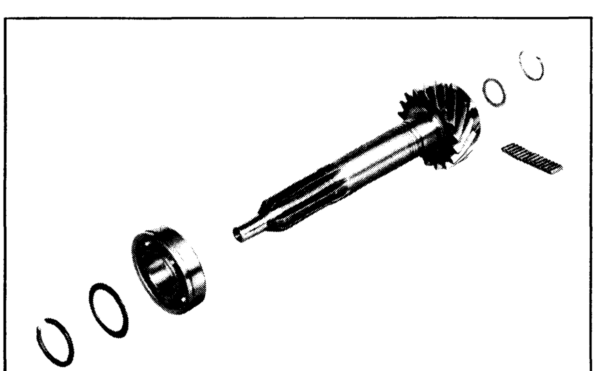


Fig. 11-23 Main Drive Gear Assembly

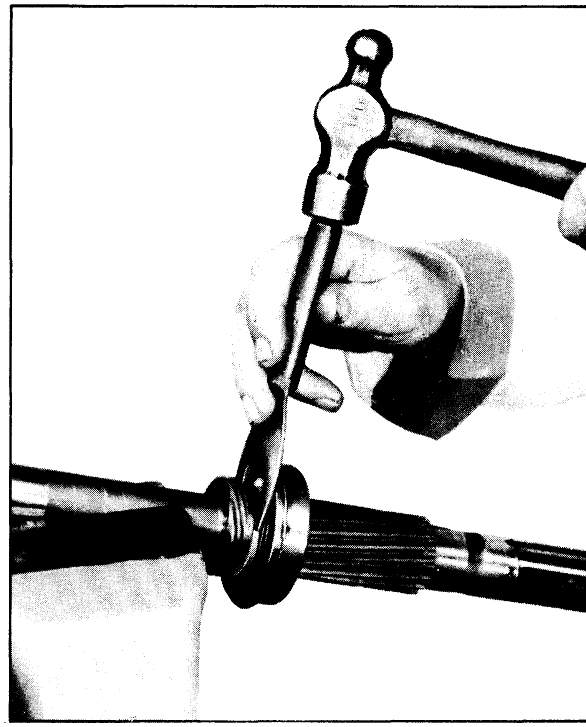


Fig. 11-24 Removing Rear Bearing Retainer Ring

Servicing Main Shaft

1. Remove rear bearing snap ring as shown in Fig. 11-24.

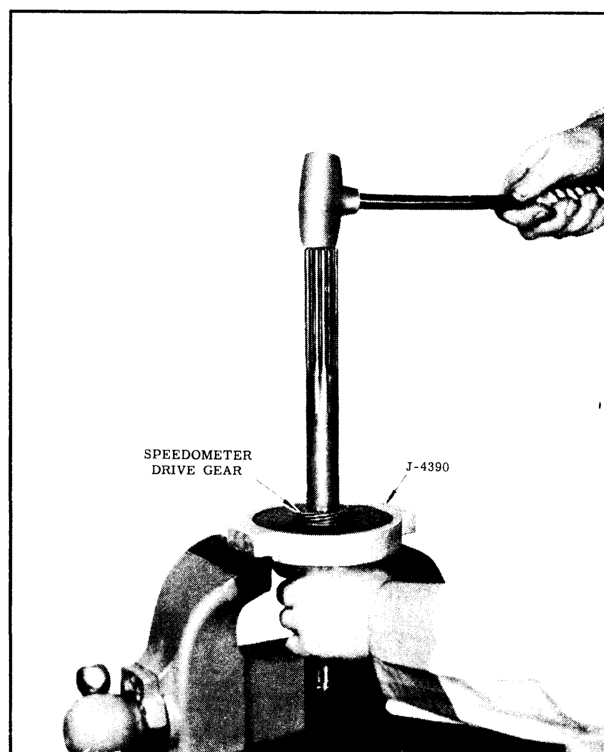


Fig. 11-25 Removing Speedometer Drive Gear Using Tool J-4390

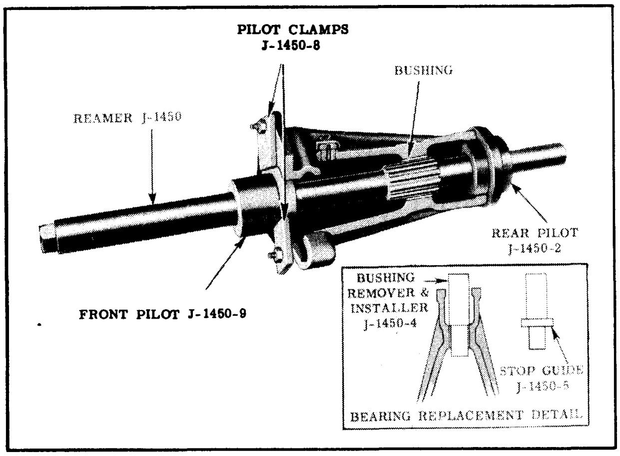


Fig. 11-26 Removing Retainer Bushing

2. Remove speedometer drive gear using Tool J-4390. (See Fig. 11-25) Then remove gear spacer.
   NOTE: If Tool J-4390 should be too thick to easily slide between speedometer gear and bearing, the flange at the inside diameter of each plate should be ground down sufficiently to allow the tool to be freely inserted in place.
3. Remove bearing by jarring end of shaft on block of wood.

To Assemble

1. Press on inner race to install bearing against shoulder on main shaft.
2. Install snap ring and speedometer gear spacer on shaft.
3. Press or tap speedometer drive gear on shaft against spacer, using Tool J-4390.

Servicing Rear Bearing Retainer Bushing

The transmission rear bearing retainer bronze bushing is serviced separately from the housing. If replacement is necessary, the bushing can be removed and a new bushing installed as follows:

1. Remove old bushing from housing with Tool J-1450-4. (See Fig. 11-26)
2. Install a new bushing in place using tool J-1450-4 and Stop Guide Tool J-1450-5.

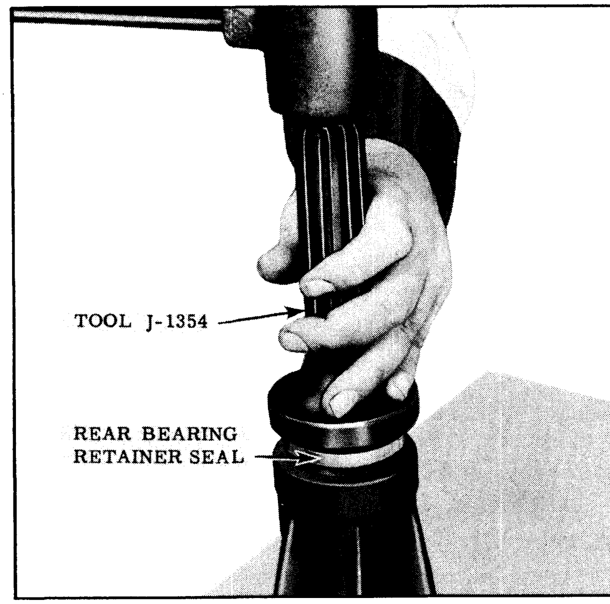


Fig. 11-27 Replacing Retainer Seal

3. Assemble reamer pilot into rear end of retainer housing.
   NOTE: Pilot has two diameters; select pilot diameter which fits tightly into housing.
4. Place reamer J-1450 into housing and assemble Front Pilot J-1450-9 over shaft down into counterbore of housing. Tighten pilot in place with Clamps J-1450-8. (See Fig. 11-26)
5. Ream inside diameter of bushing.

Servicing Rear Bearing Retainer Seal and Shield

1. Remove seal from rear bearing retainer.
2. Line up new seal over bore in housing and tap lightly on outer edge to start seal in place.
3. Finish driving seal into retainer housing, using Tool J-1354. (See Fig. 11-27)

Servicing Synchronizing Clutch (Fig. 11-28)

The synchronizing springs are serviced separately and replacement, if necessary, can be accomplished by prying each spring loose from gear and pushing out of groove. After the old springs have been removed, the new ones should be placed over the clutch and the synchronizing coupling pulled up into place over springs.

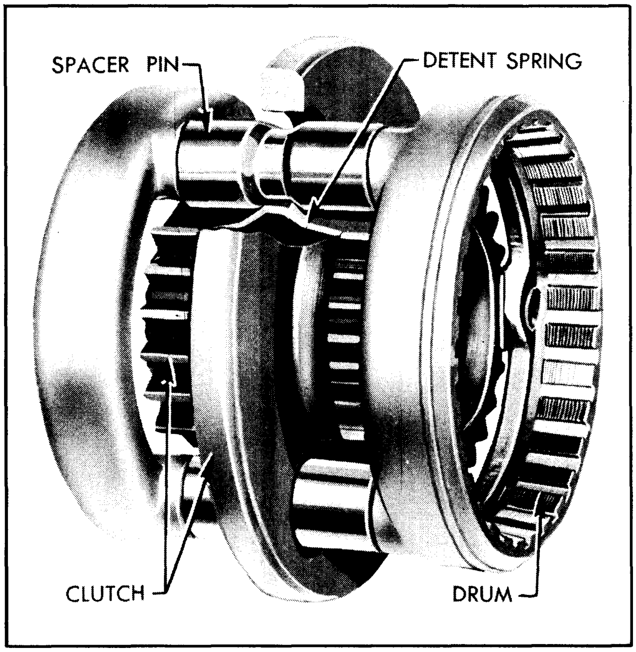


Fig. 11-28 Gear Synchronizing Clutch

ASSEMBLY OF TRANSMISSION

Using new snap rings, interlock retainer, welch plug, shaft lock pins, oil seals and gaskets, assemble transmission as follows:

1. Position reverse idler gear and bronze thrust washers into transmission case with chamfered teeth to rear of case. Then install idler gear shaft until the front of the shaft picks up the front thrust washer and just starts into the inner support. Coat the protruding end of the shaft with Permatex #2 or other non-hardening sealer and complete installation of shaft making sure that lock pin hole in shaft lines up with hole in case.
2. Install a new lock pin coated with sealing compound to prevent leaks. Drive lock 1" below surface of boss on case.
3. Place spring washer, flat washer, and oil seal on selector lever shaft in order named, with crowned side of spring washer against flat washer. Apply lubricant to shaft and assemble into transmission case. Then install outer selector lever.
4. Lay counter gear with bearings, Bearing Loader J-1001, retainer washers, and thrust washers into bottom of transmission case. Note that a small diameter bronze washer and a steel washer are used at the rear of the gear: the locating pin in the steel washer must be engaged in oil groove in case. A larger bronze washer, only, is used at the front.

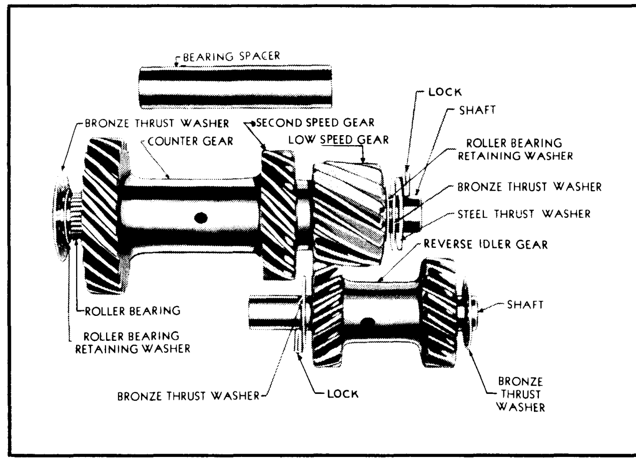


Fig. 11-29 Counter Gear and Reverse Idler Gear

5. Install main drive gear into front wall of transmission case and replace snap ring.
6. Mesh the teeth of the counter gear with teeth on main drive gear and reverse idler gear. With smaller end first, drive counter gear shaft into place from rear of transmission, being careful that it closely follows Bearing Loader J-1001 so that bearings and washers are held in proper position. When front end of shaft just enters bore in front wall of transmission apply Permatex #2 or other non-hardening sealer to protruding end of shaft and to bore in front wall, then complete installation of shaft making sure that lock pin holes in shaft and case are in line.
7. Install a new counter gear shaft lock pin coated with sealing compound to prevent leaks. Drive pin flush with surface of transmission case.
8. Replace poppet ball and spring, interlock pin, and low and reverse yoke shaft with yoke.
9. Replace poppet ball and spring, yoke, and second and high yoke shaft.
10. Place both yoke shafts in neutral position.

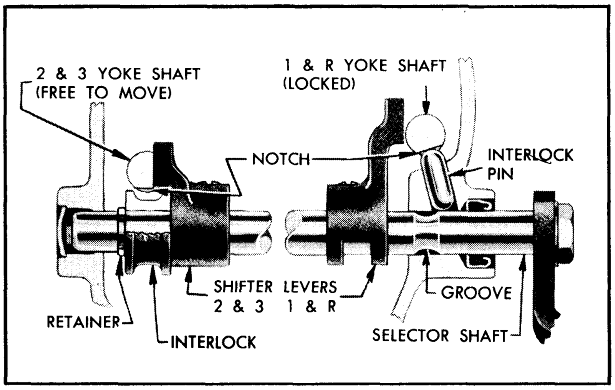


Fig. 11-30 Transmission Interlock

NOTE: Each yoke shaft is in neutral position when the notch for the shifter lever is directly above the selector shaft bore in transmission case.

11. Install a new welch plug, coated with sealing compound, in right side of transmission case.
12. Raise low and reverse interlock pin into groove in yoke shaft, then from left side of transmission case install selector shaft. Place low and reverse shifter lever on shaft, making sure selector lever engages notch in bottom of shifter lever. Install second and high shifter lever and interlock on shaft.
13. Install a new second and high interlock retainer on selector shaft.
14. Replace set screws securing shifter levers and yokes to their respective shafts.
15. Replace shift lever on left end of selector shaft.
16. Insert mainshaft through bore in rear of transmission case, slide low and reverse gear onto shaft, and replace lock washer holding gear to shaft. Engage low and reverse yoke with gear.
17. Install second speed gear onto shaft.
18. After lining up the small wire spacer ring in bottom of main shaft snap ring groove with the spline which is machined part way onto the ground second speed gear bearing surface, install second speed gear thrust washer and snap ring.

    Note that one spline is machined the entire length of the second speed gear bearing surface on the main shaft. This full spline is for lubrication purposes and should not be obstructed by the thrust washer key.
19. Install synchronizer with counterbored end next to second speed gear, engage second and high shifter yoke with synchronizer, and finish replacing main shaft by piloting front of shaft into bearing in main drive gear and rear bearing into transmission case. If removed, replace rear bearing snap ring.
20. Use new gasket and install rear bearing retainer to transmission case, sealing cap screws with sealing compound.
21. Replace speedometer driven gear.
22. Install new top cover gasket and replace cover and spring clip.
23. Replace toggle spring and spring extension between spring clip and outer shift levers.
24. Fill transmission to level of filler plug with SAE 80 Multi-Purpose Gear Lubricant (approximately 2-1/2 pts.).

CORRECTION FOR GREASE LEAKAGE INTO CLUTCH

If transmission grease is found to be leaking into the clutch housing the following correction procedure should be used. (If grease is present on clutch facing it may result in clutch "grabbing" and if such is the case, a new clutch disc must be installed).

1. With transmission removed from car, install the bearing retainer sleeve on the main drive gear shaft.
2. Attach a dial indicator to the transmission case as shown in Fig. 11-31.
3. Move the sleeve upward on the shaft as far as it will go in each of six positions (approximately 30° apart) throughout 180° of rotary travel as shown in Fig. 11-31.
4. Total indicator reading in any of the six points mentioned in Step 3 should not exceed .012 inch.
5. If excessive clearance is found, install a new bearing retainer sleeve, and seal the area between the sleeve and clutch housing as shown in Fig. 11-32.

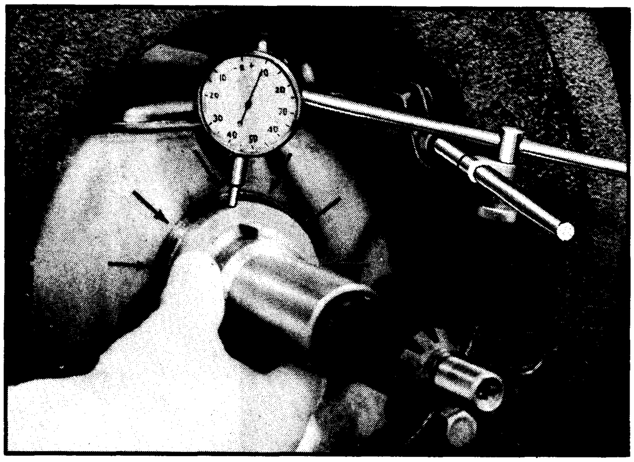


Fig. 11-31 Checking Sleeve Clearance

NOTE: Inspect new sleeve as outlined above to be sure it is within the clearance specifications listed.

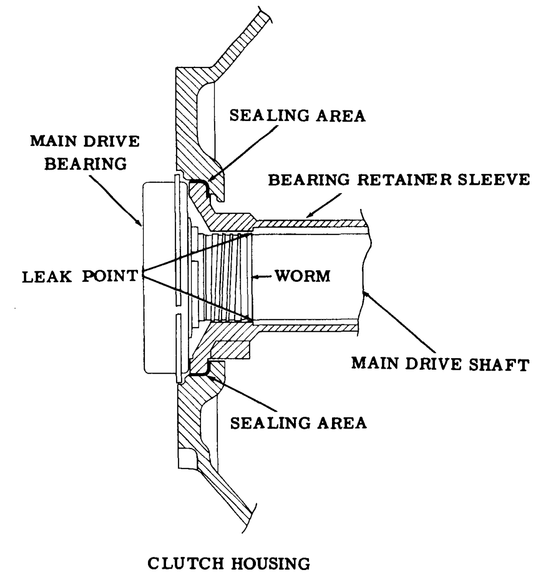


Fig. 11-32 Sleeve Installation

LEAKAGE AT FRONT OF TRANSMISSION

If grease leaks between the front face of the transmission and the clutch housing and it does not originate from the front of the countershaft, install two gaskets between transmission and clutch housing.

SYNCRO-MESH TRANSMISSION SPECIFICATIONS

TYPE . . . . Three speed with second and high gear synchronized

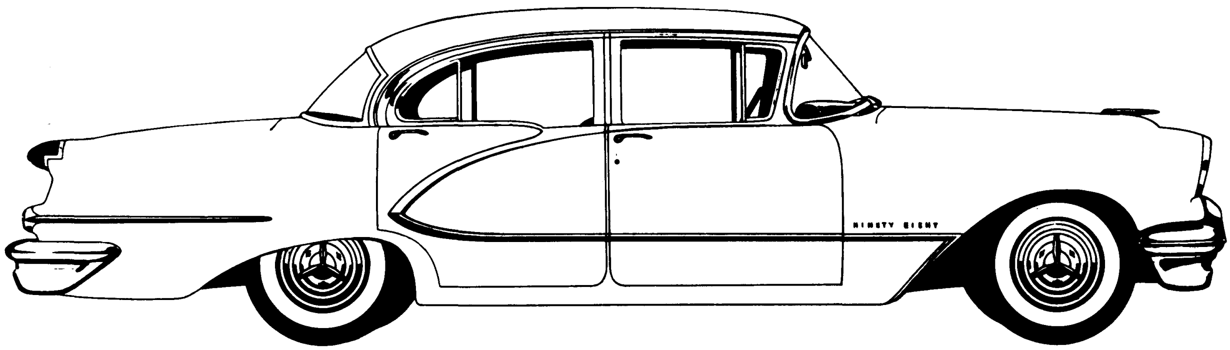
CAPACITY . . . . 2-1/2 Pts.

GEAR RATIOS

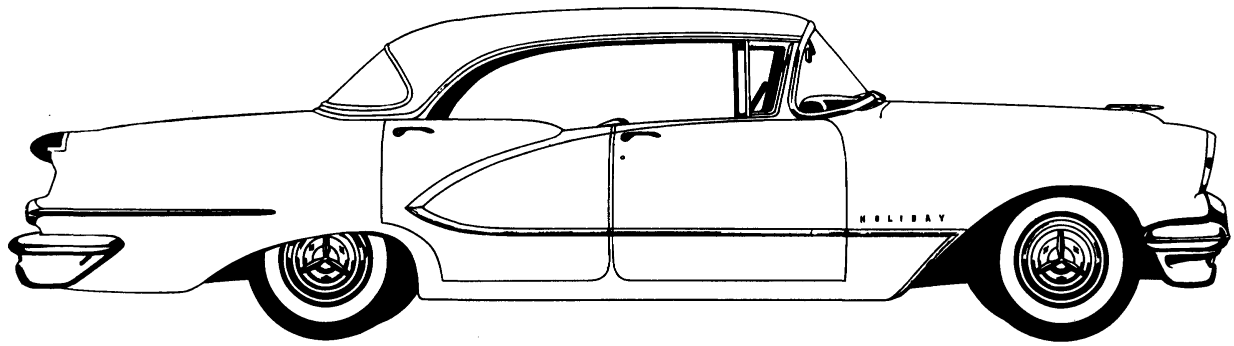
- 1st 2.39:1
- 2nd 1.53:1
- 3rd . . . . Direct
- Rev 2.53:1

TORQUE APPLICATION

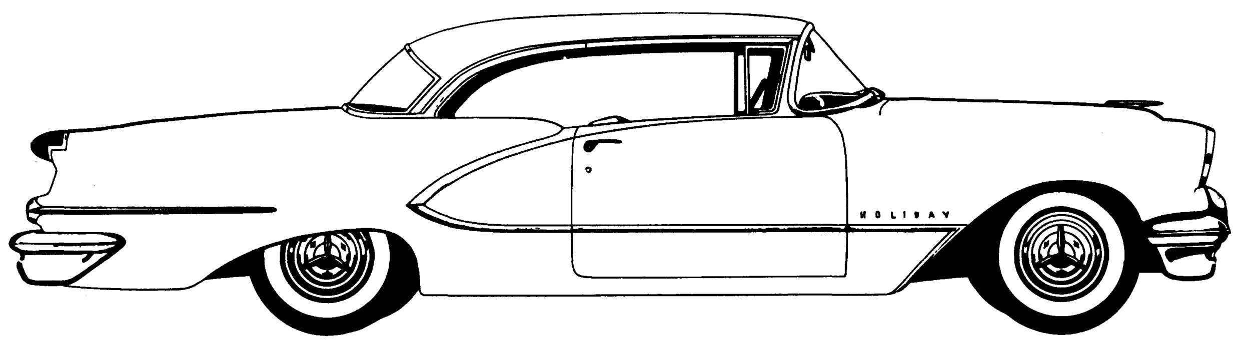
- Transmission to clutch housing bolts . . . . 60-70 Ft. Lbs.
- Cover bolts . . . . 10-12 Ft. Lbs.
- Rear bearing retainer bolts . . . . 28-33 Ft. Lbs.
- Speedometer driven gear . . . . 6-8 Ft. Lbs.



98 4-DOOR SEDAN (DS)



98 DELUXE HOLIDAY SEDAN (DHS)



98 DELUXE HOLIDAY COUPE (DHC)

FRAME AND BUMPERS

CONTENTS OF SECTION 12

BODY MOUNT LOCATIONS

Fig. 12-1 shows the numbering system used for body mount positions on "88" and "98" series. Various body styles require different body support locations. No one body style uses all the body mount locations shown.

FRAMES

The frames for all 1956 models are of the same general construction as those used in 1955 with revised front extension side rails and "K" section in frame horns.

When supporting car on a jack or floor stands, the car should be supported at the suspension points only. Under no condition should the car be supported at the center of "X" member or at extreme ends of frame.

CHECKING FRAME ALIGNMENT

The diagram shown in Fig. 12-2 can be used to check the alignment of a car frame that has been distorted.

The reference points indicated in the figure are transferred to a level floor by means of a plumb bob. The dimensions

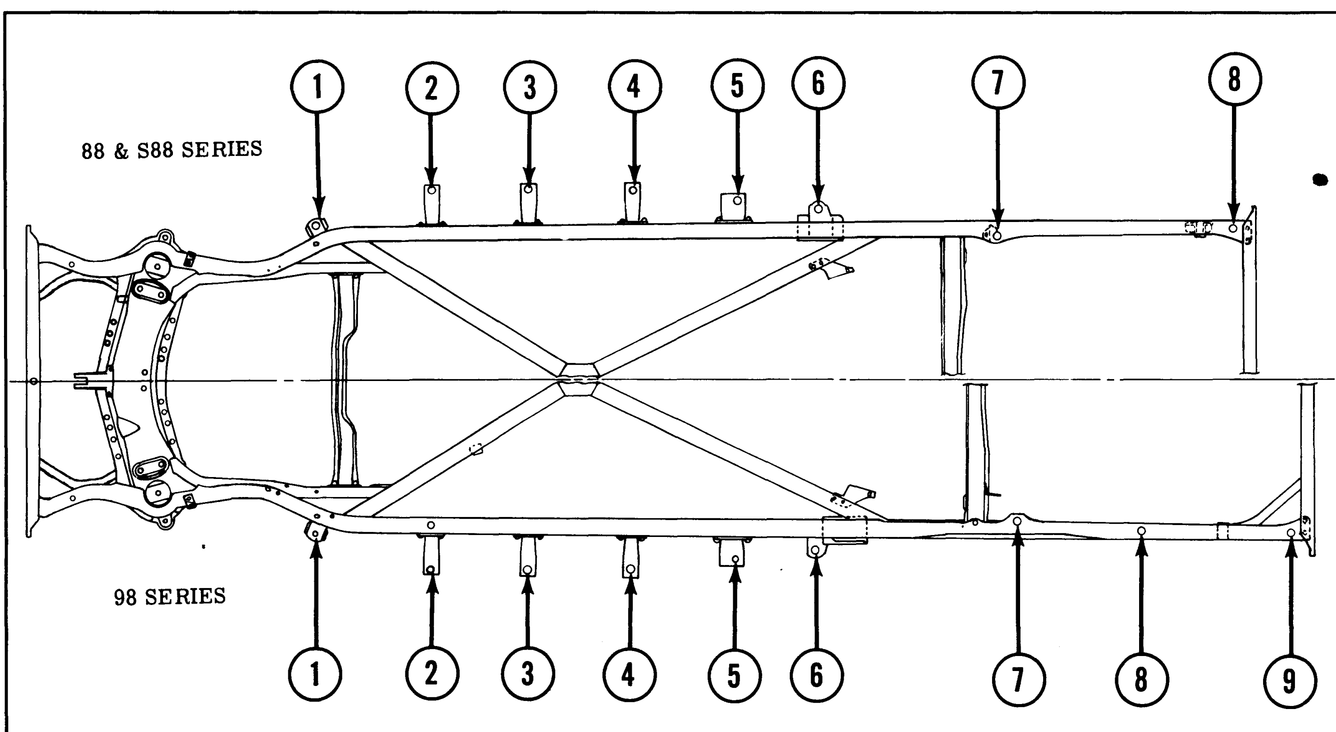


Fig. 12-1 Frame

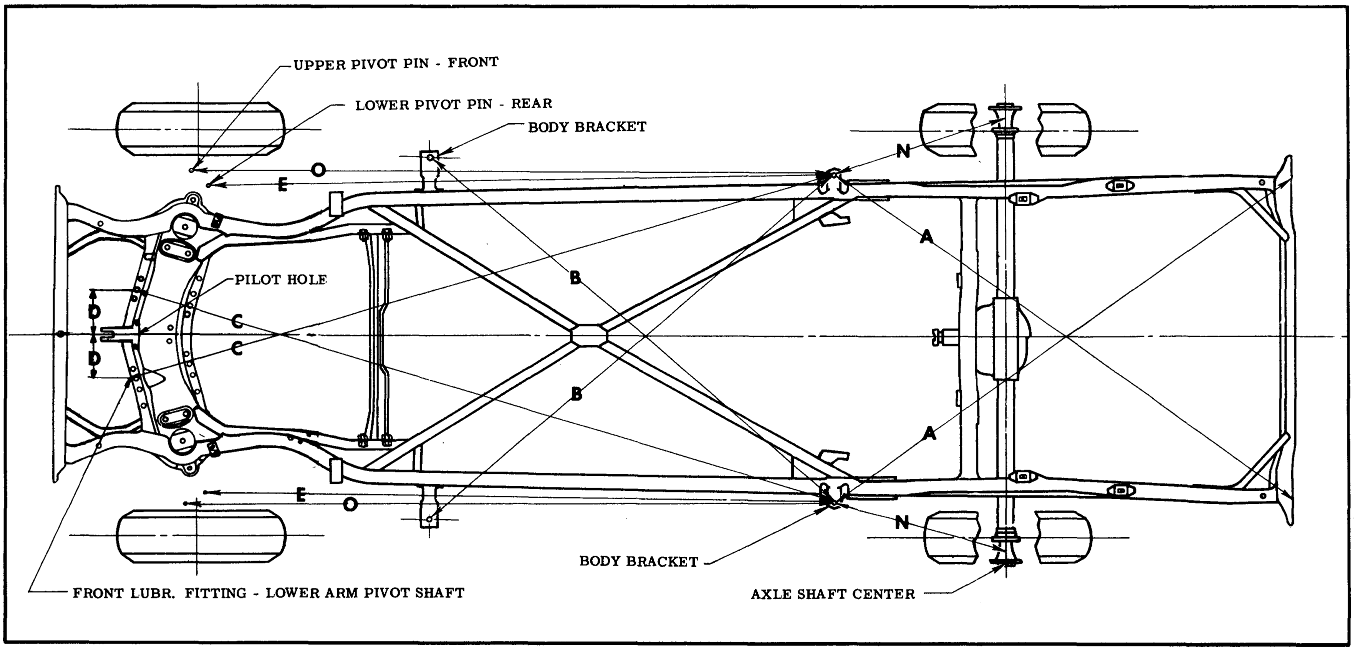


Fig. 12-2 Frame Alignment Diagram

between the various reference points shown in the figure compared with similar points on the frame to be checked, will show where straightening operations are necessary.

To check for frame misalignment at any point in the frame, proceed as follows:

1. Place car on clean, level floor and set brakes.
2. Drop plumb bob and mark floor from corresponding points, as indicated, on each side of the frame.
3. Move car and make all measurements between the marks placed on the floor.

   NOTE: Corresponding measurements must be equal within 1/4".
4. Measure A-A. If not equal, rear end of frame is misaligned. If A-A are equal, mark point on floor where lines cross.
5. Measure B-B. If not equal, center portion of frame is misaligned. If B-B are equal, mark point on floor where lines cross.
6. If A-A are equal and B-B are equal, draw center line through the points where A-A and B-B cross.

   If the center line passes over the pilot hole mark, then frame alignment is correct. If the center line does not pass through the pilot hole mark, then the forward part of frame is misaligned.

   In the event that collision had occurred from the rear end of the automobile, center line could be produced by starting from the pilot hole mark on the floor and producing line through the point where B-B crosses.

   If collision had occurred in the middle portion of the frame, then center line could be produced by means of the pilot hole mark and the intersection of A-A.

THE FOLLOWING CHECK CANNOT BE MADE UNTIL IT IS DEFINITELY DETERMINED THAT THE FRAME IS PROPERLY ALIGNED.

7. C-C not equal, then front suspension cross member has shifted.
8. If C-C are equal, then position of front suspension cross member MAY be correct. Measure D-D; if not equal, front suspension cross member has shifted.
9. E-E not equal, then lower control arm is bent.
10. O-O not equal, then upper control arm is bent.
11. N-N not equal, then the rear axle housing is bent or has shifted.

STRAIGHTENING FRAME

In case of collision, frame members can often be satisfactorily straightened to the required limits. Since the front suspension cross member is made to unusually close limits necessary for proper front wheel alignment, straightening of this unit may not be successful.

It is possible that the ordinary straightening methods will suffice for minor damage; however, in case of serious damage or fracture, the entire front suspension cross member must be replaced. Before the member is replaced, it is essential that the frame alignment be checked, and corrected if necessary.

Whenever possible, the parts should be securely fastened with hot rivets. In case riveting equipment is not available, finished bolts snugly fitted in reamed holes may be used. The nuts should be securely tightened and lock washers used, care being taken that washers do not spread. (Cold driven rivets are not recommended unless the heavy power press equipment necessary to make secure fastening is available.)

When the frame repair is completed and inspected, the various parts of the front suspension may be assembled.

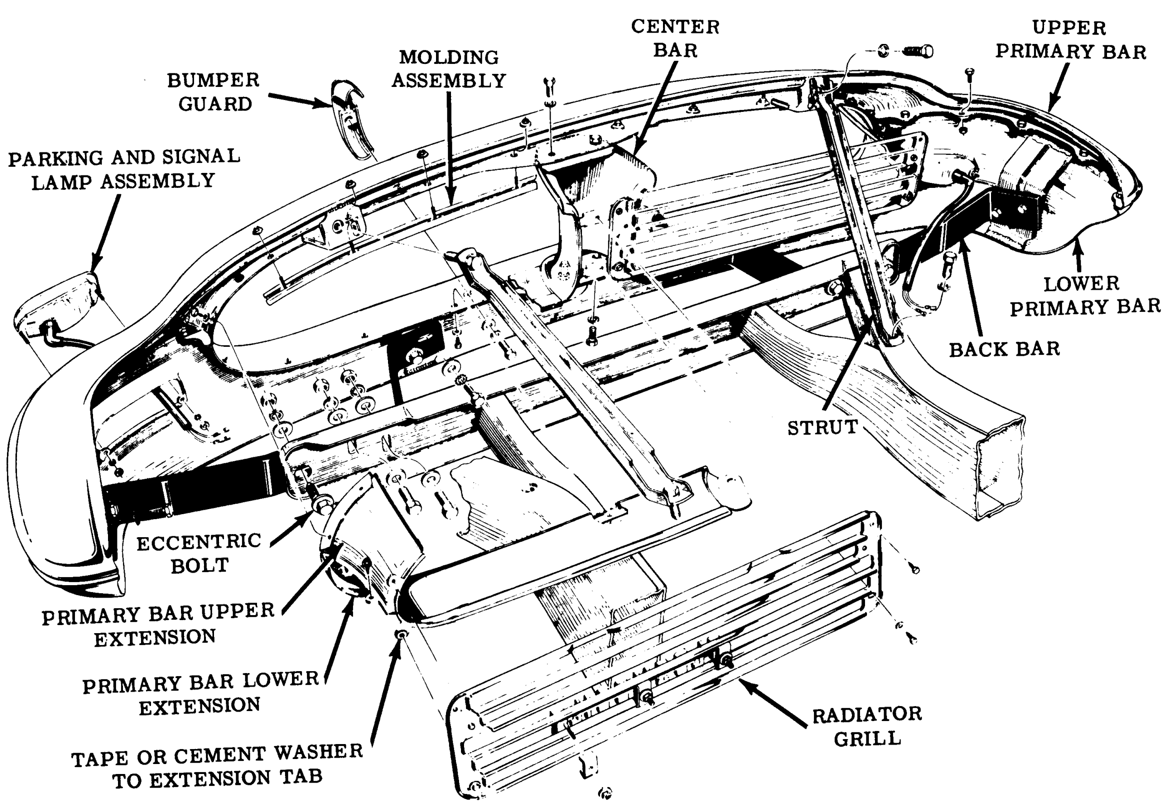


Fig. 12-3 Front Bumper Assembly

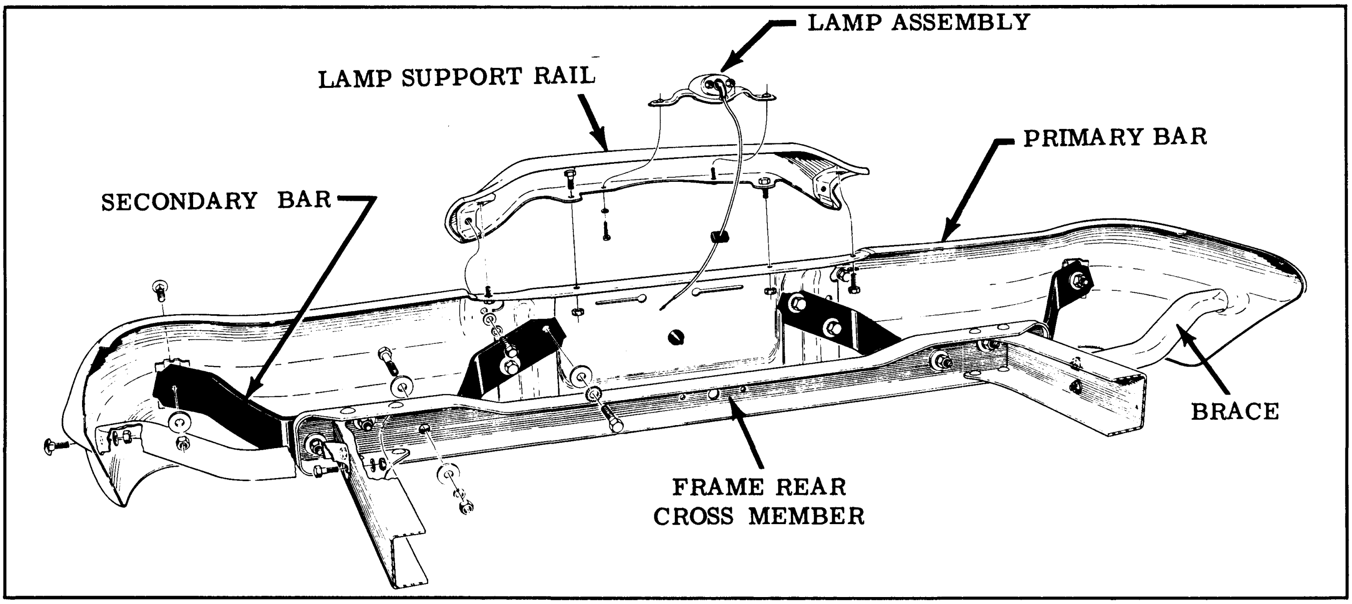


Fig. 12-4 Rear Bumper Assembly

TORQUE SPECIFICATIONS

	Application	Ft. Lbs.
1.	Front Bumper Strut to Upper Bar Bolt	30-40
2.	Front Bumper Strut to Frame Bolt	30-40
3.	Front Bumper Upper Primary Bar to Lower Primary Bar Bolts	20-30
4.	Rear Bumper Primary Bar to Upper Bar Reinforcement Bolt	20-30
5.	Secondary Bumper Bar to Frame Bolts & Nuts - Front & Rear	50-60
6.	Secondary to Primary Bar Reinforcement - Front Bumper Bolt	50-60
7.	Secondary to Primary Bar Reinforcement - Rear Bumper Bolt	40-45
8.	Body Bolts (Rubber Shims)	15-20
9.	Body Bolts (Steel Shims)	25-30

ELECTRICAL

CONTENTS OF SECTION 13

WIRING SYSTEM (FIG. 13-4)

A combination junction block and fuse panel is mounted on the dash under the instrument panel. (See Fig. 13-1) A color code system is used on the fuse panel corresponding to the color code of the circuit wiring protected by each fuse. As

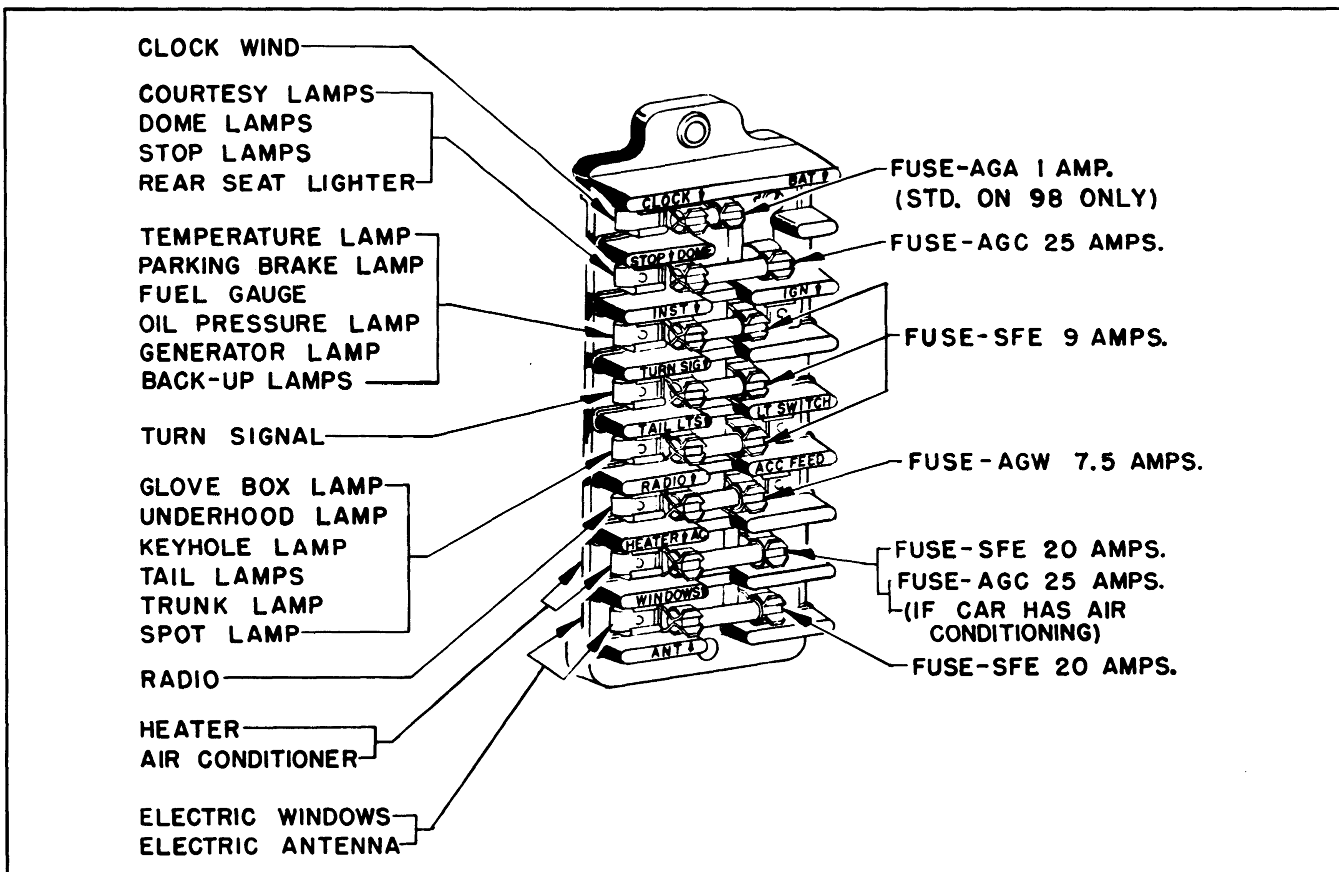


Fig. 13-1 Fuse Panel

a further aid to service, color dots have been provided on the instrument cluster, light switch, ignition switch, and ignition resistor, to indicate the correct wire colors which should be connected to these units.

Both the fuse panel and the light switch have push-on type terminals. The instrument panel light circuit fuse is located on the light switch to protect the dimmer resistor element. The cigar lighter fuse is on the back of the lighter body. All other fuses are on the fuse panel.

Body wiring is connected to chassis wiring through a multiple contact plug located under the left side of the instrument panel. The plug halves are keyed to prevent improper assembly.

CHARGING CIRCUIT

The charging circuit includes the battery, generator, regulator, and generator warning light. The simplified wiring diagram shown in Fig. 13-2 illustrates this circuit.

BATTERY

The Delco Battery used in all 1956 models is a 12-volt, 62 ampere-hour unit containing 9 plates per cell. It is assembled in a hard rubber container, has rubber seperators, and is fitted with the "visual level fill" cell covers.

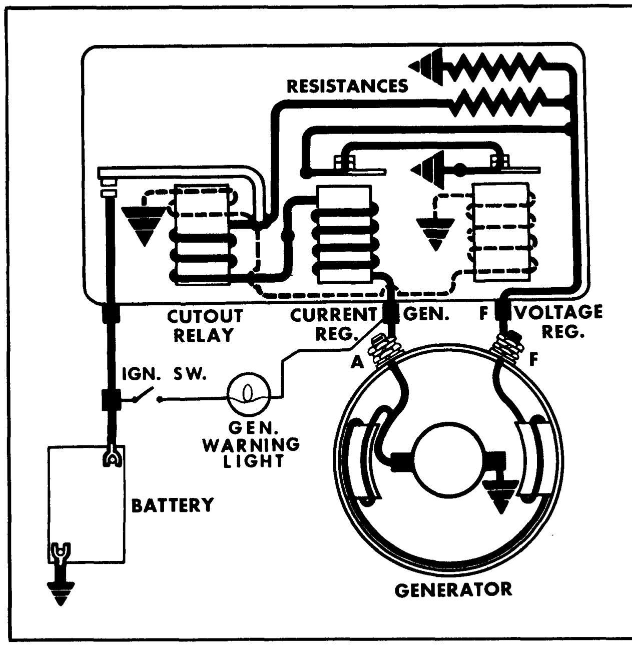


Fig. 13-2 Charging Circuit

GENERATOR

The generator is a 12-volt, 30 ampere, brush shunt unit. Generator output is limited by the generator regulator. The brushes, which are not manually adjustable, are held by reaction type holders, provided with springs, which cause the brushes to bear on the commutator. The generator structure and nomenclature are shown in Fig. 13-3.

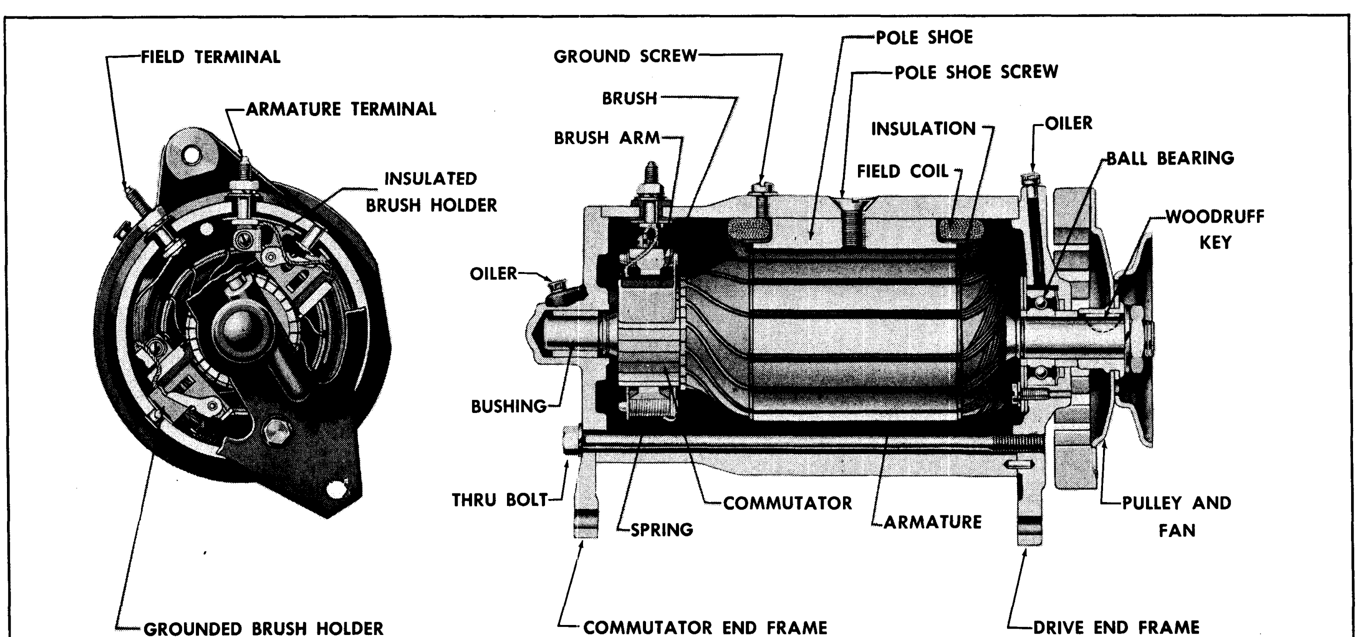


Fig. 13-3 Generator Details

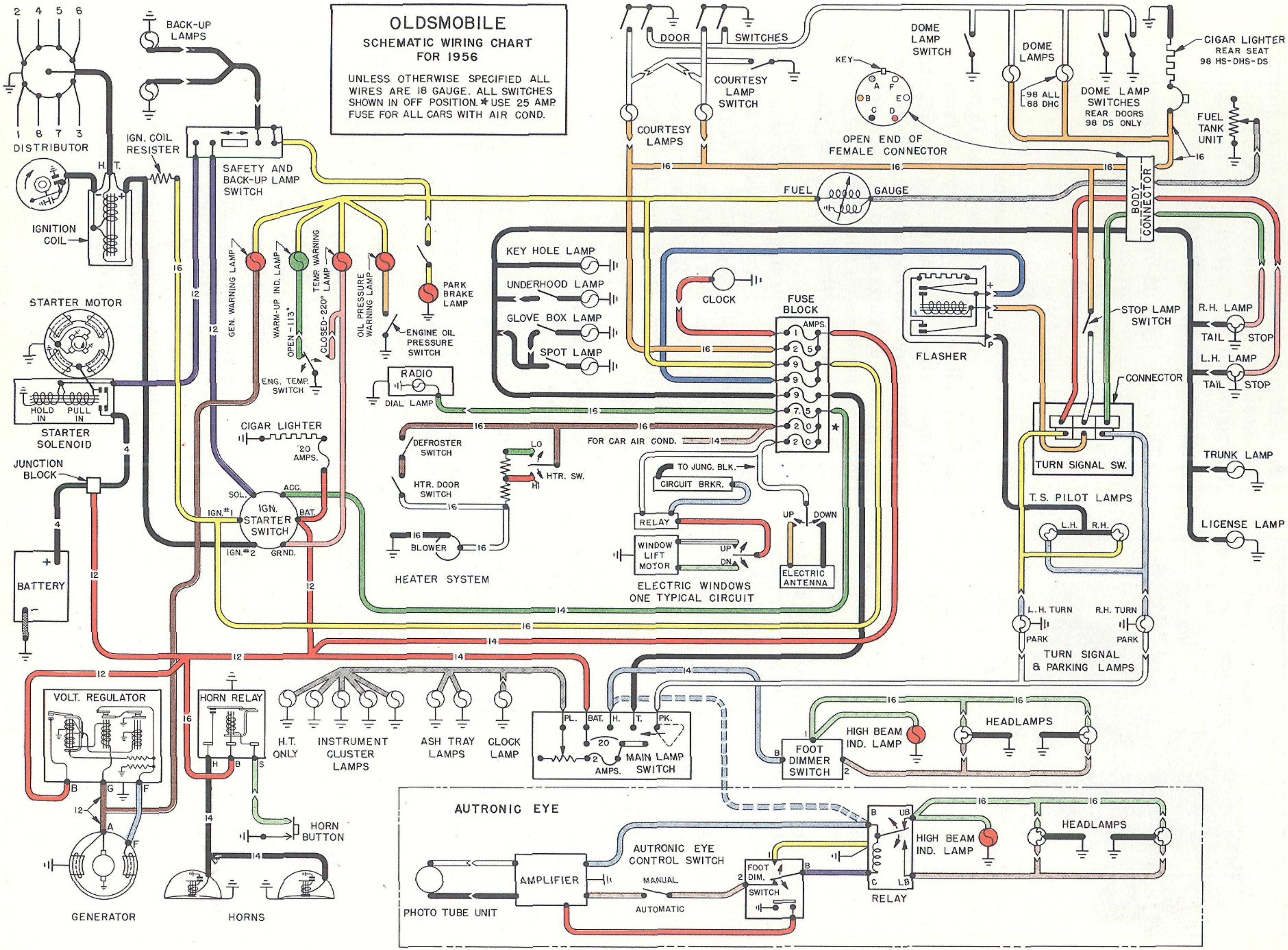


Fig. 13-4 Wiring Diagram

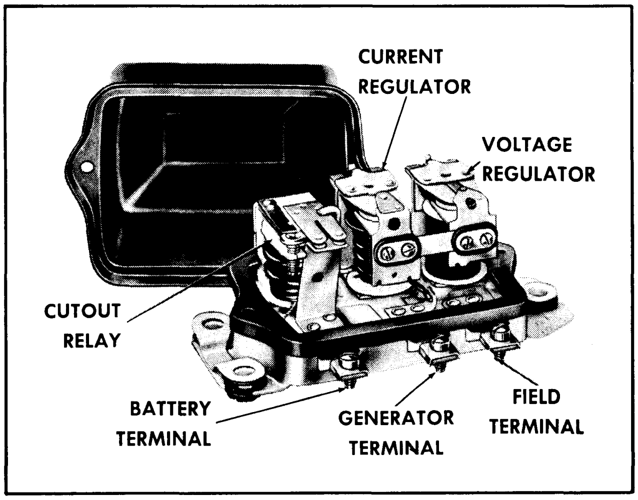


Fig. 13-5 Regulator

REGULATOR

The three unit Delco-Remy 12-volt regulator contains a cutout relay, voltage regulator, and current regulator, and is designed for use with a negative grounded battery and Delco-Remy shunt type generator. (See Fig. 13-5)

Cutout Relay - The purpose of the cutout relay is to close and open the charging circuit between the generator and battery. When the generator voltage reaches the value for which the cutout relay is adjusted, the contact points close and current flows from the generator toward the battery. When generator voltage falls below battery voltage, the contact points open to prevent battery discharge through the generator while the engine is idling or stopped.

Voltage Regulator - The purpose of the voltage regulator unit is to limit the electrical system voltage to a safe maximum. Vibrating contacts of the voltage regulator limit voltage by intermittently inserting resistance in the generator field circuit as required. With the electrical system voltage properly limited, electrical accessories are protected and the battery is not subject to excessive overcharging.

Current Regulator - The purpose of the current regulator unit is to prevent overheating of the generator armature by limiting generator output. Vibrating contacts of the current regulator limit current output by intermittently inserting resistance in the generator field circuit as required.

GENERATOR WARNING LIGHT

This new light is red and is located in the instrument cluster. This light should light when the ignition key is turned on. When the ignition key is turned on and the warning light fails to light, it is an indication that either the bulb is burned out or the generator has an open circuit. As the generator speed increases, the light will go out, indicating the generator is functioning normally. Normally the warning light will come on during engine idle but will go out as driving speed is resumed. If the light remains on during normal driving speeds, it is an indication that the generator is not functioning.

NOTE: The warning light does not indicate whether or not the battery is being charged or if the regulator is functioning properly. Use a Service Test Meter (A.V.R. Unit) to determine if regulator is adjusted properly in the event that the battery is suspected of not being charged properly.

PERIODIC SERVICE

BATTERY

The liquid level in the battery should be checked every 2,000 miles or once a month. In extremely hot weather, the checking should be more frequent. If the liquid level is found to be low, add distilled or demineralized water to each cell until the liquid level rises to the bottom of the vent well. DO NOT OVERFILL.

The top of the battery and the battery cable terminals should be cleaned every 5,000 miles. The top of the battery should be kept clean and the battery hold-down bolts should be kept properly tightened. Acid and dirt should be removed from the top of the battery by using a diluted ammonia or soda solution. When the foaming stops, flush away the solution with clean water.

NOTE: The vent plugs must be tight during this operation to prevent the cleaning solution from entering the cells.

Check for pin holes or openings in the sealing material on the top of the battery. Holes or openings can be sealed with a hot iron.

Battery cables should be checked for tightness and corrosion. Corroded cables should be disconnected and cleaned with diluted ammonia or soda. After cleaning and flushing, apply a thin coating of petrolatum on the posts and cable clamps to help retard corrosion.

GENERATOR

The hinge cap oilers of the generator should be filled with light engine oil at each vehicle lubrication period. If the oil reservoir in the commutator end frame appears to be dry, fill the reservoir three times consecutively, allowing time between fillings for the oil to saturate the wick. The hinge cap oiler on the drive end frame should never be filled more than once at each lubrication period.

Periodically inspect the commutator and brushes for cleanness and wear by observing through the end frame. If the commutator is dirty, it should be cleaned by using No. 00 sandpaper, brush seating stone, or paste applied against the commutator with the engine running. DO NOT use emery cloth. If the brushes are worn to less than half their original length, they should be replaced as outlined under SERVICING OF UNITS IN THE CHARGING CIRCUIT. If the generator belt appears to be improperly adjusted, torque to 16 ft. lbs. as outlined in ENGINE SECTION.

REGULATOR

Normally, periodic service of the regulator is not required. However, it may become necessary to clean the regulator contact points as outlined under SERVICING OF UNITS IN THE CHARGING CIRCUIT.

GENERATOR WARNING LIGHT

There is no periodic service for the generator warning light except replacement of the light bulb when necessary.

CHECKS AND ADJUSTMENTS OF THE CHARGING SYSTEM ON THE CAR

WIRING

To check for excessive voltage drop (resulting from loose connections or other high resistance) in the charging circuit, proceed as follows:

1. Ground the "F" terminal of the regulator.
2. Turn off all accessories and operate the generator at a speed which will produce a charge rate of 20 amperes.
3. Measure the voltage drop at V_1, V_2, and V_3 as shown in Figure 13-6. Readings V_1 plus V_2 should not exceed 0.5 volt. Reading V_3 should not exceed 0.3 volt. If the voltage drop exceeds these limits, excessive resistance is indicated in the circuit checked.
4. Remove the ground lead at the "F" terminal of the regulator and, with the engine stopped, turn on the full lighting and accessory load. Measure the voltage drop at V_4 in Figure 13-6. If this voltage drop exceeds 0.1 volt, excessive resistance is indicated in this portion of the charging circuit. If excessive resistance is found, check the wiring for defects and repair as necessary. Clean and tighten all connections.

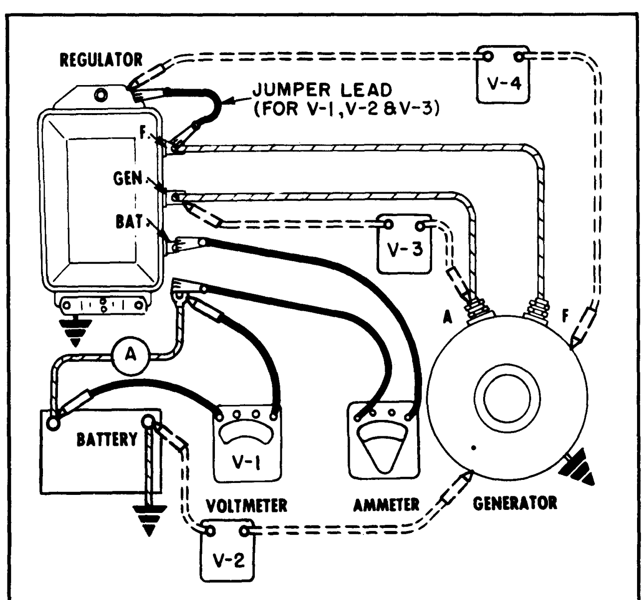


Fig. 13-6 Charging Circuit Test

BATTERY

To check the battery on the car, use a hydrometer which will indicate the state of charge.

NOTE: If water has been recently added to the cells or the battery fast charged, the hydrometer reading will be incorrect.

This test determines the state of charge of the battery. It DOES NOT necessarily indicate whether the battery is able to perform its normal functions, such as starting.

Since the specific gravity of the electrolyte varies with temperature, it is necessary to add 4 gravity points per 10° that the electrolyte is over 80°F. to correct the reading. For every 10° that the electrolyte is below 80°, 4 gravity points must be subtracted from the gravity reading.

Example:

a.	Gravity Reading	1.235	
	Electrolyte Temperature 110°F.	+12	(4x3)
	Correct Gravity Reading	1.247	
b.	Gravity Reading	1.250	
	Electrolyte Temperature 0°F.	-32	(4x8)
	Correct Gravity Reading	1.218	

State of Battery Charge in Terms of Electrolyte Specific Gravity

(Corrected Reading or Temperature at 80°F.)

Specific Gravity	State of Charge
1.260-1.280	Fully Charged
1.225-1.250	3/4 Charged
1.195-1.220	1/2 Charged
1.160-1.180	1/4 Charged
1.100-1.125	Completely Discharged

The specific gravity of a charged battery should not vary more than 25 points (.025) between cells. A greater variation may be caused by the low cell being shorted, loss of electrolyte, or an old battery. Such batteries should be removed for a slow charge and further tests. (Refer to SERVICING OF UNITS IN THE CHARGING CIRCUIT.)

REGULATOR

Four regulator electrical checks can be made on the car: the settings of the cutout relay, voltage regulator, current regulator, and a check for oxidized regulator contact points. Mechanical checks and adjustments requiring removal of the regulator from the car are outlined under SERVICING OF UNITS IN THE CHARGING CIRCUIT.

NOTE: The regulator must have the cover in place and must be at operating temperature when the electrical settings are checked. The electrical checks should be made in the order given:

Voltage Regulator Setting

1. Connect a 1/4 ohm fixed resistor (approximately 25 watts) into the charging circuit at the "BAT" terminal of the regulator. (See Fig. 13-7)
2. Connect a voltmeter from the regulator "BAT" terminal to ground.
3. Run engine at 1600 R.P.M. for at least 15 minutes with cover in place to bring the regulator to operating temperature.

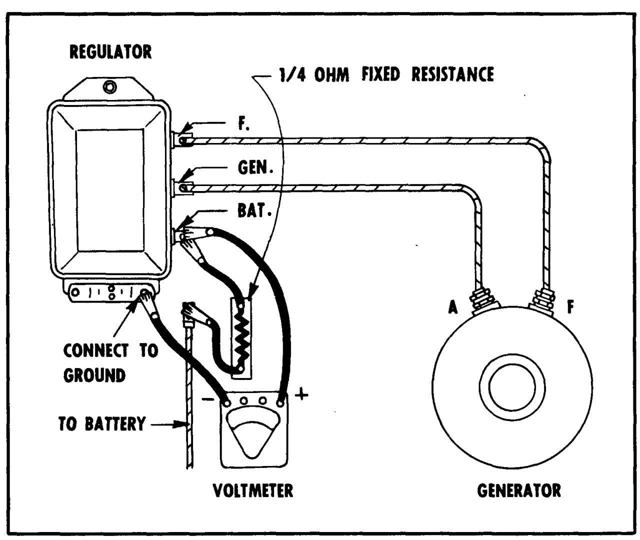


Fig. 13-7 Checking Voltage Setting with Fixed Resistance

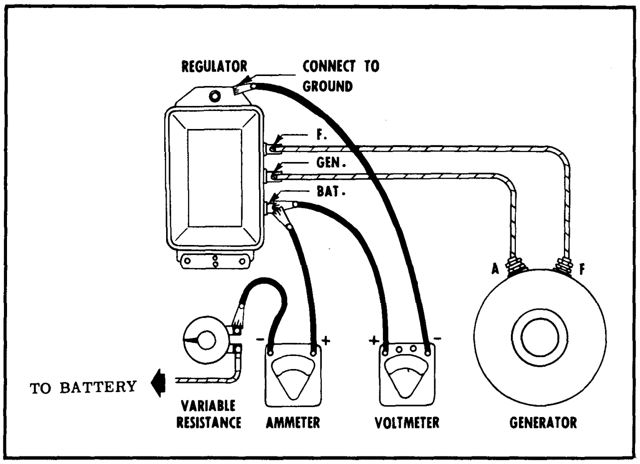


Fig. 13-8 Checking Voltage Setting with Variable Resistance

4. Cycle the generator by either of the following methods:
   Method A - Stop the engine; restart, and bring engine back to 1600 R.P.M. and record the voltage setting.
   Method B - Connect a variable resistor into the field circuit as in Figure 13-8. Move the voltmeter lead from "BAT" to "GEN" terminal of regulator. With the generator operating at 1600 engine R.P.M., slowly increase (turn in) the resistance of the variable resistor until generator voltage is reduced below 4 volts. Move voltmeter lead back to "BAT" terminal of regulator. Decrease (turn out) all of the resistance of the variable resistor. Record voltage setting.
5. Adjust voltage setting to 14.5 if room temperature is 80 ; if not, refer to Fig. 13-9 and add or subtract the correction factor, then adjust the voltage setting accordingly.
6. To adjust the voltage setting, remove the regulator cover and turn the adjusting screw. (See Fig. 13-10) Increase spring tension to raise the setting; decrease spring tension to lower the setting. Before taking the reading after each adjustment, replace the regulator cover as quickly as possible and cycle the generator. (The engine should be stopped while removing, and replacing the regulator cover to reduce the possibility of causing a short.)

CAUTION: Final adjustment should always be made by increasing spring tension to assure contact between the screw head and spring support. Sometimes the spring support does not follow the screw head as spring tension is decreased, and it will be necessary

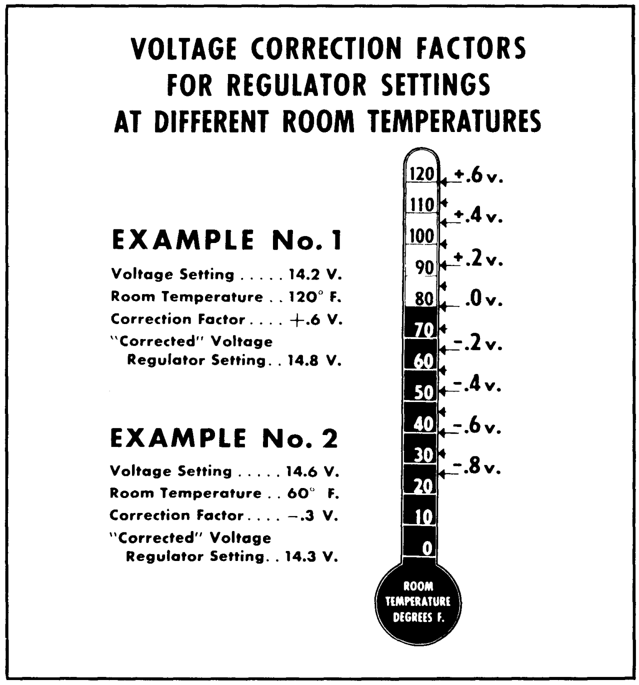


Fig. 13-9 Voltage Correction Factors

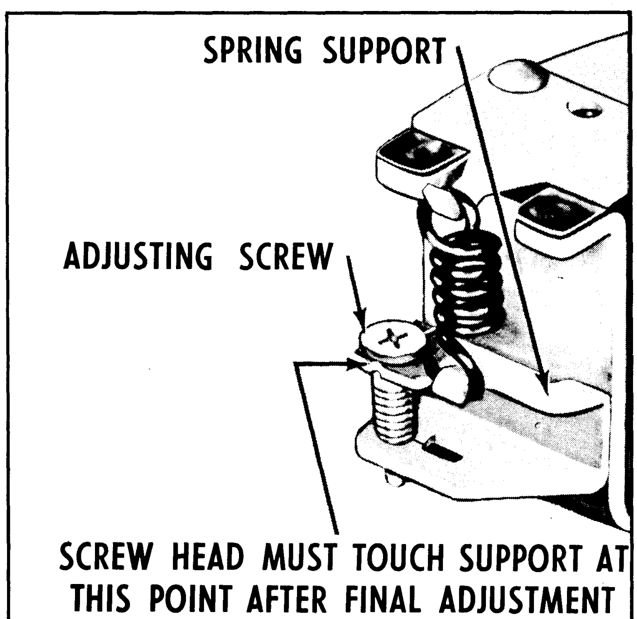


Fig. 13-10 Adjusting Voltage Setting

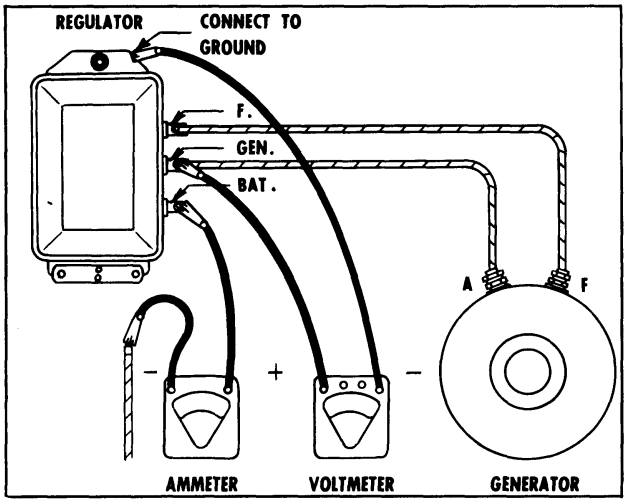


Fig. 13-11 Checking Closing Voltage of Cutout Relay

to bend the spring support up to insure contact between the spring support and screw head before final adjustment is completed.

Cutout Relay Closing Voltage

1. Connect a voltmeter between the regulator "GEN" terminal and ground. (See Fig. 13-11)
2. Check cutout relay closing voltage by slowly increasing generator speed and

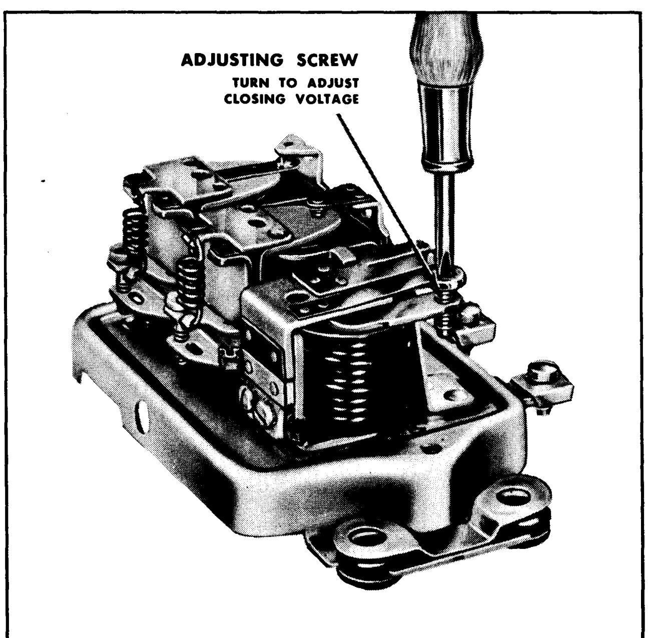


Fig. 13-12 Adjusting Closing Voltage on Cutout Relay

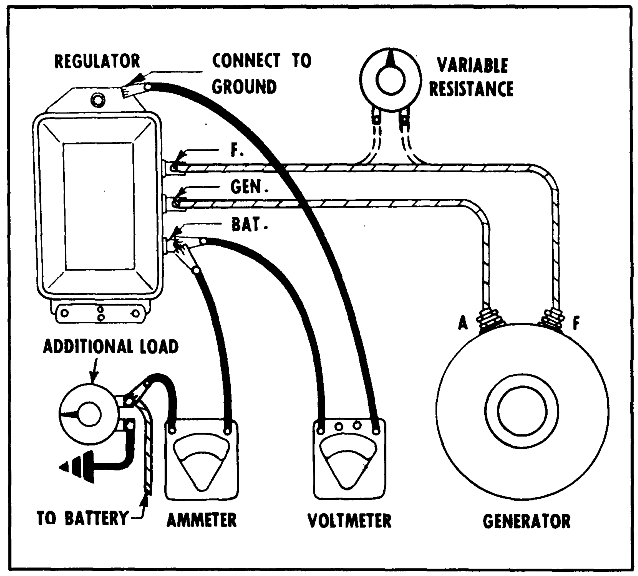


Fig. 13-13 Checking Current Regulator Setting

note the voltage at which the relay closes. Decrease generator speed and make sure the cutout relay contact points open.
3. Adjust the closing voltage by turning the adjusting screw. (See Fig. 13-12) Turn the screw clockwise to increase the setting and counterclockwise to decrease the setting.

Current Regulator Setting

1. Connect an ammeter into the charging circuit. (See Fig. 13-13)
2. Turn on all accessory load (lights, radio, etc.) and connect a load (resistor) across the battery so as to drop the system voltage 12.5 to 13.0 volts. (See Fig. 13-13)
3. Operate the generator at 1600 engine R.P.M. for at least 15 minutes to establish operating temperature. The regulator cover must be in place.
4. Cycle the generator and note the current regulator setting. (See instructions under Voltage Regulator Setting for cycling procedure.)
5. Adjust the current setting to 30 amps in the same manner as that used for adjusting the voltage regulator setting.

Check For Oxidized Regulator Points

1. Turn on the headlights.

2. Operate the generator at speed which will produce a charge rate of 5 amperes.
3. Ground the "F" terminal of the regulator.
4. If generator output increases more than 2 amperes, oxidized regulator contact points are indicated and the regulator should be removed from the car and the contact points should be cleaned as outlined under SERVICING OF UNITS IN THE CHARGING CIRCUIT.

SERVICING OF UNITS IN THE CHARGING CIRCUIT

BATTERY

Charging

Batteries removed from the car for charging should be charged continuously at a low rate until fully charged. Batteries may be safely slow-charged at a rate in amperes equal to 7% of the battery's ampere-hour capacity. Ex: 7% of 62 A.H. = 4.3 amperes. This is called the "Normal" charge rate. The battery is fully charged when specific gravity readings taken at hourly intervals show no increase during three consecutive readings. Although the slow-charge method is recommended for charging all batteries, discharged batteries in otherwise good condition, may be given a "boost" with a fast charger if time does not permit complete slow-charging. When using a quick charger, it must be remembered that the battery is only receiving a partial charge and that the battery electrolyte temperature must not be allowed to exceed 120°F. If the battery heats excessively, quick charging must be discontinued.

NOTE: Do not load-test batteries having a specific gravity reading less than 1.215 @80°F.

Batteries removed from the car for further checking in order to determine whether or not the unit should be replaced, first should be brought to a fully-charged condition by slow-charging. Badly sulfated batteries may require a continuous slow charge for 48 hours or more before a rise in gravity readings occurs. If the specific gravity reading of any cell fails to reach 1.215 (corrected to 80 F.) or if there is a variation of more than 25 points between cells after thorough slow charging, replace the battery. If the specific gravity of each cell is 1.215 or more and variation between cells is less than 25 points, the battery may be given a load test as follows to determine its ability to deliver current under load.

Load Test

CAUTION: Do not make this test if the specific gravity is below 1.215.

1. Connect the battery-starter tester to the battery positive and negative terminals.
2. Adjust the resistance knob to obtain 140 amps. on the ammeter.

Voltmeter should read a minimum of 9.0 volts after 5 seconds. If the voltmeter reads less than 9.0 volts, it indicates that the battery does not have sufficient capacity and it should be further checked as follows:

1. Slow charge the battery at rate of 1 amp. per plate (9 plates x 1 = 9 amps.) for 12 hours.
2. Place 140 amp. load across the battery.
3. Quickly measure the individual cell voltages by piercing the sealing material over the cell straps.
4. If the cell voltage falls below 1.5 volts or there is a difference of more than .2 volt between cells, the battery is not in satisfactory condition.

   In order to determine the battery's actual condition, it should be recharged slowly. If the slow charge shows:

   a. Little or no voltage increase in some cells - indicates these cells are shorted and battery should be replaced.
   b. Uniform voltage increase in cells but unequal specific gravity at full charge - indicates loss of acid, and the acid should be readjusted and the battery again load tested.

   CAUTION: The acid content of the battery should be adjusted only by a skilled battery technician.

c. Slow and uneven increase in both specific gravity and voltage - indicates excessive sulfation, and the slow charge should be continued for 24 to 48 hours.

GENERATOR

Disassembly

To disassemble the extruded frame generator, remove the two through bolts and slide off the commutator end frame. The field frame (with brush rigging), armature, and drive end frame can then be further disassembled if required.

Cleaning and Inspection

1. Check brush holders to see that they are not deformed or bent so as to interfere with holding brushes properly against commutator. Check brush spring tension as shown in Figure 13-14. Proper spring tension is approximately 28 ounces.
2. With the generator completely disassembled, wash all metal parts except the armature and fields in cleaning solvent. Fields and armature must never be cleaned with any degreasing solvents since this may damage the insulation.
3. After a thorough cleaning in solvent, inspect generator ball bearing for roughness, scored races, and deformed balls.

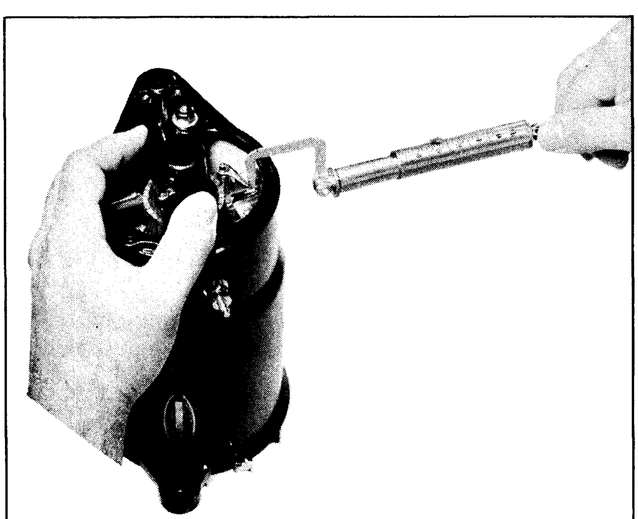


Fig. 13-14 Checking Brush Tension

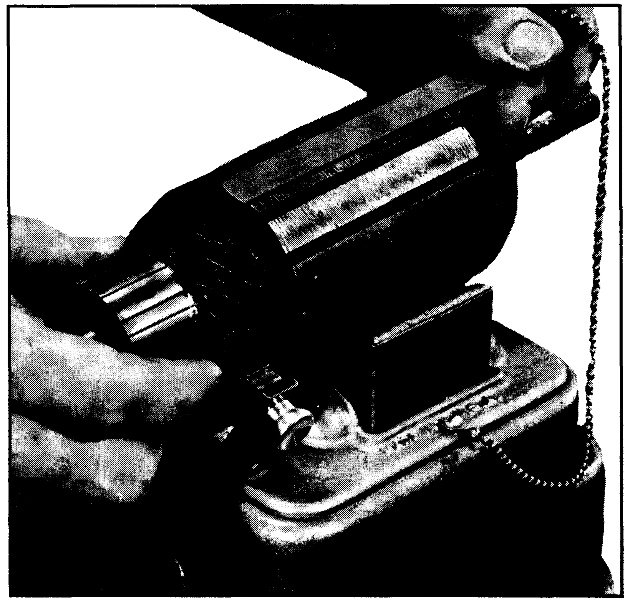


Fig. 13-15 Growler Test

4. Check fit of armature shaft in bushing in commutator and frame. If bushing is excessively worn, it should be replaced.
5. Inspect armature commutator; if rough, it must be turned down and insulation undercut. Inspect solder at points where armature wires fasten to ends of commutator riser bars to make sure solder is in place so as to assure a good connection.
6. Check armature for shorts by placing on growler and with hack saw blade over armature core, rotate armature. (See Fig. 13-15) If saw blade vibrates, armature or commutator is shorted. Recheck after cleaning between the commutator bars and if saw blade still vibrates, armature is shorted and must be replaced.
7. Using a 110-volt test lamp, place one lead on armature core and other on each commutator bar. If lamp lights, armature is grounded and must be replaced. (See Fig. 13-16)
8. Using a 110-volt test lamp, place one lead on field terminal on generator frame and the other lead on armature terminal. If lamp does not light, the field coils are open and must be

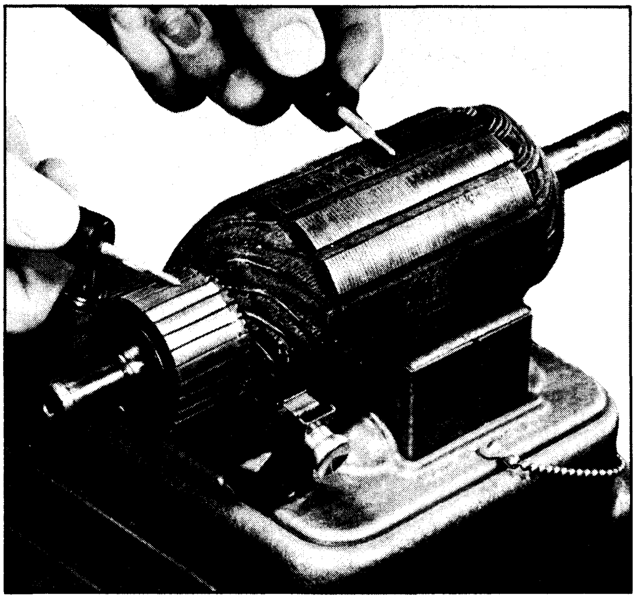


Fig. 13-16 Checking Armature

replaced (unless a loose connection is found which can be soldered). (See Fig. 13-17)

9. Using a 110-volt test lamp, place one lead on ground (touch to generator frame) and other lead on field terminal on generator frame (be sure free end of field wire is not touching ground and field terminal insulation is not broken). (See Fig. 13-18) If lamp lights, the field coils are grounded. If ground in field coils cannot be located or repaired, coils must be replaced.
10. Using a 110-volt test lamp, place one lead on generator positive (or output) terminal on generator frame, and place other lead on generator frame. (Be sure loose end of terminal lead is not touching ground.) If lamp lights, positive terminal insulation through generator frame is broken down and must be replaced. (See Fig. 13-19)
11. Using a 110-volt test lamp, place one lead on the positive or insulated brush holder and the other lead on generator frame. If lamp lights, the brush holder is grounded due to defective insulation at the frame. (See Fig. 13-20)

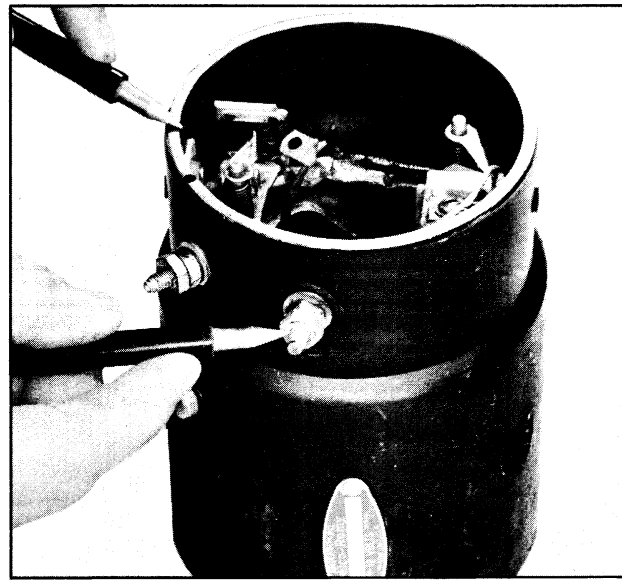


Fig. 13-18 Checking Field Coils for Ground

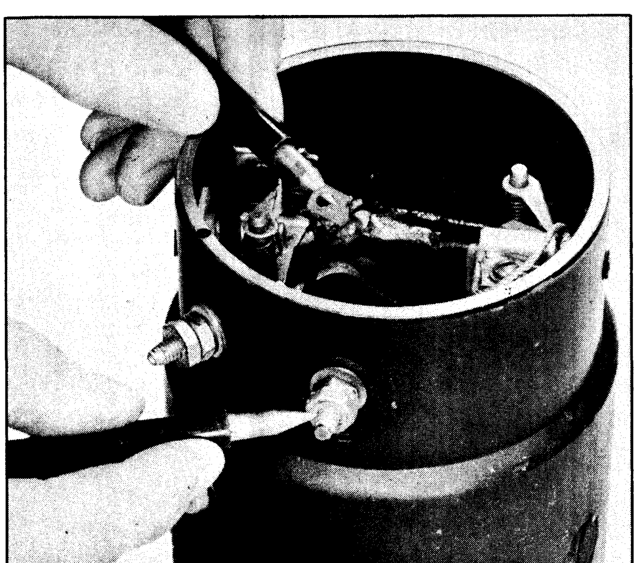


Fig. 13-17 Checking Field Coils for Open

Fig. 13-19 Checking Positive Terminal Insulation

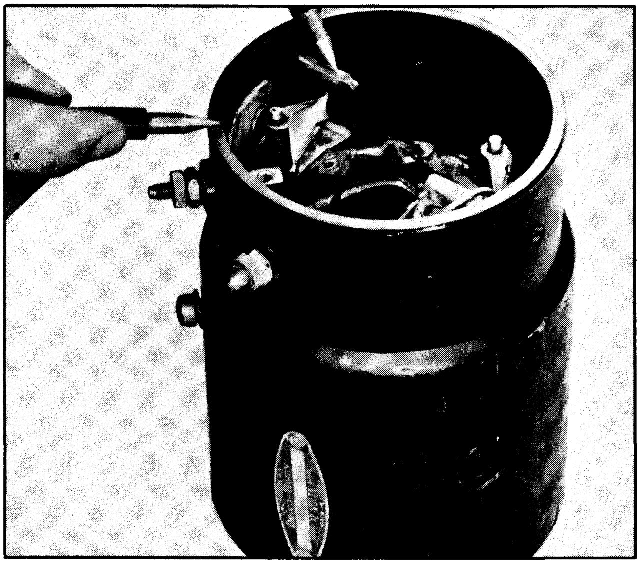


Fig. 13-20 Checking Brush Holder

12. Check the armature for an open circuit by making a bar-to-bar check on the commutator if test equipment is available.

Generator Repair

Loose Electrical Connections - When an open soldered connection is found during inspection, it may be resoldered provided rosin flux is used for soldering.

CAUTION: Acid flux must never be used on electrical connections.

Turning Commutator - When inspection shows commutator roughness, it should be cleaned as follows:

1. Turn down commutator in a lathe until it is thoroughly cleaned.
   CAUTION: Do not cut beyond section previously turned.
2. Undercut insulation between commutator bars 1/32". This undercut must be the full width of insulation and flat at the bottom; a triangular groove will not be satisfactory. After undercutting, the slots should be cleaned out carefully to remove any dirt and copper dust.
3. Sand the commutator lightly with No. 00 sandpaper to remove any slight burrs left from undercutting.
4. Recheck armature on growler for short circuits.

Installation of Generator

1. After the generator has been assembled, position the generator on the engine and install the generator attaching bolts, but do not tighten.
2. Install generator and fan belt.
3. Using Tool J-4170 and a torque wrench (Tool J-1264), adjust belt torque tension to 16 ft. lbs., and tighten generator adjusting link bolt.
4. Torque generator adjusting bolts 14 to 17 ft. lbs.
5. Connect positive generator lead and field lead to terminals on generator frame.
   IMPORTANT: On radio equipped cars, connect the radio by-pass condenser to generator output (A) terminal.
6. Polarize the generator by momentarily connecting a jumper wire between the "BAT" and "GEN" terminals on regulator.
7. Start engine. If brushes squeak, seat them by placing brush seating paste on the commutator. The soft abrasive material of the paste will be carried under the brushes and wear the brush faces to the commutator contour in a few seconds.

REGULATOR

While electrical adjustments are made with the regulator on the car as outlined under CHECKS AND ADJUSTMENTS ON THE CAR, it is necessary to remove the regulator for cleaning contact points and adjusting air gaps on the three regulator units.

Removal

To remove the regulator, disconnect the leads from the regulator and remove the regulator to dash mounting screws.

Regulator Inspection and Adjustment (Removed from Car)

Contact Points

Inspect contact points for pits and oxidation. Replace points if badly burned. To

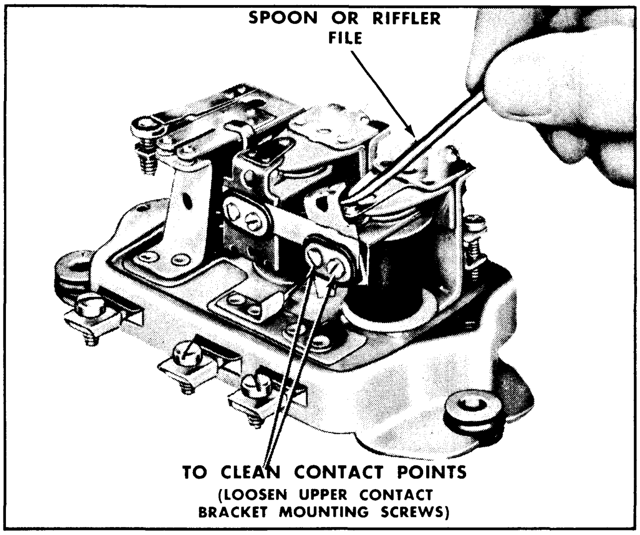


Fig. 13-21 Cleaning Contact Points

clean the contact points, loosen the upper contact bracket mounting screws and tilt the bracket as shown in Fig. 13-21. Check to make sure that the connector strap between the voltage and current regulators is insulated from the contact mounting screws on both the voltage and current regulator.

The large flat contact point, located on the voltage regulator armature and the upper contact support on the current regulator, always develops a slight cavity and should be cleaned of oxides by using a riffler file.

CAUTION: DO NOT FILE CONTACT POINTS EXCESSIVELY. NEVER USE SANDPAPER OR EMERY CLOTH.

If it is necessary to replace the upper contact points of the regulator, reassemble the regulator as shown in Fig. 13-22.

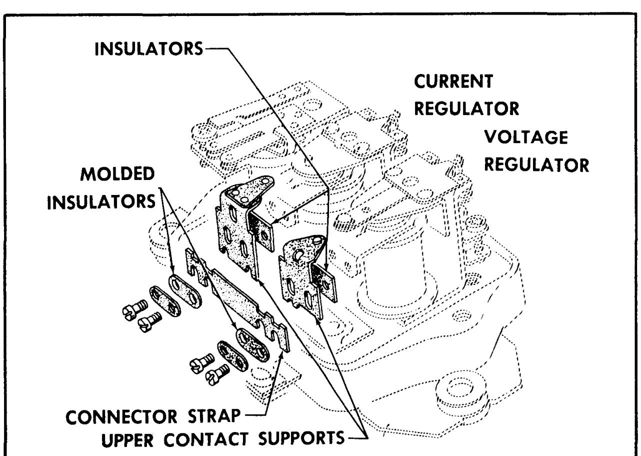


Fig. 13-22 Contact Support Brackets

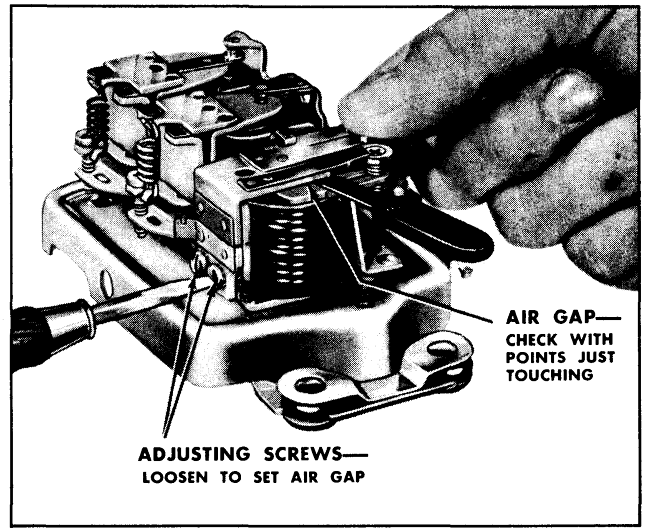


Fig. 13-23 Adjusting Cutout Relay Air Gap

Cutout Relay Inspection and Gap Adjustment

1. Place fingers on armature directly above core and move armature directly down until points just close and then measure air gap between armature and center of core. Air gap should be .020". Check to see that both points close simultaneously. If not, bend spring finger so that they do.

   To adjust air gap, loosen two screws at back of relay and raise or lower armature as required. Tighten screws securely after adjustment. (See Fig. 13-23)
2. Check point opening and adjust to .020" by bending upper armature stop. (See Fig. 13-24)

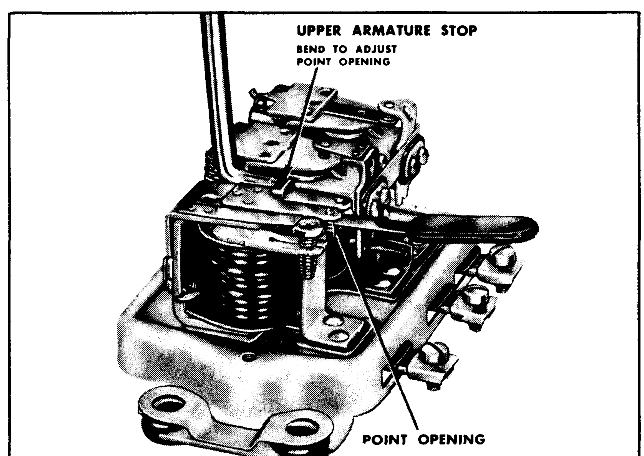


Fig. 13-24 Adjusting Cutout Relay Point Opening

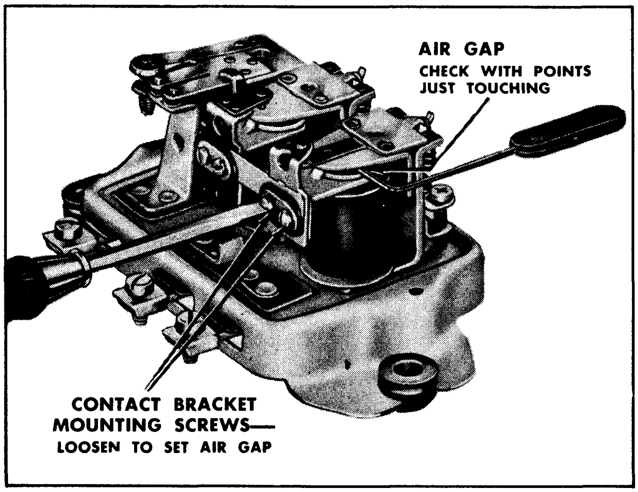


Fig. 13-25 Adjusting Voltage Regulator Air Gap

Voltage Regulator Inspection and Gap Adjustment

Push armature down to core and release it until contact points just touch and then measure air gap between armature and center of core. Air gap should be .075". Adjust gap by loosening contact mounting screws and raising or lowering contact brackets as required. (See Fig. 13-25) Check to see that points are lined up and tighten screws after adjustment.

Current Regulator Inspection and Gap Adjustment

Check and adjust current regulator air gap in exactly the same manner as voltage regulator. Air gap should be .075".

Installation of Regulator

1. With rubber gasket in place on regulator base and cover installed, install regulator and tighten mounting screws.
   CAUTION: Do not tighten the mounting screws excessively as this will destroy the cushioning effect of rubber grommets in the mounting.
2. Attach "BAT", "GEN", and "FIELD" leads to regulator and polarize generator by momentarily connecting a jumper wire to the "BAT" and "GEN" terminals on the regulator before starting the engine.
3. Check and adjust the electrical settings of the regulator on the car as outlined under CHECKS AND ADJUSTMENTS ON THE CAR.

STARTING CIRCUIT

The starting circuit consists of the starting motor assembly (including solenoid), ignition and starting switch, neutral safety switch, and battery. (For information pertaining to the battery, refer to the CHARGING CIRCUIT)

STARTING MOTOR ASSEMBLY FIG. 13-26

The Delco-Remy Starting Motor is a 12-volt extruded frame type unit. It has four poles and a compound field - three field coils connected in series from the field terminal to the insulated brushes, and one shunt coil connected from the field terminal to ground. The armature rotates in oilless bearings at both ends. An overrunning clutch type of drive is used to engage the cranking motor pinion with the flywheel. The overruning action of the clutch protects the cranking motor armature from excessive speed when the engine fires.

A solenoid switch, mounted on the motor frame, operates the overruning clutch drive by means of a linkage to the shift lever. When the control switch is closed manually, the solenoid is energized, shifting the cranking motor pinion into mesh with the flywheel. The main switch contacts are then closed so that battery current is delivered to the cranking motor.

The armature shaft and clutch have spiral splines which prevent the cranking motor from loading-up until the clutch pinion is fully engaged in the flywheel ring gear.

IGNITION AND STARTING SWITCH

The ignition system incorporates an enclosed starter switch. The ignition key must be turned to the extreme right

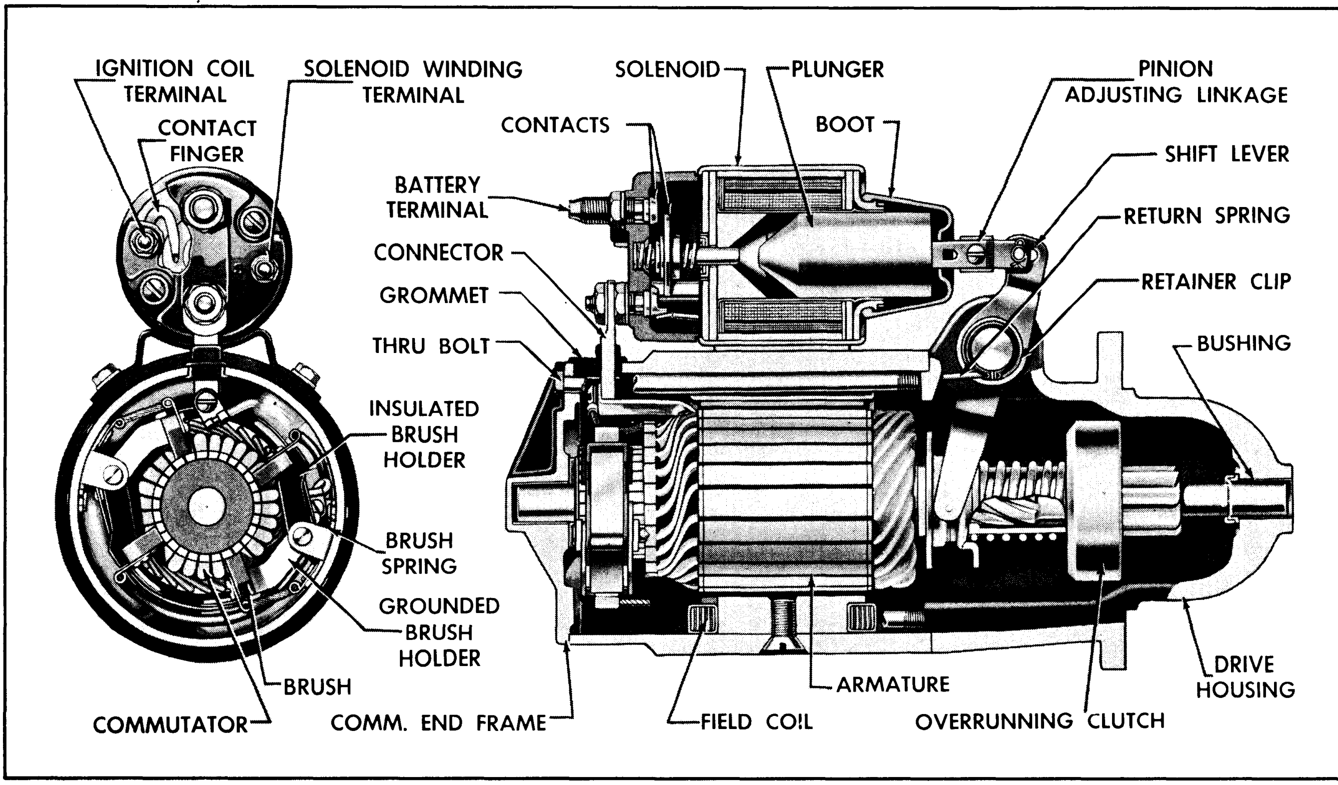


Fig. 13-26 Starter Motor Details

position to engage the starter switch. Spring tension returns the key to the normal ignition position when it is released.

NEUTRAL SAFETY SWITCH

A neutral safety switch is employed as a safety factor on Hydra-Matic models. The switch prevents unintentional starting of the engine with the transmission in gear.

NO PERIODIC SERVICE OF THE STARTING CIRCUIT IS REQUIRED

CHECKS AND ADJUSTMENTS ON THE CAR

Although the starting motor cannot be checked against specifications on the car, a check can be made for excessive resistance in the cranking circuit. To check for excessive resistance in the cranking circuit, measure:

1. The voltage drop during cranking, between the insulated battery post and the "BATTERY" terminal of the solenoid.
2. The voltage drop, during cranking, between the "BATTERY" terminal of the solenoid and the "MOTOR" terminal of the solenoid.
3. The voltage drop, during cranking, between the grounded battery post and the cranking motor frame.

CAUTION: To prevent the engine from firing during the above checks, ground the distributor primary lead going to the coil terminal.

If the voltage drop for any one of the above three checks exceeds 0.2 volt, excessive resistance is indicated in that portion of the cranking circuit being checked. Locate and eliminate the cause for any excessive voltage drop in these circuits in order to obtain maximum efficiency of the cranking system.

When the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid circuit. To check for this condition, close the starting switch and measure the voltage drop between the "BATTERY" terminal of the solenoid and the "SWITCH" terminal of the solenoid. Excessive resistance in the solenoid circuit is indicated and should be corrected if this voltage drop exceeds 3.5 volts.

If the voltage drop does not exceed 3.5 volts and the solenoid does not pull in, measure the voltage available at the "SWITCH" terminal of the solenoid. If the solenoid does not feel warm, it should pull in whenever the voltage available at the "SWITCH" terminal is 7.7 volts or more. When the solenoid feels warm, it will require a somewhat higher voltage to pull in.

After the above checks have been made and the solenoid does not pull in even though the voltage exceeds 7.7 volts, remove the starting motor and check the solenoid current draw, and cranking motor pinion clearance and make sure shift lever linkage operates freely as outlined in SERVICING OF UNITS IN THE STARTING CIRCUIT.

CHECKING STARTER SWITCH AND NEUTRAL SAFETY SWITCH

Check the voltage drop across each switch separately with the ignition switch in start position and the starter linkage blocked out to prevent the solenoid from pulling-in into cranking position. If the voltage drop across each switch is over .3 volt, the switch is defective and should be replaced. (Be sure terminal screws on ignition switch are tight).

NEUTRAL SAFETY SWITCH ADJUSTMENT (HYDRA-MATIC)

To adjust the neutral safety switch loosen the switch attaching screws on the mast jacket. With the selector lever in the Neutral position, position the switch so that a .090" pin can be inserted through the hole in the switch arm and into the hole in the face of the switch. Tighten the switch attaching screws and remove the pin.

Checking Adjustment

1. Apply hand brake firmly.
2. Put shift lever into "Dr" range and turn ignition switch to "Start".
3. While holding switch on "Start", slowly move shift lever toward neutral until engine cranks and starts.
4. Without moving the shift lever after engine starts, accelerate to determine whether or not transmission is in gear.

   If neutral safety switch is properly adjusted, transmission will not be in gear.

SERVICING OF UNITS IN THE STARTING CIRCUIT

STARTING MOTOR

Removal

1. Disconnect positive battery cable at junction block, and disconnect the sole-wire (purple) from the chassis wiring harness.
2. Hoist car and remove engine filler plate.
3. Disconnect starting motor from flywheel housing and remove motor while sliding battery cable loom through sleeve.

Disassembly

1. Remove cotter pin and pin from plunger linkage.
2. If necessary to remove solenoid:
   a. Remove nut and lock washer connecting switch to MOTOR terminal.
   b. Remove 4 attaching screws and take off solenoid.
3. Remove thru bolts, then remove commutator end frame, drive gear, housing, and armature from the field frame assembly.
4. Remove shift lever retaining ring, then unhook and remove return spring.
5. Remove small retainer ring, then remove upper shift lever shaft.
6. Remove armature with clutch and lower shift lever from drive end housing; also, remove thrust collar.
7. If removal of the overruning clutch is necessary, proceed as follows:

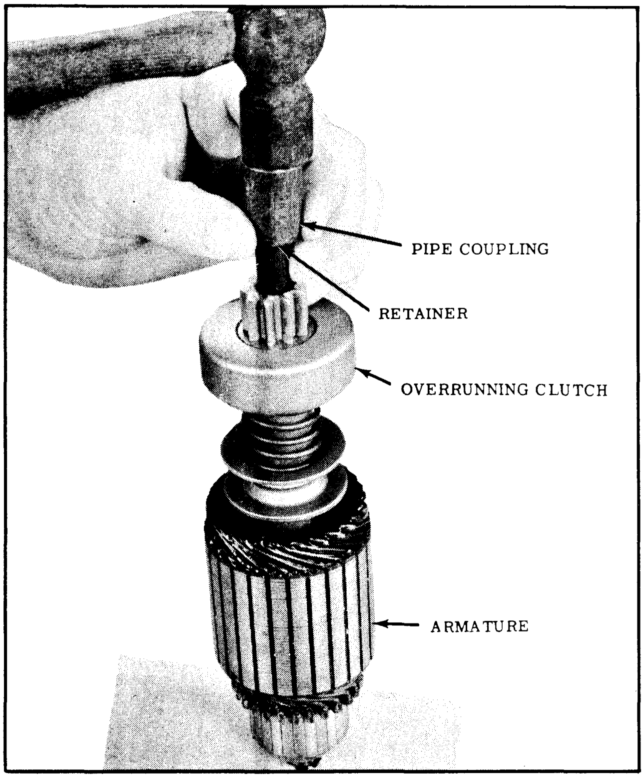


Fig. 13-27 Removing Pinion Retainer

a. Slide thrust collar off end of armature shaft.
b. Slide a standard half inch pipe coupling or other metal cylinder of suitable size (an old pinion can be used if available) onto shaft so end of coupling or cylinder butts against edge of the retainer. (See Fig. 13-27) Tap end of coupling with hammer, driving the retainer towards armature and off snap ring.
c. Remove snap ring from groove in shaft.
d. Slide retainer and clutch from armature shaft.

8. If necessary to replace brush holding rigging parts in the field frame, proceed as follows:
   a. Remove screws attaching leads and brushes to the holders.
   b. By hand, press down on the flat spring so that center of spring clears the retaining slot. Slide off the brush spring and two brush holders as a group.
   c. Reassemble and install new brushes if necessary.

CLEANING, INSPECTION, AND TESTING OF STARTING MOTOR

1. Clean all starting motor parts, but DO NOT USE GREASE DISSOLVING SOLVENTS FOR CLEANING THE OVERRUNING CLUTCH, AMATURE, AND FIELD COILS, since such a solvent would dissolve the grease packed in the clutch mechanism and would damage armature and field coil insulation.
2. Test overruning clutch action. The pinion should turn freely in the overrunning direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Replace assembly if necessary.
3. Check brush holders to see that they are not deformed or bent, but will properly hold brushes against the commutator.
4. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced.
5. Inspect armature commutator. If commutator is rough or out-of-round, it should be turned down and the mica undercut 1/32". Inspect the points where the armature conductors join the commutator bars to make sure that it is a good firm connection. A burned commutator bar is usually evidence of a poor connection.
6. If test equipment is available:
   a. Check the armature for short circuits by placing on growler and holding hack saw blade over armature core while armature is rotated. If saw blade vibrates, armature is shorted. Recheck after cleaning between the commutator bars. If saw blade still vibrates, replace the armature.
   b. Using a 110-volt test lamp, place one lead on the armature core or shaft and the other on the commutator. If the lamp lights, the armature is grounded and must be replaced.
   c. Using a 110-volt test lamp, place one lead on each end of the three

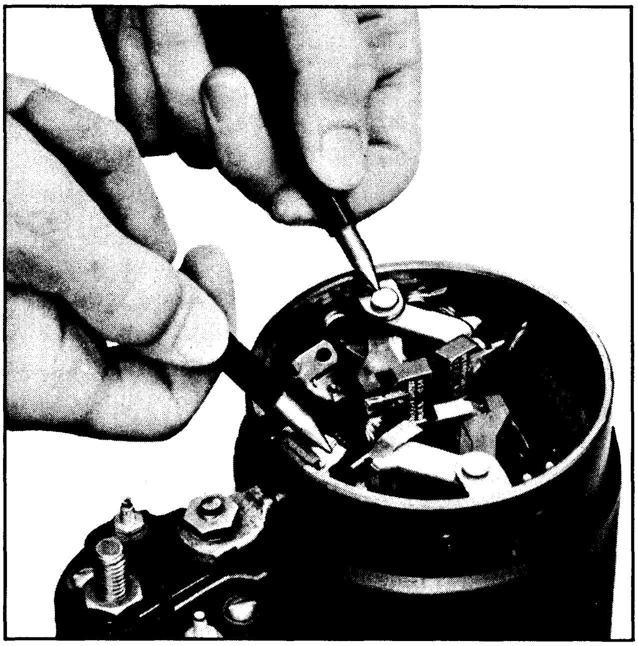


Fig. 13-28 Checking Field Coil for Open

Fig. 13-29 Checking Field Coil for Ground

field coils connected in series. (See Fig. 13-28) If the lamp does not light, the field coils are open and will require repair or replacement.

d. Using a 110-volt test lamp, place one lead on the connector bar and the other on the field frame. (See Fig. 13-29) Disconnect the shunt coil ground before this check is made. If the lamp lights, the field coils are grounded and the defective coils will require repair or replacement.

e. Using a 110-volt test lamp, place one lead on each end of the shunt coil. (See Fig. 13-30) Disconnect the shunt coil ground before this check is made. If the lamp does not light, the shunt coil is open and will require replacement.

f. Check the current draw of the solenoid windings. To check the current draw of the hold-in winding, connect a variable source of voltage (in series with an ammeter) to the switch terminal of the solenoid and ground. To check the current draw of both windings, ground the solenoid motor terminal, and connect a source of voltage (in series with an ammeter) to the switch terminal of the solenoid and ground.

CAUTION: Either of the above checks must be completed in a minimum length of time to prevent heating of the solenoid windings. Heating will cause the current draw readings to be below the specifications which are based on a temperature of 80 F.

Current Draw

Hold-In Winding	(at 10 Volts)	72-76 Amps
Both Windings	(at 10 Volts)	18-20 Amps

SOLENOID CURRENT CHECK

The solenoid windings can be tested with the solenoid either off or on the cranking motor. Two tests must be made to determine the current draw of both windings in parallel and of the hold-in winding alone. To test current draw of both windings:

1. Disconnect the lead from the terminal on the starter motor and ground the main solenoid terminal (which is normally connected to the starter motor) to the solenoid base with a jumper lead.
2. Connect a source of variable voltage (battery and a variable resistance) in series with an ammeter between the solenoid base and the small solenoid switch terminal.

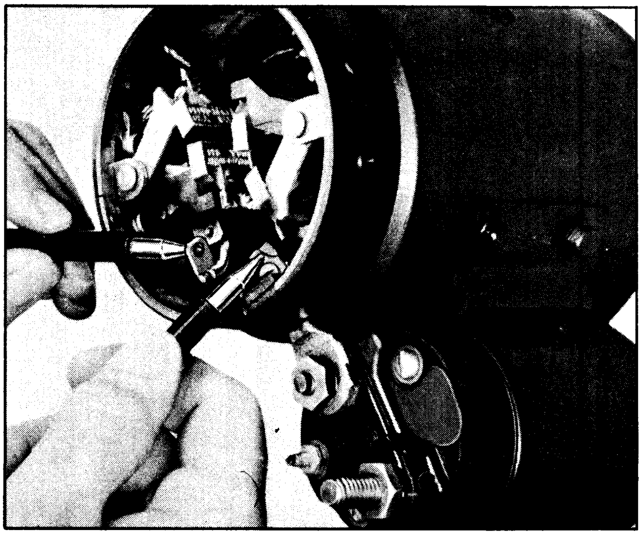


Fig. 13-30 Checking Shunt Coil for Ground

3. Connect a voltmeter between the solenoid base and the small switch terminal.
4. Adjust voltage to 10.0 volts. The current draw should be 72 to 76 amps. at 80°F.

To check current draw of the hold-in winding, disconnect the jumper lead grounding the main solenoid terminal and readjust the variable resistance to obtain 10.0 volts. The current draw should be 18 to 20 amps. The small terminal may be checked for continuity by connecting a test light between this terminal and ground. With the solenoid in cranking position, the test light should indicate a complete circuit. (See Fig. 13-31)

NOTE: The above current-draw checks must be completed in a minimum length of time to prevent heating of the solenoid windings. Heating will cause the current draw readings to be below the specifications which are based on a temperature of 80°F.

When the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid control circuit. To check for this condition, close the starting switch and measure the voltage drop between the "BATTERY" terminal of the solenoid and the "SWITCH" terminal of the solenoid. If this voltage drop exceeds 2.5 volts excessive resistance in the solenoid

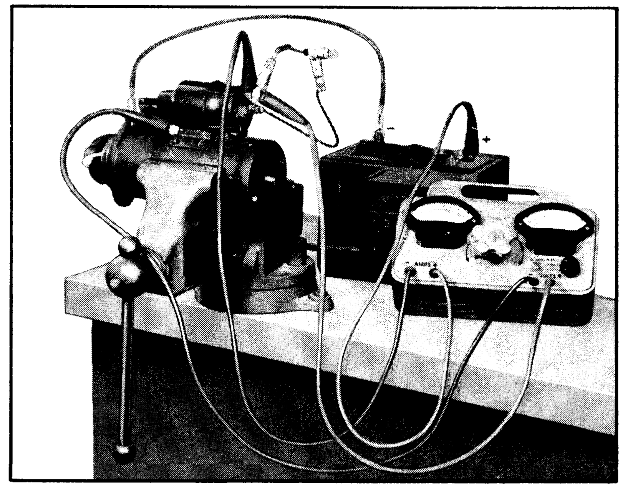


Fig. 13-31 Checking Solenoid Current

circuit is indicated and should be corrected.

If the voltage drop does not exceed 2.5 volts and the solenoid does not pull in, measure the voltage available at the "SWITCH" terminal of the solenoid. If the solenoid does not feel warm, it should pull in whenever the voltage available at the "SWITCH" terminal is 9 volts or more. (When the solenoid feels warm, it will require a somewhat higher voltage to pull in.)

If above tests do not meet specifications, the solenoid switch contacts and the contact disc should be checked for burned condition.

Assembly

1. If the overrunning clutch was removed from the armature shaft, proceed as follows:
   a. Lubricate drive end of armature shaft with SAE No. 10 oil.
   b. Slide clutch assembly onto armature shaft with pinion outward. (See Fig. 13-32)
   c. Slide retainer onto shaft with cupped surface facing end of shaft.
   d. Install snap ring into groove on armature shaft.
   e. Assemble thrust collar on shaft with shoulder next to snap ring.
   f. Position retainer and thrust collar next to snap ring; then, using two pairs of pliers at same time

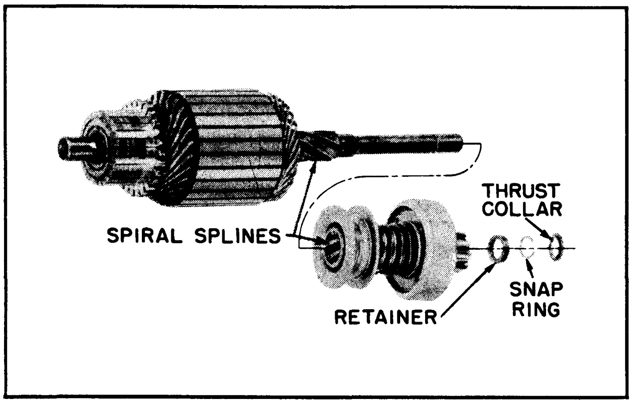


Fig. 13-32 Overrun Clutch Installation

(one pair on either side of shaft), grip retainer and thrust collar and squeeze until snap ring is forced into retainer.

2. Assemble armature and clutch assembly, commutator end frame, drive housing, and solenoid to the field frame by reversing the disassembly procedure.

PINION CLEARANCE AND ADJUSTMENT

Whenever the cranking motor has been disassembled or the solenoid has been replaced, it is necessary to check the pinion clearance. Pinion clearance must be adjusted correctly to prevent the buttons on the shift lever yoke from rubbing on the clutch collar during cranking. Clearance between the end of the pinion and the pinion stop, with the pinion in the cranking position, should be .010" to .140".

To check, connect a voltage source of

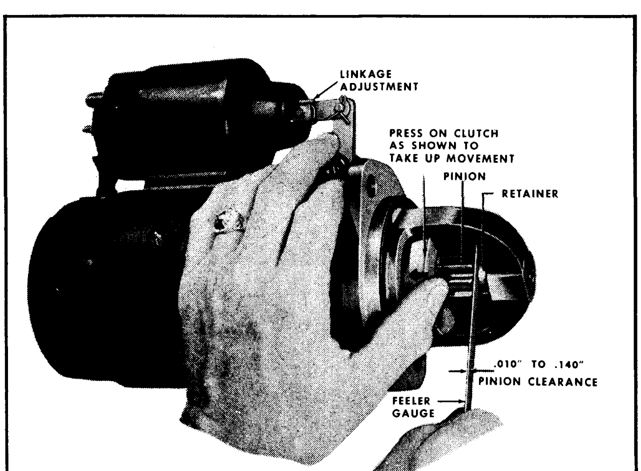


Fig. 13-33 Checking Pinion Clearance

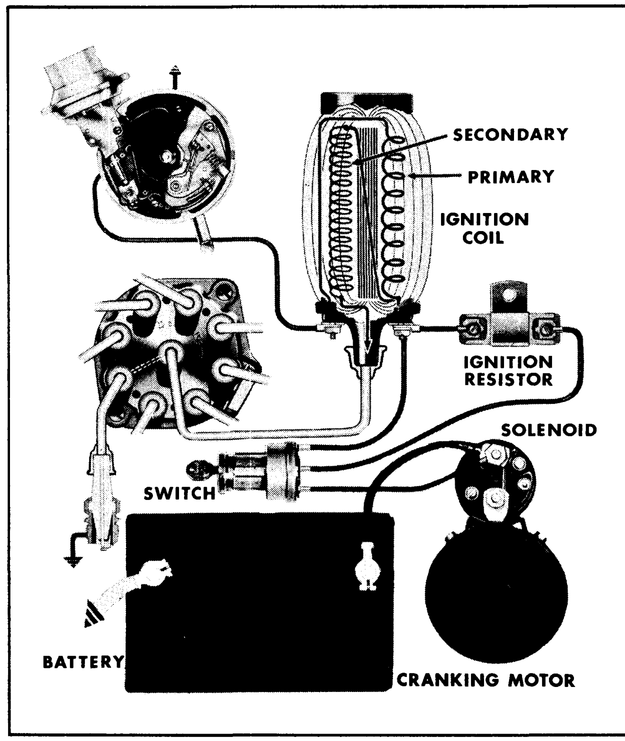


Fig. 13-34 Ignition System

approximately 4 volts (two battery cells in series) between the solenoid winding "S" terminal and ground.

CAUTION: Do not connect the voltage source to the ignition coil terminal of the solenoid. Do not use a 12-volt battery instead of the 4 volts specified, as this will cause the motor to operate. As a further precaution to prevent motoring, connect a heavy jumper lead from solenoid motor terminal to ground. Push the solenoid plunger into the solenoid by hand. Once in, battery current will hold it in place. Push the pinion back as far as possible to take up any movement, and check the clearance with a feeler gauge. (See Fig. 13-33) Adjust pinion clearance by loosening the screw in the plunger linkage and shortening or lengthening the linkage as required. Retighten the screw securely when adjustment is correct.

IGNITION CIRCUIT

The ignition circuit (Fig. 13-34) includes the distributor, ignition coil, ignition resistor, ignition switch, spark plugs, and battery. (For servicing of the battery, see CHARGING CIRCUIT.)

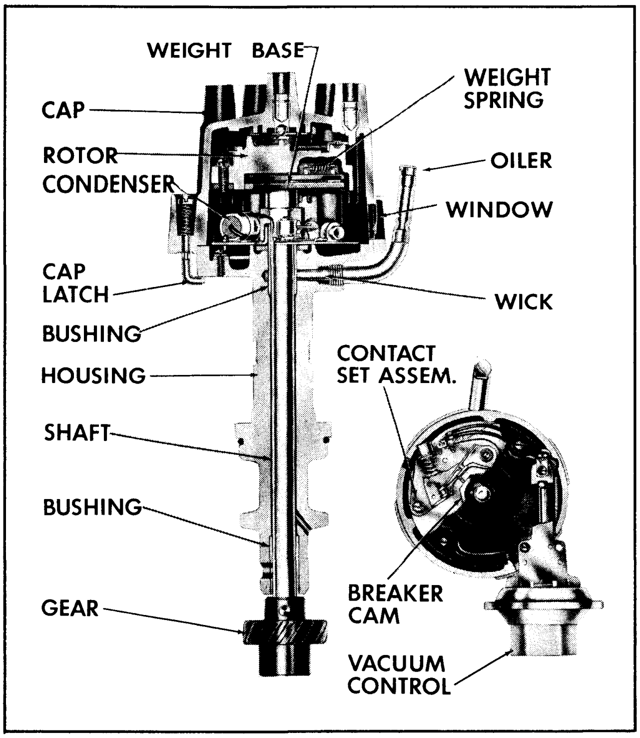


Fig. 13-35 Distributor Details

DISTRIBUTOR FIG. 13-35

The new external adjustment type distributor is a 12-volt, 8-cylinder unit. The cap has a window for adjusting point opening while the cap is in a mounted position. The contact point set is replaced as one complete assembly. The service replacement contact set has the BREAKER LEVER SPRING TENSION and POINT ALIGNMENT pre-factory adjusted. Only the POINT OPENING requires adjusting after replacement.

Under part throttle operation the intake manifold vacuum is sufficient to actuate the vacuum control diaphragm; thus advancing the spark and increasing fuel economy. During fast acceleration or when the engine is pulling heavily, the vacuum is not sufficient to actuate the diaphragm, and the movable breaker plate is held in the retarded position.

The centrifugal advance mechanism consists of a cam actuated by two centrifugal weights controlled by springs. As the speed of the distributor shaft increases with engine speed, the centrifugal advance weights move outward which advances the cam causing the contact points to open earlier and thus advancing the spark.

IGNITION COIL AND IGNITION RESISTOR

The external resistor, connected in series with the primary circuit between the battery and coil increases coil efficiency by dissipating nearly half the heat which otherwise would be generated within the coil itself. The resistor is bypassed during cranking, thereby connecting the ignition coil directly to the battery. This makes full battery voltage available to the coil and thus keeps ignition voltage as high as possible during cranking. The bypassing of the resistor during cranking is accomplished within the ignition switch.

IGNITION AND STARTING SWITCH

The ignition and starting switch is key-operated to close the ignition primary circuit and to energize the solenoid for cranking. Accessories, including electric windows, may be used when the engine is not running if the ignition key is turned to the extreme left position.

SPARK PLUGS

Type 44 spark plugs are used on 1956 Rocket engines. Plugs have 14 mm. threads and 13/16" hex body. The proper gap setting is .030". Satisfactory results can be assured only when genuine AC plugs of the type recommended are used.

A silicone nipple is installed on each spark plug to keep the spark plug porcelain clean and dry in all weather conditions.

PERIODIC SERVICE

The distributor and spark plugs are the only ignition system components that require periodic service. The remainder of the ignition system requires only periodic inspection to check operation of the units, tightness of the electrical connections, and condition of the wiring.

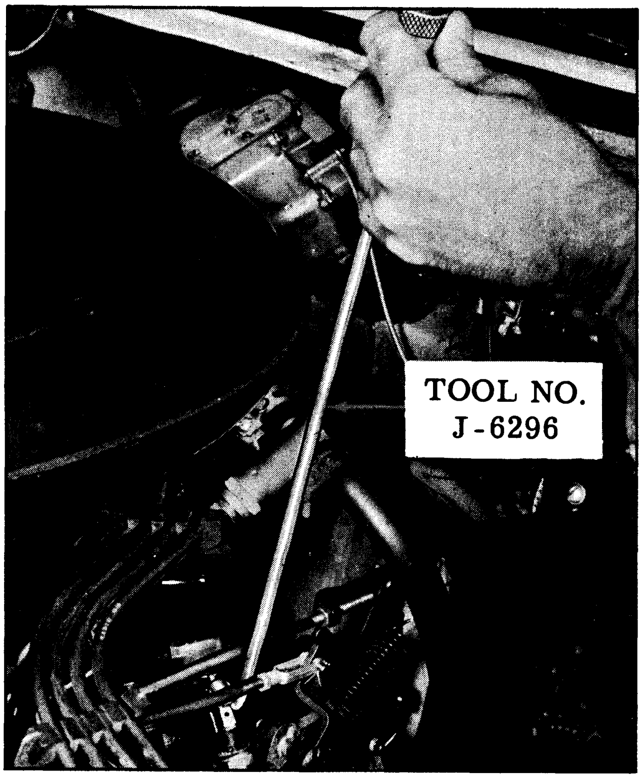


Fig. 13-36 Adjusting Dwell Angle

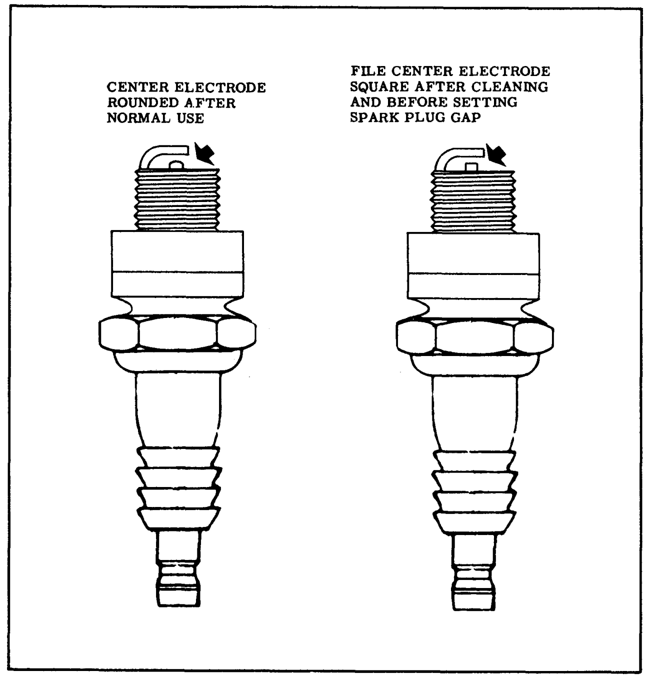


Fig. 13-37 Filing Center Electrode

DISTRIBUTOR

The hinge cap oiler should be filled with light engine oil at each vehicle lubrication period. When replacing contact set assembly, and at every 5,000 mile interval thereafter add a trace of Delco-Remy Cam and Ball Bearing Lubricant, or equivalent, to the breaker cam. No other lubrication is required. The movable breaker plate is lubricated by oil from the upper main shaft bushing.

In addition to lubrication, the distributor requires periodic inspection of the cap and rotor, wiring, breaker points, and timing.

Adjustment of Distributor Dwell Angle On The Car

1. Inspect contact points and clean if necessary.
2. Connect a dwell meter to the primary distributor lead terminal on the coil and a suitable ground.
3. With the engine running at idle, the dwell angle is adjusted by first disconnecting the thermal unit wiring to gain accessibility; then raise the window provided in the cap and insert dwell adjusting Tool J-6296, into the head of the adjusting screw as shown in Figure 13-36.
4. Adjust the dwell angle to 29°. (Tolerance is 26° to 33°)

   NOTE: If the dwell angle reading is erratic, checking of the primary circuit, points, and condenser will be necessary. The variation in cam angle readings between idle speed and 1750 engine R.P.M. should not exceed 3°. Excessive variation in this speed range indicates wear in the distributor.

SPARK PLUGS

Spark plugs should be checked and tested frequently to obtain maximum performance. Each time spark plugs are removed from an engine and cleaned, the following precautionary steps should be performed to insure against voltage leakage.

1. The spark plug center electrode should be filed absolutely flat before the gap setting is made. (See Fig. 13-37)

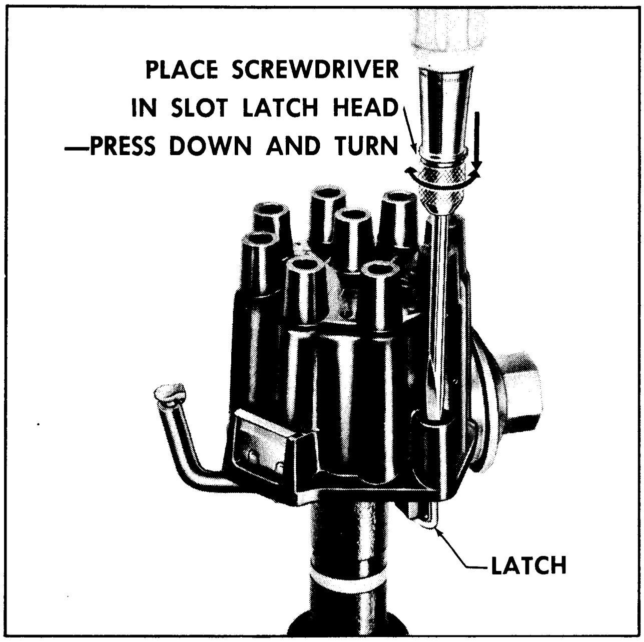


Fig. 13-38 Distributor Cap Removal

2. Any traces of paint or dirt should be cleaned from the spark plug porcelain.
3. All plugs should be checked for cracks in the porcelain. These cracks are not always visible because they may be hidden by the steel body. Use a spark plug tester to test plugs. Replacement must be made if cracks are found.

IGNITION SYSTEM DIAGNOSIS

If the engine does not run, the ignition system may be at fault if:

1. There is no spark during cranking when a spark plug wire is held 1/4" from the engine.
2. The engine starts but immediately stops when the ignition switch is released from the "START" position.

If the above checks indicate that the ignition system is at fault, the following checks may be made to help locate the difficulty, or locating trouble in the ignition system if the car runs, but not satisfactorily. All checks are to be made with the lights and accessories off and in the sequence shown.

DISTRIBUTOR

Removal of Distributor

1. Disconnect the distributor primary wire from coil.
2. Remove distributor cap as shown in Fig. 13-38. Place screw driver in slot of latch, press down and turn 1/4 of a turn in either direction.
3. Remove vacuum line from distributor.
   NOTE: Check position of rotor arm so distributor can be installed in same position.
4. Remove distributor clamp screw and hold-down clamp; then, remove distributor.
5. If necessary to remove secondary leads from distributor cap mark position on cap tower for lead to No. 1 cylinder. This will aid in reinstallation of leads on cap.

Distributor Inspection and Cleaning

With the distributor removed from the vehicle, place the distributor in a distributor testing machine. When mounting distributor in tester, first secure the gear in the drive mechanism, then push distributor housing down toward the gear to take up end play between the gear and housing, and finally secure the housing in the tester. Test the distributor for variation of spark, correct centrifugal and vacuum advance (See TEST SPECIFICATIONS), and condition of contact points. This test will give valuable information on the distributor condition and indicate parts replacement which may be necessary.

Replacing Distributor Contact Set

1. Remove the two attaching screws which hold the base of contact set assembly in place. (See Fig. 13-39)
2. Remove the condenser lead and primary lead from the contact set terminal by loosening the screw.
3. Upon reassembly, install the primary leads as shown in Fig. 13-40. Leads must be properly located to eliminate lead interference between cap, weight base, and breaker advance plate.
4. Apply a film of Delco-Remy Cam and Ball Bearing Lubricant, or equivalent, to the breaker cam.

IGNITION SYSTEM CHECKS

Step No.	Operation	Specification	Refer to Following Chart
1	Check all connections in Primary and Secondary circuit		
2	Remove secondary lead from distributor cap. Hold 1/4 inch from engine while cranking, and observe if spark occurs.		If spark occurs-Group A
3	Check Voltage V_1 while cranking	1 Volt Max.	Group B
4	Check Voltage V_2 ignition switch "On", points open.	Normal Battery	Group C
5	Check Voltage V_2 ignition switch "On", points closed.	5 to 7 Volts	If over 7-Group D or E If under 5-Group F or G
6	Check Voltage V_3 ignition switch "On", points closed.	0.2 Volts Max.	Group D
7	Check Voltage V_4 ignition switch "On", points closed.	0.7 Volts Max.	Group F
8	If these checks to fail to find cause of trouble - remove distributor, coil, and resistor from engine and check to specifications. Also, check wiring harness.		

CONDITIONS PERTAINING TO IGNITION SYSTEM CHECKS

Group No.	Possible Trouble
A	Distributor Cap Rotor Spark Plug Wiring
B	Open circuit from battery side of coil to solenoid switch Solenoid switch not closing ignition circuit Ground in circuit from coil terminal to solenoid switch Ground in coil
C	Low battery Points not open Ground in circuit from coil to distributor Ground in distributor Ground in coil Ground in circuit from coil to solenoid switch or to resistor
D	Contacts not closed Loose connection in distributor Distributor not grounded to engine Faulty contacts - if faulty, recheck Step 5
E	Loose connection between coil and distributor Resistor out of circuit due to shorted or incorrect wiring Solenoid switch contacts stay closed Resistor has too little resistance Coil primary is open
F	Loose connection from resistor through ignition switch circuit to battery.
G	Loose connection between resistor and coil Resistor is open or has too much resistance

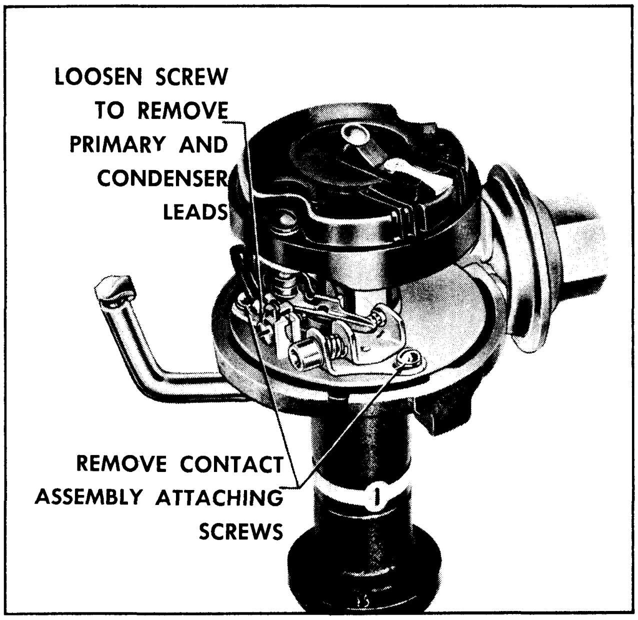


Fig. 13-39 Contact Point Assembly Removal

Adjusting Distributor Dwell Angle

1. With distributor mounted in distributor testing machine, connect the dwell meter to the distributor primary lead.
2. Turn the adjusting screw to set the dwell angle at 29° (Tolerance is 26° to 33)

If a distributor tester is not available, the dwell angle may be adjusted as follows:

1. Mount distributor in a vise.
2. Connect a testing lamp to the primary lead.
3. Rotate the shaft until one of the circuit breaker cam lobes is under the center of the rubbing block of the breaker lever.
4. Turn the adjusting screw (clockwise) until the lamp lights, then give the wrench one-half turn in the opposite direction (counter-clockwise) giving the proper dwell angle.

When distributor has been installed in car, point opening must be reset by connecting a dwell meter to the primary distributor lead terminal on the coil and a suitable ground. The dwell angle must be set at 29° with the engine running at idle speed.

Rotor

The rotor is retained by two screws and

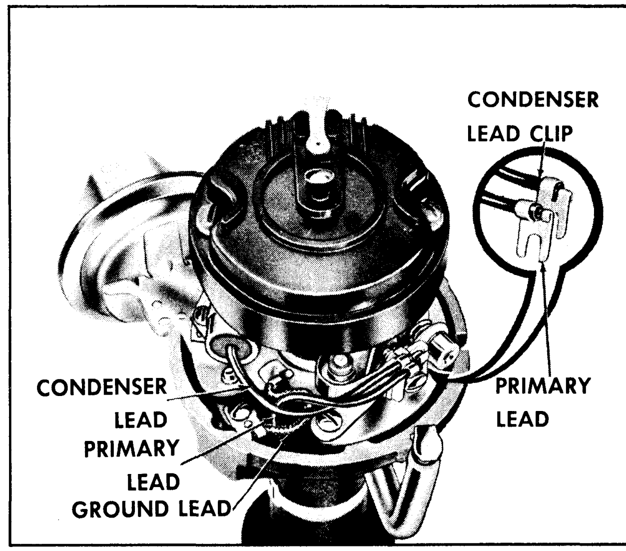


Fig. 13-40 Distributor Wiring

is provided with round and square lugs which engage with the mechanical advance plate so that the rotor may be installed in only one position. (See Fig. 13-41)

Mechanical Advance

The mechanical advance weights and springs are accessible by removing the rotor. The mechanical advance plate is assembled to the breaker cam. In order to remove the breaker cam and advance

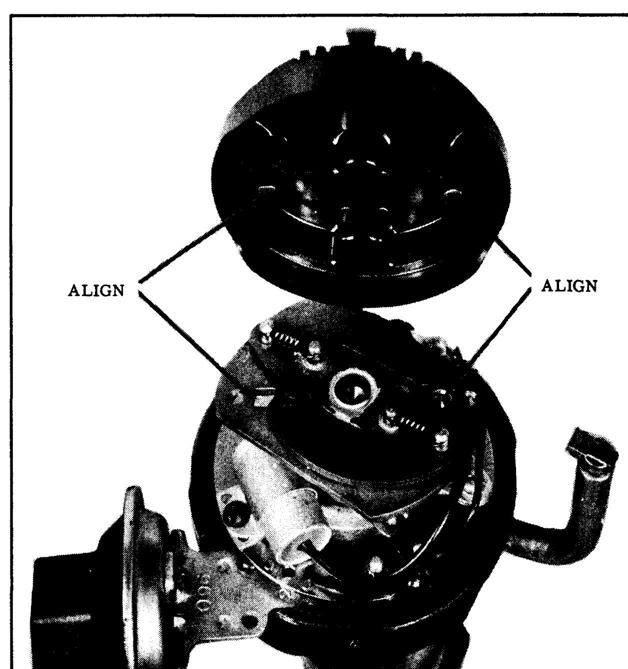


Fig. 13-41 Rotor Installation

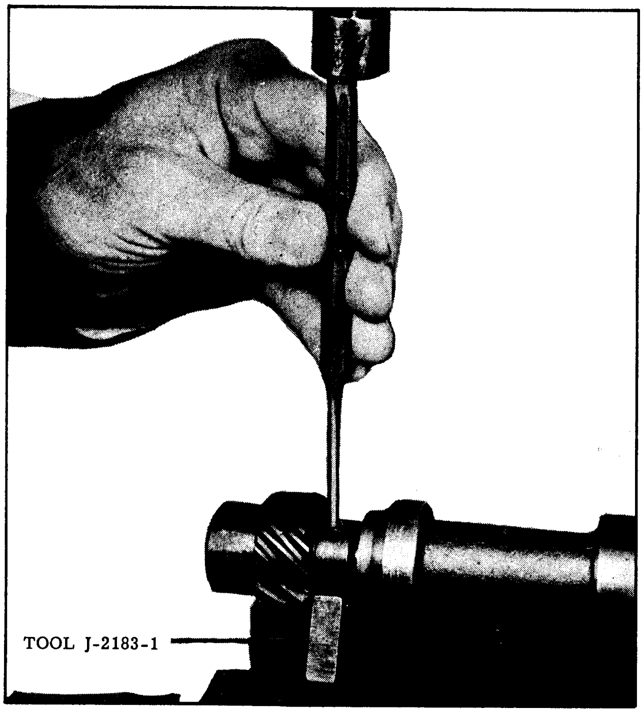


Fig. 13-42 Removal of Driven Gear Pin

plate, follow the procedure for Vacuum Advance Unit, Removal.

VACUUM ADVANCE UNIT

Removal

1. Remove the 2 vacuum advance attaching screws with an off-set screw driver. (See Fig. 13-35)
2. Turn the breaker plate clockwise and push the rod end of the vacuum advance down so that it will disengage

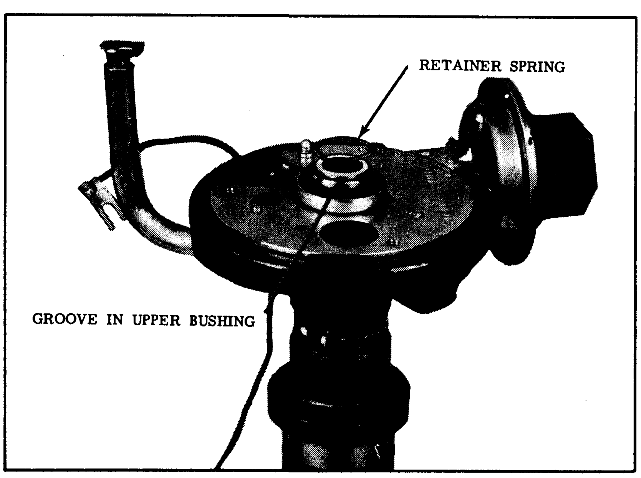


Fig. 13-43 Breaker Plate Removal

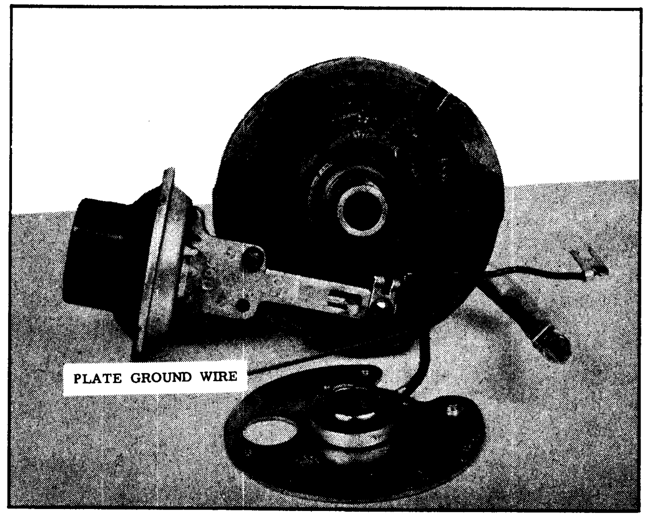


Fig. 13-44 Vacuum Advance Installation

and clear the breaker plate. Remove vacuum advance unit.

Replacement

1. Insert the rod end of the unit between the housing and the breaker plate.
2. Turn the breaker plate clockwise so that the rod end of the vacuum advance can be inserted into the hole in the breaker plate.
3. Install the attaching screws with the ground lead terminal under the inner mounting screw. (See Fig. 13-44)

DISTRIBUTOR DISASSEMBLY AND ASSEMBLY

NOTE: To remove the breaker plate, or breaker cam it is necessary to remove the distributor driven gear and shaft. To remove the above mentioned parts, the following procedure should be followed.

Disassembly

1. Mark distributor shaft and gear so that they may be reassembled in the same position.
2. File the staking from the driven gear pin and drive out the pin. (See Fig. 13-42)
3. Pull the distributor assembly from the gear, then pull the distributor shaft and breaker cam from the housing.
4. Remove the snap ring from the upper

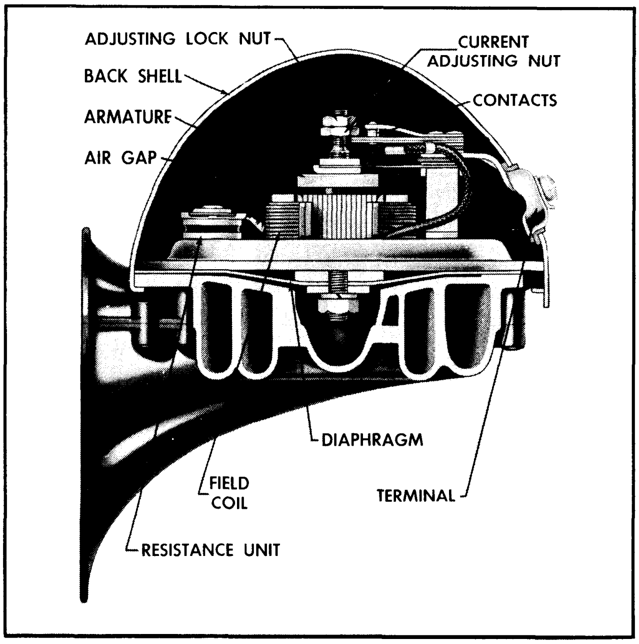


Fig. 13-45 Horn Assembly

bushing and lift breaker plate and felt wick from the upper bushing. (See Fig. 13-43)

5. Remove the two retaining screws and the vacuum advance.

ASSEMBLY

1. Install the vacuum advance with the ground lead terminal under the inner mounting screws. (See Fig. 13-44)
2. Place the felt wick on the upper bushing, then place the breaker plate over the upper bushing and vacuum advance link.
3. Install the snap ring on the upper bushing.
4. Slide the distributor shaft through housing bushings.
5. Push the distributor shaft into the driven gear with the holes aligned.
6. Install and stake a new pin. Exercise care while staking, to prevent damaging the gear.
7. Lubricate distributor as outlined under PERIODIC SERVICE, and check and/or adjust dwell angle, vacuum advance, and mechanical advance. Refer to ELECTRICAL SPECIFICATIONS (Distributor).

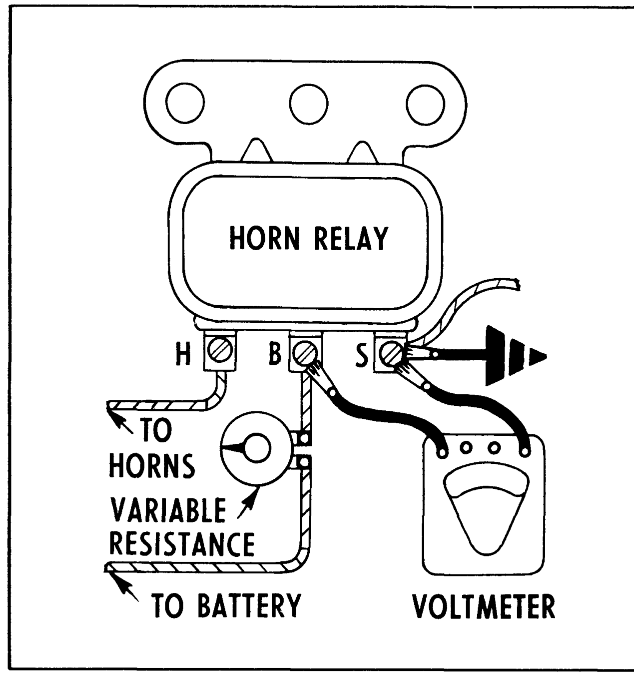


Fig. 13-46 Checking Horn Relay Closing Voltage

HORNS

The two horns are designed to give a blended tone when operated together. Each of these horns uses a magnetically actuated diaphragm to develop a resonating air column in the horn projector.

Quick Checks For Horn Trouble

When analyzing faulty horn operation, any of three basic conditions may be found. These conditions are:

1. Horn Will Not Operate
2. Horn Operates But Has Poor Tone
3. Horn Operates Intermittently

Horn Will Not Operate—

This condition may result from:

1. Defective relay, horn button, or wiring.
2. Defects within the horn. (See Bench Checks)

To locate the trouble, connect a jumper lead to the "H" and "B" terminals of the relay. (See Fig. 13-46) If the horn blows, the trouble is in the relay, horn button, or wiring. To determine whether the relay, horn button, or wiring is at fault, ground the "S" terminal of the relay. If the horn blows, the horn button or wiring is at fault. If the horn does not blow, and the wiring between the battery and relay is not defective, connect a voltmeter between the horn terminal and the horn mounting nut. Again, connect the jumper lead to the "H" and "B" terminals of the relay and note the voltmeter reading.

If no voltmeter reading is obtained, the wiring between the relay and horn is open or the horn is not grounded. If the voltmeter reading is less than 7.0 volts, the trouble is due to high resistance connections in the wiring or a faulty horn. If the voltmeter reading is above 7.0 volts, the trouble is due to a faulty horn which should be removed for a bench check.

Horn Operates But Has Poor Tone—

This condition may result from:
1. Low available voltage at the horn.
2. Defects within the horn. (See Bench Checks)

Although the horn should blow at any voltage above 7.0 volts, a weak or poor tone may occur at operating voltages below 11.25 volts. If the horn has a weak or poor tone at an operating voltage of 11.25 volts or higher, remove the horn for a bench check.

Horn Operates Intermittently—

This condition may result from:
1. Loose or intermittent connections in the horn relay or horn circuit.
2. Defective horn switch.
3. Defective horn relay. (See Horn Relay Checks and Adjustments)
4. Defects within the horn. (See Bench Checks)

Bench Check

Inspection

Remove the back shell and carefully check the horn for loose or broken leads and connections. Inspect the air gap to make certain it is free of foreign material, such as burrs, steel shavings, etc. If no cause for failure is found, check the current adjustment.

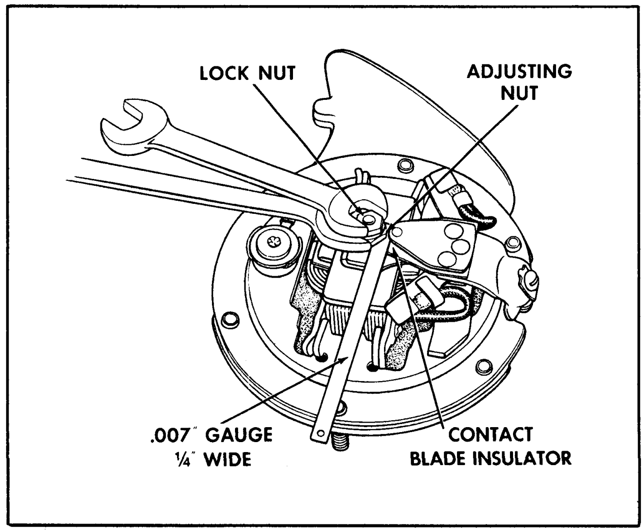


Fig. 13-47 Horn Current Adjustment

Current Adjustment

To check the current adjustment, measure the current draw of the horn while the horn is operating. The low note horn (identified by 753 on the edge of the casting) should have a current draw of 8.5 - 10.5 amperes at 11.5 volts. The high note horn (identified by 754 on the edge of the casting) should have a current draw of 7.5 - 9.5 amperes at 11.5 volts. To change the current adjustment, bend the adjusting bracket down to decrease the current and up to increase the current. Adjust the current to the specified value.

An alternate method of adjusting the horn is as follows: Insert a .007" feeler gauge (not more than 1/4" wide) between the adjusting bracket and the contact blade insulator. (See Fig. 13-47) Do not allow the gauge to touch the contact point. Connect the horn to a 12-volt battery and bend the adjusting bracket to a position where the horn will just operate. Check the horn performance with the feeler gauge removed.

Horn Relay Checks and Adjustments

Three checks and adjustments are required on the horn relay: air gap, point

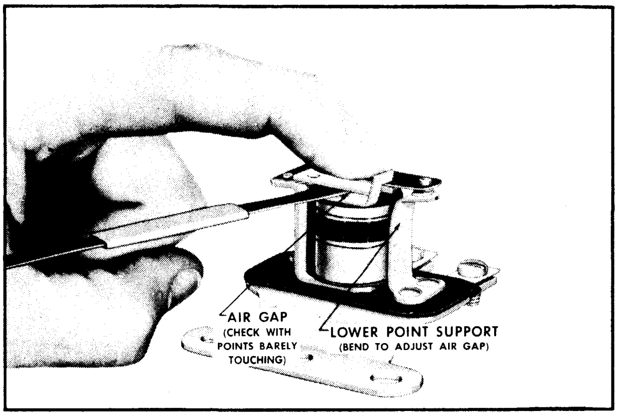


Fig. 13-48 Checking Horn Relay Air Gap

opening, and closing voltage. The air gap and contact point opening checks and adjustments should be made with the battery disconnected.

Air Gap

Check the air gap with the points barely touching and adjust to .014", if necessary, by bending the lower point support. (See Fig. 13-48)

Contact Point Opening

Check the contact point opening and adjust to .027" by bending the upper armature stop. (See Fig. 13-49)

Closing Voltage

To check the relay closing voltage, con-

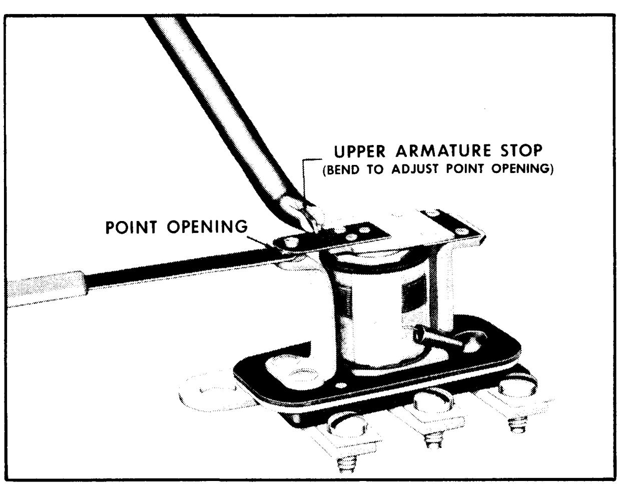


Fig. 13-49 Adjusting Horn Relay Contact Point Opening

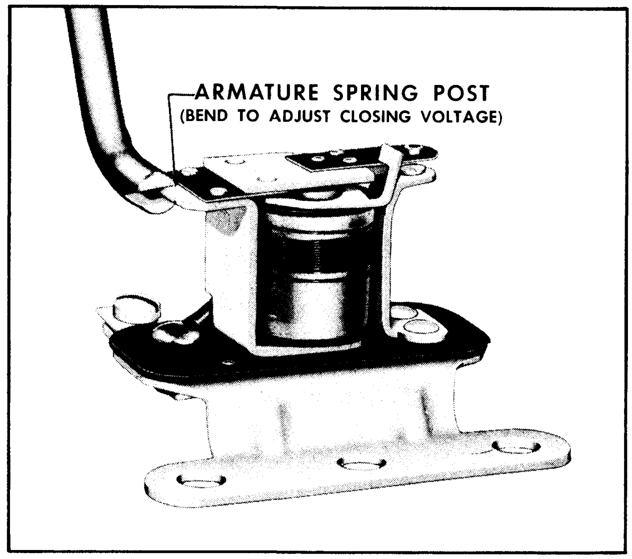


Fig. 13-50 Adjusting Horn Relay Closing Voltage

nect a variable resistance of not less than 10 ohms in series with the relay "B" terminal and connect a voltmeter between the "S" and the "B" terminals as shown in Fig. 13-46. Slowly decrease the amount of resistance in order to check the relay closing voltage. Adjust the closing voltage to 6.5 (if outside of 5.0 - 9.0) by bending the armature spring post. (See Fig. 13-50) Bending down to increase the spring tension increases the closing voltage while bending up decreases the closing voltage.

NOTE: Horn relay terminals may not carry any markings but relationship of the terminals is as shown in Figure 13-46.

TURN SIGNAL

A turn signal, standard on all models, is used to indicate when a turn is about to be made. The signal is operated by a small control lever mounted at the left side of the housing just below the steering wheel.

When a turn is to be signaled, the lever should be pushed up for a right turn or down for a left turn which will cause the parking light at the front and the stop light at the rear, as well as a pilot light at one side of the speedometer face, to automatically flash the direction to be turned at the rate of 80 to 100 flashes per minute. (The flasher rate is not adjustable.)

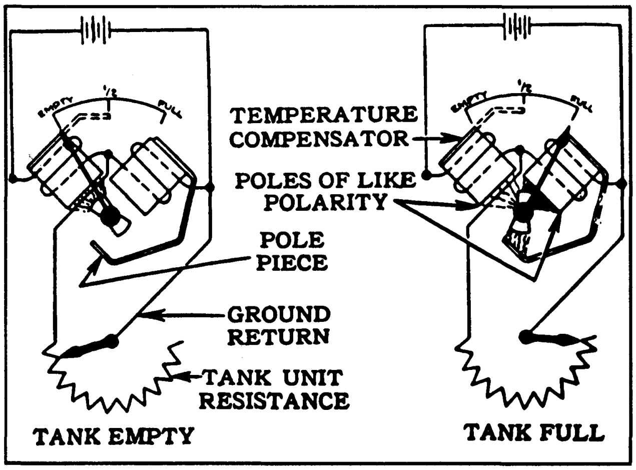


Fig. 13-51 Gasoline Gauge Diagram

NOTE: Failure of the pilot bulb on the instrument panel to light indicates either a burned out bulb in the parking, tail, or pilot lamp, or a failure in the signal system. The most frequent causes of failure are loose connections and burned out bulbs. The turn signal switch is mounted on the mast jacket below the instrument panel. For servicing of the turn signal collar see STEERING SECTION.

Adjustment

To adjust the turn signal switch (on cars equipped with Hydra-Matic), loosen the switch attaching screws on the mast jacket. With the turn signal lever in the "neutral" position, position the switch until two .090" pins can be inserted into the holes on the face of the switch. Tighten the switch attaching screws and remove pins.

GASOLINE GAUGE

An electric gasoline gauge with push-on type terminals is used on all models.

The instrument panel unit consists principally of two coils spaced 90^o apart with an armature and pointer assembly mounted at the intersection of the coil axis.

The tank unit is essentially a rheostat, the movable contact of which is actuated by a float which rests on the surface of the gasoline in the tank.

The gauge is compensated for temperature variation and is not affected by variation in voltage of the battery.

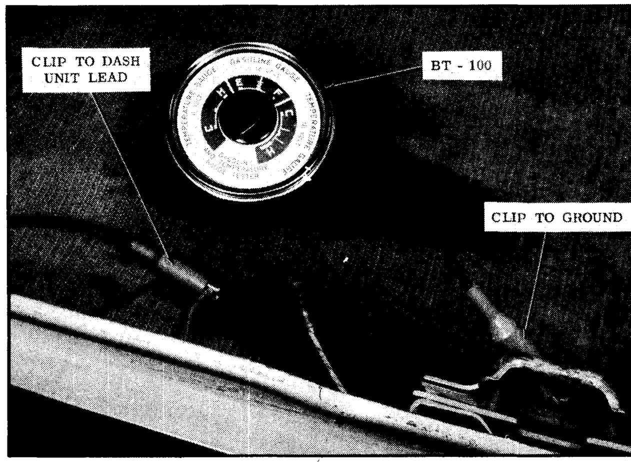


Fig. 13-52 Checking Fuel Gauge

Figure 13-51 shows the fundamental electrical circuit of the gauge, and also the magnetic relationship of the two coils.

Checking Tank Unit and Instrument Panel Unit of the Gas Gauge

The gas gauge is composed of two units: a unit mounted in the instrument panel, and a second unit mounted in the gas tank. The accuracy of these units may be checked with the Borroughs Tester BT-100.

Testing Gasoline Gauge

1. Connect Tester BT-100 between gas tank unit wire and ground of car at bayonet terminal as shown in Fig. 13-52.
2. Turn Tester pointer to "E" calibration position.
3. Turn on ignition key, start engine, and read instrument cluster gauge. Instrument cluster gauge should read within 1/16 inch of "E" position.
4. Turn Tester pointer to "1/2" calibration position.
5. Turn ignition key "off" and then "on", start engine, and read gauge. Instrument cluster gauge should read within 1/16 inch of the "1/2" calibration point.
6. Turn Tester pointer to the "F" calibration position.
7. Turn ignition key "off" and then "on", start engine, and read gauge. Instrument cluster gauge should read within 1/16 inch of the "F" calibration position.

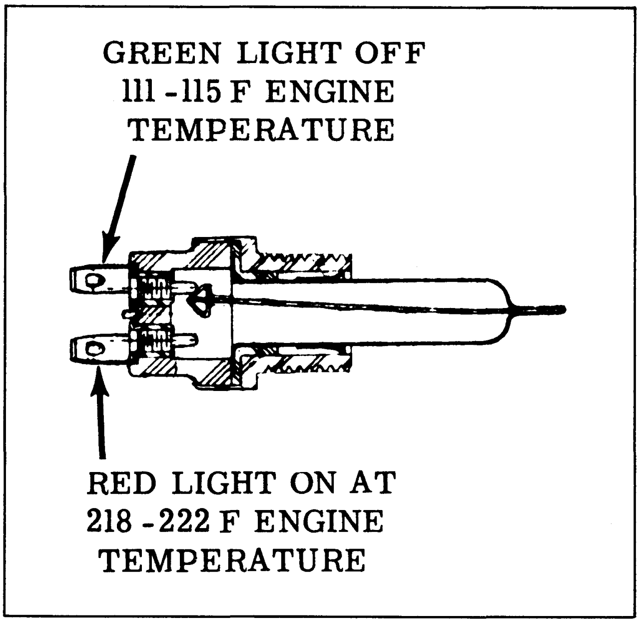


Fig. 13-53 Thermo Unit Details

NOTE: If gauge registers correctly, the trouble is in the gas tank unit. If gauge does not register correctly, the trouble may be in the wiring or cluster gauge. Remove wire from terminal of gas gauge and connect Tester directly between gauge terminal and ground. Test gauge as outlined above. If gauge now registers correctly, the trouble is in the wiring. If gauge does not register correctly, the trouble is in the gauge.

The acceptable tolerance is not more than 1/16 inch high or low from calibration position "E", "1/2", and "F".

If dash unit and wiring check O.K.:

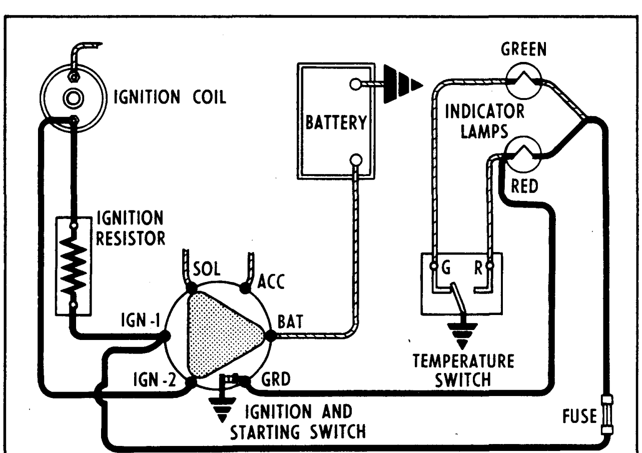


Fig. 13-54 Temperature Indicator Wiring Circuit

1. Drop tank and remove tank unit. Clean away all dirt that has collected around tank unit terminal. Road dirt, particularly calcium chloride, causes an electrical leak that will throw the unit out of calibration.
2. After cleaning thoroughly, connect tank unit to wire leading to dash grounding tank unit with a short piece of wire from outer edge to any part of car. Turn ignition switch "on" and move float arm up and down. If this unit is O.K., dash unit will give corresponding "EMPTY" and "FULL" readings.
3. If tank unit is O.K., reinstall in the tank. If not, replace with a new tank unit but first repeat above test before installing in the tank.

NOTE: Always check tank units for freedom of movement of the float arm by raising it to various positions and observing that it will fall to "EMPTY" position in every instance.

When connecting wires to dash unit, make certain that the wire which leads to the tank unit does not come in contact with ammeter connection or the upper terminal on dash unit marked "ignition", as this might result in damage to the tank unit rheostat.

TEMPERATURE INDICATOR

The engine temperature indicator lights in the instrument cluster are operated by a thermal unit located at the rear of the left hand cylinder head. The new thermal unit contains a bi-metal strip which is actuated between two terminals within the unit. (See Fig. 13-53) When the engine is cold or excessively hot, the bi-metal strip contacts a terminal which permits the green or red indicator light circuit to be completed by grounding through the thermal unit. When the ignition switch key is turned to the start position a test circuit is closed to determine if the red light is functioning properly. (See Fig. 13-54) When a cold engine is started, the green light comes on to indicate that the engine is not up to operating temperature. This light remains on until engine temperature, at the rear of

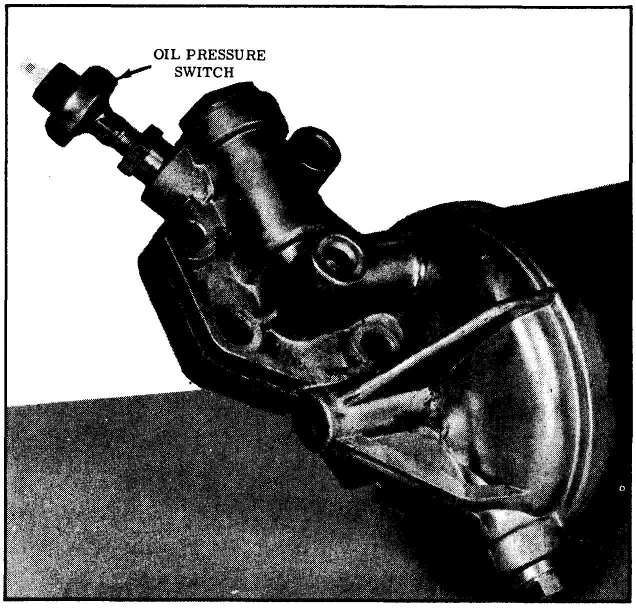


Fig. 13-55 Oil Pressure Switch

the cylinder block, reaches 111° - 115°F. at which time the light automatically turns off. If the engine reaches an abnormally high temperature, the red indicator light in the instrument cluster will come on at 218° - 222°F. denoting that the engine cooling system is not functioning properly.

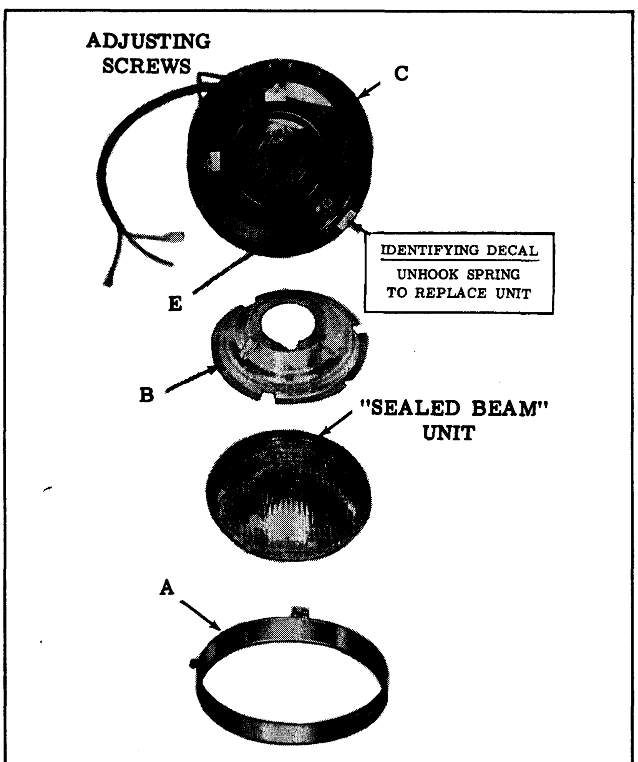


Fig. 13-56 Headlamp Assembly

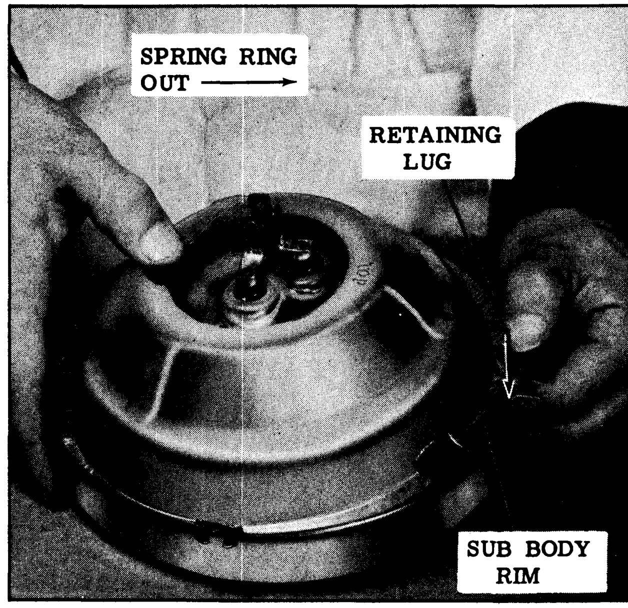


Fig. 13-57 Sub-Body Removal

Engine Oil Pressure Indicator FIG. 13-55

The engine oil filter pad now houses a diaphragm operated switch which completes a circuit for the oil pressure indicator light in the instrument cluster. When the ignition switch is turned on, a red light comes on solely for the purpose of indicating that the light circuit is functioning properly. After the engine is started and the oil pressure builds up to a safe operating pressure, the red light goes out.

HEADLAMPS

A "Sealed Beam" headlighting system is used on all models. These lamps are designed so that the light source, the reflector, the lens, and the gasket, are all assembled in one securely sealed unit.

Lamp Construction

The "Sealed Beam" unit is held between the retaining ring "A" and sub-body "B" by the snap-in engagement of the rim on the sub-body with retaining lugs on the inside edge of the retaining ring. (See Fig. 13-56) The "Sealed Beam" unit, retaining ring, and sub-body are held to the lamp

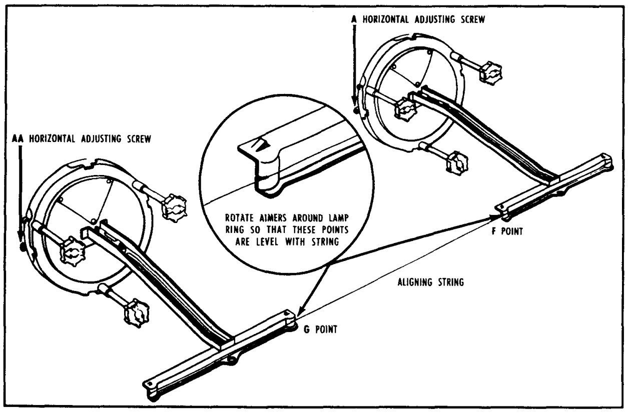


Fig. 13-58 Horizontal Aim

housing "C" by a coil spring "E" which hooks into a hole in the side of the retaining ring, and the two adjusting screws which engage slotted tabs on the retaining ring.

With the vertical and the horizontal adjustment screws, the horizontal light beam adjustment can be made without disturbing the vertical light beam setting and vice versa. The reflector unit is provided with three locating lugs which fit into corresponding slots in the sub-body. These lugs are so located that the reflector unit can be mounted in only one position.

Lamp Unit Replacement

1. Remove headlamp rim.
2. With a button-hook tool, disengage coil spring from hole in retaining ring and remove assembly. (A suitable tool can be made from an old air vent control knob assembly).
3. Spring retaining ring to disengage rim of sub-body from top lug on retaining ring and remove sub-body. (See Fig. 13-57)
4. Remove "Sealed Beam" unit from retaining ring.

To replace the "Sealed Beam" unit, proceed as follows:

1. Position "Sealed Beam" unit in retaining ring so that the "TOP" of the unit aligns with the diagonally slotted tab on the retaining ring.
2. Install sub-body by inserting flange under bottom retaining lug in retaining ring and snapping into position under side and top retaining lugs.
3. Place assembly in housing and engage slotted retaining tabs in slots in two adjusting screws.
4. Using button-hook tool, place end of coil spring in hole in retaining ring.
5. Replace headlamp rim.

"Sealed Beam" Headlamp

Aiming

To obtain the maximum results in road illumination and safety that has been built into the headlighting equipment, the headlamps should be properly aimed with the use of Guide T-3 Safety-Aimer.

NOTE: Certain states require a loading allowance for headlight aiming in which case, the headlights must be aimed with a machine that can be adjusted to compensate for the loading allowance (such as Robot Headlight Tester J-1900-C).

Adjustment (Using Guide T-3 Safety-Aimer)

NOTE: Before aiming headlights, aimers must be adjusted and the car should be on a level floor as outlined in the Tool Manufacturer's Instruction Booklet.

1. Remove headlight rims.
2. Mount aimers on seal beam units so cross arms are horizontal.
   NOTE: Mount aimer with attached string on left headlight.
3. Fasten spring-loaded string to R.H. aimer arm. Rotate aimers until string is lined up with points "A" & "B". (See Fig. 13-58)
4. Rock car sideways to equalize car springs.
5. Horizontal Aim:
   a. Loosen left headlamp horizontal adjusting screw "A", then tighten until string just touches point "F". (See Fig. 13-58)
   b. Repeat step (a) on right headlamp. Tighten adjusting screw "AA" until string just touches point "G".
   c. Recheck points "F" and "G". If necessary, readjust.
6. Vertical Aim:

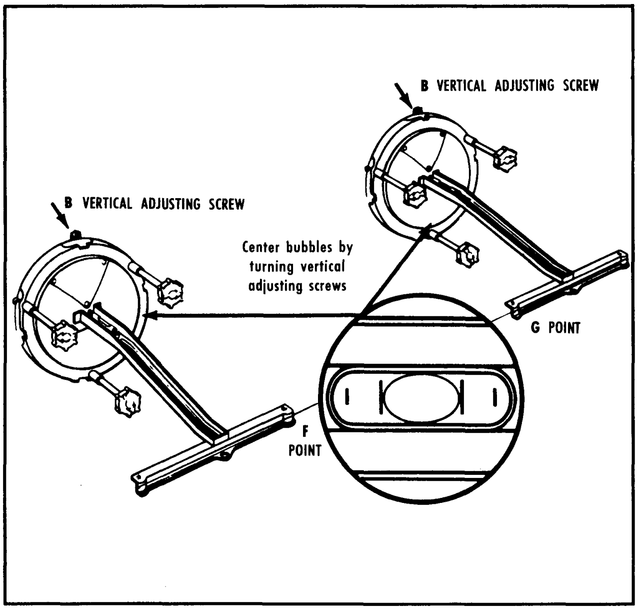


Fig. 13-59 Vertical Aim

a. Loosen vertical adjusting screws "B", then tighten until bubbles are centered in level. (See Fig. 13-59)

7. Recheck string at point "F" and "G" and readjust if necessary.

   NOTE: Always turn adjusting screws clockwise when making final adjustment.

Figures 13-58 and 13-59 illustrate the correct aiming for the upper beam. No further adjustment is needed for the traffic (lower) beam.

8. Remove aimers and install headlight rims.

Headlamp Housing

The headlamp housing is attached to the fender with sheet metal screws, and sealed with an auto-body sealer between the housing and the fender. (See Fig. 13-60)

TAIL LAMP

The tail lamp bulb is a double contact, double element unit which functions as both tail light and stop light. (See Fig. 13-61 for assembly details) - The reflector lens is an integral part of the tail light lens.

LIGHT CONTROL SWITCH

The headlighting system on all models is controlled by two switches: the control switch on the instrument panel, and the

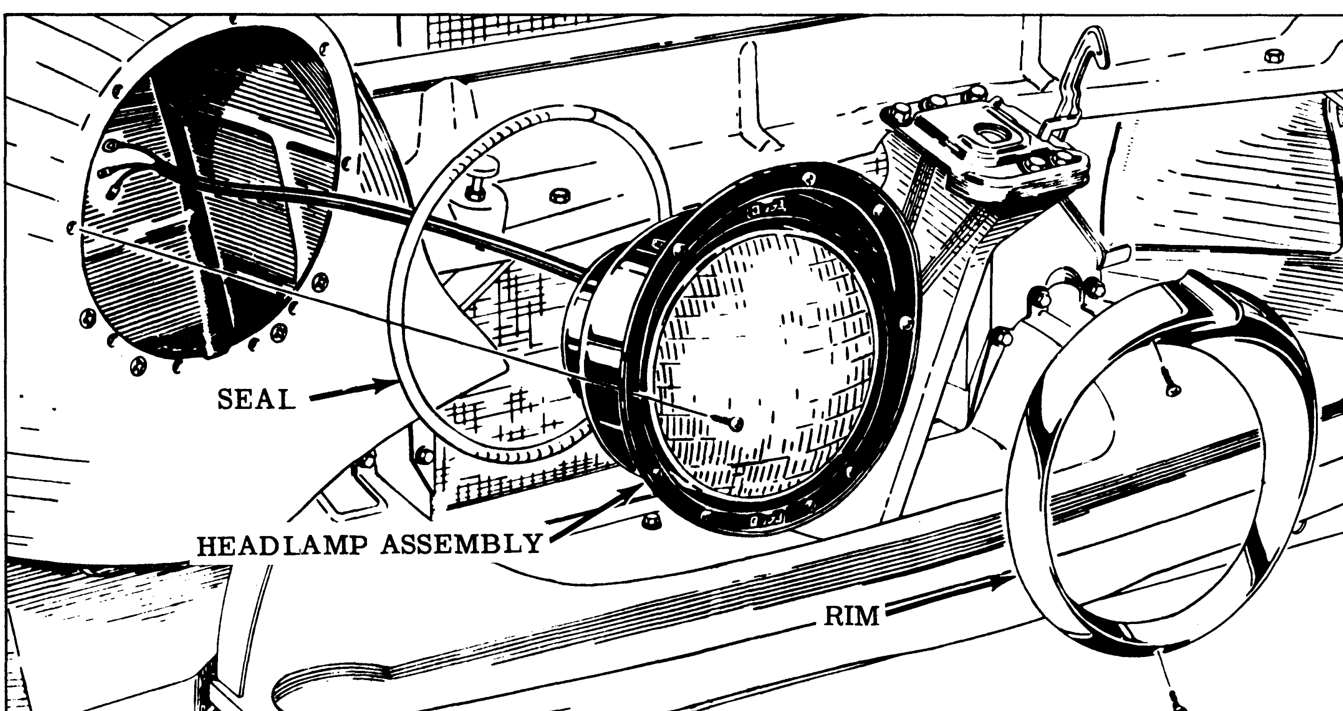


Fig. 13-60 Headlamp Housing

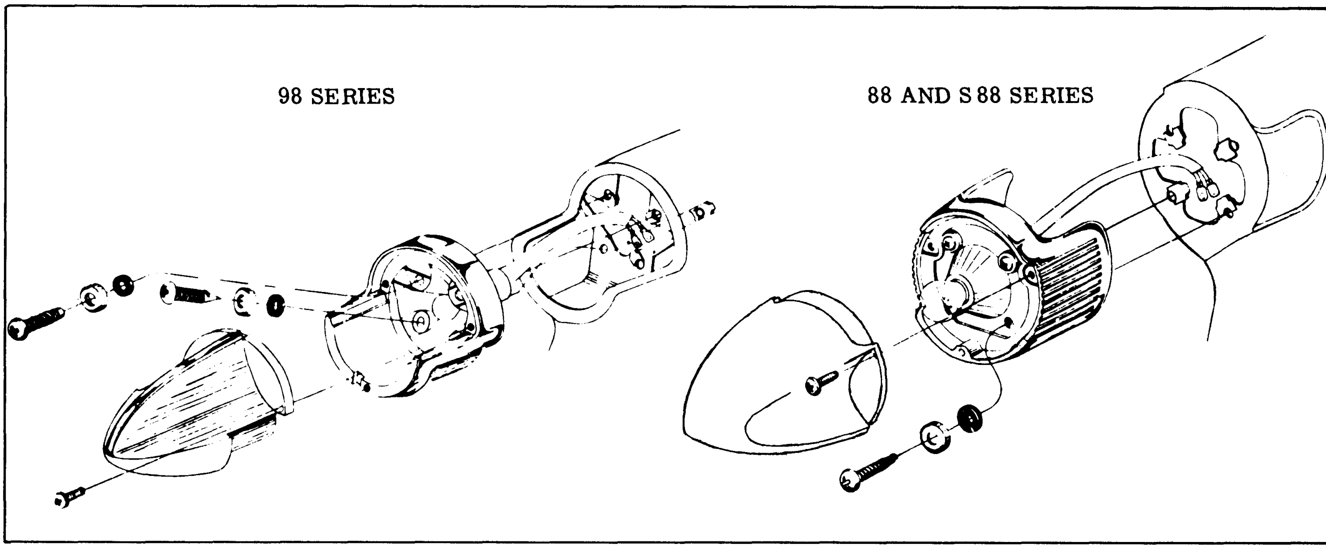


Fig. 13-61 Tail Lamp Assembly

floor control selector or "Dimmer" switch on the left side of the toe board. On cars equipped with Autronic-Eye a combination over-ride and "Dimmer" switch is used.

The instrument panel control has three positions: "Off", "Park," and "Drive," as follows:

1. First position out switches on the parking and tail lights.
2. Second position out switches on the tail lights and the headlamp upper beam or lower beam depending upon the position of the foot switch.

The upper and lower beams may be readily selected by means of the foot control switch.

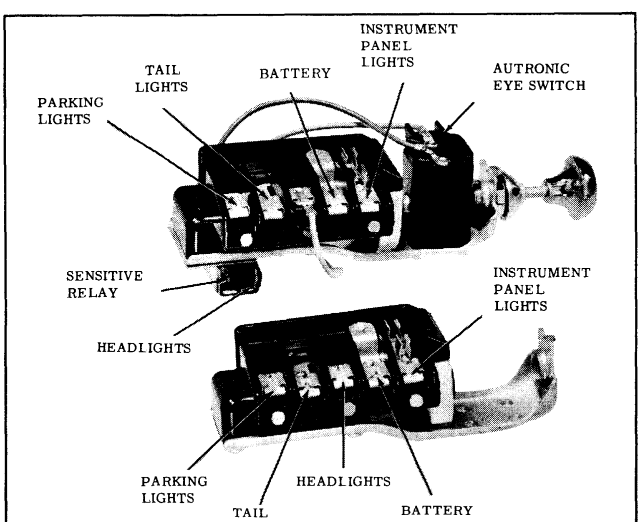


Fig. 13-62 Headlight Switch

The small red indicator, above the face of the speedometer, lights when the upper beam is in use.

On cars equipped with Autronic-Eye, the light switch incorporates an Autronic-Eye switch, located between the pull knob and bezel, which permits the selection of automatic or manual headlight beam control. However, it is necessary to have the foot dimmer switch in the upper beam position for automatic headlight control. (See Fig. 13-62)

A circuit breaker protects the parking and headlamp circuits. The tail lights are fused in the main fuse panel on the dash.

The brightness of the instrument panel lights is controlled through a resistor unit by turning the light switch knob right or left. A fuse on the light switch protects the resistor as well as the instrument panel light circuits.

Headlamp Circuit Breaker

The function of the circuit breaker on the light switch is to protect the headlamp circuits from damage which might result from short circuits.

The normal lighting current is not sufficient to operate the breaker, but a short circuit in the head light circuits will cause the breaker points to function and make the lights flicker. This provides a distinctive

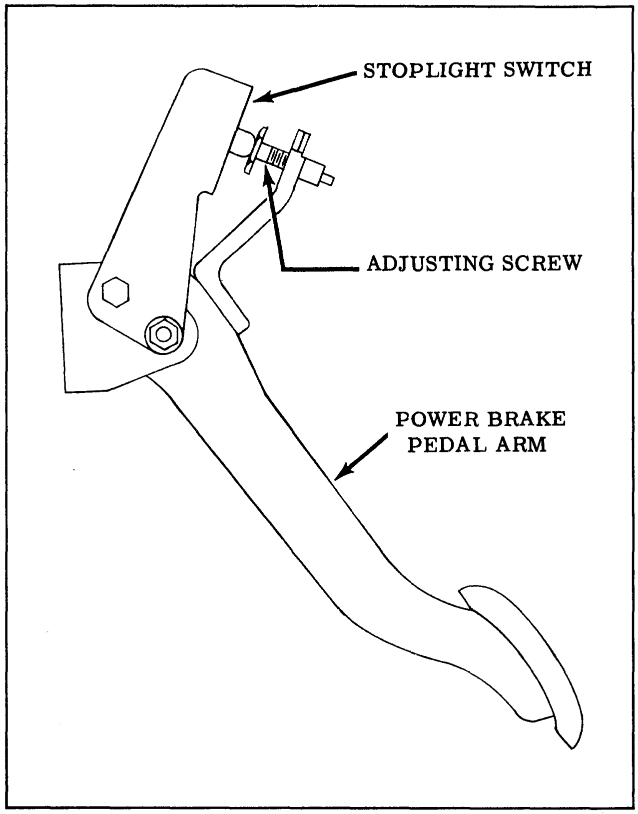


Fig. 13-63 Power Brake Switch Adjustment

warning. The flicker will continue until the trouble is remedied.

The circuit breaker is non-adjustable and should permit continuous load of 22 amps. at 70 F. for 30 minutes minimum. Points should open in less than 4 minutes under 30 amps. at 70 F., and a dead short should limit current to about 18 amps.

STOP LIGHT SWITCH (Standard Brake)

The stop light switch used with the standard brake is attached to the underside of the toepan, and is actuated by the movement of the brake pedal. If the stop light switch does not operate properly, it should be replaced.

STOP LIGHT SWITCH (Power Brake)

The stop light switch used with the power brake is mounted on the brake pedal bracket. Adjustment is made with an adjustable contact screw. (See Fig. 13-63) To obtain proper operation of the stop lights, adjust the screw as follows:

1. With brake pedal in the fully released position, turn adjusting screw until stop lights just go "off"; then turn adjusting screw four turns toward switch to obtain proper adjustment.
2. Check stop light switch operation by applying and releasing the brake, making certain that stop lights go off when brake pedal is in the fully released position.

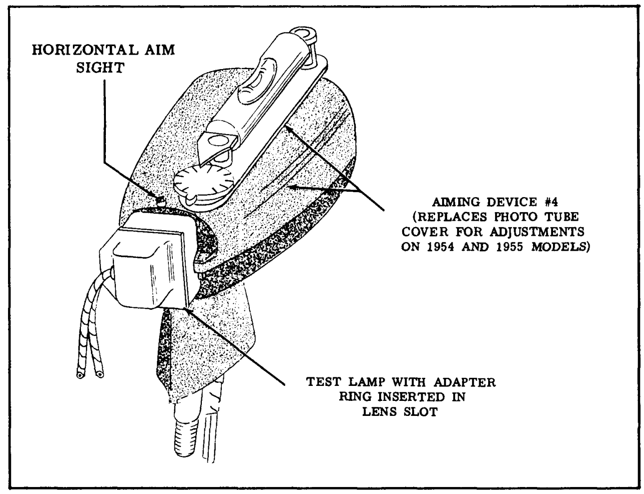


Fig. 13-64 Aiming Device AE-4 in Position

AUTRONIC EYE ADJUSTMENTS

Instructions for Using Aiming Device AE-4

Aiming Device AE-4 must be used with test lamp on model AE Tester for making adjustments on the 1956 models as shown in Fig. 13-64.

1. Remove phototube unit cover and lens.
2. Install the test lamp with adapter ring in lens slot with locator notch down.

CAUTION: Aiming Device AE-4 contains a special filter to permit the use of same meter settings on model AE-1 or AE-2 Tester for 1952 thru 1955 "Autronic-Eye" units. Do not damage filter. When not in use, Aiming Device AE-4 should be properly stored in its mounting case to protect the filter from dust and foreign particles. If the filter or any component of Aiming Device AE-4 becomes damaged, Aiming Device AE-4 should be returned to the supplier.

3. Replace original cover with Aiming Device AE-4.

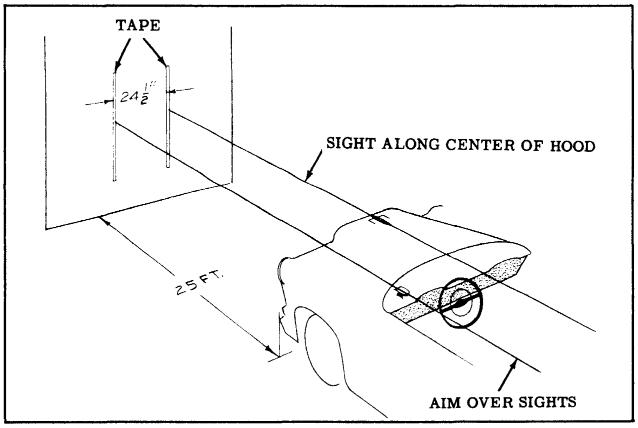


Fig. 13-65 Horizontal Aim

4. Tighten both phototube unit screws.

Vertical Aiming Adjustment

1. Phototube unit aiming should be done with car unloaded, with trunk empty except for spare tire, preferably with tank at least half full, and with correct tire pressure.
2. Locate car on a level floor. Floor must be level within 1/4" fore and aft of car.
3. Rock car gently sideways to equalize springs.
4. Adjust aiming dial on the Aiming Device to the number stamped on the name plate on bottom side of phototube unit.
5. Adjust phototube unit aiming screw until bubble is centered in level.

NOTE: The phototube unit must be aimed accurately. If the phototube unit is aimed too low, back reflections from the headlamps of the car on which the "Autronic-Eye" is installed will hold its own headlamps on the lower beam. Also, the phototube unit must be aimed as low as possible to provide the maximum tolerance for car loading.

Horizontal Aiming Adjustment

NOTE: It is important that the horizontal aim of the phototube unit be straight ahead. If the phototube unit has been removed for service, the mounting holes in the instrument panel may allow the phototube unit to be reinstalled with the HORIZONTAL AIM mispositioned. The center line of the phototube unit must be aimed parallel to the center line of the car after the installation of the phototube unit is made.

1. Place two pieces of tape or chalk marks 24-1/2" apart on a wall or screen at hood level height. (See Fig. 13-65)
2. Place the car 25 feet back from screen with center line of hood aimed at the right hand tape.
3. Remove cover and replace with Aiming Device AE-4.
4. Aim over sights to the left hand tape.

NOTE: If the unit is aimed more than 4 inches to the right or left of the left hand tape, reset phototube. In some cases it may be necessary to elongate one of the mounting stud holes in the instrument panel.

Hold Sensitivity Test

CAUTION: The "Autronic-Eye" develops 800 volts. Turn headlamps "Off" before removing cover from the phototube unit.

1. Install Aiming Device AE-4 according to instructions under Mounting of AE-4 Kit.
2. Turn headlamps "On" and WAIT AT LEAST FOUR MINUTES for amplifier to stabilize. Set standard foot dimmer switch to "Automatic" position.
   NOTE: Headlamp switch provides "Manual" and "Automatic" controls. Set this switch to "Automatic" position. (Upper beam will then be "On".)
3. Turn Zero Corrector on face of meter until meter pointer is on zero set line.
4. Turn Intensity Rheostat of tester counter-clockwise.
5. Insert tester Connector into cigar lighter receptacle.
   CAUTION: Push straight in.
6. Check car battery voltage. If less than 12 volts, operate engine at fast idle while making sensitivity tests and adjustments.
7. Turn Tester Selector Switch to "Dim" position. (Be sure to use proper Dim position for clear or tinted windshield.)
8. Turn Intensity Rheostat all the way clockwise to end of adjustment to obtain a lower beam.

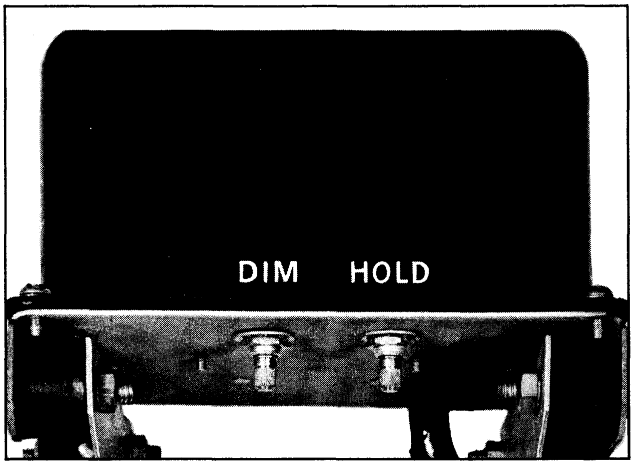


Fig. 13-66 Hold and Dim Adjustments

9. Turn tester Selector Switch to "Hold" position.
10. Slowly turn Intensity Rheostat counter-clockwise just to point where headlamps switch to upper beam. The meter pointer should now read in the Hold Sensitivity Adjustment Bar on the meter scale.

If Hold Sensitivity is not properly adjusted, proceed with Hold Sensitivity Adjustment.

Hold Sensitivity Adjustment

The Hold and Dim adjustments are knurled finger-tip controls located on the underside of the amplifier unit. The location of each is indicated by a stamp on the amplifier cover. (See Fig. 13-66) THE DIM SENSITIVITY ADJUSTMENT MUST NOT BE MADE UNTIL AFTER THE HOLD SENSITIVITY IS CORRECTLY ADJUSTED.

NOTE: A "fish-paper" retainer is pressed over the knurled adjusting knobs after the initial setting is made at the factory. The "fish-paper" retainer should be removed and DISCARDED whenever adjustments are necessary.

1. Turn Hold adjustment clockwise to end of adjustment.
2. Rotate Intensity Rheostat all the way clockwise.
3. Turn Selector momentarily to "Dim" position to switch lights to lower beam, then switch back to "Hold" position.

   NOTE: If lights do not switch to lower beam, the Dim control must be turned clockwise to end of adjustment and then readjusted after Hold adjustment is correct.)

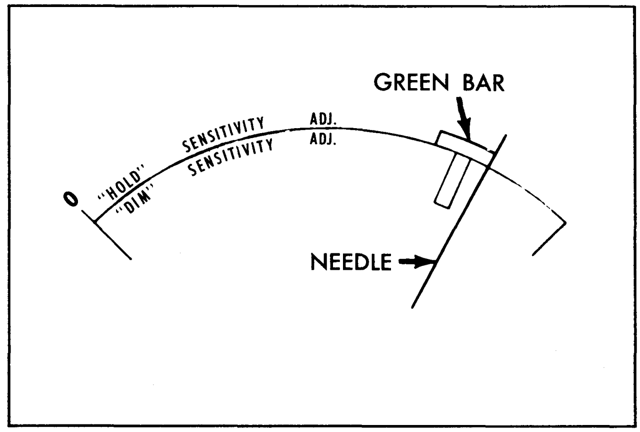


Fig. 13-67 Meter Reading for Hold Adjustment

4. Adjust tester Intensity Rheostat until meter pointer is in center of Hold Sensitivity Bar.
5. Turn the Hold control counter-clockwise SLOWLY just to the point where headlamps switch to upper beam.
6. Rotate tester Intensity Rheostat clockwise to end of travel, then turn Selector Switch momentarily to "Dim" position and back to "Hold". (Headlamps should now be on lower beam.)
7. Recheck Hold adjustment by turning Intensity Rheostat SLOWLY counter-clockwise just to point where headlamps switch to upper beam. Meter pointer should now be aligned with the right hand edge of "hold" adjustment green bar if adjustment is correct. (See Fig. 13-67) If not, repeat procedure starting with step 1.

Dim Sensitivity Test

1. Rotate tester Intensity Rheostat completely counter-clockwise.
2. Turn Selector Switch to "Dim" position. Headlamps should now be on upper beam.
3. Turn Intensity Rheostat SLOWLY clockwise stopping at the exact point where the headlamps switch to lower beam. Meter pointer should read within the Dim Sensitivity Adjustment Line.

If Dim Sensitivity is not properly adjusted, proceed with Dim Sensitivity Adjustment.

Dim Sensitivity Adjustment

1. Rotate Dim control completely counter-clockwise. (See Fig. 13-66).
2. Momentarily turn tester "Off", then back to "Dim" position. Headlamps should now be on upper beam.
3. Adjust Intensity Rheostat until meter pointer reads in the right hand edge of the Dim Sensitivity Adjustment Line.
4. SLOWLY rotate Dim control clockwise just to point where headlamps switch to lower beam. DO NOT GO BEYOND THIS SETTING.
5. Turn tester Intensity Rheostat completely counter-clockwise then momentarily turn tester to "Off" and back to "Dim".
6. Rotate tester Intensity Rheostat SLOWLY clockwise just to point where headlamps switch to lower beam. Meter will read within Dim Sensitivity Line if adjustment is correct. If not, repeat Steps 1 thru 5.
7. Turn off headlights and disconnect tester from cigar lighter receptacle.
8. Remove tester and Aiming Device AE-4 from phototube unit. Replace lens, cover, and screws.

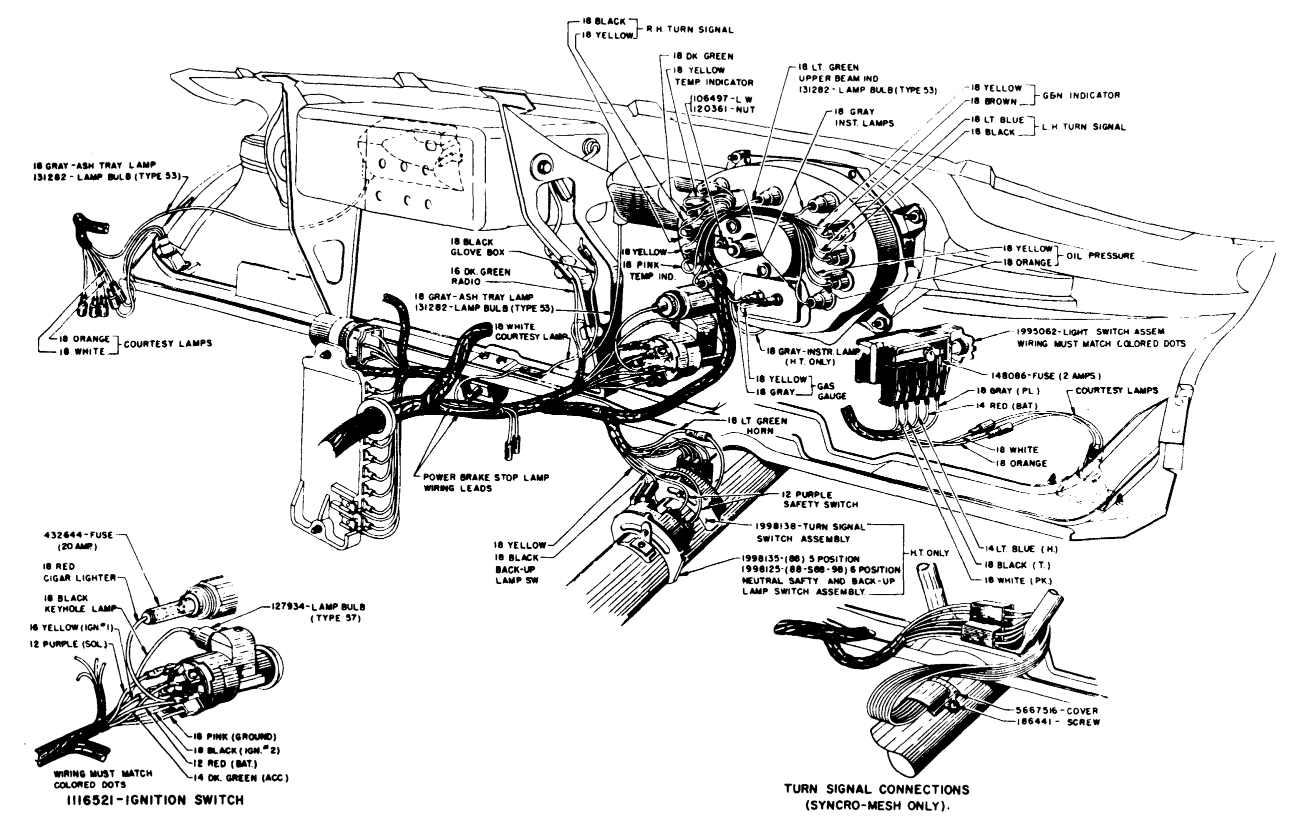


Fig. 13-68 Instrument Panel Wiring

TORQUE SPECIFICATIONS

	Application	Ft. Lbs.
1.	Battery Box Hold-Down Nuts	1.5-2.5
2.	Coil to Intake Nuts	9-11
3.	Connector Strap to Junction Block & Starting Motor Bolt	6-8
4.	Distributor Clamp to Cylinder Block Bolt	11-14
5.	Generator Bracket to Exhaust Manifold Bolts	22-26
6.	Generator to Bracket Bolts & Nuts	14-17
7.	Ignition Coil to Intake Manifold Stud	9-11
8.	Spark Plugs	23-28
9.	Starter Motor to Flywheel Lower Housing Nut & Bolt	45-50
10.	Battery Cable to Starter Motor Nut	10-12
11.	Junction Block Nut	13-15
12.	Starter Terminals (Solenoid & Ignition)	1.50-1.75
13.	Ignition Coil Terminal Nuts	1.75-2.00
14.	Generator Terminal Nuts	2-3

ELECTRICAL SPECIFICATIONS

(See Page 13-3 for Color Wiring Diagram)

DISTRIBUTOR SPECIFICATIONS

Dist. No.	Rotor Rot.	Spr. Ten.	VAC. ADV.		MECH. ADV.		
1110857	L.H.	19-23 oz.	4.5"-6.5" Start	17" 18°-22°	1000 2.4°-6.4°	2000 15 1/2°-19 1/2°	4000 20°-24°

*This allows a cam angle range of 26° to 33°.

NOTE: The above specifications are given in Engine R.P.M. and Engine advance. When checking a distributor on a distributor machine calibrated in distributor R.P.M. and distributor advance, the vacuum and mechanical advance specifications given above must be divided by 2.

STARTING MOTOR

a. Make . . . . . Delco-Remy
b. Type . . . . . Solenoid
c. Lock Torque in Ft. Lbs. . . . . . 11 Ft. Lbs.
d. Lock Amperage 460
e. Lock Voltage 5.2
f. Brush Spring Tension . . . . . 35 oz. min.
g. No. of Brushes Used 4
h. No. of Fields 4
i. No. of Teeth on Starter Pinion 9
j. No. of Teeth on Flywheel 176
k. Ratio Between Starter Pinion and Gear Flywheel 19.5:1
l. Rotation, viewed from Drive End . . . . . Clockwise
m. Pinion Clearance . . . . . .010"-.140"
n. Free Speed 3500 R.P.M. min. at 10.1 Volts, 95 Amps. max.

ELECTRICAL SPECIFICATIONS (Cont'd)

SOLENOID SWITCH
- a. Current Consumption, Both Windings at 10 Volts @ 80°F. . . . . . . 72-76 Amps.
- b. Current Consumption, Hold-In Winding at 10 Volts @ 80°F. . . . . 18-20 Amps.

GENERATOR
- a. Make . . . . Delco-Remy
- b. Charging Rate Cold - at 14.0 Volts @ 2150 R.P.M. . . . . 30 Amps. min.
- c. Charging Rate Hot . . . . (Controlled by Current Regulator)
- d. Brush Spring Tension . . . . 28 oz. ± 15%
- e. Field Current at 12-Volts @ 80°F. . . . . 1.48-1.62 Amps.
- f. Armature Rotation, viewing Drive End . . . . Clockwise

CURRENT - VOLTAGE CONTROL UNIT
- a. Make . . . . Delco-Remy
- b. Cutout Relay Air Gap . . . . .020"
- c. Cutout Relay Point Opening . . . . .020"
- d. Cutout Relay Closing Voltage at Operating Temperature . . . . . Adjust to 12.8 V
- e. Current Regulator Air Gap . . . . .075"
- f. Current Regulator Setting at Operating Temperature . . . . . . Adjust to 30 Amps.
- g. Voltage Regulator Air Gap . . . . .075"
- h. Voltage Setting at Operating Temperature . . . . Adjust to 14.5

NOTE: Operating temperature shall be assumed to exist after not less than 15 minutes of continuous operation with a charge rate of 8-10 amperes and voltage regulator operating.

BATTERY - 12 VOLT
- a. Make . . . . Delco-Remy
- b. Model 3KMR62
- c. Plates . . . . 9 Per Cell
- d. Capacity at 20 Hr. Rate . . . . 62 Ampere Hour
- e. Case . . . . Hard Rubber

COIL
- a. Make . . . . Delco-Remy

RESISTOR, IGNITION COIL
- a. Resistance . . . . 1.40 - 1.65 Ohms

IGNITION SWITCH
- a. Make . . . . Delco-Remy

DISTRIBUTOR
- a. Make . . . . Delco-Remy
- b. Cam Angle Range . . . . 26°-33°
- c. Contact Point Opening . . . . .016"
- d. Contact Arm Spring Tension . . . . 19-23 oz.
- e. Condenser Capacity . . . . 18- 23 mfd.

SPARK PLUGS
- a. Make . . . . AC
- b. Type 44
- c. Thread . . . . Metric-14 mm
- d. Body . . . . 13/16" hex.
- e. Spark Gap . . . . .030"

ELECTRICAL SPECIFICATIONS (Cont'd)

HORNS

a. Make . . . . Delco-Remy
b. Current Draw - Low Note Horns . . . . 8.5-10.5 Amps.
c. Current Draw - High Note Horns . . . . 7.5- 9.5 Amps.

HORN RELAY

a. Point Opening . . . . .027"
b. Closing Voltage . . . . Adjust to 6.5 (if outside of 5.0-9.0)
c. Air Gap - Points Closed . . . . .014"

LIGHTS

a. Headlamp Type . . . . Sealed Beam
b. Bulb Sizes:

(1) Headlights - 50-40 Watt . . . . No. 5400
(2) Parking Lights (With Turn Signal) 32-4 c.p. . . . . No. 1034
(3) Instrument Cluster Lamp 2 c.p. . . . . No. 57
(4) Stop Light and Tail Light 32-4 c.p. . . . . No. 1034
(5) Dome Light 15 c.p. . . . . No. 1004
(6) Rear License Light 3 c.p. . . . . No. 67
(7) Glove Compartment Light 2 c.p. . . . . No. 57
(8) Beam Indicator 1 c.p. . . . . No. 53
(9) Underhood Lamp 6 c.p. . . . . No. 89
(10) Rear Compartment Lamp 6 c.p. . . . . No. 89
(11) Spot Lamp . . . . 32 c.p.
(12) Back-Up Lamps 32 c.p. . . . . No. 1073
(13) Ignition Switch Lamp 2 c.p. No. 57
(14) Radio Dial Lamp 2 c.p. . . . . No. 57
(15) Turn Signal Indicator Lamp 2 c.p. . . . . No. 57
(16) Electric Clock Lamp 2 c.p. No. 57
(17) Dome Light (Convertibles and Deluxe Holiday Coupes) 6 c.p. No. 90
(18) Ash Tray Lamp 1 c.p. . . . . No. 53
(19) Courtesy Lamp 6 c.p. . . . . No. 90
(20) Hand Brake Warning Light 2 c.p. . . . . No. 57

LIGHTING SWITCH

a. Make . . . . Delco-Remy

TURN SIGNAL

a. Flashes per Minute (non-adjustable) 80-100

GASOLINE GAUGE

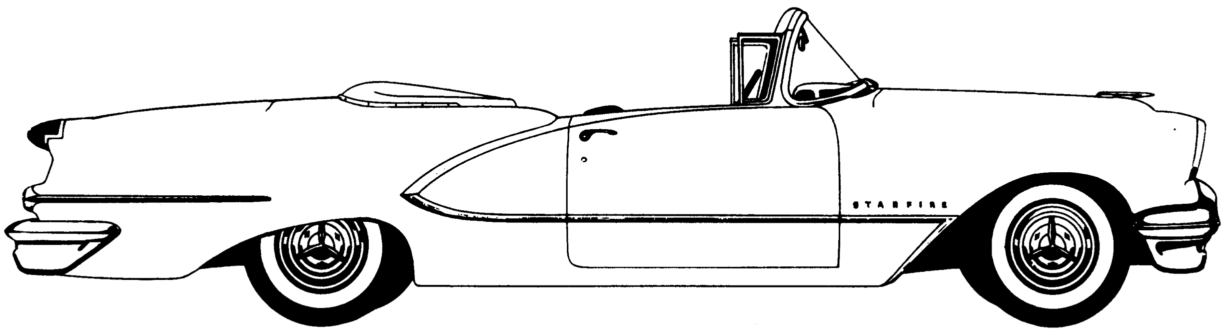
a. Make . . . . AC

GASOLINE GAUGE (Tank Unit)

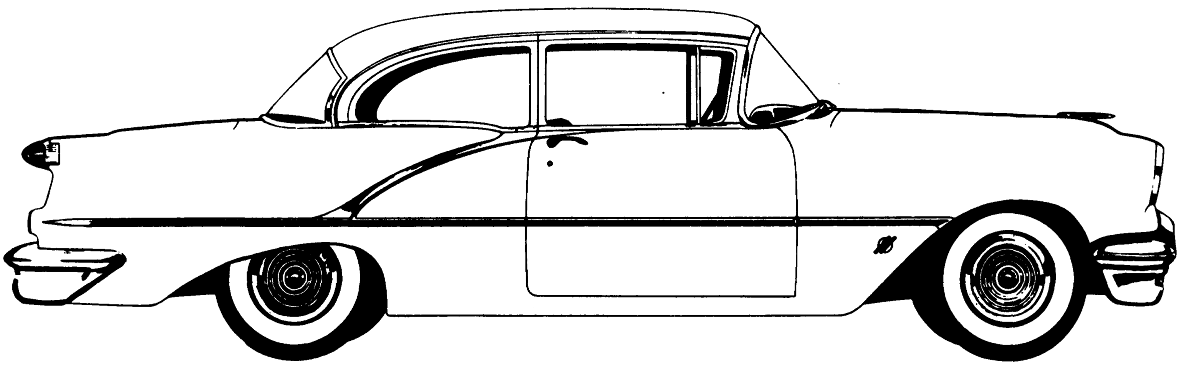
a. Make . . . . AC

FUSE SPECIFICATIONS

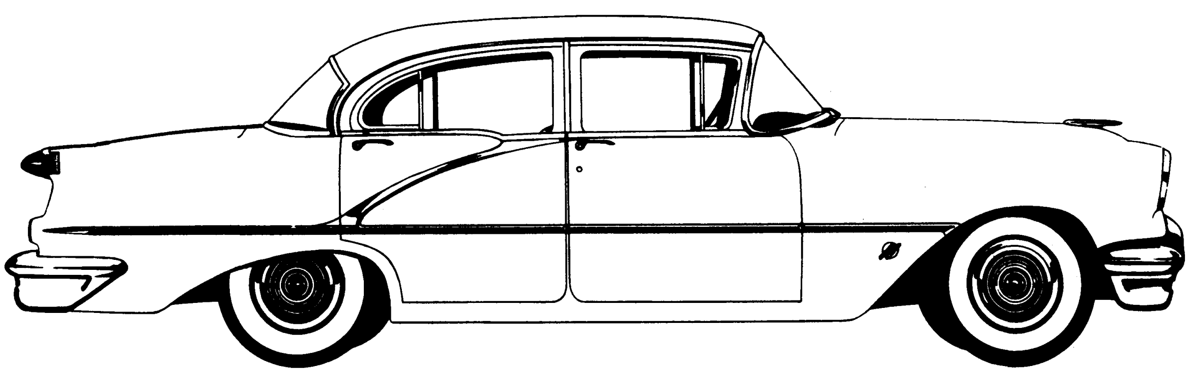
APPLICATION			
Electric Clock	AGA	1	Located in Special Fuse Block on Dash Behind Instrument Panel
Courtesy Lights Dome Lights Stop Lights Rear Seat Lighter	AGC	25	Located in Special Fuse Block on Dash Behind Instrument Panel
Fuel & Temperature Gauges Hand Brake Warning Hydra-Matic Shift Indicator Back-Up Lights	SFE	9	Located in Special Fuse Block on Dash Behind Instrument Panel
Turn Signal	SFE	9	Located in Special Fuse Block on Dash Behind Instrument Panel
Glove Box Light Under Hood Light Ignition Switch Light Tail Lights Spot Light Trunk Light	SFE	9	Located in Special Fuse Block on Dash Behind Instrument Panel
Radio	AGW	7.5	Located in Special Fuse Block on Dash Behind Instrument Panel
Heater	SFE	20	Located in Special Fuse Block on Dash Behind Instrument Panel
Air Conditioner if Air Conditioning Equipped	AGC	25	Located in Special Fuse Block on Dash Behind Instrument Panel
Electric Windows and Antenna	SFE	20	Located in Special Fuse Block on Dash Behind Instrument Panel
Instrument Cluster Lights Ash Tray Light Clock Light	AGA	2	On Head Light Switch
Cigar Lighter (Also Rear Seat Lighter)	SFE	20	Behind Cigar Lighter



98 STARFIRE COUPE (DCR)



SUPER 88 2-DOOR SEDAN (DK)



SUPER 88 4-DOOR SEDAN (DS)

AIR CONDITIONING

CONTENTS OF SECTION 14

GENERAL DESCRIPTION

The Oldsmobile Air Conditioning system provides refrigerated and dehumidified air to cool the car interior. All air is filtered to remove dust and other foreign materials. This system uses both outside air and recirculated air. This provides rapidly changing air inside the car which will result in more enjoyable driving due to the reduction of objectionable elements in the air and the elimination of wind noise from open windows.

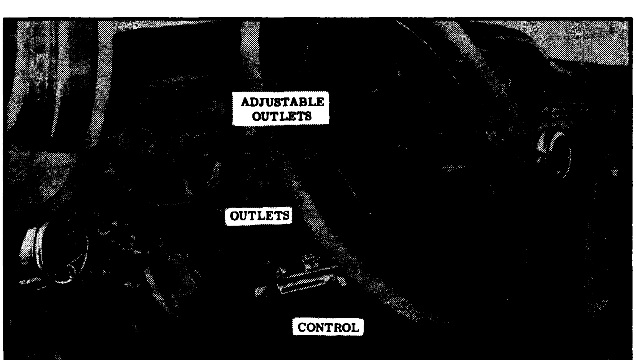


Fig. 14-1 Air Outlet and Controls

The temperature of the air entering the passenger compartment is regulated by a single control. Outside air is directed through the filter and discharged from the passenger compartment outlets for normal ventilation. For normal cooling, 100% outside air passes through the filter and the evaporator core. For maximum cooling, approximately 75% recirculated air and 25% outside air is directed through the evaporator core.

Air Outlets and Control FIG. 14-1

Refrigerated air enters the passenger compartment through four air outlets on the instrument panel. Adjustable air outlets are located on either side of the instrument panel and on the air conditioning control. The left and right hand air outlets consist of adjustable outlets and may be adjusted to direct the air as desired. The center outlet contains two doors which can be individually controlled to change the direction of air flow or to shut off the air from the center outlets. For best cooling results these doors should be wide open. Floor cooling is automatically provided by discharging air directly to the floor from fixed openings in the air manifold located under the glove box.

The air conditioning control assembly is mounted on the instrument panel below the glove box. A sliding lever is the basic control. Movement of the control lever from left to right increases the quantity of air traveling through the evaporator core and correspondingly increases the degree of cooling within the car. A three speed fan switch is located directly above the control lever.

FAST COOL DOWN

To rapidly cool a car which has been standing for a period of time in the sun, move the air conditioning lever to detent position and switch Fan Control to HI position. Open both center outlet doors. Open car windows just long enough to expel hot air. After the car has cooled, adjust temperature of cool air by selecting a control lever position to suit individual comfort. Direct air flow by adjusting outlets at either end of instrument panel. The recommended position of these outlets, for best over-all front and rear seat cooling, is when the outlets are adjusted to direct the air flow along the inside roof line.

DRIVING CONDITIONS

For normal driving conditions, the driver may adjust the .temperature of cool air by selecting a control lever position to suit individual comfort. Selection of blower speeds is dependent upon the amount of air forced into the passenger compartment by the forward motion of the car. Thus, when driving in heavy traffic, it may be desirable to set the Fan Switch in HI position. At higher car speeds, air will be forced, by the forward motion of the car, into the passenger compartment in greater volume; therefore, lessening the speed requirements of the blower motor. It then may be desirable to set the Fan Switch in MED, or LO position.

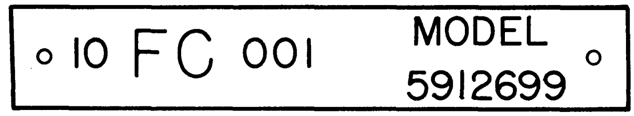


Fig. 14-2 Compressor Serial Number Plate

SERIAL NUMBER

The serial number plate is attached to the top side of the compressor and includes the Serial Number and Model Number. The starting Serial No. is 10FC001. (See Fig. 14-2) The Model No. is 5912699. Service compressor (less hand shut off valves and solenoid clutch) are stamped with Model Number 5441499 and the starting serial No. is 10HC001.

IMPORTANT: Always include both Serial Number and Model No. on reports.

VENTILATING SYSTEM FIGS. 14-3 and 14-4

The air conditioning control assembly is mounted on the instrument panel below the glove box. Movement of the control lever between OFF, VENT, and REFRIGERATION, activates the air intake and the recirculating valve permitting the entry of outside and/or recirculating air. The electrical circuit to the blower motor is "ON" when the lever is in the VENT range and remains "ON" through the REFRIGERATION range. When position REFRIGERATION is selected, the compressor solenoid clutch engages and activates the compressor. Movement of the control lever from left to right increases the quantity of air traveling through the evaporator core and correspondingly increases the degree of cooling within the car. The fan switch is located directly above the control lever. Three speeds, MED, LO, and HI, are available for forced ventilation.

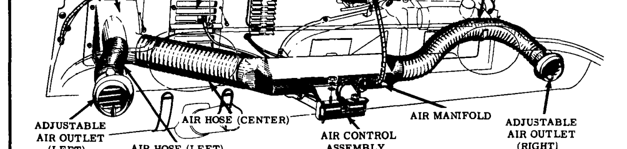


Fig. 14-3 Unit Location

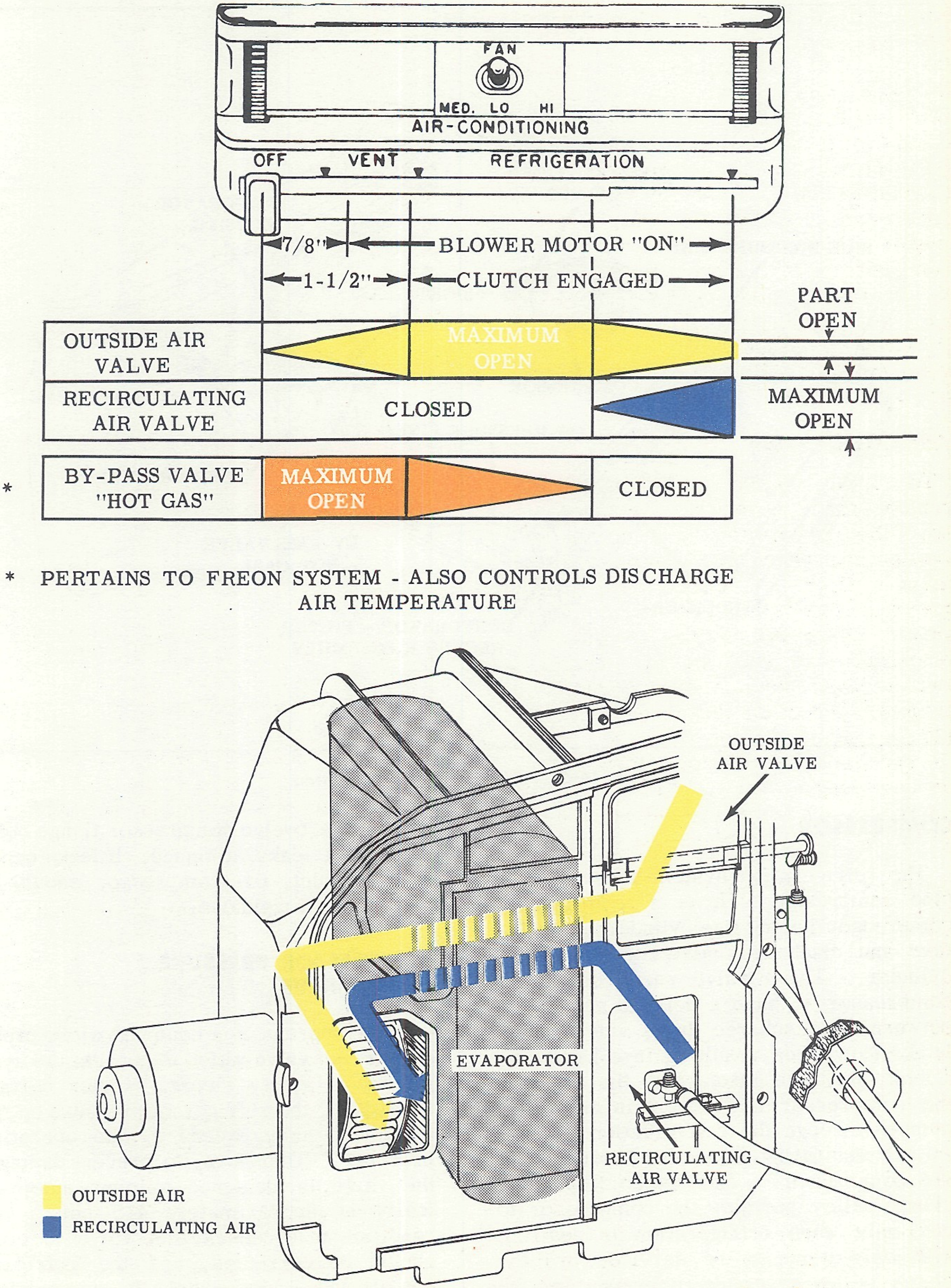


Fig. 14-4 Valve Openings in Relation to Control Lever Position

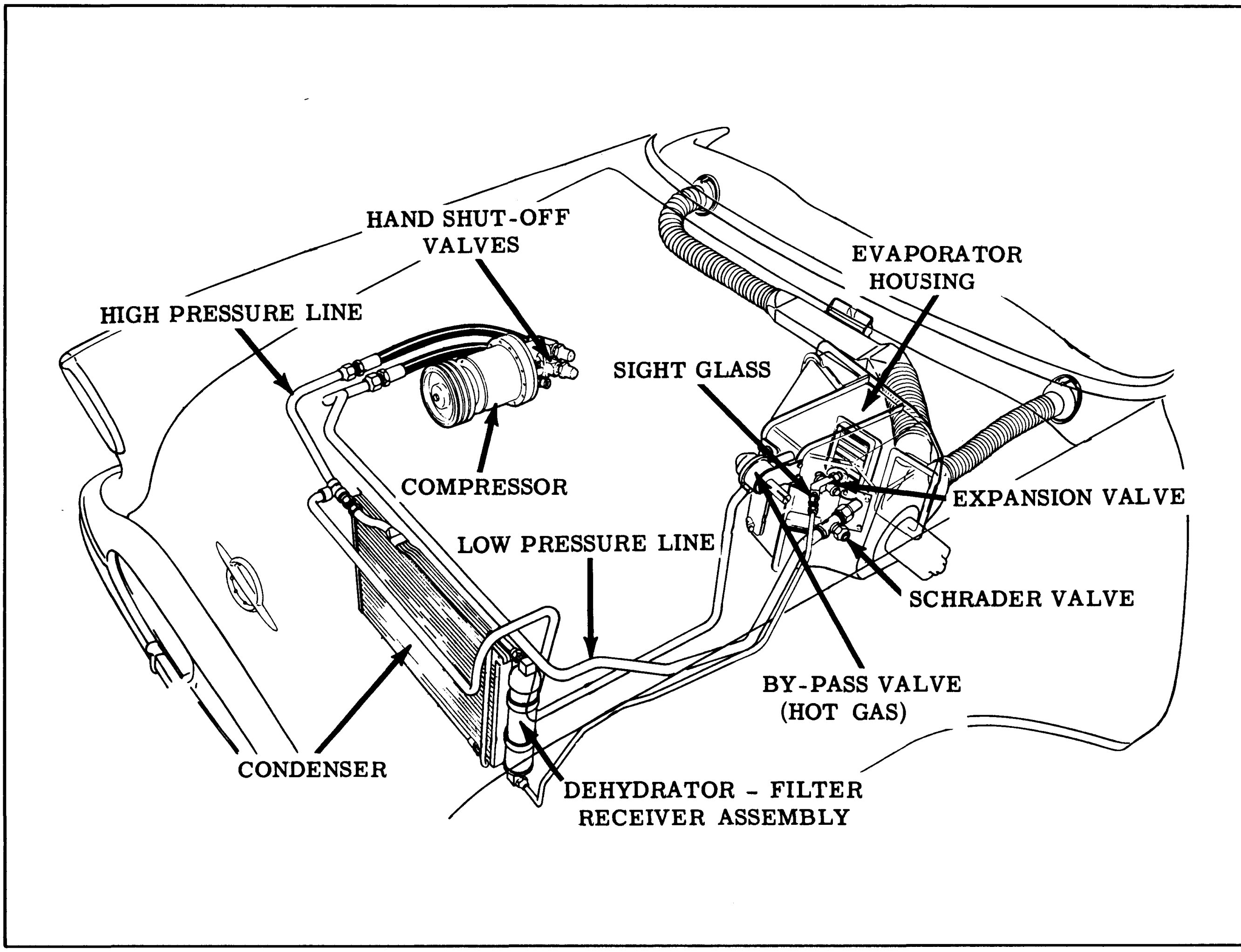


Fig. 14-5 Freon System Unit Location

COMPRESSOR

The refrigeration system uses an axial type compressor. It is a reciprocating compressor having five cylinders, with intake and discharge valve reeds for each cylinder. These valve reeds cause the compressor to have a definite separation between the discharge (high) side and the intake (low) side resulting in a highly efficient unit. Oil mixes with the Freon in the compressor and a certain amount is pumped through the refrigeration system. An oil test fitting is on the lower side of the compressor. The solenoid operated clutch pulley permits the compressor to run only when refrigeration is desired. The only items to be serviced are the clutch pulley assembly, solenoid, and the compressor shaft seal and seat. Do not tighten the twelve compressor flange bolts to correct leaks at flange. If leaks occur at this point, the compressor should be returned to Frigidaire.

COMPRESSOR PRESSURE RELIEF VALVE

The compressor is equipped with a pressure relief valve which is put into the system as a safety factor. Under certain conditions, the refrigerant pressure on the high side may exceed a safe operating pressure. Therefore, to prevent damage, the valve is designed to open automatically at approximately 415 psi. Any condition that causes this valve to open should be corrected, and the refrigerant oil and Freon should be replenished as necessary.

COMPRESSOR HIGH AND LOW PRESSURE VALVES (HAND SHUT-OFF)

The compressor inlet and outlet lines attach to shut-off valves on the outside of the compressor. These valves are necessary to permit pressure checks and servicing of the Freon system.

The compressor high and low pressure valves are two way valves. When turned completely counter-clockwise, the passage to the compressor is connected to the refrigerant line, but sealed from the gauge fitting. (See Fig. 14-6) This is the normal operating position.

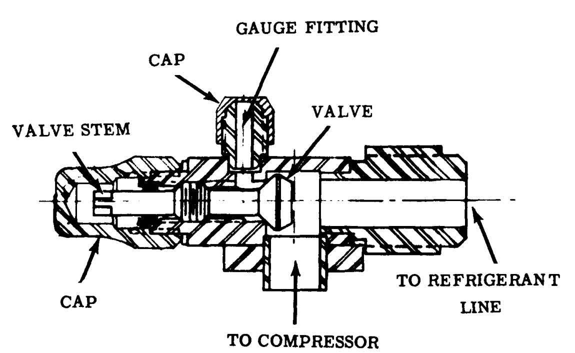


Fig. 14-6 Compressor Valve

When the valve stems are turned completely clockwise, the passages to the refrigerant lines are sealed, and the passage to the gauge fittings are opened. In this position, the evaporator and condenser are shut off from the compressor and the compressor can be removed or serviced. CAUTION: Never operate the compressor with the high pressure valve closed. (fully clockwise)

When the valve stems are turned to the middle position, both the passages to the gauge fittings and the compressor are open. This permits pressure gauge readings while operating the system.

NOTE: The high pressure valve is the upper valve and the low pressure valve is the lower one.

The valves are serviced as an assembly and are sealed at the compressor by the means of two "O" rings.

CONDENSER

The condenser is similar to the ordinary car radiator. It is made up of coils which carry the Freon, and cooling fins which provide rapid transfer of heat. The condenser is located in front of the engine cooling system radiator so that it receives a high volume of air from the movement of the car and from the engine fan. The air passing over the condenser cools the high pressure Freon vapor causing it to condense into liquid Freon.

SIGHT GLASS

The Freon sight glass is provided to aid in diagnosis, by permitting the Freon in the high pressure line to be observed. The appearance of bubbles or foam, after the compressor has run long enough to stabilize, indicates a shortage of Freon.

DEHYDRATOR-FILTER-RECEIVER ASSEMBLY

The functions of this unit are to absorb moisture and foreign material that may be present in the system after assembly, and to insure a solid column of liquid Freon in the line feeding the expansion valve, providing the system is properly charged. This unit is not serviceable, and should be replaced when there has been a leak in the low pressure side of the system that permitted air and moisture to be drawn into the system, or when a restriction is indicated in the Dehydrator-Filter-Receiver Assembly by a abnormally high pressure reading at the high pressure hand shut-off valve gauge fitting.

EXPANSION VALVE FIG. 14-7

The expansion valve mounted outside the evaporator housing controls the flow of Freon into the evaporator. It is adjusted so that the temperature of the Freon at

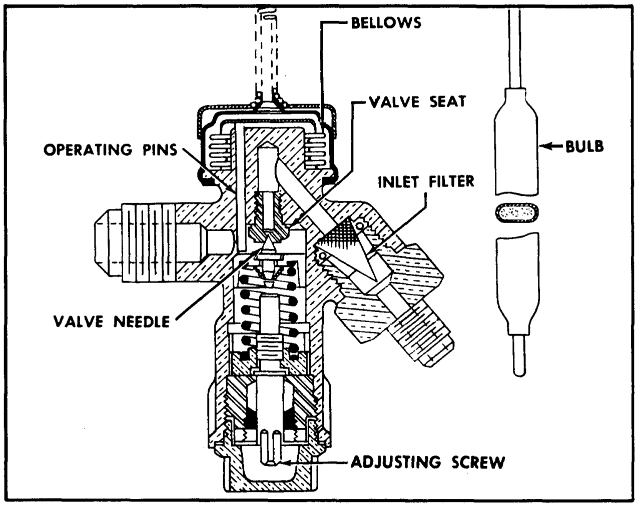


Fig. 14-7 Expansion Valve

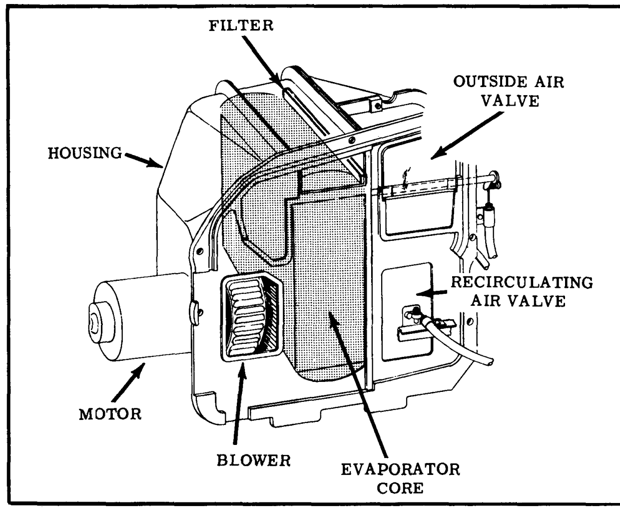


Fig. 14-8 Evaporator Assembly

the evaporator outlet must be 6 F. higher than the temperature of the Freon at the inlet before more Freon is allowed to enter the evaporator. A capillary tube filled with carbon dioxide provides the temperature regulation of the expansion valve. The capillary tube is fastened to the low pressure Freon line coming out of the evaporator so that it communicates the temperature of the Freon at this point to the expansion valve. If the temperature differential between the inlet and outlet decreases toward 6 F., the expansion valve will automatically reduce the amount of Freon entering the evaporator, thus reducing the amount of cooling. If the temperature differential increases, the expansion valve will automatically allow more Freon to enter the evaporator, thus increasing the cooling. The only service operations to be performed are the expansion valve adjustment and the cleaning and/or replacement of the screen.

NOTE: It is very important that the expansion valve capillary tube bulb be tightly clamped to the low pressure Freon line coming out of the evaporator, for proper operation.

EVAPORATOR ASSEMBLY

The evaporator housing contains the evaporator core (cooling coils), air filter, fresh air valve, recirculating air valve, blower, and motor.

FREON "HOT GAS" BY-PASS VALVE FIG. 14-9

The Freon by-pass valve performs two functions in the refrigeration circuit. First, it acts as a temperature control and secondly it limits the evaporator minimum pressure to prevent "freezing-up" of the evaporator coils. The valve serves as a temperature control, being linked directly to the instrument panel control by a control cable. As shown in Fig. 14-9, the by-pass valve is wide open in the left hand position of the control and in that position it maintains high evaporator pressure which

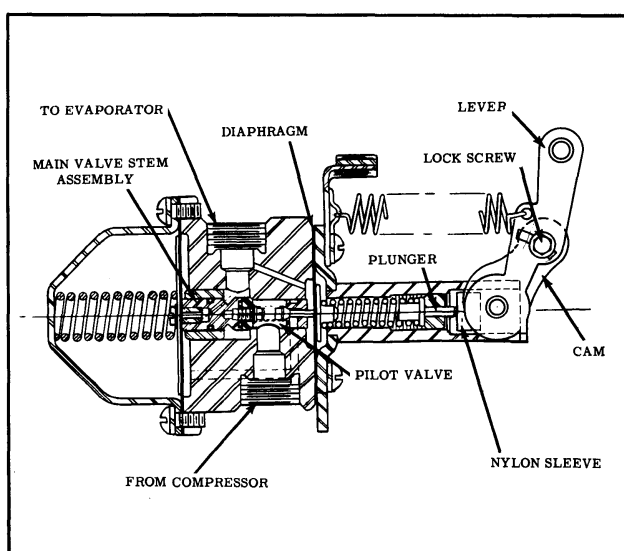


Fig. 14-9 By-Pass Valve "Hot Gas"

results in warming the evaporator and the discharge air temperature. The farther to the right the control is positioned, the lower the evaporator pressure will become and thus the car will become cooler. The by-pass control cable adjustment is of extreme importance to insure proper operation in all control positions.

When the control is moved past the detent position, the by-pass valve is set to maintain low evaporator pressure (29.5 psi) which results in maximum cooling ability of the evaporator and consequently maximum cooling of the discharge air. The evaporator minimum pressure is limited by automatically injecting "Hot Freon Gas" into the upper tank of the evaporator core. This action takes place when the evaporator pressure tends to drop below 29.5 psi.

REFRIGERATION CIRCUIT FIG. 14-10

Heat laden, low pressure vapor is drawn into the compressor and pumped from the compressor the condenser under high pressure. The vapor is heated as a result of the compression process. As it passes through the condenser, the high pressure - high temperature vapor is cooled, which causes the vapor to condense into liquid Freon. The liquid Freon passes from the condenser into the de-hydrator-filter-receiver which acts as a reservoir. The liquid in the receiver is still under high pressure.

Liquid Freon from the receiver passes through the sight glass to the expansion valve. The expansion valve meters Freon into the evaporator core. Since the pressure in the evaporator is reduced to 29.5 psi for maximum cooling, the liquid Freon immediately begins to boil at approximately 32°F. as it enters the evaporator. As the Freon passes through the evaporator, it continues to boil at 32°F. drawing heat from (and thereby cooling) the air passing through the evaporator core. By the time the Freon leaves the evaporator, it has completely vaporized and has warmed approximately 6°F.

Freon returns from the evaporator through the low pressure line to the compressor. When the evaporator pressure drops below 29.5 psi. the Freon by-pass valve partially opens to permit "Hot Gas" from the compressor to enter the upper tank of the evaporator core to prevent freezing of the core. It is this same action that regulates the amount of cooling when the control on the instrument panel is moved to a warmer position. Thus when "Hot Gas" is directed to the evaporator core, the cooling ability is impaired and warmer air is discharged from the outlets.

On a cold day, the system will by-pass almost constantly. As the ambient (atmospheric) temperature becomes higher, the by-pass system will work less and less.

PRECAUTIONS IN HANDLING FREON 12

Do Not Leave Freon Drum Uncapped

All refrigerant drums have a metal screw cap. This cap protects the valve and safety plug from damage; therefore, the protective cap should always be replaced when the drum is not in use.

Do Not Subject Drum to
High Temperature

The drum should not be exposed to the radiant heat of the sun, for the resulting increase in pressure may cause the safety plug on the drum to burst.

The Freon drum should never be subjected to excessive temperature when charging a system. The Freon drum should be heated for charging purposes by placing in 125°F. water. Never heat above 125°F. or use a blow torch, radiator, or stove to heat the drum.

Do Not Weld or Steam Clean
On or Near the System

Welding or steam cleaning of, or near, any of the refrigerant lines or components of the refrigerant system can build up dangerous pressures in the system.

Do Not Fill the Drum Completely

When filling a small drum from a larger one, always allow space above the liquid for expansion. If the drum were completely filled and the temperature increased, tremendous hydraulic force would be developed.

Do Not Discharge Vapor Into Areas Having Exposed Flame

Discharging large quantities of Freon 12 into a room can usually be done safely as the vapor would produce no ill effects. However, this should not be done if the area contains a flame-producing device, such as a gas heater. While Freon normally is non-poisonous, heavy concentrations of it in contact with a live flame will produce a poisonous gas. The same gas will attack all bright metal surfaces.

Do Not Expose Eyes to Freon

One of the most important precautions is protection of the eyes when handling Freon. Any liquid Freon which may accidentally escape is approximately 21.7°F. below zero. If any Freon comes in contact with the eyes, serious damage could result. Always wear goggles to protect the eyes when handling Freon.

If Freon should come in contact with the eyes, here is what to do:

1. DO NOT rub the eye. Splash the affected area with quantities of cold water to gradually get the temperature above the freezing point.
2. Apply a protective film of an antiseptic oil over the eye ball to reduce the possibility of infection.
3. Consult a doctor or an eye specialist immediately.

Should liquid Freon come in contact with the skin, the injury should be treated the same as though the skin has been frostbitten or frozen.

MAINTAINING CHEMICAL STABILITY IN THE REFRIGERATION SYSTEM

The efficient operation of the air conditioning refrigeration system is dependent on the pressure-temperature relationship of pure Freon 12. As long as the system contains pure Freon 12 (plus a certain amount of compressor oil which mixes with the Freon), it is considered to be chemically stable.

When foreign materials, such as dirt, air, or moisture, are allowed to get into the system, they will effect chemical stability and change the pressure-temperature relationship of the Freon. Thus, the system will no longer operate at the proper pressures and temperatures, and the efficiency will decrease.

The following general practices should be observed to insure chemical stability in the system:

Keep Tubing Sealed

Whenever it becomes necessary to disconnect a refrigerant line, it should be immediately capped. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly. Capping the lines will also prevent dirt and foreign matter from entering.

Keep Tools Clean

Tools should be kept clean and dry. This includes the gauge set and replacement parts.

Use Clean Dry Oil Container

When adding oil to compressor, the container should be exceptionally clean and dry due to the fact that refrigeration oil is as moisture-free as possible; therefore, it will quickly absorb any moisture with which it comes in contact.

Keep Oil Container Capped

The oil container should not be opened until ready for use and should be capped immediately after use to reduce the possibility of oil absorbing moisture.

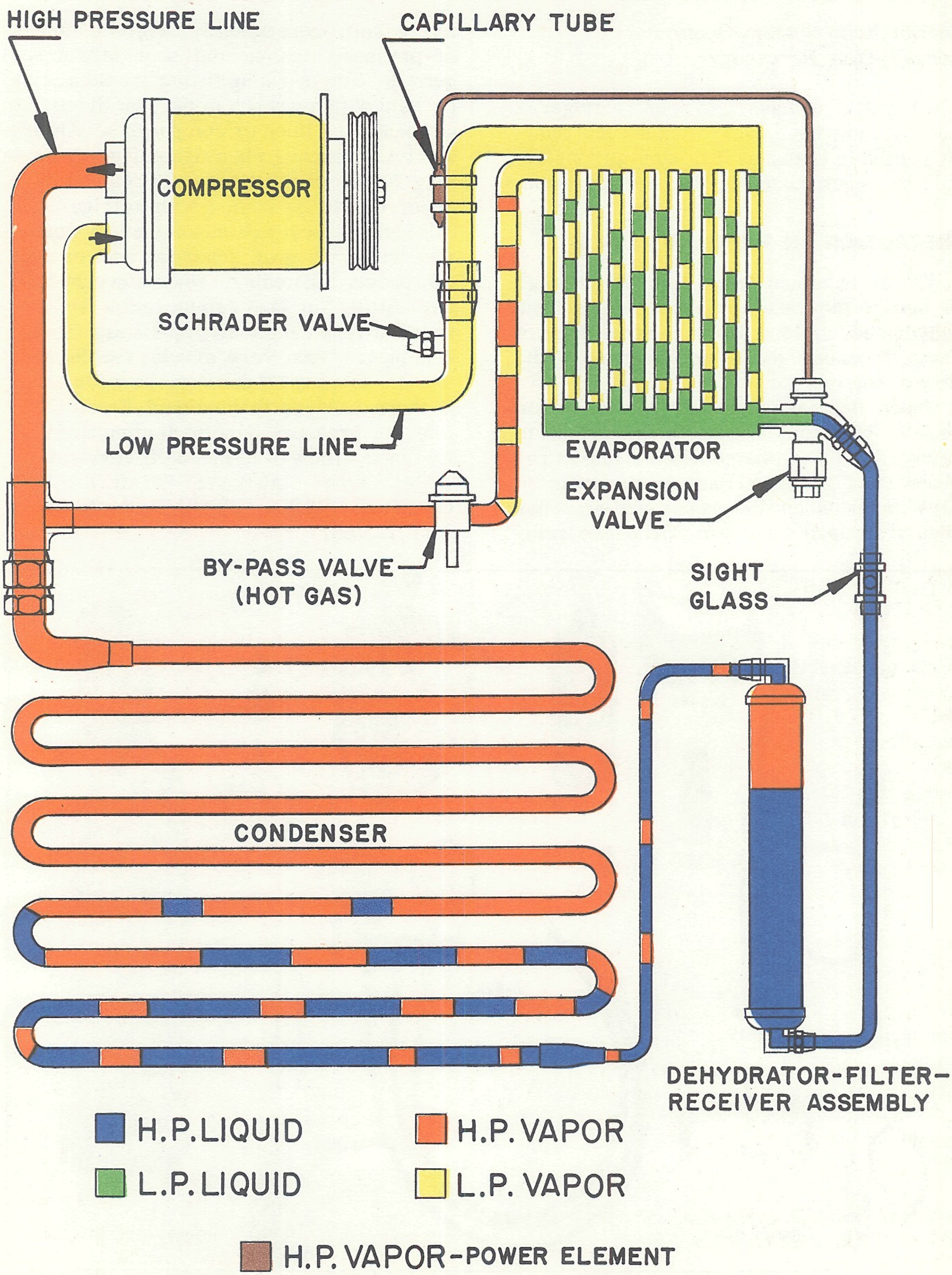


Fig. 14-10 Refrigeration Circuit

Do Not Keep System Open
Longer Than Necessary

When it is necessary to open a refrigeration system, have everything needed readily available so that as little time as possible will be required to perform the operation.

PRECAUTION IN HANDLING LINES

All replacement lines must be checked to see if they are completely sealed and dehydrated. Freon lines must be free of kinks, because these would restrict the flow of refrigerant.

Freon line insulated clamps are used to reduce vibration and it is important to reinstall all the clamps when a line is replaced. Tightening flare connections is very important and the proper size wrenches should be used. Copper flares are relatively soft; consequently, a great amount of pressure against the seat is not required. The opposing fitting should always be held with a wrench to prevent distortion of connecting lines or components. Always use two wrenches when tightening or loosening Freon line fittings. Flares and flare seats should be coated with refrigeration oil before they are assembled to permit the flares to seat squarely and provide for proper tightening. When disconnecting any fitting in the refrigeration system, proceed very cautiously regardless of gauge readings. Open very slowly, keeping face and hands away so that no injury can occur if there happens to be liquid Freon in the line. If pressure is noticed when fitting is loosened, allow it to bleed off very slowly.

CAUTION: ALWAYS WEAR SAFETY GOGGLES WHEN OPENING REFRIGERANT LINES.

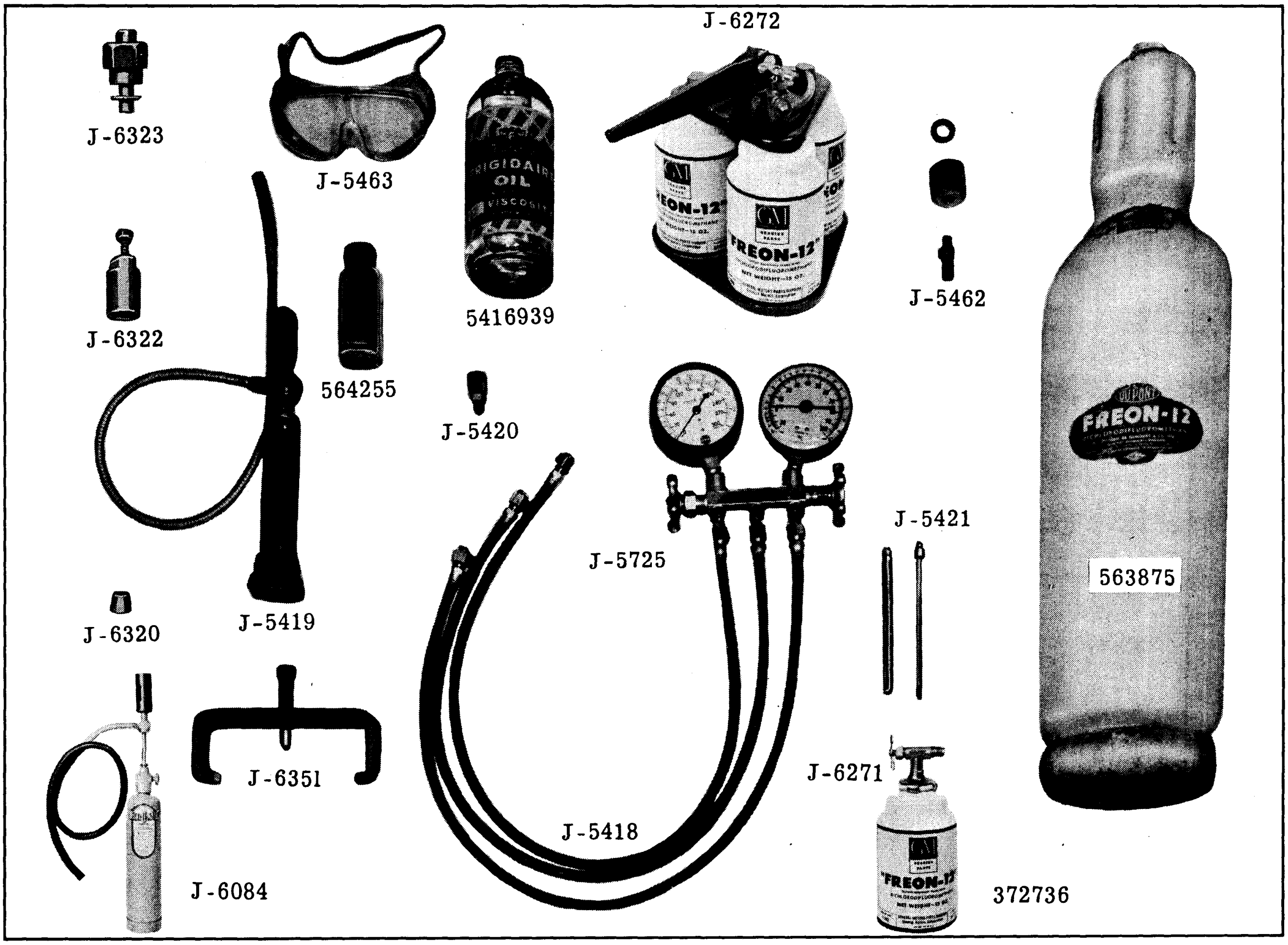


Fig. 14-11 Refrigeration Service Equipment

In the event any line is opened to atmosphere, it should be immediately capped to prevent entrance of moisture and dirt.

SPECIAL EQUIPMENT FIG. 14-11

Refrigeration Gauge Set Fig. 14-12

The gauge set is used when purging, evacuating, charging, or diagnosing trouble in the system. The low pressure gauge is graduated into pounds of pressure from 0 to 100 and in the opposite direction in inches of vacuum from 0 to 30. The high pressure gauge is graduated from 0 to 300 pounds pressure. The center connection is common to both and is for the purpose of attaching a line for adding Freon or evacuating the system. When this connection is not required, it should be capped with a flare nut and cap.

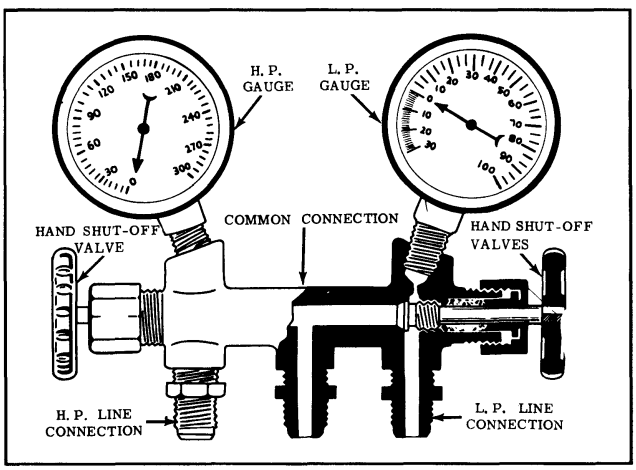


Fig. 14-12 Gauge Set

The hand shut-off valves close each opening to the connector and to each other. They DO NOT open or close off pressure to the gauges.

Leak Detector (Torch)

The leak detector is used to locate a leak in any part of the Freon system. To operate, the detector is ignited and the sampling tube is held close to all possible points of leakage (fittings, connections, etc.). If the flame changes color, particularly green, brilliant blue, or purple, Freon is being drawn into the sample tube, indicating a leak.

CAUTION: DO NOT BREATHE THE FUMES THAT ARE PRODUCED BY THE LEAK DETECTORS AS THEY ARE POISONOUS.

While most volatile fuels will produce a flame, anhydrous methyl alcohol (J-5419-13) is the only one that will aid in detecting small leaks without eventually damaging the detector.

CAUTION: The valve should never be closed tightly when the needle is hot because the needle will "freeze" when the burner cools and the valve seat will be damaged. The small orifice should be kept clean by occasionally inserting a wire cleaner provided. The upper flame ring should be replaced when it becomes noticeably burned away.

LEAK DETECTOR (LIQUID)

There are a number of fittings and places throughout the air conditioning unit where leak detector solution (Part No. 564255) may be used to pin-point leaks.

By applying the solution to the suspected area with a swab that is attached to the bottle cap, bubbles will form within seconds if there is a leak.

For confined areas, such as sections of the evaporator and condenser, the alcohol torch or a Bernz-O-Matic torch is the only method which can be used.

VACUUM PUMP

The vacuum pump is recommended as a service tool. If a leaking system has been operated in a discharged condition the receiver-dehydrator-filter assembly should be replaced and a vacuum pump should be used to thoroughly evacuate the system.

SERVICING OF INDIVIDUAL UNITS (NOT IN FREON SYSTEM)

The following services and repairs concern parts of the air conditioning system which can be serviced without opening the Freon system.

COMPRESSOR BELT ADJUSTMENT

The compressor and generator belts are adjusted with Tool J-4170 and a torque wrench as follows:

1. Loosen generator attaching bolts.
2. Place Tool J-4170 under generator as shown in Fig. 14-13.
3. Using a 0 to 50 ft.-lbs. torque wrench adjust belt tension to 20 ft. lbs.
4. Tighten generator attaching bolts.

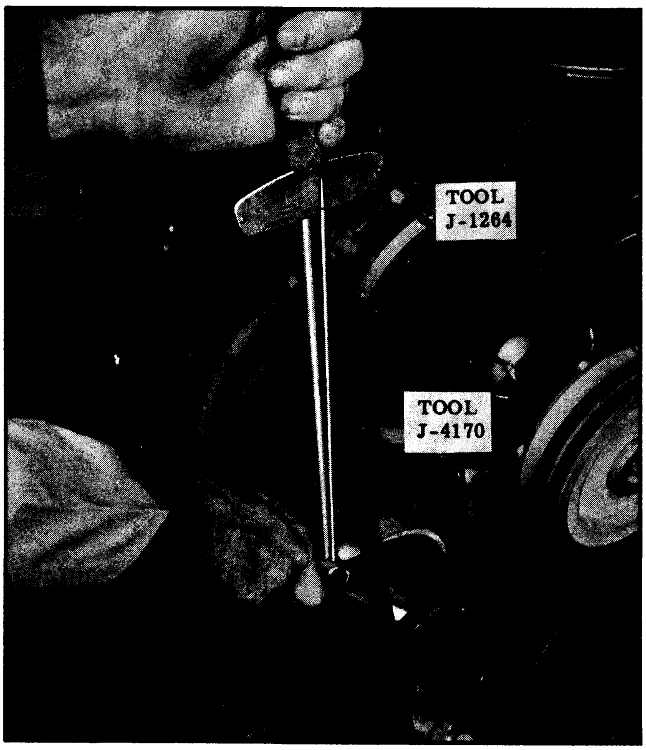


Fig. 14-13 Adjusting Compressor Belts

CLEAN AND SERVICE AIR FILTER

The filter should be cleaned at the start of the "cooling" season and whenever necessary thereafter. In some areas, one or two cleanings per season may be sufficient while in dusty areas, more frequent cleaning will be required.

1. Remove control cable from "Hot Gas" By-Pass valve.
2. Remove filter cover attaching wing nuts and remove cover from front of evaporator housing.
3. Remove filter by pulling forward out of evaporator housing. (See Fig. 14-14)

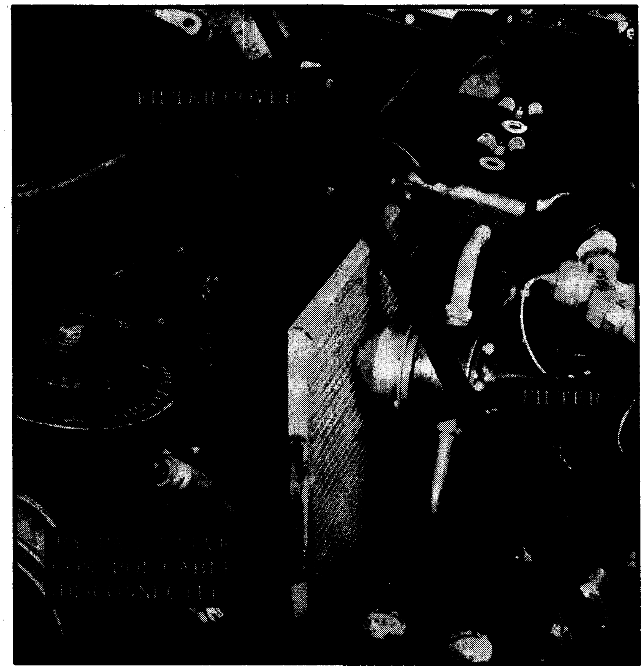


Fig. 14-14 Filter Removal

4. The filter may be cleaned in solvent or by washing in a soap solution made with any household detergent. After the filter is cleaned it should be rinsed and then dried with compressed air.
5. Recoat filter with a light coat of R.P. Filter Coat or a SAE-30 detergent-free non-odorous engine oil. Spray both sides to make sure all of filter element is coated.

   NOTE: R.P. Filter Coat is available at most refrigeration supply outlets.
6. If necessary to replace filter cover gasket, cement gasket in place on cover with 3-M Super Weatherstrip Adhesive. Install filter and replace filter cover.
7. Reassemble By-Pass Valve Control Cable and adjust cable as outlined under "By-Pass Valve Cable Adjustment".

AIR OUTLETS

Adjustment (Fig. 14-15)

Nozzles should be free to rotate but tight enough to remain in a set position. If the tension is insufficient, the felt must be replaced. To remove the nozzle; first remove the air hose, then tap the nozzle from the bezel with a wood block.

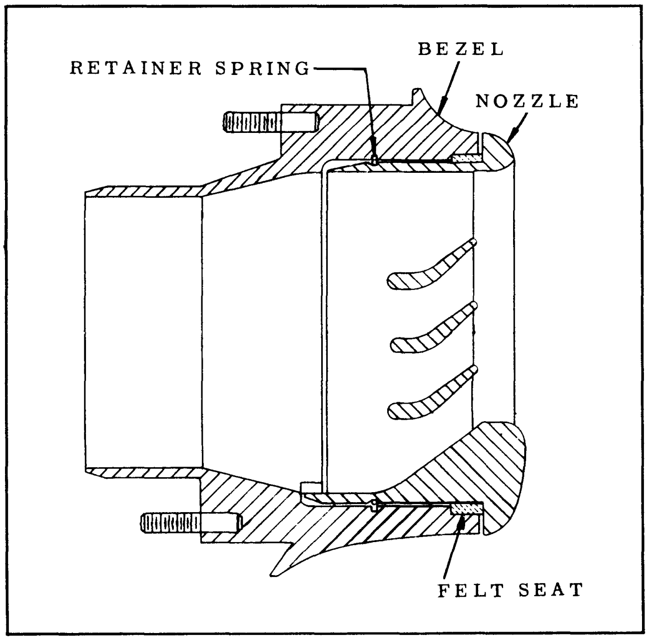


Fig. 14-15 Outlet Assembly

To replace felt seat, make sure seating surface is clean; then, cement felt seat in place using 3-M Super Weatherstrip Adhesive. To replace the outlet nozzle, place the retainer spring into the nozzle groove and press the nozzle into the bezel until it locks.

REPLACEMENT (Fig. 14-16)

To replace the air outlet assembly, remove air hose, two nuts, washers, and clamps. Pull the assembly from instrument panel.

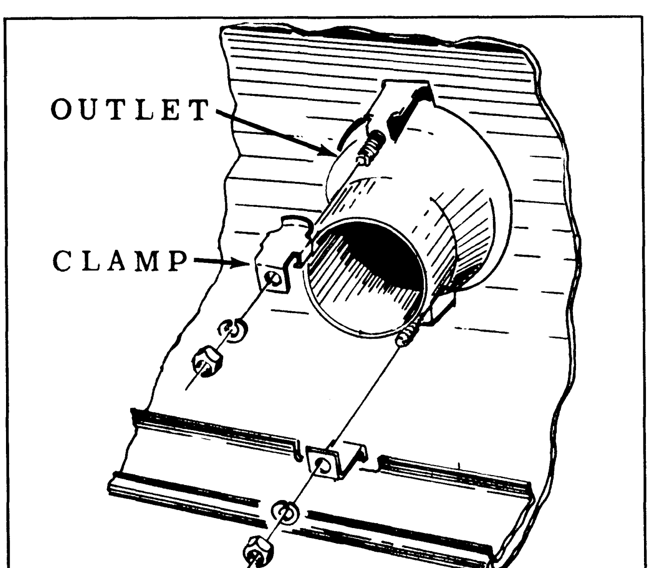


Fig. 14-16 Outlet Installation

CENTER OUTLET DOOR ADJUSTMENT (FIG. 14-17)

The center outlets can be individually adjusted for proper tension by means of Allen Set Screws located on either side of the control bracket.

COMPRESSOR CLUTCH AND BLOWER SWITCH

Adjustment

1. Pull air hoses from manifold, remove the two air manifold attaching screws, and slide manifold towards steering column.
2. From under glove box, loosen two switch cap screws on control assembly. (See Fig. 14-17)
3. Turn ignition switch to ACCESSORY position.
4. Position control lever to BLOWER position. (See Fig. 14-18)
5. Pivot switch assembly "in" or "out" until blower just turns on, then tighten screws.
6. To check switch adjustment, move control to OFF position. Move control lever slowly to the right and compare control lever position when blower starts and compressor clutch engages with positions shown Fig. 14-18.

   NOTE: A test lamp may be connected to the clutch lead in wire at the compressor and to a suitable ground, to observe when the clutch becomes energized.

REPLACEMENT FIG. 14-17

The combination switch can be removed without disturbing the control assembly as follows:

1. Disconnect air manifold and slide toward steering column.
2. Remove two cap screws that retain the switch.

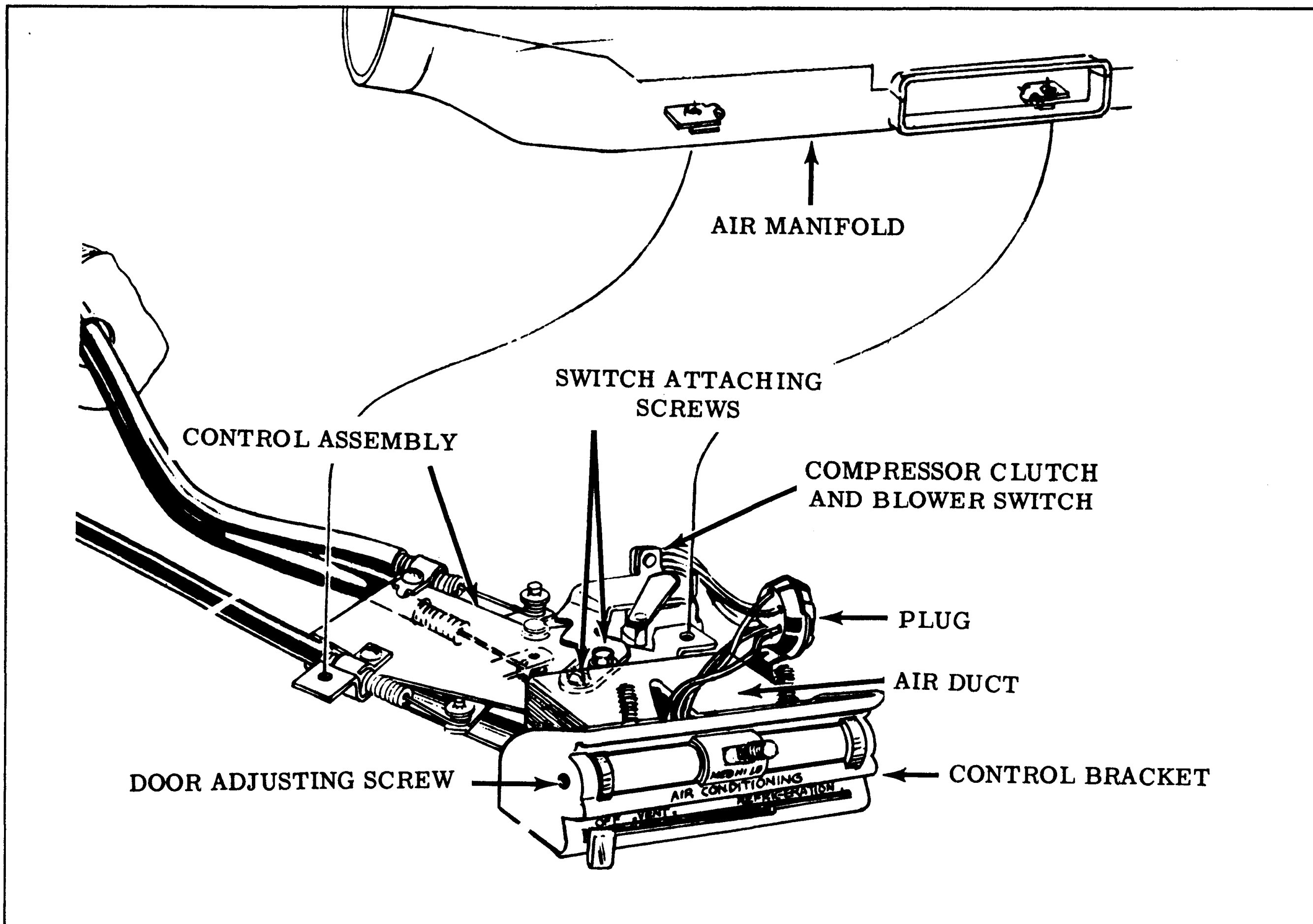


Fig. 14-17 Bracket and Control Assembly

3. Remove male plug from bracket and push the three switch terminals out of the plug.

NOTE: Switch must be adjusted after replacement.

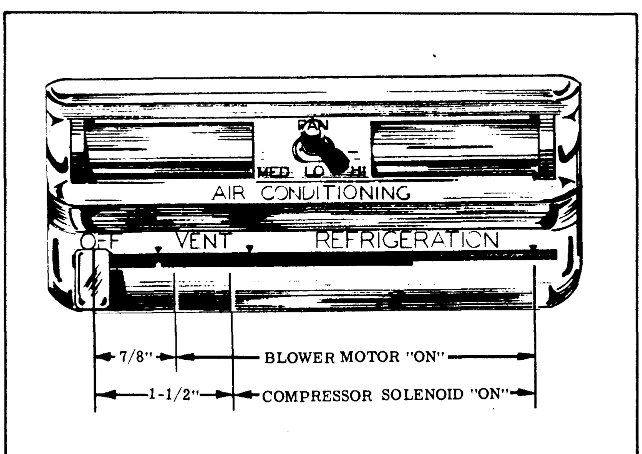


Fig. 14-18 Position for Switch Adjustments

CONTROL AND BRACKET ASSEMBLY

Replacement
FIG. 14-17

1. Disconnect air manifold and slide manifold toward steering column.
2. Remove defroster hose from behind glove box.
3. Remove glove box screws and push glove box toward dash insulator.
4. Disconnect plug assembly.
5. Remove control attaching screw at dash insulator.
6. Remove two nuts and lock washers from control bracket to instrument panel.
7. Disconnect valve control cables at the control.

With the assembly removed, any of the following parts can be replaced: Control assembly, air duct, bracket and/or fan speed switch.

To replace, reverse the above sequence of operations and adjust control cables. If necessary, adjust the blower and compressor clutch switch.

The control assembly cams and linkage should be lubricated with "Lubriplate" whenever the control does not operate freely.

CONTROL CABLE ADJUSTMENT

Outside Air Valve
FIG. 14-19

1. Check to insure cable is not kinked and operates freely.
2. Place control lever in the off position.
3. Loosen control cable clamp at right hand side of evaporator housing.
4. Place a 1/8" gauge pin in hole in lever and boss in housing; then, while pulling down on cable conduit, tighten cable clamp. This holds the valve closed with the proper compression on the valve gaskets. (See Fig. 14-19)
5. Remove gauge pin and move control lever to detent notch, return lever to off position and check to see that holes in lever and boss line up. This indicates proper closing of valve.

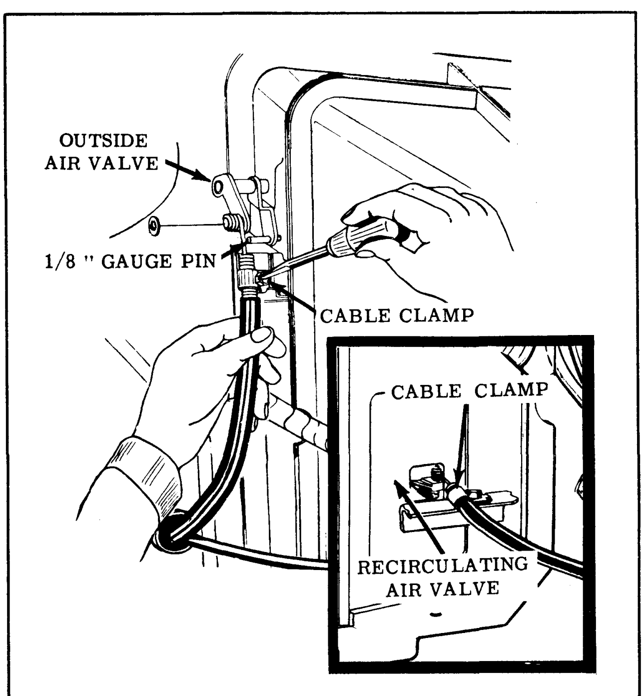


Fig. 14-19 Air Control Cable Adjustments

Recirculating Air Valve
FIG. 14-19

1. Position control lever in OFF position.
2. Adjust control cable at recirculating air grille on the dash insulator so that the valve gasket is slightly compressed. If too much pressure is applied, the control lever effort will increase.

After the above valves have been adjusted, a check should be made for air leakage by positioning the control lever in OFF position and connecting a jumper wire to the blower motor positive lead terminal. Only a slight amount of air leakage should be observed at the instrument panel outlets.

"Hot Gas" By-Pass Valve Cable Adjustment
FIG. 14-20

1. Check to insure cable is not kinked and operates freely, then disconnect return spring.
2. Place the control lever in the extreme right position.
3. Disconnect the control cable from the lever and loosen the control cable clamp on the by-pass valve bracket.
4. Loosen the lock screw on the lever assembly.

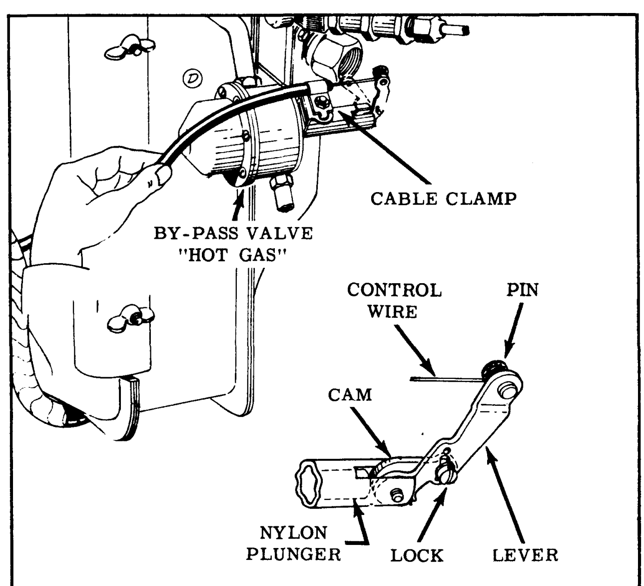


Fig. 14-20 By-Pass Valve Cable Adjustment

5. With the lever against stop, position the cam so that it just touches the nylon plunger. Tighten the lock screw in this position.

6. Install the control wire coil over the lever pin and while pushing the cable conduit toward the lever, tighten the cable clamp. Install return spring.

7. Move the control to the left and back to the extreme right position. Again check to make sure that the cam is against the nylon plunger.

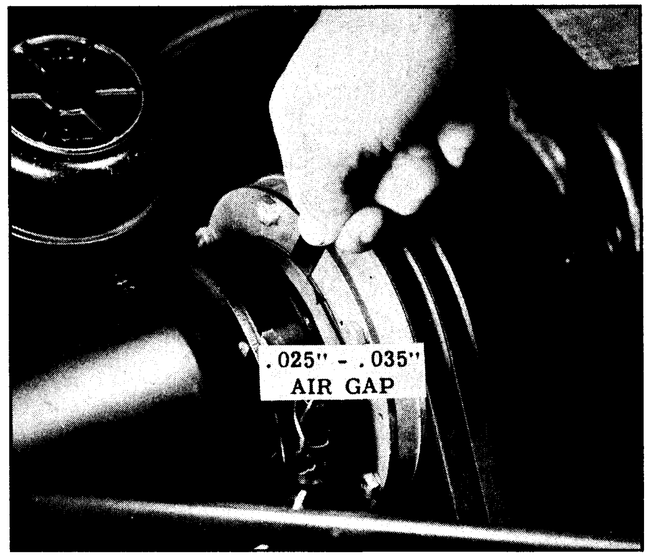


Fig. 14-21 Checking "Inner" Clutch Plate Air Gap

BLOWER MOTOR

The blower motor assembly is mounted on the left side of the evaporator housing. To remove the motor and/or the blower, the left hood hinge has to be removed. The assembly is retained by five sheet metal screws and no sealer is required at the mounting flange. The ground wire is retained by a blower motor attaching screw and the positive lead terminal is plugged into a plastic connector which is clipped onto the hood hinge support.

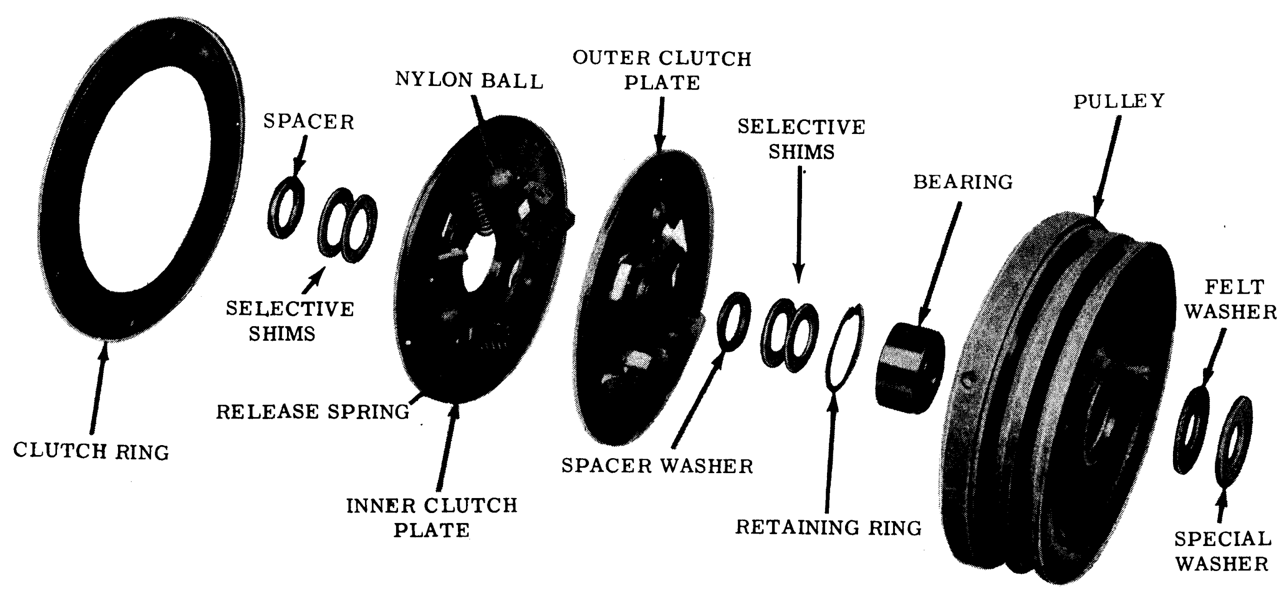


Fig. 14-22 Pulley and Clutch Assembly

CLUTCH AND PULLEY ASSEMBLY

Clutch Adjustment (Fig. 14-21)

1. Energize clutch coil by turning ignition switch to ACCESSORY position and moving control lever to REFRIGERATION position.
2. With feeler gauge, check air gap between clutch plate and housing. This air gap should be .025" to .035". If the air gap is not within these specifications, it will be necessary to remove the clutch and add or subtract shims. These shims come in four thicknesses: .010", .015", .020", .025", and by proper selection of these shims, .005" variation in air gap can be obtained.

Pulley and Clutch Removal FIG. 14-22

NOTE: If clutch and pulley removal is due to suspected malfunction of the clutch, the air gap between the clutch plate and the coil housing should be checked before the assembly is removed.

1. Energize compressor clutch coil long enough to permit removal of the compressor shaft nut after straightening lock tangs.

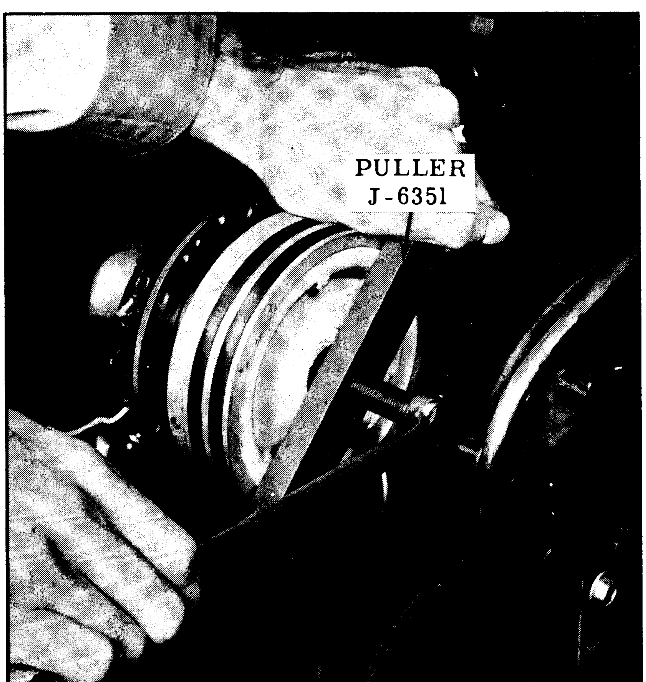


Fig. 14-23 Pulley Removal

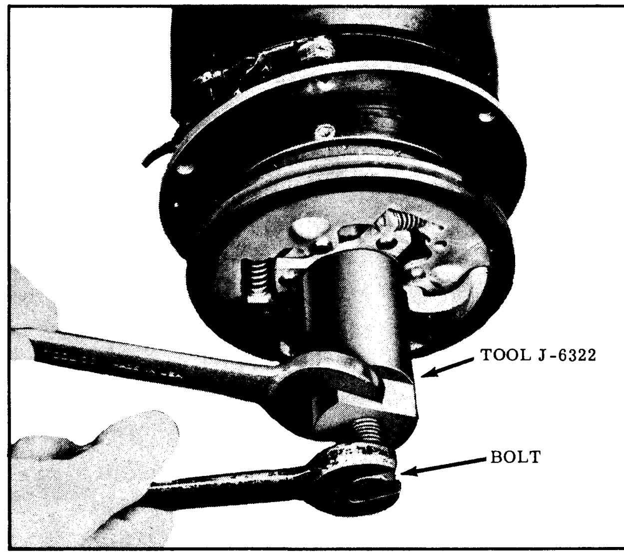


Fig. 14-24 Clutch Removal

NOTE: To energize coil turn ignition switch to accessory position and move control to refrigeration position. Remove nut, lock, and washer with felt from the compressor shaft.

2. Remove the 3 coil retaining screws from the coil housing.
3. Remove the 6 clutch ring attaching screws, lockwashers and locks, and position the clutch ring rearward.
4. Using Tool J-6351, remove pulley. (See Fig. 14-23)
5. Remove spacer washer and shims from compressor shaft. Important: The same shims should be reinstalled upon assembly if the same pulley and clutch are to be reinstalled.
6. Thread Tool J-6322 onto hub of clutch assembly. While holding the tool with a wrench, tighten the tool bolt to remove clutch assembly. (See Fig. 14-24) Remove Tool J-6322 from the clutch hub.
7. If selective shims or spacer are to be removed, remove the Woodruff key.

Pulley to Clutch Plate Clearance

If it is necessary to replace clutch plates, pulley, bearing or if the parts are being assembled on a service replacement compressor, a different combination of shims may be required to obtain .008" to .013" clearance between the friction material on the clutch plate and pulley face, with the clutch disengaged.

NOTE: This clearance must be obtained before the clutch assembly and the pulley are pressed onto the shaft.

To obtain the clearance, proceed as follows:

1. Place the pulley (with bearing installed) on a flat surface with clutch side of pulley facing up.
2. A combination of the following shims; .010", .015", .020" and .025" when used with the bearing spacer washer will permit a .008" to .013" clearance.
3. Select a combination for trial use, and place these shims on the inner race of the bearing, then place the bearing spacer on the shims. Place the clutch plate assembly in the pulley, so that the hub is in contact with the spacer and shims.
4. Press down firmly at the center of the hub. Rotate the clutch plate assembly. If a HEAVY "drag" is felt, thicker shims must be selected in order to provide a VERY slight "drag". If no "drag" is felt, thinner shims should be selected, so as to obtain a VERY slight "drag". When this condition is obtained,

determine the total thickness of the shims assembled. Either add an additional .010" shim or replace one of the shims with a .010" thicker shim which will provide .008" to .013" clearance between the outer clutch plate and the pulley.

Pulley and Clutch Replacement

1. Remove the clutch ring from coil housing and while pressing on coil retainer install the three coil retaining screws.
2. With spacer, shims, and Woodruff key installed, position clutch assembly, with clutch ring held against inner clutch plate, on compressor shaft. (Counterweight facing away from compressor.)
3. Place washer of Tool J-6323 on the compressor shaft with the chamfered side facing the clutch assembly.
4. Thread the bolt of Tool J-6323 onto the compressor shaft and while holding the

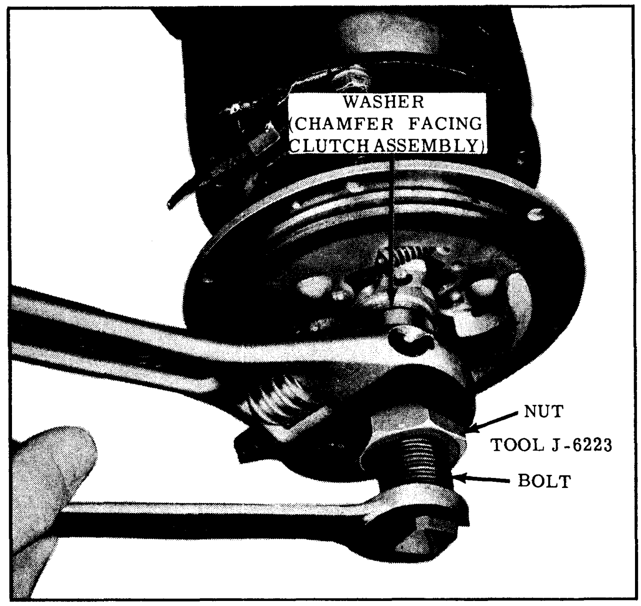


Fig. 14-25 Installing Clutch

bolt, turn the nut counterclockwise until the clutch assembly seats against the spacer and shims. (See Fig. 14-25) Remove the tool and washer.

5. Place the pulley spacer against the clutch hub, install the shims and then start pulley on compressor shaft. Place the washer of Tool J-6323 over the tool bolt with the chamfered side away from the tool. Thread tool bolt onto compressor shaft. While holding the tool

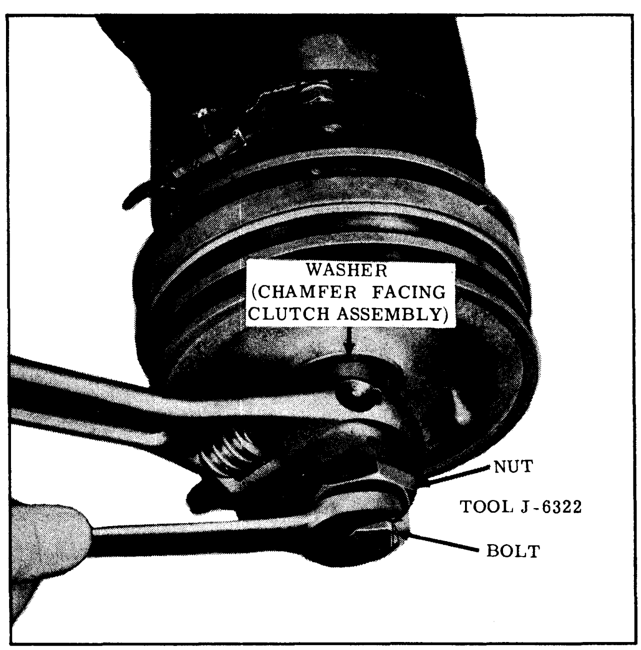


Fig. 14-26 Installing Pulley

bolt, turn the tool nut counterclockwise to press the pulley onto the compressor shaft. (See Fig. 14-26)

6. Install special washer and felt washer, with hub of washer and felt facing the pulley, over the compressor shaft.
7. Install lock with tang facing in, and nut on compressor shaft. (Do not torque at this time.)
8. Install the 6 clutch ring to pulley cap screws, with locks and lockwashers, and torque to 2 ft. lbs.
9. With the clutch coil energized, torque the compressor shaft nut 5 to 7 ft. lbs.
10. Check clutch air gap. The air gap must be .025" to .035". (See Fig. 14-26)
11. Install and adjust compressor belts to 20 ft. lbs. torque.

PULLEY BEARING

Removal

1. Remove pulley.
2. Remove bearing retainer ring from groove in pulley cavity using No. 3 Tru-Arc pliers.
3. Remove bearing from pulley hub.

   NOTE: If pulley hub shows evidence of wear due to outer race of bearing rotating in hub, replace pulley.

Replacement

1. Install new bearing into pulley by pressing on outer race of bearing.
2. Install retainer ring, (chamfer out) then install pulley.
3. Check clutch air gap.

CLUTCH FIG. 14-22

Disassembly

1. Remove the 3 clutch release springs by disengaging springs from spring seats.

   CAUTION: Clutch springs are under moderate tension, therefore care should be exercised in removal.
2. Separate clutch plates and remove 3 nylon balls.

Cleaning and Inspection

CAUTION: Do not clean the clutch assembly with cleaning solvent. Parts may be cleaned with a clean, dry, oil-free cloth. Examine nylon balls, tear-drop depressions, and friction surfaces of clutch plates. If the nylon balls are deformed, excessively worn, or damaged, they should be replaced. The clutch release springs may be replaced if necessary. If the clutch surfaces are worn or tear-drop depressions are deformed, the clutch plates must be replaced.

To assemble, place the rear clutch plate (lining side down) on a bench, place the nylon balls in the tear-drop depressions, place the clutch plate (with the counterweight up) over the nylon balls, and install the springs over the spring seats.

CLUTCH ACTUATING COIL FIG. 14-27

Removal

1. Remove the pulley and the clutch.
2. Remove clutch ring from coil housing.
3. Remove Woodruff key, shims and spacers from the compressor shaft.
4. Remove the coil retainer and insulator.
5. Disconnect the lead-in wire, remove the lead-in terminal, ground wire screw and the coil wire retaining clamp from the compressor flange.
6. Remove the coil and insulator from coil housing, taking care not to damage the coil.
7. Inspect insulators and replace if damaged.

Replacement

1. Place the inner insulator in the coil cavity with the opening aligned with the opening in the housing.
2. Route coil leads through opening in coil housing, and install coil.
3. Install retaining clamp, connect ground wire, and connect positive leads to the connector. Attach connector bracket to compressor flange.

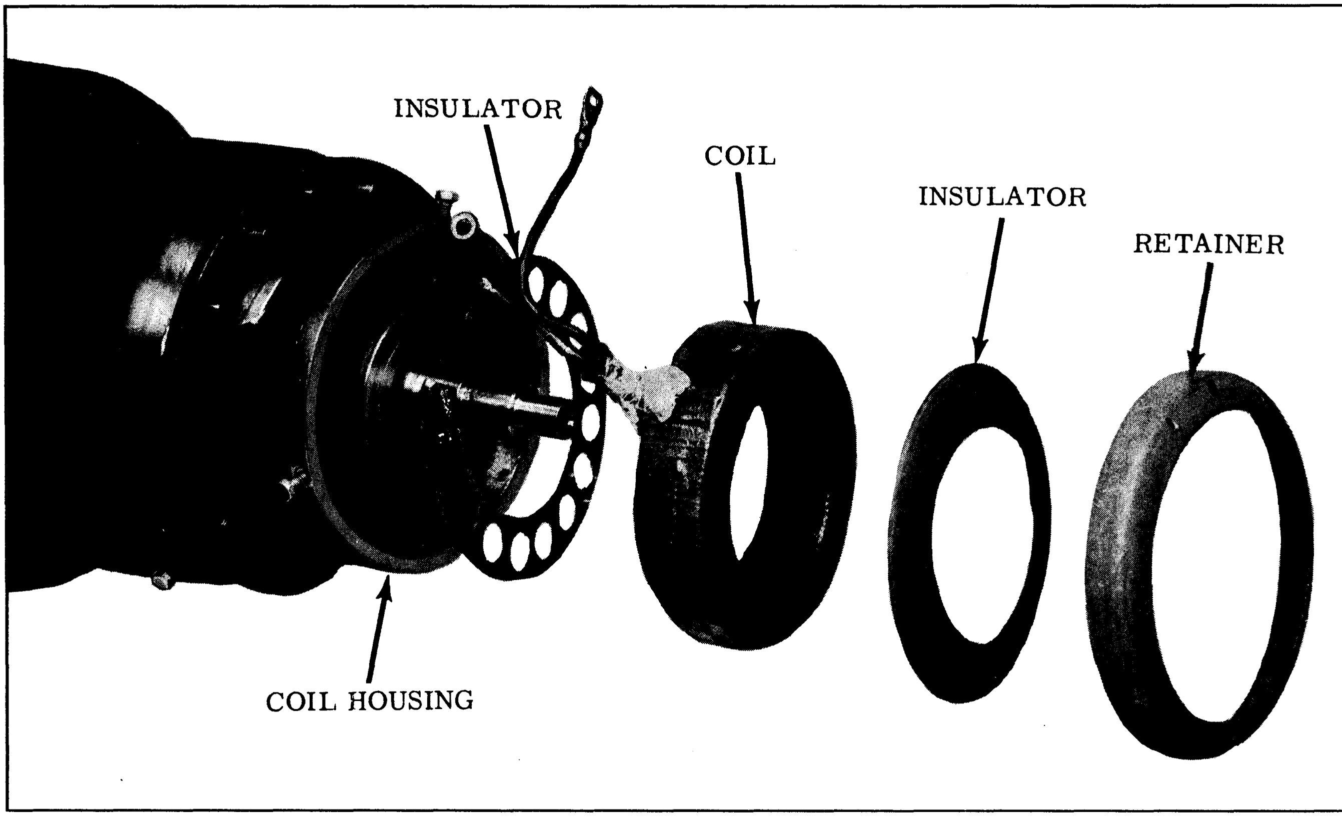


Fig. 14-27 Clutch Coil Assembly

4. Install paper insulator with the dished side toward the coil.
5. Install coil retainer over coil insulator with dished side toward coil and press firmly in place while installing the 3 retainer screws.
6. Install spacer washer, shims and woodruff key.
7. Place the clutch ring over the inner clutch plate, and install the clutch assembly on compressor shaft. (See Fig. 14-25)
8. Install the pulley.
9. Install compressor belts and torque to 20 ft. lbs.
10. Energize clutch coil and torque compressor shaft nut 5 to 7 ft. lbs.
11. Check the air gap between the clutch and the housing. Air gap must be .-25" to .035".

SERVICING OF THE FREON SYSTEM

In removing and replacing any part in the Freon system except the compressor, the following operations must be performed:

1. Purge the system by releasing the Freon to atmosphere.
2. Remove and replace the defective part.
3. Evacuate the system of air and moisture.
4. Charge the system with Freon-12.

PURGING THE SYSTEM

1. With the engine stopped, remove valve caps from compressor high and low pressure hand shut-off valves. (See Fig. 14-28)
2. Make sure both valves are turned fully counter-clockwise; this is to assure that gauge outlets are closed.
3. Remove caps from both gauge outlets on compressor.
4. Crack open (turn clockwise) high and low pressure hand shut-off valves on compressor and allow Freon to escape from the system.

   CAUTION: Do not open valves too much or compressor oil may be discharged with the Freon.

The complete system has now been

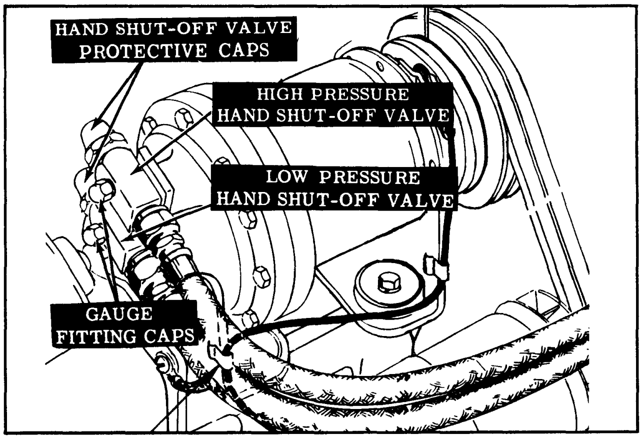


Fig. 14-28 Shut-Off Valves

purged of Freon and any part in the refrigerant system can be replaced.

EVACUATING THE SYSTEM

1. Have gauge set and Freon drum connected as shown in Fig. 14-29.
2. Turn compressor high pressure hand shut-off valve fully counter-clockwise, then two turns clockwise. Replace end caps and tighten. CAUTION: Leave compressor high pressure gauge outlet cap off.

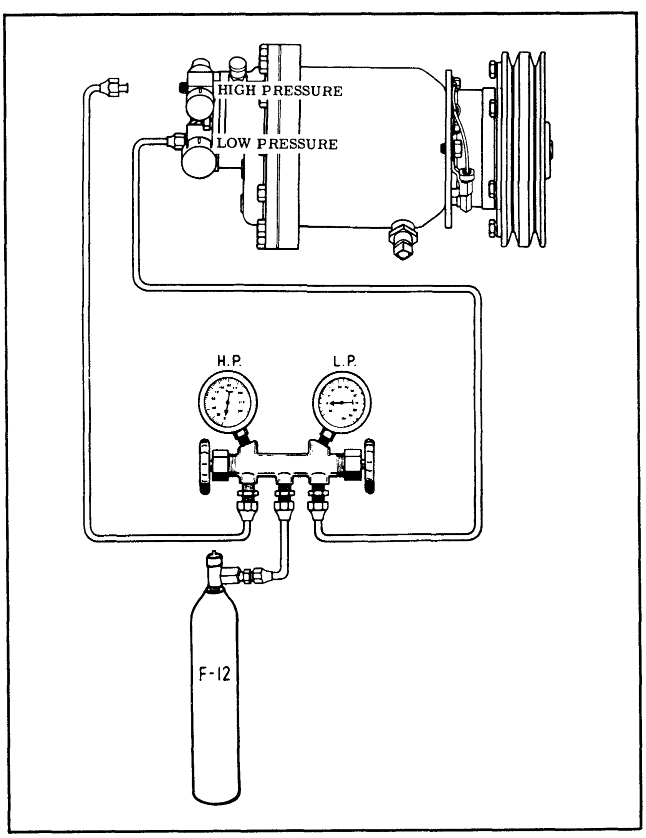


Fig. 14-29 Evacuating The System

3. Close high pressure gauge valve and open low pressure gauge valve.
4. Set refrigeration control against the detent, start engine and allow to run at slow idle to obtain a vacuum of 28" for 5 minutes.

   NOTE: Position a container to receive any oil discharged from the high pressure gauge outlet so that an equivalent amount of new oil can be added.
5. While engine is running, install cap on compressor high pressure gauge outlet.
6. Stop engine and observe if 28" vacuum will hold for 3 minutes.
7. Open valve on Freon drum and allow system to charge up to drum pressure; then, close valve on Freon drum.
8. Again purge the system through the compressor high pressure gauge outlet, by removing gauge outlet cap. After system is purged, start the engine. Allow to run at slow idle to obtain a vacuum of 28" for 5 minutes.
9. While engine is running, install cap on compressor high pressure gauge outlet, then stop the engine.

   NOTE: This second evacuation is to eliminate any air or moisture that might have remained in the system.
10. Place Freon drum on scales and weigh accurately. This is to determine amount of Freon used to bring the system up to drum pressure and to complete the full charge of Freon. Set drum in a pail of water heated to not more than 125 , if desired. (If pail of water is used, weight it with Freon drum.)
11. Open valve on Freon drum to charge system to drum pressure.
12. Turn compressor high pressure hand shut-off valve fully counter-clockwise and remove gauge outlet cap.
13. Crack open compressor high pressure hand shut-off valve to purge outlet, crack open high pressure gauge valve to purge hose, and connect hose to compressor while purging.
14. Turn compressor high pressure hand

shut-off valve clockwise two turns, then close high pressure gauge valve.

The system is now ready for charging. Total charge 3-3/4 lbs. Freon-12 (Includes amount used to bring system up to drum pressure)

CHARGING THE SYSTEM WITH FREON

NOTE: After the system is evacuated, leave the gauge set and Freon drum connected for the charging process. Make sure the high pressure gauge valve is closed, the low pressure gauge valve is open, and the valve on the Freon drum is closed; then, proceed as follows:

1. Open valve on Freon drum to allow Freon to enter the system. Start the engine and operate at fast idle with the refrigeration control against the detent. Close low pressure valve in gauge set at frequent intervals to be certain pressure in the low side is always maintained above 5 lbs.
2. When 3-3/4 lbs. of Freon has entered the system, close the Freon drum valve and the low pressure gauge valve.
3. Turn both compressor hand shut-off valves fully counter-clockwise, remove the gauge set, and replace caps on hand shut-off valves and gauge fittings.

EXPANSION VALVE ADJUSTMENT FIG. 14-30

Whenever diagnosis indicates that the expansion valve is incorrectly adjusted, it can be adjusted as follows:

1. Remove cap from expansion valve.
2. Turn adjusting screw fully clockwise, then counter-clockwise 4-1/2 turns.
3. Replace cap on expansion valve.

BY-PASS VALVE ADJUSTMENT FIG. 14-31

The "Hot Gas" by-pass valve is adjusted to regulate evaporator pressure so that it will not fall below 29 to 30 psi. If it controls below 29 psi, the evaporator will ice up and refrigeration capacity will be reduced. If the valve controls higher than

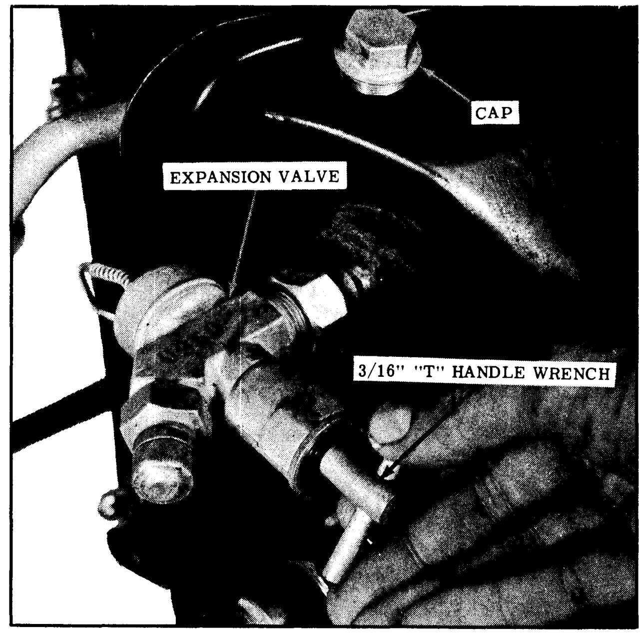


Fig. 14-30 Expansion Valve Adjustment

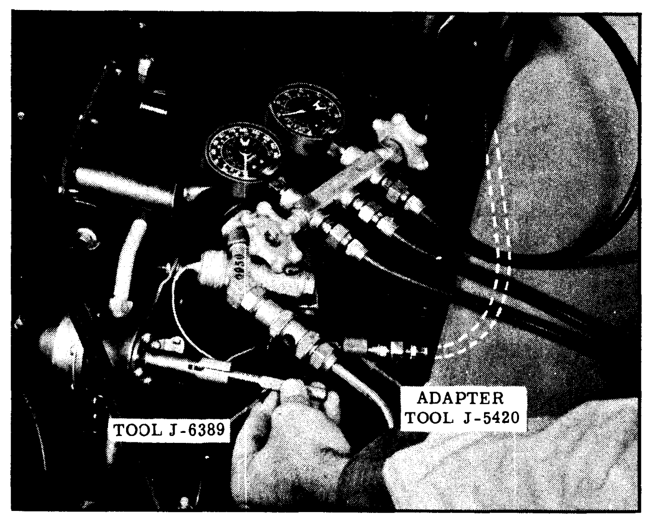


Fig. 14-31 "Hot Gas" By-Pass Valve Adjustment

this pressure, an undesirable loss of refrigeration will occur and will be especially noticeable in extremely hot weather. This is due to the fact that for each pound in pressure higher than 30 psi the discharge air temperature will be raised one degree. The controlling pressure of the valve can be checked and adjusted as follows:

1. Remove cap from gauge fitting on the low pressure line near the evaporator assembly.

   NOTE: This gauge fitting has a Schrader valve.
2. Install adapter, Tool J-5420, on the

low pressure gauge line and connect the adapter to the gauge fitting on the low pressure line.

3. Purge the gauge and hose by opening the low pressure gauge valve for a few seconds.
4. Start engine and allow to run at 2000 RPM, move refrigeration control lever against the detent, and turn blower speed on "Low".
5. Observe pressure gauge and adjust only if it is not 29 to 30 psi.

   NOTE: If necessary to adjust the pressure setting, the control cable and the lever and cam will have to be disconnected from the by-pass valve in order to insert Tool J-6389 into the valve. (See Fig. 14-31) After the valve pressure has been adjusted to 29.5 psi the control cable adjustment will have to be made. (Refer to BY-PASS CONTROL CABLE ADJUSTMENT)
6. Turn adjusting screw clockwise to increase pressure; counter-clockwise to decrease pressure to obtain 29.5 psi.
7. With engine off, remove gauge hose from pressure fitting and replace cap.

EVAPORATOR ASSEMBLY
FIG. 14-32.

NOTE: The expansion valve can be replaced without removing the evaporator assembly by following the instruction sheet in the expansion valve parts package.

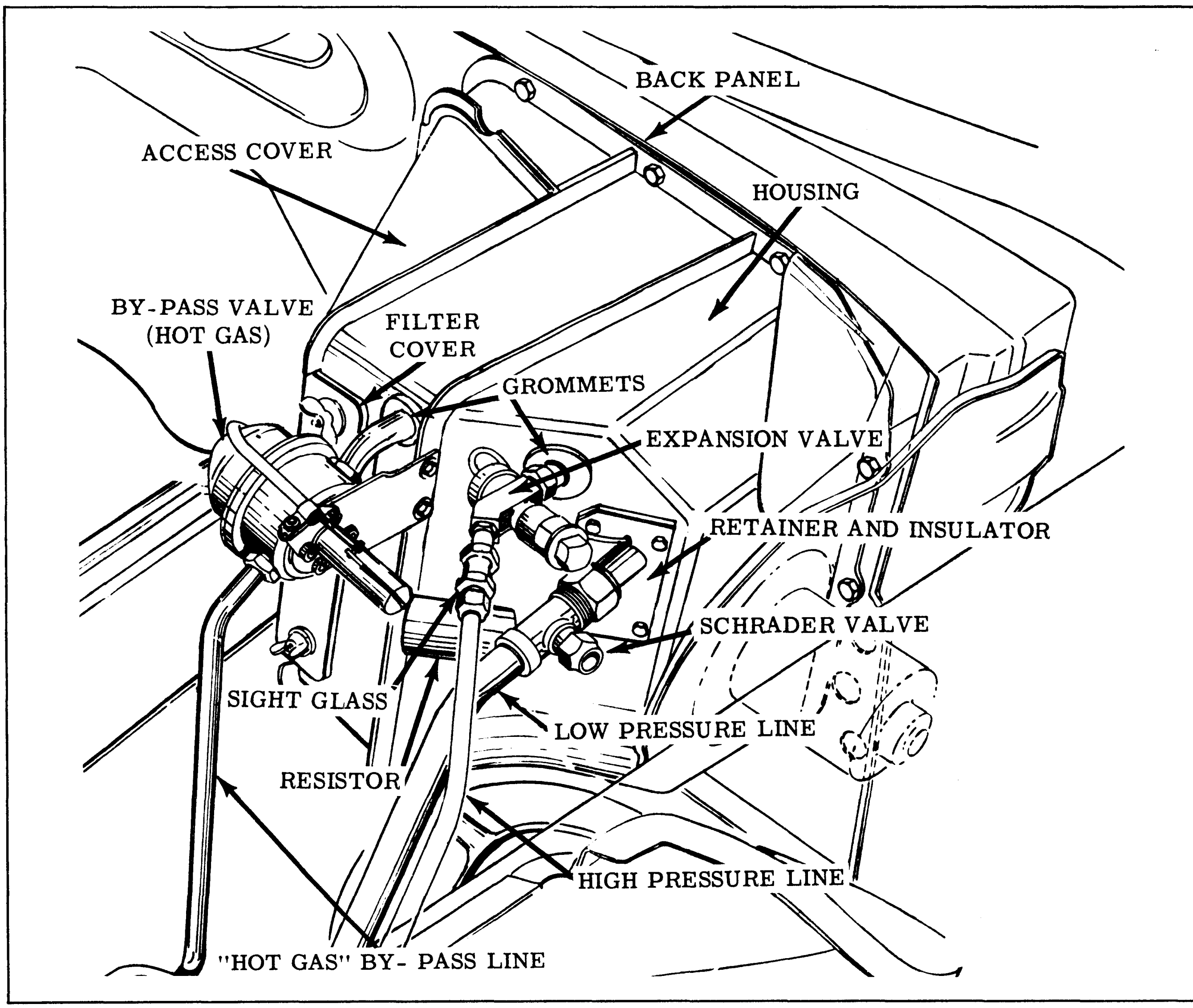


Fig. 14-32 Evaporator Assembly

Removal

1. Purge Freon system as outlined under PURGING THE SYSTEM.
2. Disconnect air control valve cables at evaporator assembly.
3. Disconnect by-pass valve cable.
4. Disconnect battery.
5. Disconnect blower motor wires and remove resistor from evaporator housing.
6. Disconnect line clamps as necessary to permit disengagement of connections.
7. Disconnect high pressure line from the expansion valve, the evaporator low pressure line at the evaporator, and remove the by-pass valve.
8. Cap all lines immediately.
9. Remove fender to body support rod and engine air cleaner.
10. If car is equipped with power brakes, disconnect vacuum line from bracket and carburetor.
11. Remove housing back panel to dash sheet metal screws and remove evaporator assembly.

    NOTE: The lower area of the housing is retained by a wedge type bracket and the bracket screws do not have to be removed.

Disassembly
FIG. 14-33

1. Remove wing nuts, filter cover, and filter.
2. Remove screws holding access cover to evaporator housing and back panel, then remove access cover.
3. Remove low pressure line insulator and retainer plate. Remove high pressure line grommet and the hot gas by-pass line grommet from housing.
4. Remove expansion valve from evaporator high pressure line.
5. Remove screws and Tinnerman nuts holding evaporator housing to back panel and mounting plate, then disengage back panel from housing to permit removal of capillary bulb.

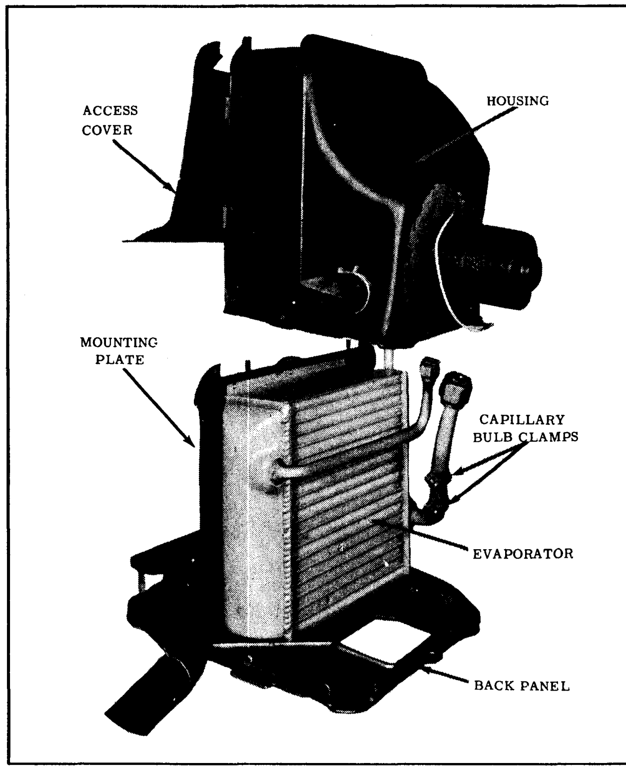


Fig. 14-33 Evaporator and Housing

6. Remove expansion valve and housing.
7. Remove three screws holding evaporator mounting plate to the back panel.

Assembly

1. Install evaporator mounting plate to back panel with three screws.
2. Scrape off old sealer and apply auto body sealer or equivalent to the evaporator housing flange.
3. Route capillary tube through evaporator housing and tightly clamp capillary bulb on the evaporator low pressure line. Make sure line and bulb are clean and bright.
4. Install the evaporator housing by lowering the housing over the pressure lines, making sure the tabs on the housing are in place over the mounting plate.
5. Make sure the blower housing fits in the back panel opening, then install the housing-to-back panel attaching screws and Tinnerman nuts.
6. Apply auto body caulking or equivalent between the blower housing and back panel opening.

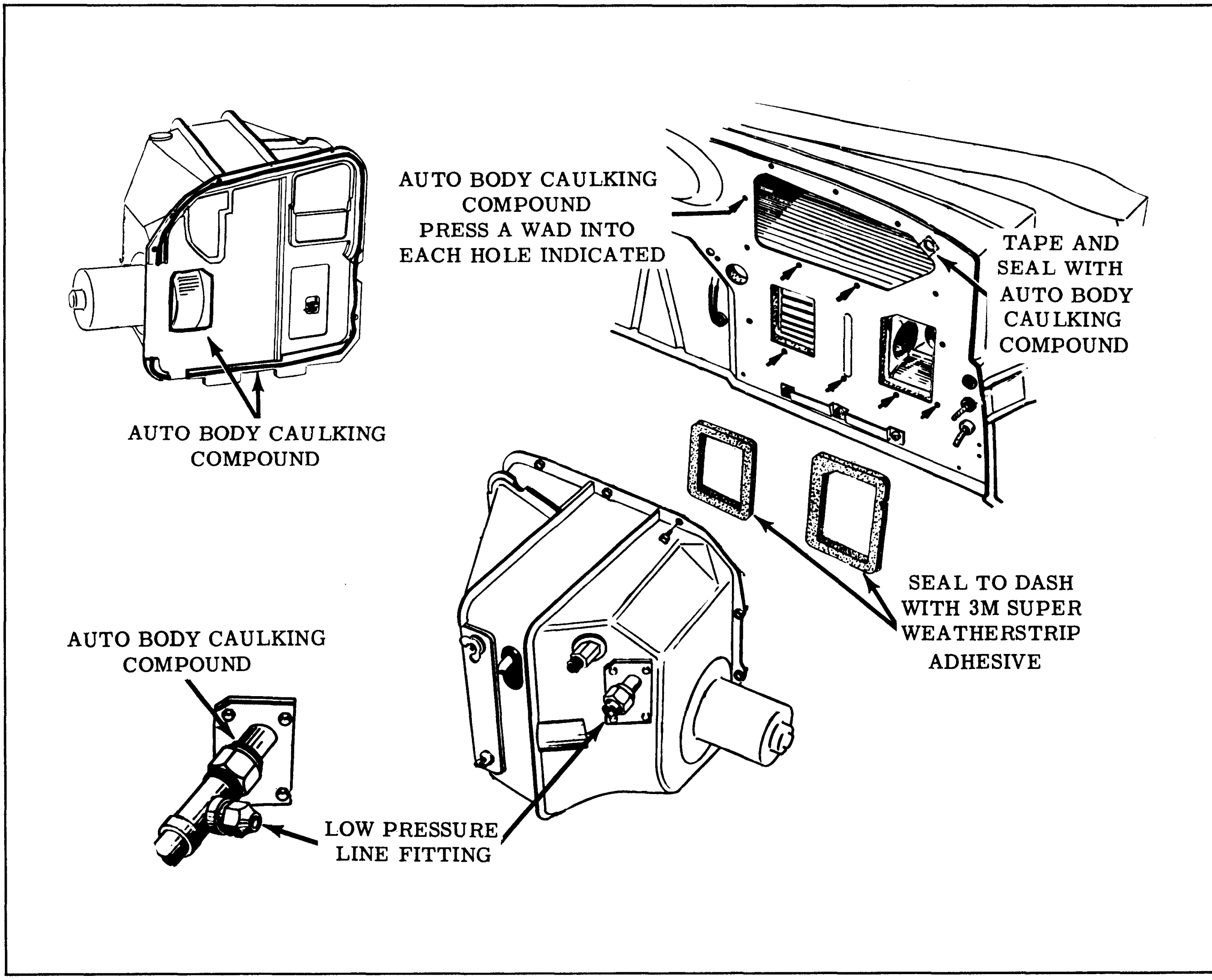


Fig. 14-34 Sealing Areas

7. Install rubber grommets in housing around the high pressure and by-pass lines and install low pressure line insulator and retainer plate on the housing.
8. Install expansion valve on evaporator high pressure line.
9. Inspect the access cover rubber gaskets. Make sure that the gaskets are properly cemented to the access cover, then install the access cover and attaching screws.
10. Install filter and filter cover, then retain with flat washers and wing nuts.

Replacement

1. Scrape old sealer from dash and apply auto body caulking or equivalent to the edge of the back panel. (See Fig. 14-34)
2. Position housing on dash and install back panel to dash sheet metal screws.
3. Remove caps from lines and connect high and low pressure lines.
4. Attach line clamps.
5. Connect blower motor wires and replace resistor on housing.
6. Connect battery.
7. Connect air control valve cables.
8. Connect by-pass valve cable.
9. Adjust cables. Refer to CONTROL CABLE ADJUSTMENT.
10. Replace fender to body support rod and air cleaner.
11. Connect vacuum line if car is equipped with power brakes.

12. Evacuate the system as outlined under EVACUATING THE SYSTEM.
13. Charge the system as outlined under CHARGING THE SYSTEM.
14. Leak test all line fittings that were disconnected. Refer to LEAK DETECTOR.

COMPRESSOR SEAL

Removal

1. Remove caps from compressor high and low pressure hand shut-off valves.
2. Turn both compressor hand shut-off valves fully clockwise to close the system and open compressor gauge outlets.
3. Loosen compressor high pressure gauge outlet cap and allow Freon to purge until "hiss" is no longer heard.
4. Remove clutch coil. Refer to Pulley and Clutch Removal, and Coil Removal.
5. Remove the 6 screws and pull the coil housing from the compressor.
6. With the compressor shaft keyway on the threaded section of the shaft facing up, to avoid losing the drive pin, remove the wavewasher and seal assembly.
7. With a screwdriver inserted into the seal shell, pry the seal from the coil housing.
8. From the compressor side of the coil housing, remove the snap ring, seal seat, and "O" ring.
9. Remove the large "O" ring from the coil housing flange.

Cleaning and Inspection of Parts

Thoroughly clean the seal cavity and shaft with wiping tissues furnished in the seal package. DO NOT touch or mar the contacting face of the new seal or seal seat with hands or tools since this may damage the seals. All Seals and "O" rings must be replaced with new parts.

Replacement
FIG. 14-35

1. Flush the coil housing seal cavity with Frigidaire Oil No. 525.
2. Install wave washer in recess of compressor flange.
3. Install Tool J-6320 on the compressor shaft with the tapered end toward the

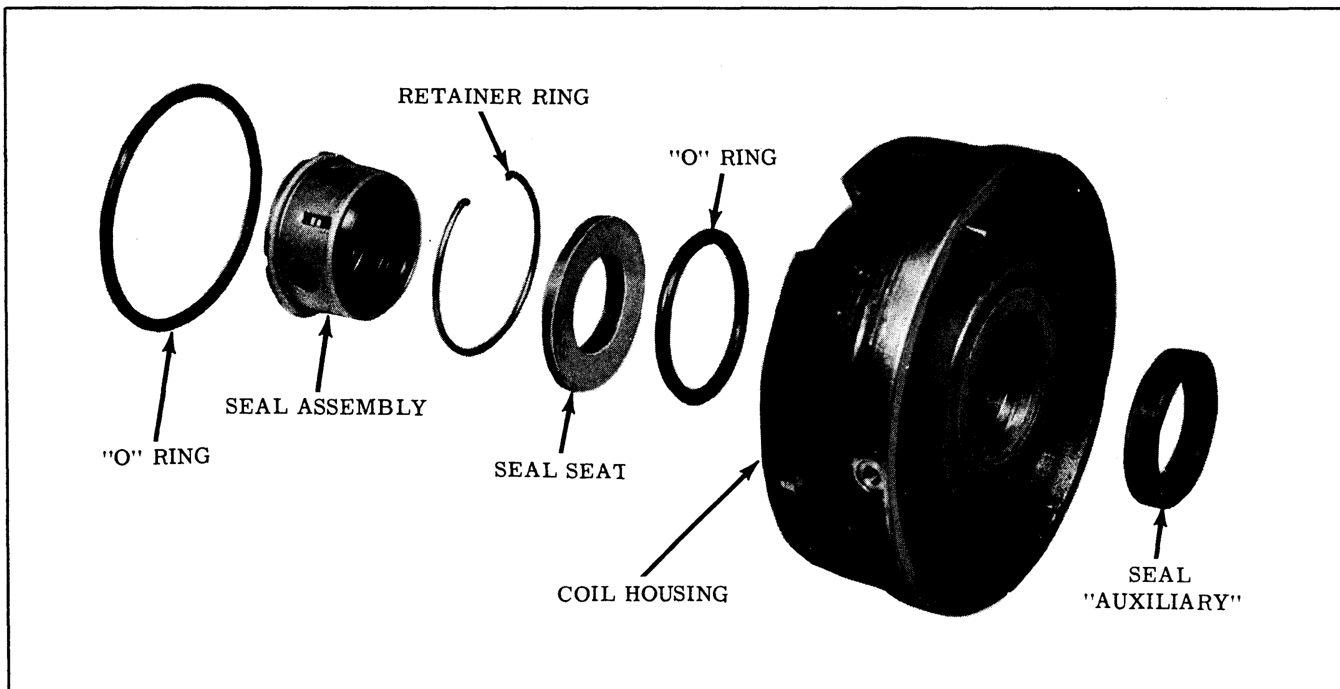


Fig. 14-35 Compressor Seal Assembly

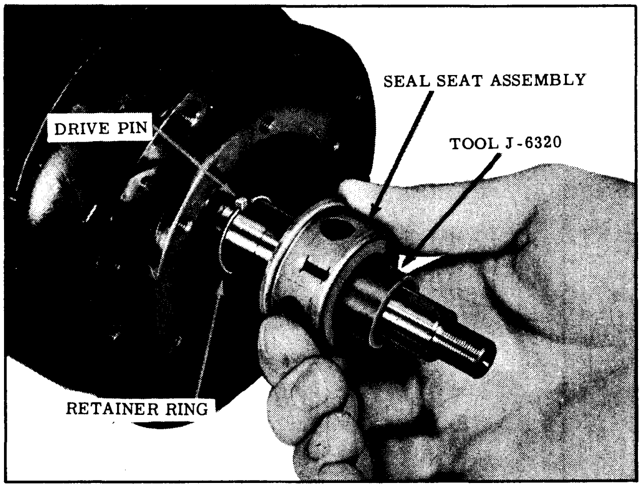


Fig. 14-36 Installing Seal

front of the shaft. Align the seal drive pin and rotate the retaining ring to contact the pin to hold it in place.

4. Coat the entire seal assembly with Frigidaire Oil and install the seal assembly, making sure the drive pin engages the keyway in the seal. (See Fig. 14-36)
5. Coat O.D. of auxiliary seal with Frigidaire Joint Compound and press seal into coil housing. (Seal lip must face compressor) (See Fig. 14-35)
6. Install the "O" ring into the seal cavity of the coil housing.
7. Coat the seal seat with Frigidaire Oil and place into seal cavity with the small diameter out so that it will face the compressor.

   CAUTION: Do not touch sealing surface.
8. Install seal seat retaining ring into seal cavity, being extremely careful not to mar sealing surface.
9. Install the large coil housing "O" ring and coat with Frigidaire Oil.
10. With Tool J-6320 in place on compressor shaft, install the coil housing with the wire opening positioned between the tapped holes for ground wire and hold-down clamp.
11. Start the 6 coil housing screws and tighten evenly to 15 ft. lbs. torque. Remove Tool J-6320 from compressor shaft.
12. Install coil, clutch, and pulley. (Refer to Coil Replacement, Clutch Assembly and Pulley Replacement.)

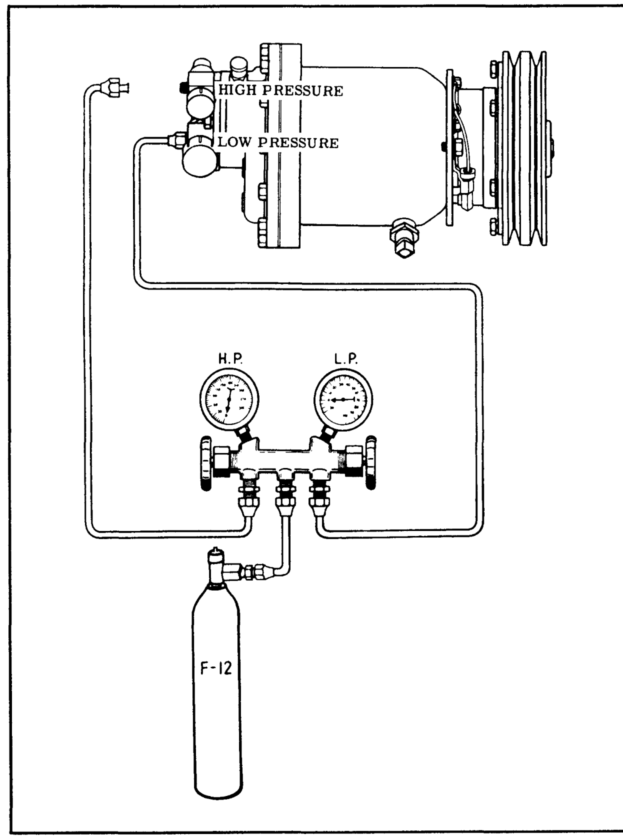


Fig. 14-37 Connections for Evacuating

13. Connect gauge set as shown in Fig. 14-37. Be sure the compressor hand shut-off valve caps are replaced after the gauge set is connected.
14. Remove cap from compressor high pressure gauge outlet, close high pressure gauge valve, and open low pressure gauge valve.
15. Start engine and allow to run at slow idle. Set refrigeration control lever against the detent. Position a container to receive any oil discharged from the high pressure gauge outlet so that an equivalent amount of new oil can be added.
16. Allow engine to run until 28" of vacuum has been maintained for 5 minutes.
17. While engine is running, install cap on compressor high pressure gauge outlet and stop engine. Observe if 28" vacuum will hold for 3 minutes.

   NOTE: If vacuum does not hold,

charge system with drum pressure and check for leaks.

18. Open valve on Freon drum and allow compressor to come up to drum pressure, then close valve.
19. Purge the compressor again through the high pressure gauge outlet, then remove the cap from the gauge outlet and start the engine. Allow to run at idle until 28" of vacuum has been maintained for 5 minutes, then install cap on compressor high pressure gauge outlet and stop the engine.
20. Open valve on Freon drum to charge compressor, then momentarily loosen the compressor high pressure gauge outlet cap to purge the air remaining in the high pressure side of the compressor.
21. Remove the compressor high pressure hand shut-off valve cap, then turn valve fully counter-clockwise, and remove the cap from the high pressure gauge outlet.
22. Crack open compressor high pressure hand shut-off valve to allow Freon to purge slowly from gauge outlet; then, crack open high pressure gauge valve to purge high pressure gauge hose, and connect hose to gauge outlet and tighten.
23. Close valve on Freon drum and high pressure gauge valve.
24. Turn compressor high pressure hand shut-off valve two turns clockwise. Turn compressor low pressure hand shut-off valve fully counter-clockwise, then two turns clockwise.
25. Check the system as outlined under "ADDING FREON - PARTIAL CHARGE". If it is necessary to add Freon, omit steps 1 through 7 of the procedure for adding freon, since the gauge set on freon drum is already connected.

MALFUNCTIONING COMPRESSOR

A new compressor does not have the clutch actuating coil parts, the pulley clutch parts, or the hand shut-off valve assembly. A service shipping plate is bolted over two "O" rings to seal the valve port openings. The two "O" rings under the shipping plate should be transferred to the old assembly and two new "O" rings used when installing the compressor on the car. A new compressor is charged with nine ounces of Frigidaire 525 Viscosity Oil, and a mixture of Freon-12 and nitrogen under approximately 5 psi pressure. Envelopes attached to the compressor contain enough shims to insure a sufficient number of shims for the compressor clutch adjustments. The old compressor, with the shipping plate attached, should be packed in the returnable crate and shipped to: Frigidaire Division, Service Receiving-Plant No. 5, Moraine, Ohio.

Removal

1. Remove caps from compressor high and low pressure hand-off valves.
2. Turn both compressor hand shut-off valves two turns clockwise to open the compressor gauge outlets.
3. Loosen compressor high pressure gauge outlet cap and allow Freon to purge from system until "hiss" is no longer heard; then turn both hand shut-off valves fully clockwise.
4. Turn ignition switch to accessory position and refrigeration control against the detent to energize clutch coil. Remove the lock, nut, special washer, and felt washer from the hub of the pulley.
5. Turn the ignition switch off and disconnect both wires at the clutch coil.
6. Remove the belts from the compressor pulley.
7. Remove the bolt holding the hand shut-off valve assembly to the compressor, then remove the assembly from the compressor.
8. Remove the compressor-to-support bolts, then remove the compressor assembly.
9. Remove the pulley, clutch, and coil. (Refer to Pulley and Clutch Removal and Coil Removal)

Replacement

1. Position the new compressor on the support plates, then install and tighten

the compressor-to-support plate bolts to 15 ft. lbs. torque.

2. Remove the protective covering from the shaft of the new compressor.
3. Install coil, clutch, and pulley. (Refer to Coil Replacement, and Clutch and Pulley Replacement)
4. Connect coil wire.
5. Turn ignition switch to accessory position, and refrigeration control against the detent to energize clutch coil.
6. Check clearance between clutch plate and coil housing. If clearance is not between .025" and .035", it will be necessary to remove pulley and add or subtract shims. (Shim thickness .010", .015", .020", .025")
7. Remove the shipping plate from the rear of the compressor. Remove two "O" rings from the valve port openings, and install two new "O" rings.
8. Install the hand shut-off valve assembly on the compressor, then install the mounting bolt and tighten to 15 ft. lbs. torque.
9. Install belts and torque to 20 ft. lbs. using Tool J-4170.
10. Install a charging line to the compressor high pressure gauge outlet and to a drum of Freon-12.
11. Disconnect the liquid line from the de-hydrator-filter-receiver assembly on the inlet side, and cap the dehydrator-filter-receiver immediately.
12. Turn the high pressure hand shut-off valve fully counter-clockwise, then turn it back two turns clockwise.
13. Open the Freon drum valve and turn the drum upside down to allow liquid Freon to flush through the condenser and out the line. Use approximately 2 lbs. of Freon for this operation.
14. Close the drum valve and connect the Freon line to the de-hydrator-filter-receiver assembly.
15. Remove the expansion valve screen and clean or replace if necessary.
16. Remove the charging line from the compressor high pressure gauge outlet, install the gauge set, and evacuate the entire system as outlined under EVACUATING THE SYSTEM.
17. Recharge the system as outlined under CHARGING THE SYSTEM WITH FREON - COMPLETE CHARGE.

ADDING FREON—PARTIAL CHARGE

The proper charge of Freon to insure a clear sight glass under operating conditions at various ambient temperatures is 3-3/4 lbs. Since less than 3-3/4 lbs. will result in a clear sight glass under some load conditions, it is necessary to consider load effects when checking and adding Freon to the system. The load can be varied by changing the blower speed as listed in the following chart. Be sure to operate the system for at least 5 minutes before checking sight glass.

Ambient Temp. (Outside Of Car)	Blower Switch Position	Control Setting	Engine RPM
70^o-80^o	High	Against the detent	1500
80^o-90^o	Medium	Against the detent	1500
90^o or above	Low	Against the detent	1500

If the system is low on Freon, proceed as follows: (See Fig. 14-38)

1. Turn off the ignition switch.
2. Remove both compressor hand shut-off valve caps and make sure both valves are turned fully counter-clockwise.
3. Remove both compressor gauge outlet fitting caps and install the gauge hoses on the fittings. (See Fig. 14-38)
4. Make sure both gauge valves are closed, then turn both compressor hand shut-off valves two turns clockwise.
5. Crack open both gauge valves to purge the gauge hoses through the center hose, and crack open the valve on the Freon drum or the Fits-All-Valve on a 15 oz. Freon can. While Freon is escaping from the center hose of the gauge set and the valve fitting on the Freon container, connect the center hose to the Freon container.
6. Close the Freon container valve and both gauge valves.

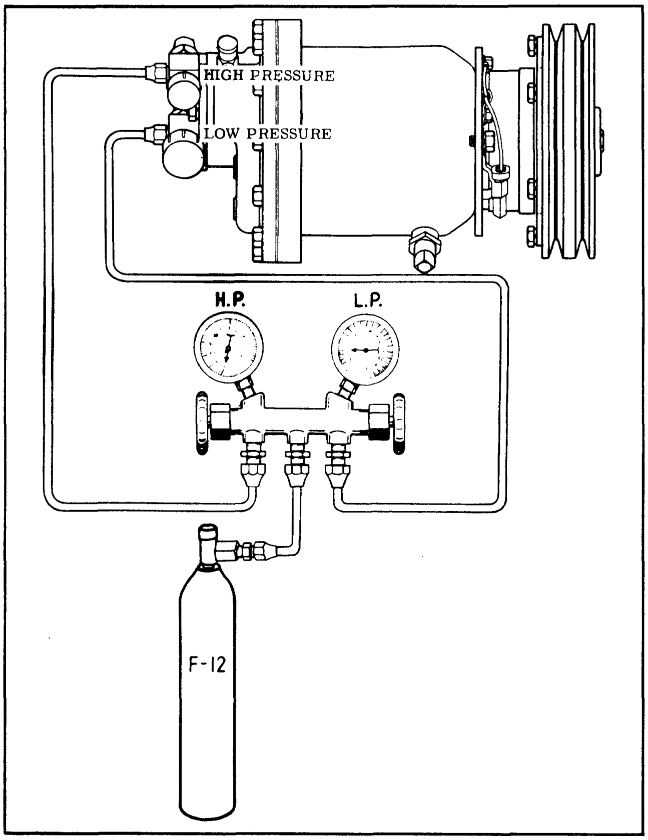


Fig. 14-38 Adding Freon (Partial Charge)

7. Start the engine and set at 1500 RPM. Make sure the refrigeration control lever is against the detent, and the blower switch is set according to the preceding chart.
8. Open valve on Freon container and the low pressure gauge valve to allow Freon to enter the system. When sight glass clears, close Freon container valve.
9. Wait two minutes, then check the sight glass. If vapor is still visible, open the Freon container valve and again allow Freon to enter the system. Add 1/4 lb. of Freon after sight glass clears.
10. Shut off engine, turn both compressor hand shut-off valves fully counter-clockwise, remove gauge set and install all protective caps.

CHECKING OIL LEVEL

If a refrigerant leak is found which indicates some loss of oil by the presence of oil around the leak, of it is is necessary to determine whether or not the compressor has a sufficient amount of oil, the following procedure should be used:

1. Start engine and operate at 1500 RPM with control against detent for 5 minutes, then stop the engine.
2. Slowly open the oil test valve on the compressor and allow the first surge of oil and Freon to escape against a clean cloth. The Freon will evaporate while the oil will saturate the cloth.

   NOTE: The first surge of oil may be only the amount of oil standing in the fitting. The valve should be held in the open position to be certain the oil level is at least to the top of the fitting.
3. If oil continues to escape with the Freon vapor, the oil level in the compressor is to be considered satisfactory.
4. If oil does not continue to escape from the test valve, the oil is below the minimum level and oil will need to be added to the compressor.

ADDING OIL FIG. 14-39

1. Remove caps from compressor high and low pressure hand shut-off valves and make sure valves are turned fully counter-clockwise.
2. Remove plug from high pressure gauge outlet and connect high pressure gauge hose to compressor high pressure fitting.
3. Install plug in center hose on gauge set.
4. Turn compressor high pressure hand shut-off valve two turns clockwise and replace cap.
5. Crack open the high pressure valve on the gauge manifold.
6. Crack open the low pressure valve on the gauge manifold to purge air from gauge set. While vapor is still escaping from the low pressure gauge line, connect to low pressure fitting on the compressor hand shut-off valve.
7. Close the high and low pressure valves on the gauge set.
8. Turn the compressor low pressure hand shut-off valve two turns clockwise.

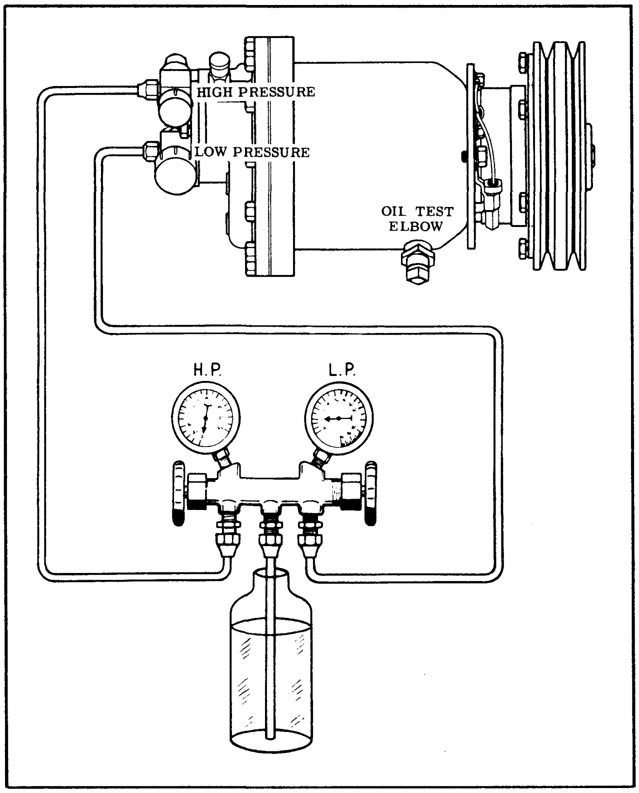


Fig. 14-39 Adding Oil

9. Remove center hose on gauge set and install oil charging line.
   NOTE: Make certain oil line is clean. (Use a 1/4" x 10" copper tube with fitting to connect to center connection on gauge set.)
10. Crack open the high pressure valve on the gauge set to purge air from the oil charging line.
11. While vapor is still escaping from the oil charging line, uncap the oil bottle (Frigidaire 525 Viscosity) and insert the oil line to the bottom of the oil bottle and allow vapor to slowly bubble through the oil.
12. Close high pressure valve on gauge set. Allow time for escaped vapor to dissipate. Leak test all connections that were made during repair.
13. Position the gauge set and oil charging line, while still inserted to the bottom of the oil bottle so that it will not be disturbed during the following procedure.
14. Move refrigeration control to detent position, start engine and allow to run at slow idle until approximately 10" vacuum is obtained.
15. Stop the engine and observe the low pressure gauge to see if the vacuum will hold. There should not be any fast change of gauge reading.
16. Open the low pressure valve on the gauge set and allow 2 ounces of oil to be drawn from the bottle.
17. Close the low pressure valve on the gauge set. Remove the oil charging line from the bottle and replace cap on bottle. Remove the oil charging line from the gauge set and install a cap on the center connection.
18. Open the high pressure valve on the gauge set.
19. Open the low pressure valve on the gauge set slowly to allow the high side pressure to force the oil remaining in the gauge set and low pressure gauge line into the compressor.
20. Close high and low pressure valves on the gauge set and then turn compressor low pressure valve fully counter-clockwise and replace cap.
21. Start engine and operate at 1500 RPM with control against detent for 5 minutes, then stop engine.
22. Again open oil test valve and allow first surge of oil to escape against a clean cloth. If oil continues to escape the oil level is satisfactory. If oil does not come out after first surge, add another 2 ounces at a time following previous procedure until test indicates a sufficient amount has been added.
23. Remove end cap from high pressure hand shut-off valve on compressor and turn valve fully counter-clockwise and replace cap.
24. Remove gauge lines and replace caps on gauge lines and on compressor valves.

CHECKING AND ADDING OIL—AFTER MAJOR LOSS

The compressor was originally charged with 9 ounces of Frigidaire 525 Viscosity Oil. During normal operation, because of the affinity of Freon-12 for oil, a certain amount of oil will circulate throughout the system along with the liquid and vapor. To determine if the compressor has sufficient oil, an oil test valve has been placed on the underside of the compressor body. If any major loss of oil has occurred, such as a severe compressor seal leak, line breakage, damaged condenser, etc., proceed as follows after making the necessary repairs.

1. Remove belts and coil electrical lead (black wire).
2. Turn compressor hand shut-off valves fully clockwise, then remove low and high pressure hand shut-off valves from compressor by removing center bolt.
3. Remove compressor to support mounting bolts.
4. Transfer compressor to bench and remove oil test valve body.
5. Allow all of the oil to drain from the compressor into a clean container; this is to determine the amount and condition of oil.

   NOTE: If the examination of the oil shows any foreign material; sludge, water, etc., flush the system as outlined under INSTALLING A NEW COMPRESSOR.

6. If the condition of the oil indicates that the compressor is free of any contamination, position the compressor so that the oil test valve flange is on the top side and pour from a graduated bottle, 9 ounces of NEW Frigidaire 525 Viscosity Oil into the compressor.
7. Replace the oil test valve. Use Frigidaire Sealer on valve body threads.
8. Install compressor on the engine and connect electrical lead to coil.
9. Using new "O" rings, install compressor hand shut-off valves; then torque bolt to 15 ft. lbs.
10. Install belts and torque to 20 ft. lbs. using Tool J-4170.
11. Evacuate the system to remove air and moisture; then charge the system with Freon.

DIAGNOSIS AND SPECIFICATIONS

AIR CONDITIONING ROAD TEST

This test does not serve as a basis for diagnosis, but only as a guide to determine if the discharge air temperature is standard. If the discharge air temperature is not standard, make the performance test to locate the cause of the malfunction.

Drive the car at 20 mph with the control lever against the detent (full outside air), and a thermometer in the left air discharge nozzle. Make sure the windows and doors are tightly closed, since this can affect the velocity and the temperature of the discharge air. After taking the temperature reading, perform this test in the opposite direction to cancel any wind effect. Also, the relative humidity must be determined for this test since it will have an effect on the discharge air temperature.

Temperature (Outside) °F.	Relative Humidity %	Discharge Air Temperature (L.H. Nozzles) °F.
70	50	43
	60	43
	90	44
80	50	46
	60	48
	90	54
90	40	52
	50	54
	60	58
100	23	55
	40	61

PERFORMANCE TEST

The Performance Test should be made with the car doors and windows closed, the refrigeration control lever against the detent (full outside air), fan speed switch on "high," an auxiliary fan in front of the radiator, and the car hood down as far as possible. Since the gauge hoses prevent the hood from being completely closed, cover the complete hood-to-cowl opening to prevent engine heat from entering the evaporator.

1. Connect Low pressure gauge to gage connection in low pressure line near evaporator; then, momentarily open the Low pressure gauge valve to purge the gauge hose.
2. Remove the compressor high pressure gauge outlet cap and install the high pressure gauge hose.
3. Make sure high pressure gauge valve is closed; then, turn the compressor high pressure hand shut-off valve two turns clockwise. Momentarily open high pressure gauge valve to purge the gauge hose.
4. In Neutral, adjust engine speed to maintain 32 p.s.i. pressure. Continue until discharge air temperature at left hand nozzle stabilizes. Vary engine speed as required to maintain 32 p.s.i. at the pressure regulator valve until stabilization is achieved.
5. After temperature and humidity have been determined, compare test results with the Performance Chart.
6. To obtain low pressure reading at compressor proceed as follows:

   A. Connect tachometer and record engine RPM with low pressure gauge still reading at 32 p.s.i. as outlined above.

   B. Disconnect low pressure gauge at connection near evaporator.

   C. Remove the compressor low pressure gauge outlet cap and install the low pressure gauge hose. (See Fig. 14-40)

   D. Make sure the low pressure gauge valve is closed. Then turn the compressor low pressure hand shut-off valve two turns clockwise. Momentarily open low pressure gauge valve to purge the gauge hose.

   E. Check tachometer to make sure engine RPM has not changed. Then compare reading with Performance Chart.

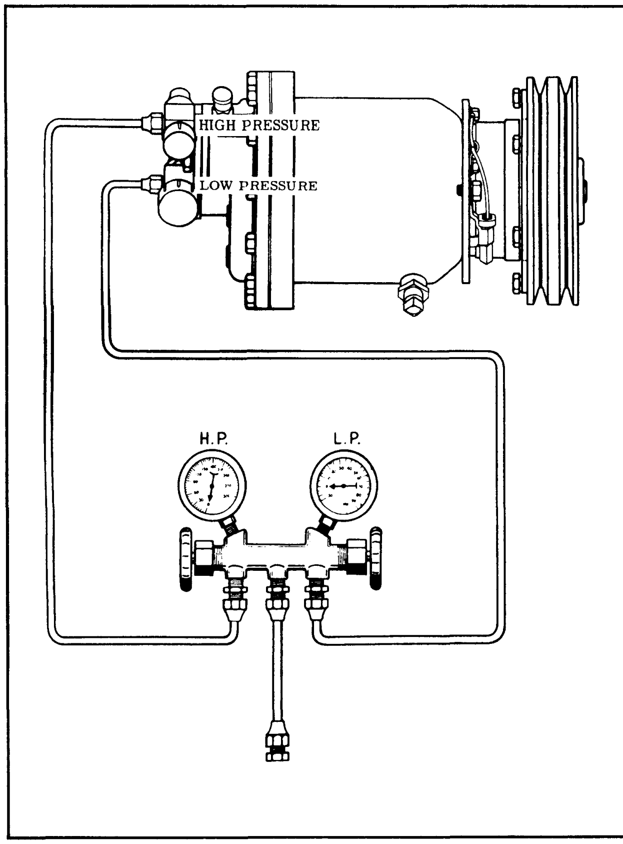


Fig. 14-40 Gauge Connections for Pressure Test

*Cowl Inlet		Evaporator Pressure	Engine	Discharge Air LH Nozzle	Pressures	
Relative Humidity	Temp.	(At Pressure Regulator Valve)	(RPM Range)	Temp. ± 1°F	Low (Suction) ± 3 lbs.	High (Discharge) ± 10 lbs.
10	70	32		40.5	31.9	102
	80	32	335-370	43	31.9	138
	90	32	475-525	45	31.7	180
	100	32	800-885	47.5	31.5	221
	110	32	1095-1210	51	30	263
20	70	32	295-325	41	31.9	109
	80	32	440-485	44	31.8	147
	90	32	665-735	46.5	31.3	190
	100	32	1045-1155	49.5	30.4	233
	110	32	1510-1670	54	28.8	277
30	70	32	350-390	42	31.9	115
	80	32	540-600	45	31.7	155
	90	32	845-935	48	31	201
	100	32	1290-1430	52	29.3	245
	110	32	1930-2130	57	27.2	290
40	70	32	400-440	42.5	31.9	121
	80	32	645-715	45.5	31.6	164
	90	32	1015-1125	49	30.6	211
	100	32	1540-1705	54.5	28.1	258
	110	32	1960-2165	60	25.6	
50	70	32	455-505	43	31.9	127
	80	32	775-825	46	31.4	172
	90	32	1200-1325	50	30.1	221
	100	32	1795-1985	57	27	270
	110	32		63	25.5	
60	70	32	500-560	44	31.9	134
	80	32	865-955	47	31.2	181
	90	32	1385-1535	51.5	29.5	231
	100	32		59		282
	110	32		66.5	25.5	
70	70	32	550-610	44	31.8	140
	80	32	970-1070	48	30.8	190
	90	32	1560-1720	53	29.1	242
	100	32		61.5		
	110	32		69.5		
80	70	32	610-670	45	31.8	146
	80	32	1080-1200	48.5	30.5	198
	90	32	1750-1930	54	28.6	252
	100	32		63.5		
	110	32		72.5		
90	70	32	665-735	45.5	31.8	152
	80	32	1185-1315	49	30.2	207
	90	32	1910-2210	55	28.1	262
	100	32		66		
	110	32		76		

*Atmospheric Temperature and Relative Humidity to be Taken at Cowl Inlet.

DIAGNOSIS OF PERFORMANCE TEST RESULTS

ENGINE RPM TOO HIGH

CAUSE	CORRECTION
A. Defective or improperly adjusted hot gas by pass valve.	A. Adjust or replace as necessary.
B. Restriction in low pressure line.	B. Remove, inspect, and clean or replace.
C. Loose compressor drive belts.	C. Adjust as outlined.
D. Defective or improperly adjusted pulley clutch.	D. Adjust or replace as necessary.
E. Defective or improperly adjusted by-pass valve.	E. Adjust or replace as necessary.
F. Defective or improperly adjusted expansion valve.	F. Adjust or replace as necessary.
G. Expansion valve capillary tube not tight to evaporator.	G. Check clamp for tightness.
H. Defective compressor.	H. Replace compressor.

HIGH PRESSURE SIDE OF SYSTEM TOO HIGH
(With High Engine Speed)

CAUSE	CORRECTION
A. Engine overheated.	A. Check Engine Cooling System.
B. Restricted air flow through condenser.	B. Remove foreign material from engine radiator and condenser.
C. Air in system or overcharge of Freon.	C. Momentarily purge system on high pressure side with engine not running; then, operate system and re-check pressure. Repeat as necessary. Check sight glass with system under load.
D. Restriction in condenser, dehydrator-filter-receiver assembly, or any high pressure line.	D. Remove parts, inspect for restricted passage, and clean or replace.

ENGINE RPM TOO LOW

CAUSE	CORRECTION
A. Insufficient Freon.	A. Add Freon as outlined.
B. Restricted air passage.	B. Check air flow.

NOZZLE DISCHARGE AIR TOO WARM
(With Other Readings OK)

CAUSE	CORRECTION
A. Air hoses not properly connected.	A. Inspect air hoses and manifolds.
B. Defective or mispositioned evaporator drain hoses.	B. Replace or align as necessary.
C. Poor Seal - Evaporator to dash.	C. Correct sealing.

ADDITIONAL DIAGNOSIS

CAUSE	CORRECTION
VELOCITY OF AIR AT DISCHARGE NOZZLES TOO LOW	
A. Restricted air filter in evaporator asbly.	A. Remove filter, clean, and lubricate.
B. Restricted air hoses.	B. Inspect and replace if necessary.
C. Defective blower motor.	C. Check and replace if necessary.
D. Defective blower switch.	D. Check and replace if necessary.
E. Poor Wiring Connection (Low voltage at blower).	E. Correct wiring.
FROSTING OF EVAPORATOR LOW PRESSURE OUTLET LINE	
A. Defective or improperly adjusted expansion valve.	A. Adjust or replace valve as necessary.
B. Defective or improperly adjusted heat gas by-pass valve.	B. Adjust or replace valve as necessary.
SWEATING OF AIR DISCHARGE NOZZLES	
A. Heater vent valve not completely closed.	A. Adjust control cable.
B. Air leak at dash or toe pan.	B. Properly seal all holes in dash and toe pan.
WATER BLOWING OUT AIR DISCHARGE NOZZLE	
A. Plugged or kinked evaporator drain hose.	A. Clean or align as necessary.
SEEPAGE OF WATER AT RECIRCULATING AIR GRILLE (With Air Conditioning Off)	
A. Plugged or kinked evaporator drain hose.	A. Clean or align as necessary.

PRESSURE-TEMPERATURE RELATIONSHIP OF "FREON-12"

Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure	Temp. °F	Pressure
-8	5.4	22	22.4	52	49.0	82	87.0	112	140.1
-6	6.3	24	23.9	54	51.0	84	90.1	114	144.2
-4	7.2	26	25.4	56	53.0	86	93.2	116	148.4
-2	8.2	28	27.0	58	55.4	88	96.4	118	153.0
0	9.2	30	28.5	60	58.0	90	99.6	120	157.1
2	10.2	32	30.1	62	60.0	92	103.0	122	161.5
4	11.3	34	32.0	64	62.5	94	106.3	124	166.1
6	12.3	36	33.4	66	65.0	96	110.0	126	171.0
8	13.5	38	35.2	68	67.5	98	113.3	128	175.4
10	14.6	40	37.0	70	70.0	100	117.0	130	180.2
12	15.9	42	39.0	72	73.0	102	121.0	132	185.1
14	17.1	44	41.0	74	75.5	104	124.0	134	190.1
16	18.4	46	43.0	76	78.3	106	128.1	136	195.2
18	19.7	48	45.0	78	81.1	108	132.1	138	200.3
20	21.0	50	47.0	80	84.1	110	136.0	140	205.5

GENERAL SPECIFICATIONS

Engine Idle Speed (With Compressor Running):

H.M. - in "DR"	400 RPM
S.M. - in Neutral	425 RPM

Cooling System Capacity:

With Heater	20-1/2 qts.
Without Heater	21-1/2 qts.
Fuse	AGC 25 amps.
Amount of Freon-12 in System:	3-3/4 lbs.
Total Amount of Oil in Freon System	9 oz.
Type of Oil	Frigidaire 525 Viscosity

Tire Pressures:

Front (cold)	24 lbs.
Rear (cold)	22 lbs.

TORQUE SPECIFICATIONS

	Ft. Lbs.
Compressor Belt Tension	20
Compressor Bracket to Intake Manifold	22-26
Compressor Bracket to Cylinder Head	55-65
Compressor Support to Compressor	15
Compressor Support to Bracket	35-50
Clutch Ring to Pulley	2
High and Low Pressure Valve Assembly to Compressor	15
Pulley to Compressor Shaft	5-7
Coil and Seal Housing to Compressor	15

CHASSIS PARTS

The following chassis parts on Air Conditioning equipped cars are different, or are in addition, to those used on cars without air conditioning:

Radiator Shroud
Fan Blade
Water Pump Pulley
Harmonic Balancer
Generator Pulley
Front Coil Springs or Coil Spring Spacers
Positive Battery Cable or Loom
Neutral Safety Switch
Engine Oil Filler Tube

NOTE: Refer to Chassis Parts Book for application and parts numbers. The fender filler plate and radiator core support upper and side baffles will be reworked if the accessory is dealer installed or carry a different part number if the accessory is factory installed.

ADDITIONAL SERVICE OPERATIONS

The following chart lists operations that must be performed on cars equipped with Air Conditioning, in addition to the standard engine service procedures.

SERVICE ITEMS REQUIRING ADDITIONAL OPERATIONS	FREON LINES		REMOVE				COMMENTS
	Open	Do not open	*Compressor and Bracket	Evaporator Access Cover	Fender Filler Plate Door	Condensor	
Intake Manifold		X	X				
L.H. Rocker Arm Assy.		X		X			
L.H. Cylinder Head		X		X			Rear head bolts cannot be removed from head until head is clear of block. Therefore, the bolts must be pulled clear of block and retained in head by stretching a rubber band over bolts.
No. 7 Spark Plug		X					For compression test or carbon blast remove exaporator access cover.
Power Brake Dipstick		X			X		
R.H. Valve Cover		X	X				
Radiator		X					Disconnect shroud from radiator to gain accessibility.
Fan and Pulley		X					
Water Pump		X					
Camshaft	X					X	Includes removal of radiator and shroud.
Harmonic Balancer		X					

* It is not necessary to disconnect compressor lines when removing compressor to gain access to engine components. Disconnect lead from connector on coil housing and remove compressor and compressor bracket with compressor flex lines attached. Position compressor so that it does not interfere with the service operation, making sure that the lines do not kink or support the weight of the compressor.

NOTE: IT IS NOT ADVISABLE TO HAVE THE COMPRESSOR RESTING ON EITHER END FOR AN EXTENDED PERIOD OF TIME SINCE THE OIL MIGHT LEAK INTO THE PISTON CYLINDERS OR PAST THE SHAFT SEAL.

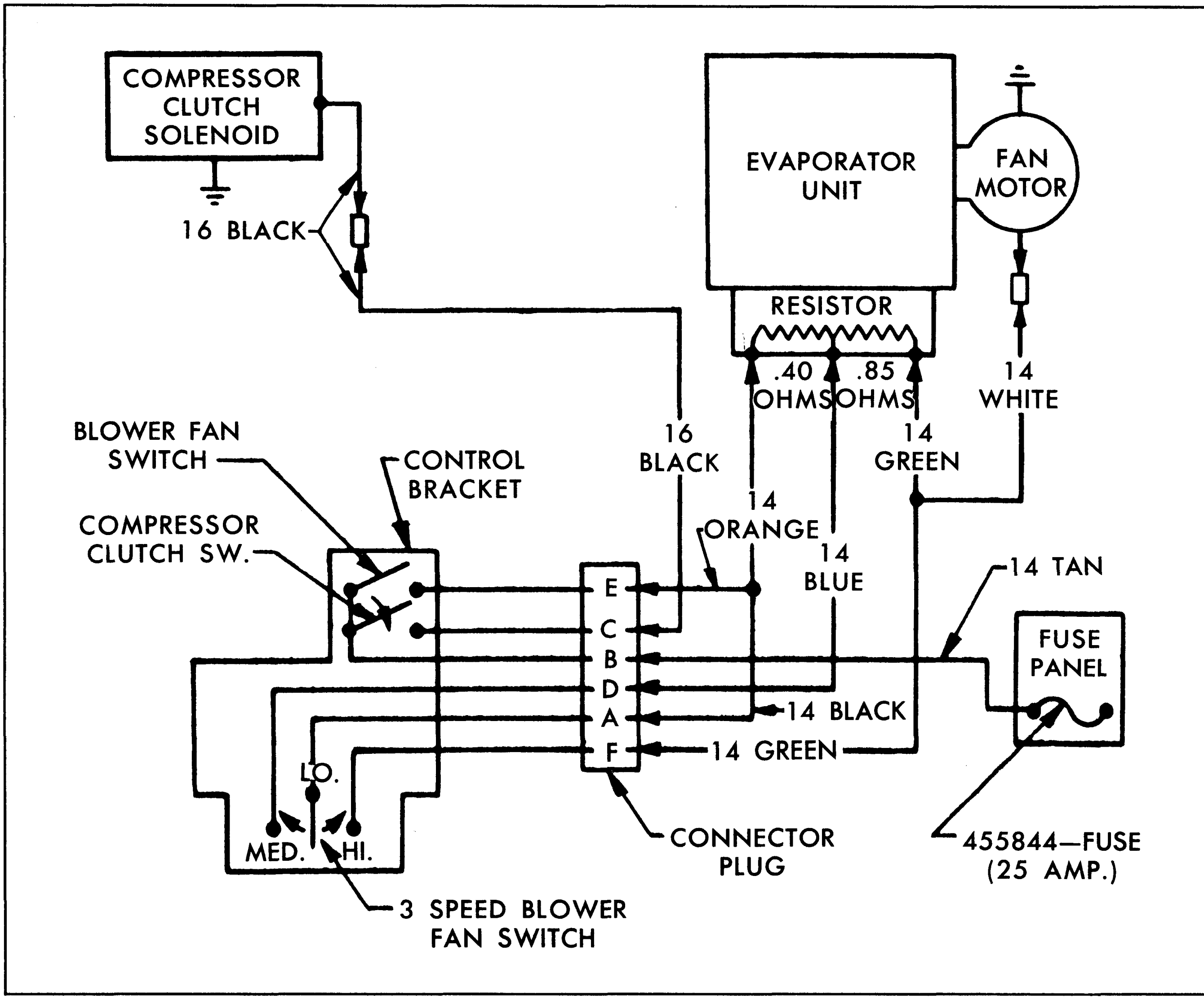
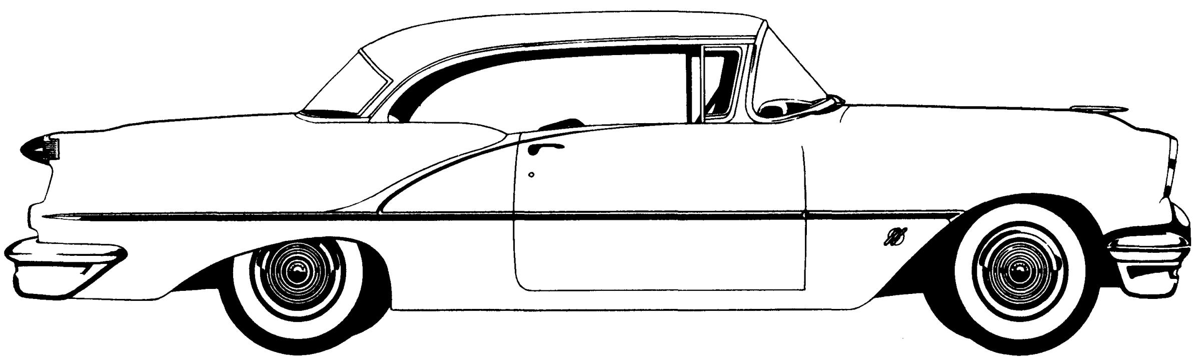
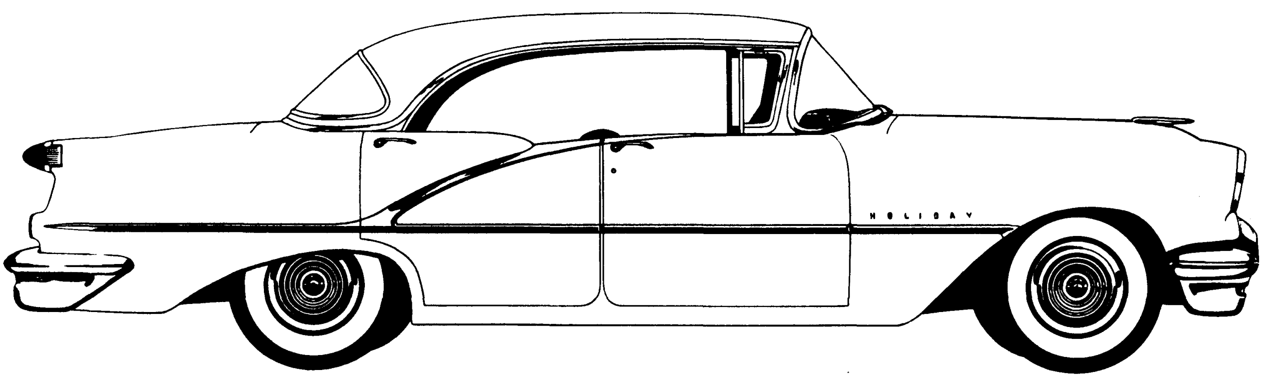


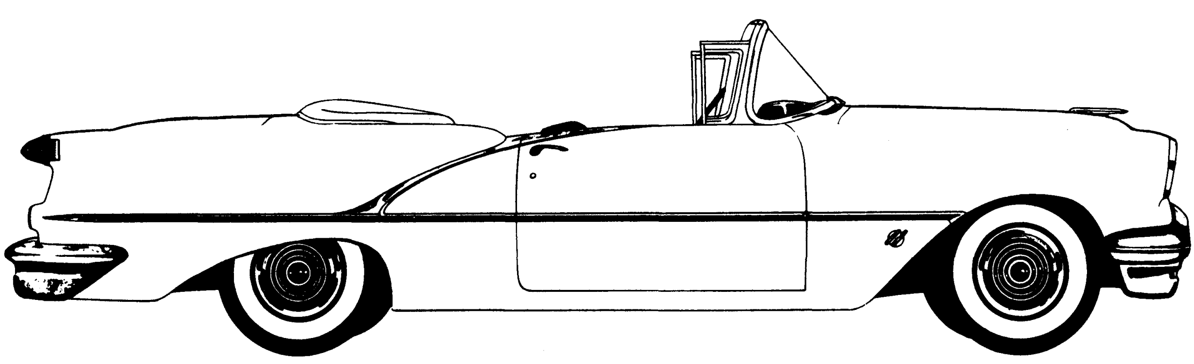
Fig. 14-41 Air Conditioning Wiring Diagram



SUPER 88 HOLIDAY COUPE (DHC)



SUPER 88 DELUXE HOLIDAY SEDAN (DHS)



SUPER 88 CONVERTIBLE COUPE (DCR)

INSTRUMENT PANEL AND RADIO

CONTENTS OF SECTION 15

NOTE: FOR TESTING AND ADJUSTING INSTRUMENT PANEL ELECTRICAL UNITS, SEE ELECTRICAL SECTION.

INSTRUMENT CLUSTER

General Information

All the instruments on the 1956 Oldsmobile instrument cluster are electrically operated, except the speedometer and the Hydra-Matic indicator which are mechanically operated.

The generator, temperature, and oil pressure indicators use colored lights to warn the driver of conditions other than normal when the engine is operating at speeds above idle.

All of the instruments except the speedometer head can be removed from the back of the cluster without removing the cluster assembly. The light sockets used in the instrument cluster are of the snap-in type, using bayonet type bulbs. Push-on type connections are used on the gas gauge. The shift indicator (Jetaway Hydra-Matic models only) is mounted on the shifter tube and protrudes into the cluster.

HYDRA-MATIC INDICATOR NEEDLE REMOVE, INSTALL AND ADJUST FIG. 15-1

The Hydra-Matic indicator needle must be removed before attempting to remove the instrument cluster. To remove the needle, remove mast jacket clamp, loosen the Allen set screws on shifter tube, then carefully guide the needle from the instrument cluster. To install, reverse the above procedure, using extreme care to prevent damage to the needle.

To adjust, move the selector lever to neutral position, align needle on "N", then tighten Allen set screws. Move selector lever through entire range to check for needle interference.

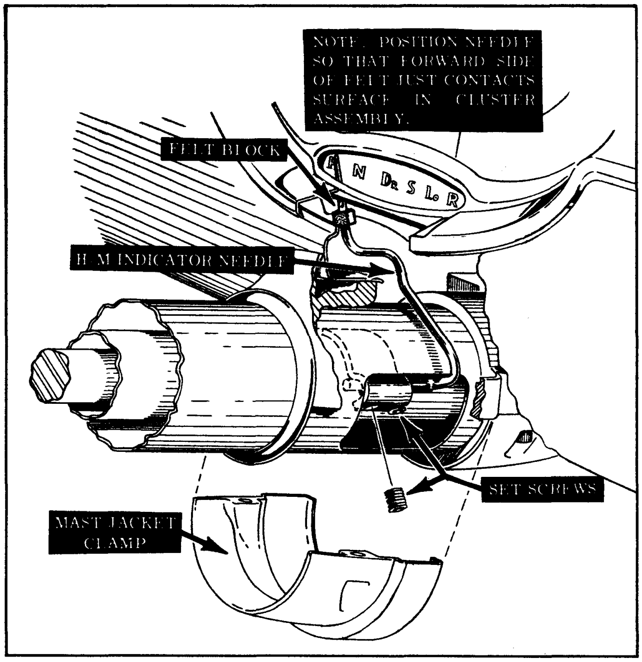


Fig. 15-1 H-M Indicator Needle

INSTRUMENT CLUSTER REMOVE AND INSTALL

1. Disconnect battery.
2. Disconnect electrical connections and lights from cluster.
3. Disconnect speedometer cable.
4. Remove H-M indicator needle as outlined under Hydra-Matic Indicator Needle.
5. Remove the four adapter to cluster attaching nuts, lockwashers, and flatwashers, then pull cluster free from adapter studs.
6. Guide cluster through opening in center molding.

To replace, reverse the above procedure. Install and adjust H-M needle as outlined under Hydra-Matic Indicator Needle.

INSTRUMENT PANEL GRILLE

The instrument panel grille is fastened to the instrument panel center molding with four studs, special washers, lockwashers, and nuts, which are also used to fasten the radio speaker assembly or the grille back cover if radio is not installed. The emblem is retained in the instrument panel grille by two screws.

CLOCK

The clock used in the 1956 Oldsmobile is electrically wound. The rewind mechanism winds the clock when the clock's electrical circuit is energized (approximately every two minutes). The clock is retained in the instrument panel grille by two screws. Wiring is attached at the rear of the clock and the light socket snaps into the clock housing.

MOLDINGS

The instrument panel molding is in three sections. The two end sections are retained by a clip fastener on the outer end and the inner end "Telescopes" over the center molding. To remove the end section, slide the end sections away from the center molding until ends are free from center molding and clip fastener.

The center molding is attached to the instrument panel by 5 studs, flatwashers, lockwashers, and nuts. To remove, disengage both end moldings from center molding, remove radio knobs and panel, speaker assembly, cluster and adapter, ash tray, lights and clock wiring. Remove the 5 nuts, lockwashers and flat washers from molding studs, then pull molding from instrument panel.

GLOVE BOX

The glove box is retained by sheet metal screws installed from inside the glove box opening.

DOOR REMOVAL AND REPLACEMENT

To remove the glove box door, remove two screws holding the door check link to the door and remove screws holding door to hinge assembly.

DOOR ALIGNMENT

The holes in the hinge assembly are slotted for adjustment of the door. It may be necessary to adjust the hinge at the instrument panel, in addition to adjusting

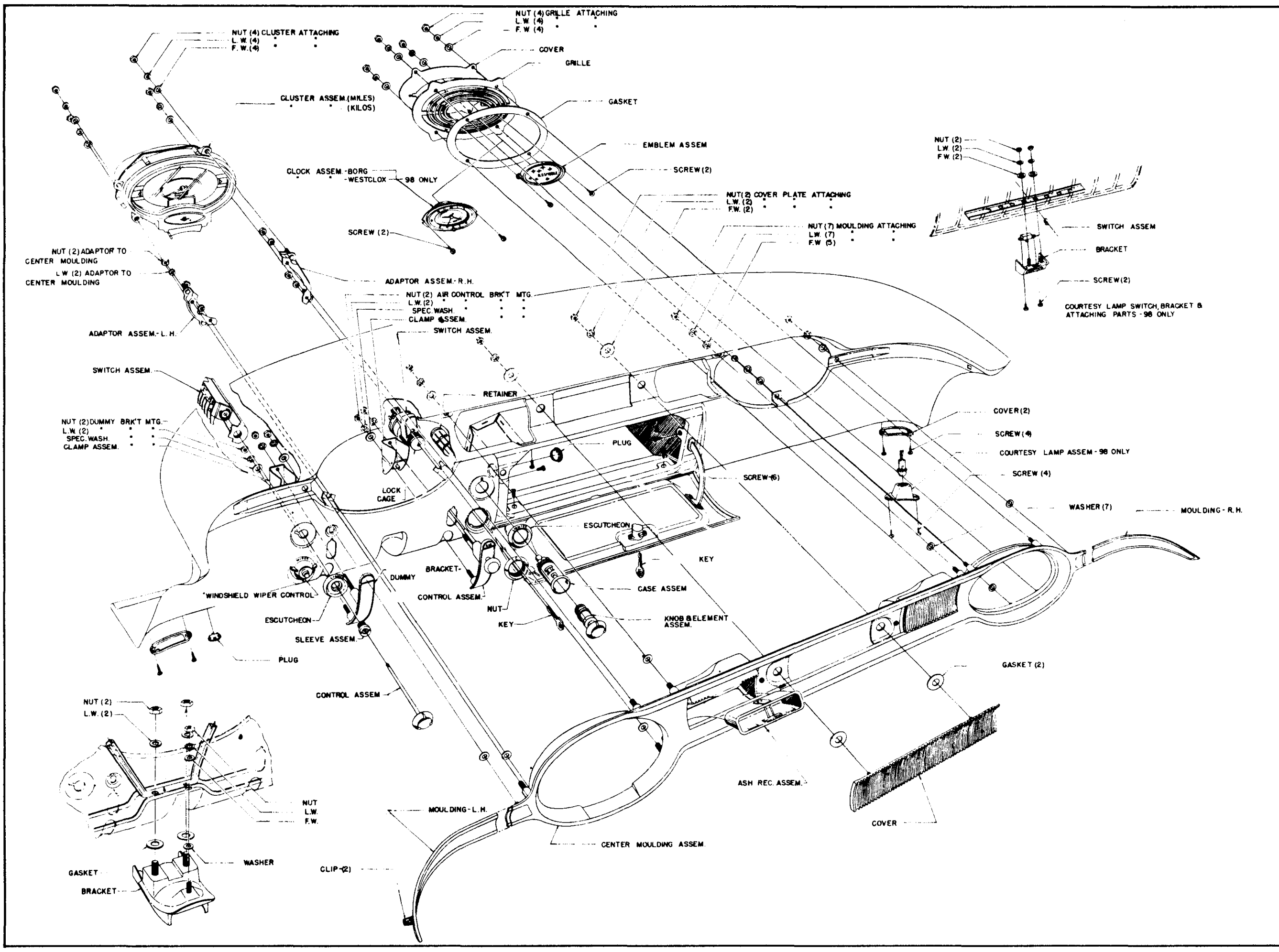


Fig. 15-2 Instrument Panel

the door at hinge, to obtain proper door alignment.

The glove box latch striker plate mounting holes are elongated to provide an "in" and "out" adjustment.

LOCK REMOVAL AND REPLACEMENT

When removing or installing the glove compartment lock cylinder, the key slot must be in the horizontal (unlocked) position. To remove the lock cylinder, open glove compartment door, insert a small wire in the square opening in right side of lock body, and depress spring loaded retainer; then, remove cylinder from front of lock body.

The lock body is installed from the inner side of the glove compartment door and is retained by a bezel which threads onto the lock body from the front of the door. A tool for removing the bezel can be made from a square head bolt which fits the octagon bezel.

ASH TRAYS

Ash tray light sockets are a push-fit in their housings which are mounted on the sides of the ash tray housings.

To remove receptacle, grasp snuffer and lift out.

COURTESY LIGHTS

The instrument panel courtesy light socket assembly is of the snap-in type, installed from behind the instrument panel. Two screws in the courtesy light rim retain the rim, lens, and housing to the panel.

PARKING BRAKE LIGHT

The parking brake light is mounted on

the parking brake release pull knob bracket. To remove, push in on the back of the unit to compress spring, and turn the bezel counterclockwise 1/8 turn.

SAFETY PAD

The safety pad trim is cemented to the instrument panel at the front and rear edge. The cemented areas are covered by the windshield garnish molding and the instrument panel molding. To remove pad and trim, it is necessary to remove the windshield garnish molding, adapter, radio, speaker grille, and instrument panel moldings.

STEERING COLUMN BRACKET

The steering column bracket is fastened to the instrument panel by two studs, washers, and nuts. Anti-squeak gaskets are used between the steering column bracket and the instrument panel.

HEADLIGHT SWITCH

All connections in the headlight switch are the push-in type, and are color coded.

A circuit breaker protects the parking and headlamp circuits. The tail lights are fused in the main fuse panel on the dash.

The brightness of the instrument panel lights is controlled through a resistor unit by turning the light switch knob right or left. A fuse on the light switch protects the resistor as well as the instrument panel light circuit.

On cars equipped with Autronic-Eye, the light switch incorporates an Autronic-Eye switch, located between the pull knob and bezel, which permits the selection of automatic or manual headlight control.

To Remove Headlight Switch:

1. Disconnect the battery.
2. Disconnect wiring from light switch.
3. Remove knob and rod by first pulling knob out of headlight position, then depress button on top of switch assembly and pull rod out.
4. If car is equipped with Autronic-Eye, loosen Autronic-Eye switch knob set screw and remove switch knob.
5. Remove escutcheon sleeve with a special tool, then remove switch from rear of instrument panel.

WINDSHIELD WIPER CONTROL ASSEMBLY REMOVAL

1. Remove the knob by loosening the set screw in knob.
2. Disconnect cable from wiper motor.
3. Disconnect hoses from control assembly. (Manifold vacuum operated windshield washer).
4. Remove escutcheon sleeve with Tool Set BT-6, and remove control assembly from rear of instrument panel.

To install, reverse the above procedure.

IGNITION—STARTER SWITCH

To Remove Switch Assembly:

1. Disconnect wires and remove light socket.
2. Using a special tool, remove ignition switch bezel.
3. Remove switch assembly from underside of instrument panel.

To Remove Lock Cylinder:

1. Insert key and turn to left.
2. Push wire in hole in face of lock cylinder.
3. Turn cylinder to left as far as it will go and withdraw cylinder.

CIGAR LIGHTER

To Remove Lighter Assembly:

1. Disconnect fuse holder on back of lighter.
2. Unscrew the retainer from lighter body assembly behind the instrument panel.
3. Remove lighter body and escutcheon from the front of instrument panel.

NOTE: When installing cigar lighter one of the square holes in the body assembly must point toward the light hole in the ignition switch to permit passage of light from the ignition switch lamp.

FRESH AIR CONTROL KNOB AND CABLE ASSEMBLY

In order to replace an air control knob, cable, or bracket, it will be necessary to replace the complete assembly. When the car is equipped with a heater or right hand air intake duct, there will be two air control knobs, one for either air intake unit, in the control assembly.

To Remove Assembly:

1. Disconnect cable(s) from valve assembly.
2. Pull cable through dash to inside of body (for heater only.) On LH side - remove grille and cable clamp.
3. Remove nuts and lockwashers from bracket studs, and remove control assembly.

HEATER—DEFROSTER CONTROL ASSEMBLY

The assembly consists of a bracket, heater fan switch, heat control knob and cable, and the defroster knob and cable. With the exception of the heater fan switch, the entire assembly must be replaced as a unit.

To Remove Heater Fan Switch:

1. Remove heater fuse from fuse panel.
2. Remove wiring leads from switch.
3. Loosen set screw in knob and remove knob.
4. Remove retainer nut using Tool J-5610, and remove switch from rear of instrument panel.

To Remove Control Assembly:

1. Disconnect cables from Ranco valve on dash and defroster valve on heater case; then free cables from clips.
2. Remove heater fan switch.
3. Remove nuts and lockwashers retaining bracket to instrument panel, and remove assembly.

RADIO

GENERAL INFORMATION

The radios for 1956 are 12 volt models and both the Deluxe and Super Deluxe radio consist of two units. The receiver unit includes the dial and controls, and the speaker unit includes the power supply.

A serial number plate, located on the bottom of the receiver chassis, may be checked through an opening provided in the top of the glove compartment box.

The dial light is mounted in a long flexible socket which is inserted through the left side of the receiver. (See Fig. 15-4) The socket may be removed to replace the light bulb.

The Deluxe model has five push buttons for touch tuning which mechanically tune the radio at pre-selected stations. In addition to the push buttons, a control knob provides for manual selection of stations.

The Super Deluxe model features automatic tuning as well as favorite station push button tuning and manual tuning. Depressing the center push bar rejects any station previously selected and automatically selects and tunes the next available station. Depressing the foot selector switch will automatically select and tune stations, provided an individual button is not depressed; if a push button is depressed the foot switch will select only the pushbutton station. The push bar on the front of the radio must be depressed to release the individual buttons. The favorite station tuner provides push button tuning for stations pre-selected. A control knob is also incorporated to permit manual selection of stations.

PUSH BUTTON ADJUSTMENT—SUPER DELUXE MODEL

Adjustment of the mechanical push button tuning system on the Deluxe radio model is accomplished as follows:

1. Allow the receiver to warm up for a few minutes.
2. Select a push button for the desired station. Pull the button slightly to the right and then out as far as it will go.
3. Tune in the desired station manually.
4. Push the selected button to its maximum IN position. This is the locking operation.
5. Proceed in the same manner for the remaining stations.
6. After all the buttons have been adjusted, recheck the settings. Push each button and see if the station can be tuned in more accurately manually.

If so, repeat step 2 and reset the station manually.

PUSH BUTTON ADJUSTMENT— SUPER DELUXE MODEL FIG. 15-3

To adjust the favorite station push button tuning system on the Super Deluxe radios, proceed as follows:

1. Allow the receiver to warm up for a few minutes.
2. Open the hinged door below the dial exposing the selector tabs.
3. Tune in the desired station nearest the left end of the dial either manually or by using the push bar.
4. Move the left selector tab until it lines up with the radio dial pointer tip.
5. Repeat steps 3 and 4 for the remaining tabs, choosing stations from left to right on the dial.
6. Check the setting of each selector tab by depressing the corresponding push button. If the correct station is not tuned in, readjust the selector tab.

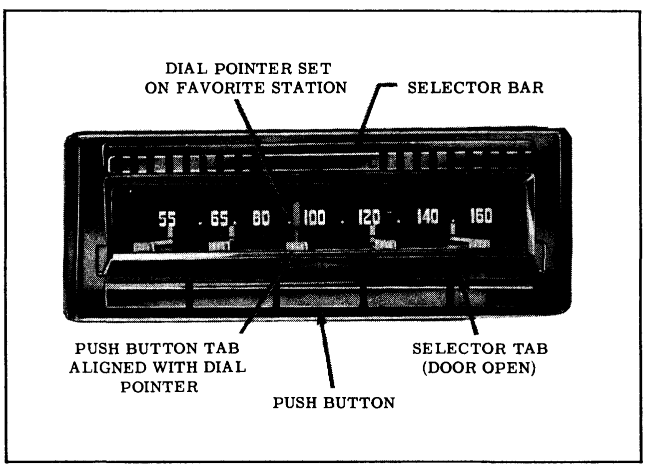


Fig. 15-3 Adjusting Selector Tabs

RECEIVER REMOVAL

To remove the Deluxe or Super Deluxe model radio receiver, proceed as follows:

1. Remove glove compartment box.
2. Disconnect radio lead (green) from lead in ignition switch branch of main wiring harness. (See Fig. 15-4)
3. Remove retaining screw from power supply plug on speaker chassis, then remove plug and bayonet lead.
4. Remove knobs, nuts, and washers from radio controls.
5. Remove 7/16" bolt from receiver side support to radio receiver while supporting receiver to prevent it from falling. Remove the receiver.

   NOTE: If car is equipped with air conditioning, remove glove box and remove radio thru glove box door opening. It is not necessary to remove air conditioning controls.

To replace receiver reverse the above procedure.

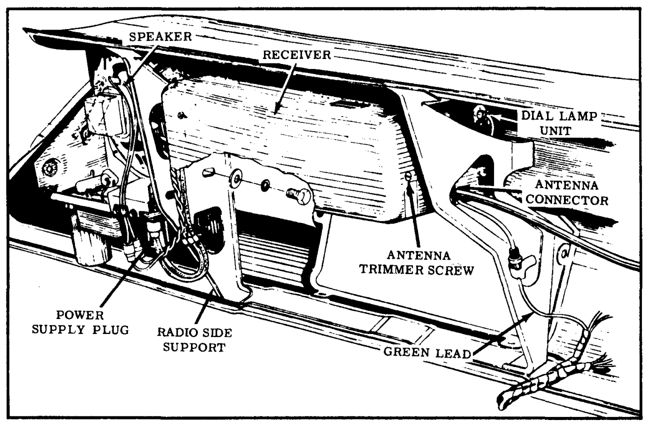


Fig. 15-4 Speaker and Receiver

FOOT SELECTOR SWITCH REMOVAL

1. Fold back floor mat to expose foot switch and remove attaching screws.
2. Remove foot switch wiring lead from clips along upper side of dash, then remove plug-in connector from bottom of radio receiver.

To replace switch reverse sequence of operations. Be sure to route wiring lead under the windshield wiper cables to provide clearance.

SPEAKER REMOVAL FIGS. 15-4 AND 15-5

1. Remove retaining screw from power supply plug on speaker chassis, then remove plug and bayonet lead.
2. Remove two 1/4" bolts, lockwashers, and flatwashers from speaker side support to speaker.
3. Remove four nuts and lockwashers

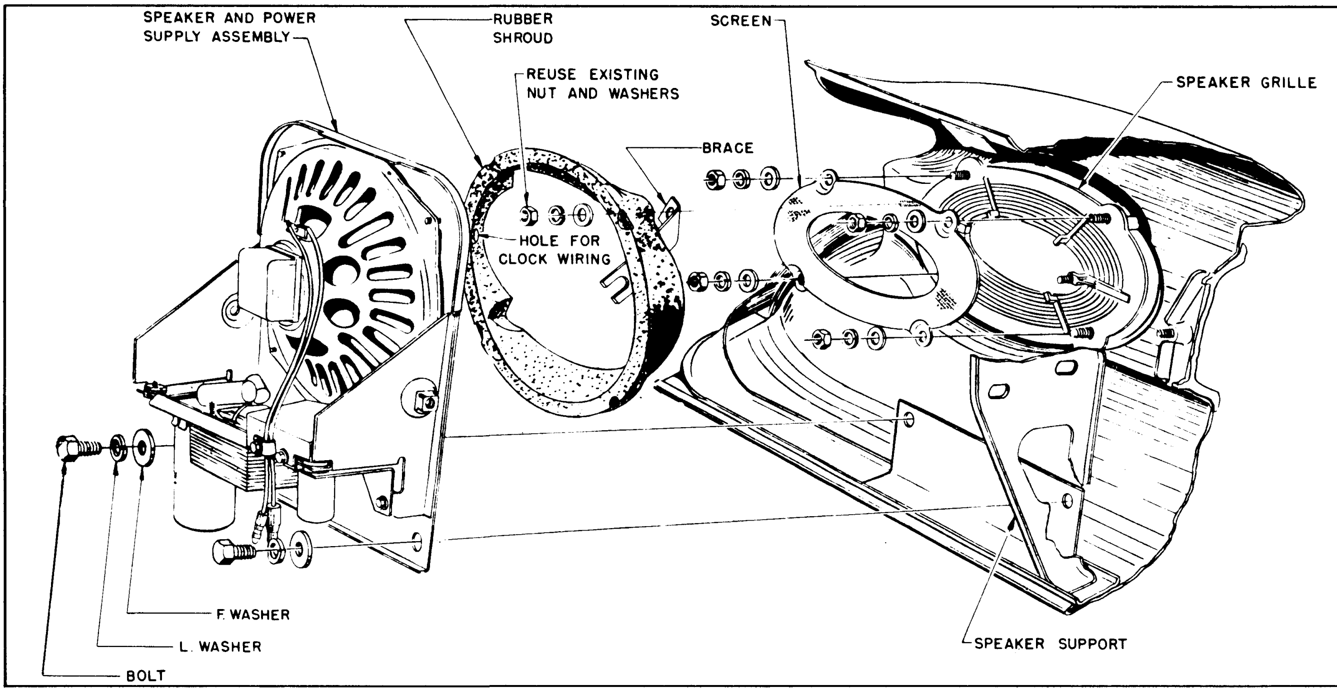


Fig. 15-5 Speaker Assembly

attaching speaker chassis to adapter plate, and remove speaker.

To replace, reverse sequence of operations.

REAR SEAT SPEAKER FIG. 15-6

The rear seat speaker is mounted under the parcel shelf, and is accessible through the trunk compartment. To remove speaker:

1. Disconnect bayonet terminal of lead.
2. Remove 4 mounting nuts, lockwashers, and flatwashers, while supporting speaker to prevent it from dropping.

To replace, reverse sequence of operations, being careful to avoid damaging the speaker cone while aligning the mounting holes over the mounting screws.

NOTE: On 98 models the speaker mounting studs are welded to the parcel shelf and no speaker bezel is required.

ANTENNA

TRIMMER ADJUSTMENT

1. With the antenna fully extended, turn the radio on.
2. Turn the volume control full on and tune the receiver to a weak station between 600 and 1000 K.C. on the dial.
3. With a small screwdriver adjust the antenna trimmer for maximum volume. (See Fig. 15-4)

CHECKING ANTENNA

To check antenna for partial short, remove lead-in from side of receiver and check resistance from lead-in connector to a good ground using an ohmmeter. Resistance should be 3 megohms or more.

MANUAL ANTENNA REMOVE AND REPLACE

To remove the antenna mast loosen the antenna cap nut and lift antenna out of

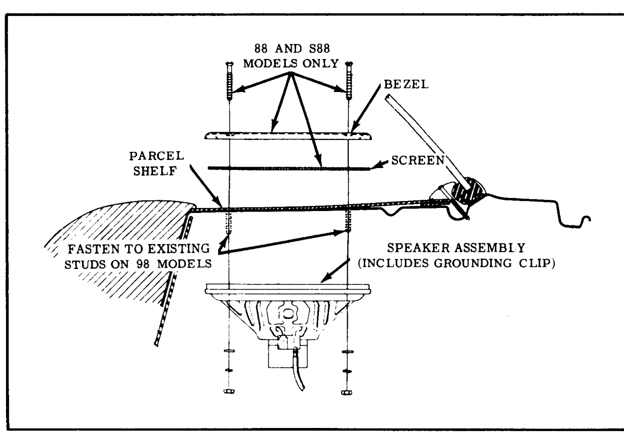


Fig. 15-6 Rear Seat Speaker

socket. To remove antenna socket and lead-in, proceed as follows:

1. Remove left kick pad.
2. Remove lead-in plug from left side of radio receiver.
3. Remove antenna mast; then remove thin nut, upper spacer, and rubber gasket.
4. Remove screws holding antenna lead-in brace to inside ledge of fender.
5. Remove lead-in assembly from under fender being careful not to lose lower spacer, and pull lead-in cable out through rubber grommet.

To replace antenna reverse sequence of operations. Be sure metal is clean where antenna brace attaches to inside ledge of

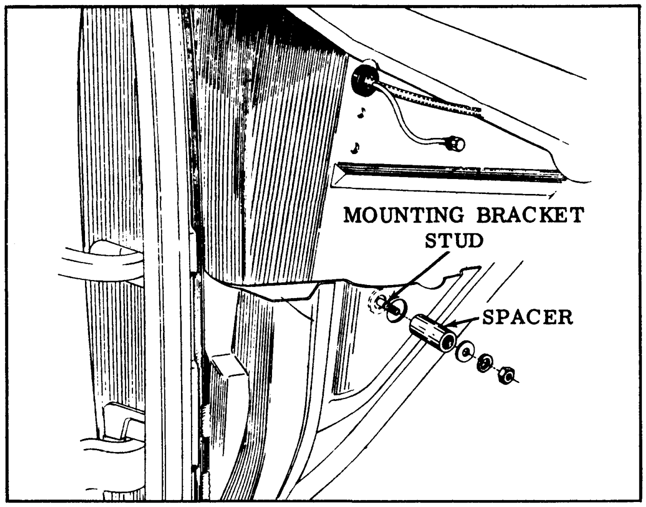


Fig. 15-7 Antenna Mounting

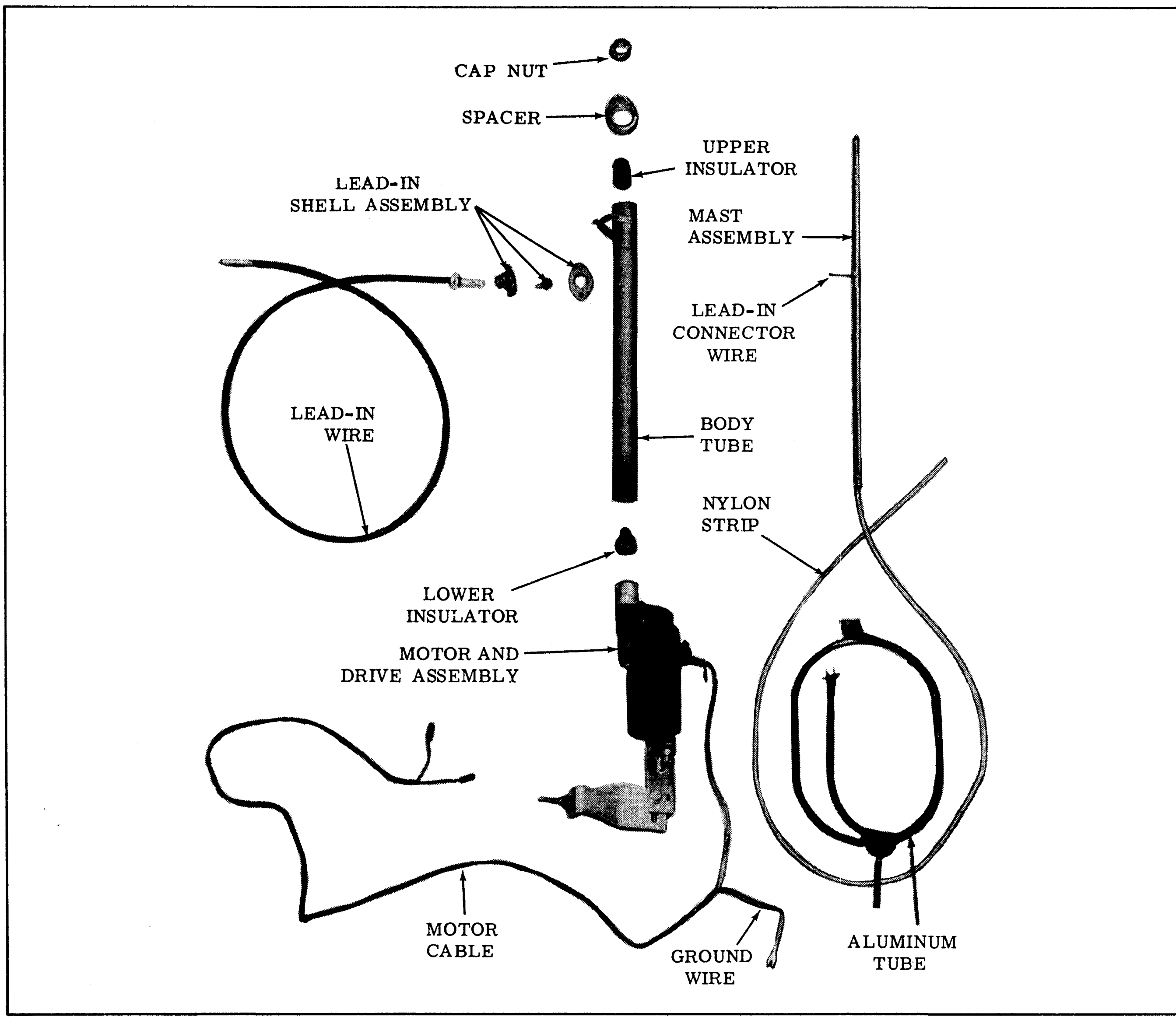


Fig. 15-8 Power Antenna Assembly

fender. Position antenna so that it tilts back slightly. Tighten brace screws, then tighten thin nut. The cap nut should be turned down finger-tight to prevent water entering the antenna socket and resulting in poor reception.

POWER ANTENNA

REMOVAL

1. Lower antenna. If antenna will not retract, clean, straighten, and lubricate mast sections, then assist lowering operation with hand pressure. If the motor is inoperative check for blown fuse and check control switch for proper contact by shorting across switch terminals.

   If antenna will not lower after the above measures have been taken, it will be necessary to cut off mast above cap nut.
2. Remove left cowl kick pad. Disconnect ground lead from cowl. Disconnect motor cable at antenna switch, then push lead wire and cable through grommet in cowl.
3. Remove nut, washers, and spacer from mounting bracket stud. (See Fig. 15-7)
4. Disconnect lead-in cable from body tube.
5. Remove cap nut and spacer using Tool J-5185-1.
6. Disconnect positive battery cable.
7. Disengage mounting bracket stud from cowl and lower antenna assembly until mast is free from fender, then remove assembly from car by pulling it out from under hood hinge bracket.

DISASSEMBLY FIG. 15-8

1. Remove tube assembly (aluminum) and brace from motor. Carefully slide tube down away from motor to remove nylon rod from tube.

   Note position of tube stop, then scribe approximate direction on drive assembly.
2. Remove body tube to driver cover screws and remove tube, mast, and nylon rod as an assembly by connecting motor to a 12-volt source and operate in UP direction while pulling body tube and mast sections away from motor and drive assembly.

   If motor is inoperative, remove upper insulator, then grip upper end of the lower section of mast assembly and pull nylon rod from drive assembly. (It will take considerable force to pull the nylon rod from the motor, but this will not damage the rod).
3. If necessary to replace mast assembly, remove lead-in shell and gasket. Apply heat to lead-in connector pin, then remove pin and grommet from lead-in

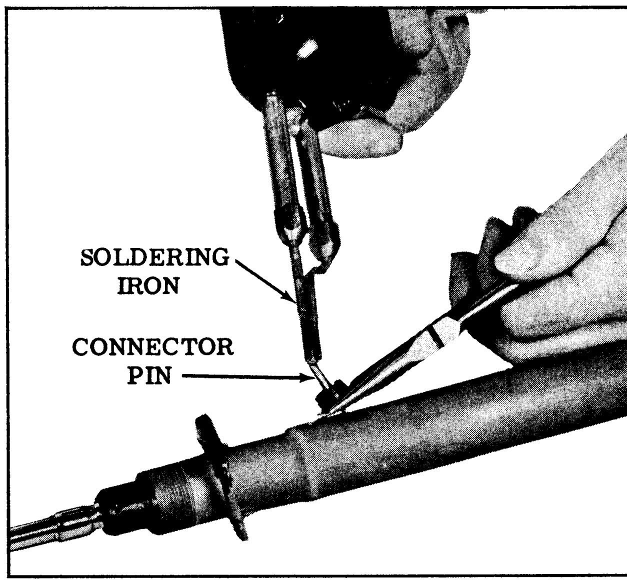


Fig. 15-9 Lead-In Connector

connector wire. (See Fig. 15-9) Remove upper insulator from body tube, then pull mast and nylon rod assembly from lower end of body tube. Remove lower insulator from body tube and the guide washer from mast assembly.
4. If the motor is to be replaced, remove the antenna support bracket from motor.

   NOTE: The motor and drive assembly must never be disassembled. This part is serviced only as a unit.

ASSEMBLY

1. If new motor is being installed, assemble plain washer, bracket, plain

washer, and self locking nut to stud on lower end of motor.

2. If mast sections have been removed, replace as follows:
   A. Place lower insulator over mast sections with slotted side of insulator seated against flanged end of bottom mast section.
   B. Insert mast assembly into lower end of body tube. Push mast into body tube until lower insulator seats against dimples in tube. (The use of a flexible wire will aid in guiding lead-in wire through lead-in connector hole).
   C. Insert end of lead-in wire in connector pin and solder in place. Install lead-in shell and gasket to body tube. Install upper insulator.
3. Install body tube and mast on motor as follows:
   A. Assemble guide washer over nylon rod and position slots of washer on tangs on lower section of mast assembly. (See Fig. 15-10)
   B. Connect motor to a 12-volt source (with motor operating in DOWN position) and insert end of nylon rod into drive unit as shown in Fig. 15-11. As nylon rod is being drawn through drive unit, guide mast sections and body tube into place on drive cover.

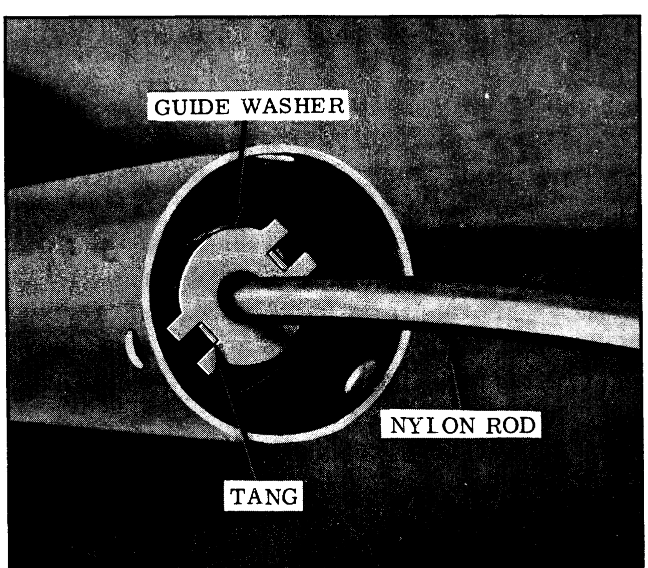


Fig. 15-10 Guide Washer Position

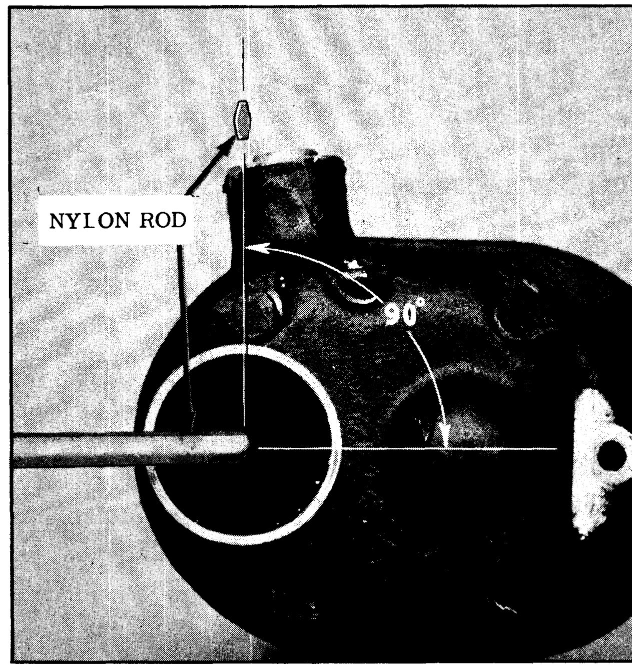


Fig. 15-11 Installing Nylon Rod

NOTE: Exercise caution during this operation so that guide washer will not be dislodged from the tangs on lower section of mast assembly.

Disconnect motor from electrical source.

   C. Turn body tube until tube stop is facing same direction as alignment marks scribed on drive housing during disassembly, then fasten body tube to drive housing.
4. Insert nylon rod into tube assembly (aluminum) and install tube and tube brace to motor.
5. Check antenna by connecting motor to a 12-volt source and operate antenna through its complete travel several times.

INSTALLATION

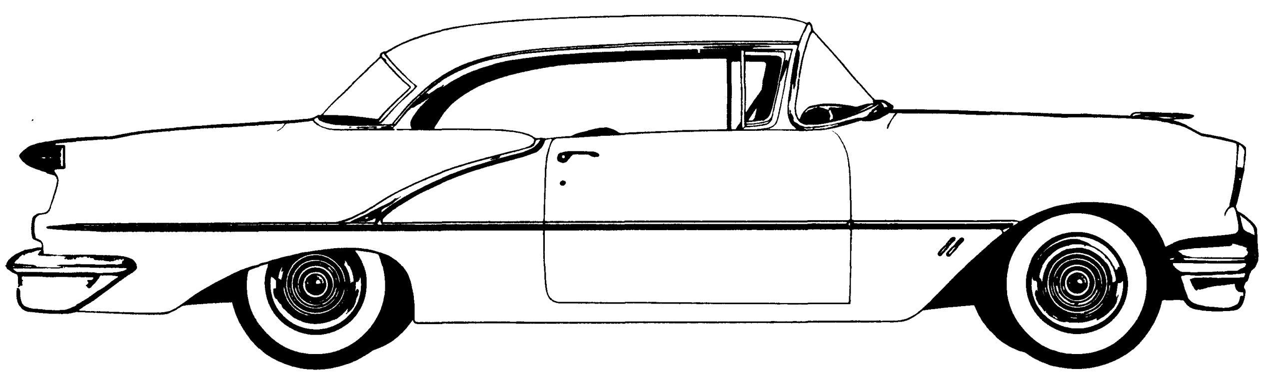
1. Install antenna assembly under fender by lowering assembly under hood hinge support. Guide upper end of mast through grommet in fender and attach spacer and cap nut finger tight. Connect antenna lead-in cable to body tube.
2. Insert cowl mounting bracket stud through cowl. Place spacer, flatwasher, and lockwasher on stud and install nut.

3. Connect motor wires to switch (orange wire to UP terminal and black wire to DOWN terminal). Fasten ground wire to cowl.
4. Connect positive battery cable and check antenna for proper operation.
5. Replace cowl kick pad.
6. Align antenna by adjusting mounting bracket to motor attaching bolt. Tighten cap nut with Tool J-5185-1 one full turn beyond finger tight position.

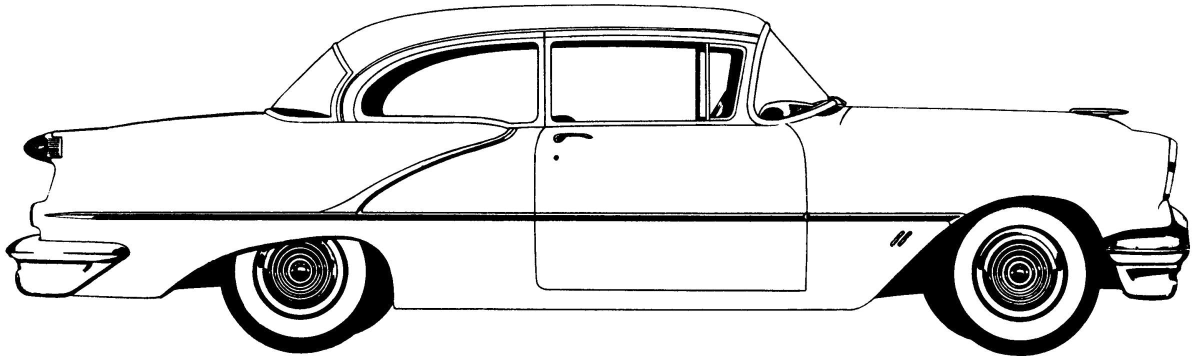
TROUBLE DIAGNOSIS

If antenna fails to operate, check for the following possible sources of trouble.

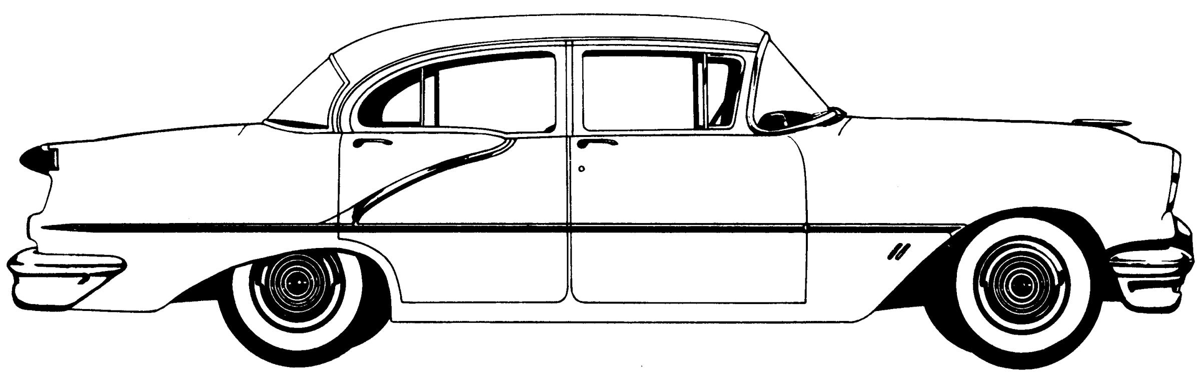
1. See that fuse in block is not burned out.
2. Examine electrical connections at switch; make sure they are securely connected.
3. Test live cable at switch with test lamp or meter.
4. Stalling or slowly operating motor may be caused by bent antenna sections.
5. If motor fails to operate, remove complete antenna assembly from car to replace according to instructions.
6. Excessive tightening of self locking nut at bottom of motor, or cap nut on fender will result in excessive operating noise in the car.



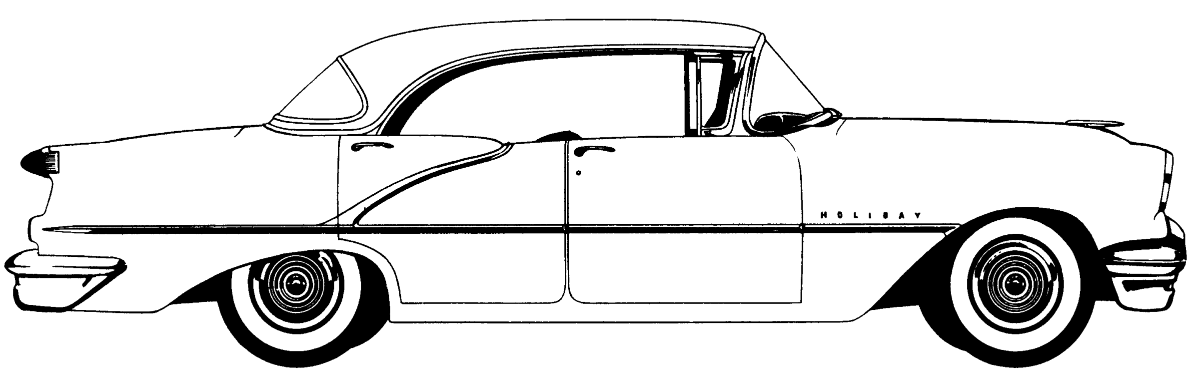
88 HOLIDAY COUPE (HC)



88 2-DOOR SEDAN (K)



88 4-DOOR SEDAN (S)



88 HOLIDAY SEDAN (HS)

CHASSIS SHEET METAL
VENTILATION AND HEATING

CONTENTS OF SECTION 16

HOOD ALIGNMENT

Hood Hinge Adjustment

The hood hinge adjustment will laterally and vertically align the rear edge of the hood with the cowl. All hood hinge to cowl and cowl bracket mounting bolt holes are enlarged to permit movement for adjustment.

1. Remove hinge springs with Tool J-5397. (See Fig. 16-2)
2. Loosen hinge bracket to cowl bracket bolt on both sides. (See "A", Fig. 16-3)
3. Loosen hinge bracket to cowl bolts, "B", Fig. 16-3, under instrument panel on both sides. Bolts should be left snug enough to keep hinge bracket from dropping out of position.
4. With hood lowered, shift hood into correct position making sure alignment is even at all alignment points. (See Fig. 16-1 for clearances)

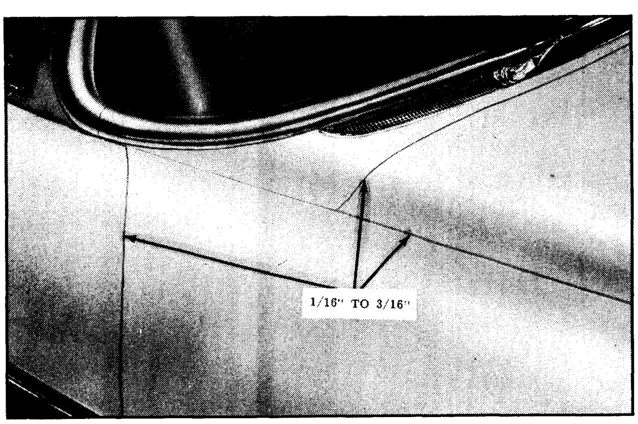


Fig. 16-1 Sheet Metal Clearances

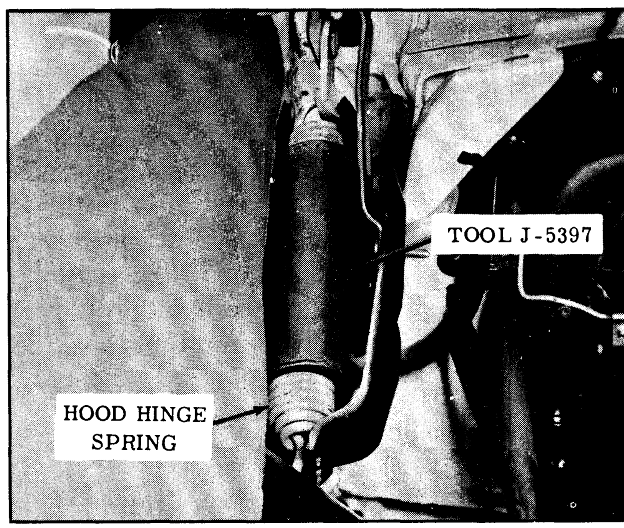


Fig. 16-2 Hood Hinge Spring Removal

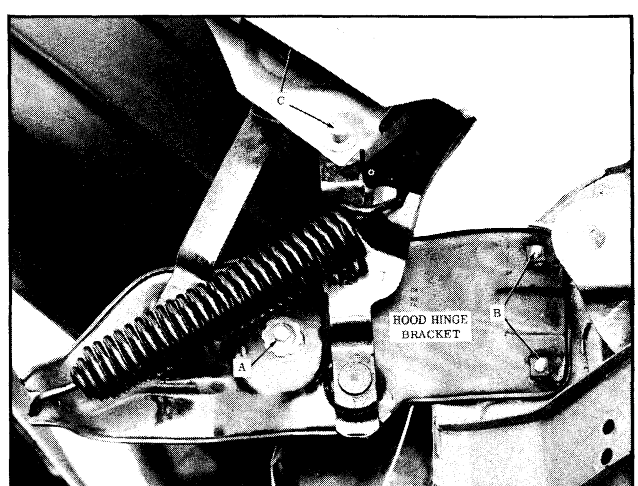


Fig. 16-3 Hood Hinge

5. Tighten hinge bracket to cowl bolts from inside of cowl, both sides.
6. Raise hood and tighten hinge bracket to cowl bracket bolt, each side, and replace the hood hinge springs.

Pilot Bolt

After aligning the hood hinges, the hood pilot bolt and rubber bumpers should be adjusted. The pilot bolt, on the under side at the front of the hood, aligns the hood as it is lowered. Vertical adjustment can be made by loosening the pilot bolt lock nut and adjusting the threaded pilot bolt up or down. The distance between the lower edge of hood and top of primary upper bar should be approximately 1 inch. (See Fig. 16-4) Tighten lock nut after adjustment is completed. The rubber bumpers at each end of the fender tie bar must be adjusted for alignment of the corners of the hood with the fenders. The latch assembly, located at the center of the fender tie bar and tie bar support, has enlarged mounting bolt holes to permit movement for lateral hood alignment. The gap between the side of the hood and the front fender should be 1/8" maximum. (See Fig. 16-4)

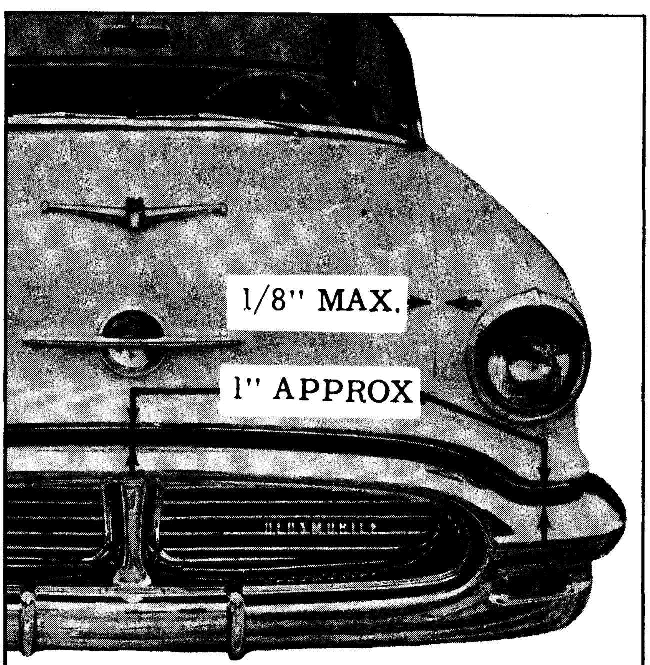


Fig. 16-4 Hood Front Clearances

REMOVE AND INSTALL HOOD ASSEMBLY

CAUTION: Never remove hood without first removing hood hinge springs. Place protective covering over cowl and fender areas to prevent damage to paint and moldings when removing or replacing hood.

1. Disconnect under hood lamp wire.
2. Remove hood hinge springs using Tool J-5397. (See Fig. 16-2)
3. While supporting hood, remove two hinge link bolts on each side of hood. (See Fig. 16-3, "C").

   NOTE: A special socket for removing hinge link bolts can be made from a 3/4" 8-point socket. Remove two points on each side by grinding as shown in Fig. 16-5.

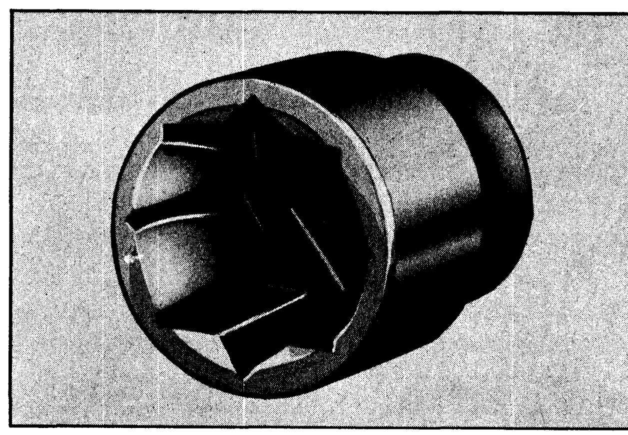


Fig. 16-5 Modified Socket

4. Remove hood.

To install, reverse above sequence of operations and align hood.

HOOD HINGE SPRING

When removing the spring from the hood hinge, raise hood to expand spring, and place Tool J-5397 over the spring. (See Fig. 16-2) When installing a new spring, a suitable expander must be used to stretch the spring. Then Tool J-5397 can be placed over the spring. (See Fig. 16-6).

HOOD HINGE

When replacing a hood hinge, it is an

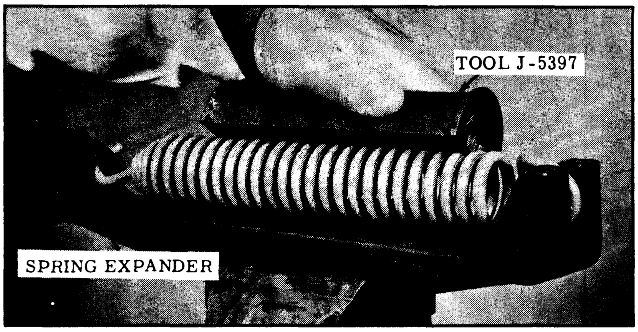


Fig. 16-6 Expanding Hood Hinge Spring

important safety factor to remove hinge spring before removing bracket or hinge link bolts. Mark the hood hinge outline on the cowl before removal to facilitate alignment when replacing. Auto body caulking compound should be placed around the hinge bracket to cowl bolt holes. Align hood after replacing hinge.

BUMPER ALIGNMENT

Vertical and horizontal alignment of the front bumper assembly is provided for through the use of eccentric bolts attaching

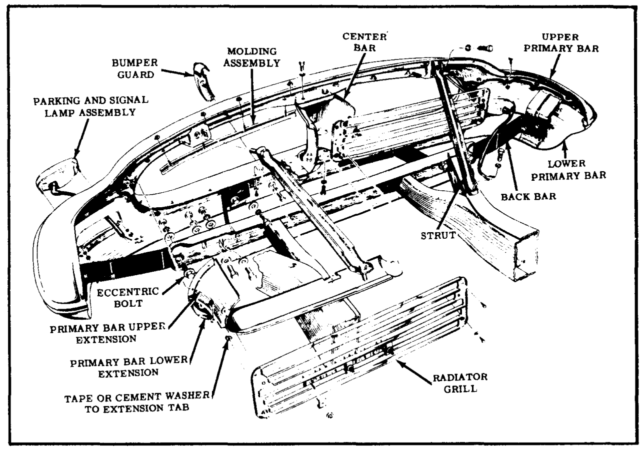


Fig. 16-7 Front Bumper Assembly

the secondary bar to the frame. (See Fig. 16-7)

To align the front bumper, the secondary bar to frame attaching bolts should be loosened on both sides, and the eccentric bolts rotated to the desired position. Make sure that the clearance between fenders and bumper is even on both sides. Tighten all secondary bar to frame attaching bolts 50-60 ft. lbs.

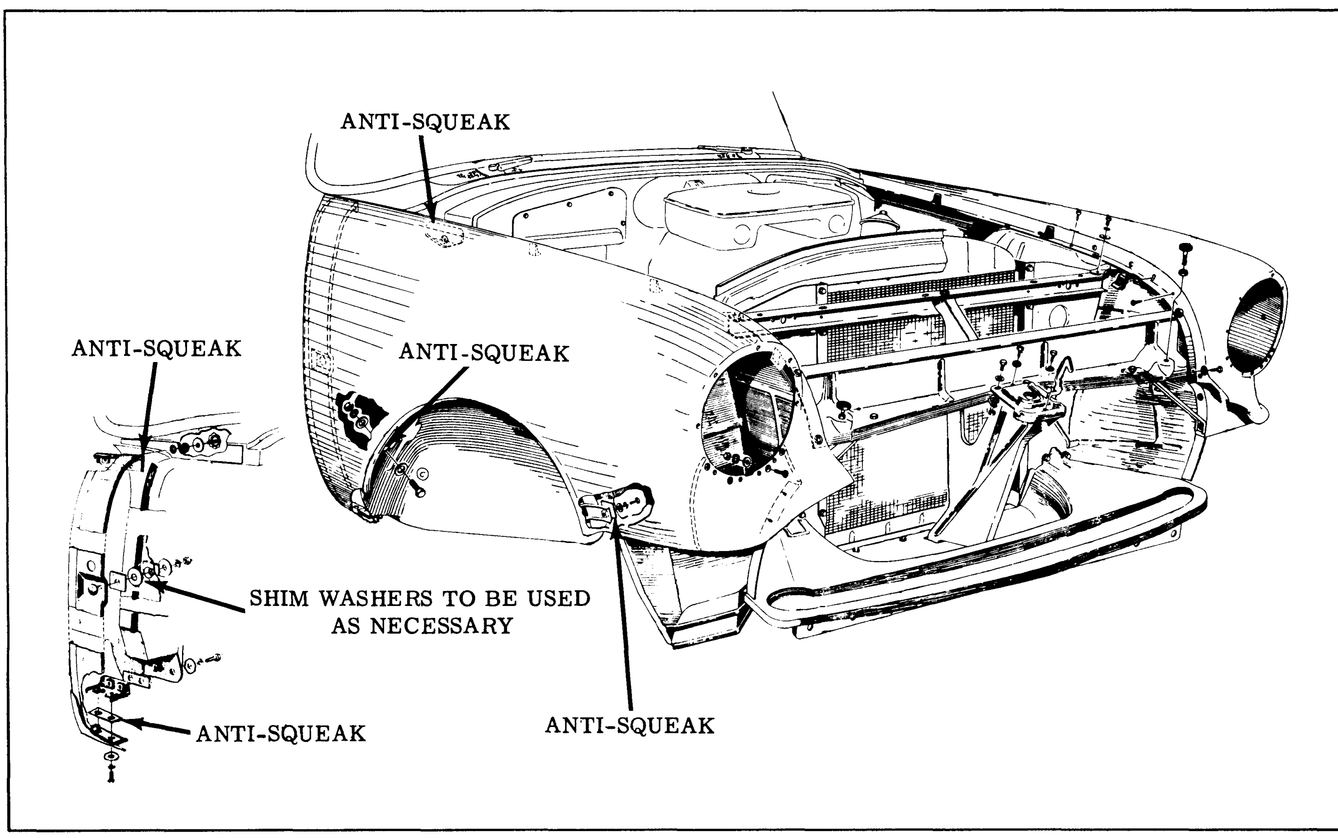


Fig. 16-8 Fender Attachment

FENDER
(See Fig. 16-8 for Fender Attachment)

Before removing and replacing a fender, painted areas and moldings adjacent to to the fender should be covered for protection against scratches. When replacing a fender, it is important that all anti-squeaks and seals be reinstalled. If the anti-squeaks and seals are damaged, they should be replaced.

Fender Alignment

The holes in the body and cowl are enlarged to permit adjustment. When making installation, fender should first be placed firmly into position, and before replacing any bolts, the contour of the rear edge of the fender must match the contour of the door. This adjustment is made by use of shim washers on the stud at the rear center of the fender. (See Fig. 16-8) After this contour adjustment, install and tighten all fender bolts just enough to permit shifting as required. After fender is properly positioned, tighten all attaching screws and bolts.

FENDER FILLER PLATE AND BAFFLE
FIG. 16-9

All necessary wiring and parts should be disconnected or removed before removing the filler plate. It is important that all seals and anti-squeaks be checked and replaced if necessary before installing.

NOTE: After the voltage regulator has been reinstalled, the generator must be polarized. (See Electrical Section)

The front fender baffles can be removed without removing any other parts. When removing a fender, the baffle plate, unless damaged, should be left attached to the fender filler plate. If the baffle has been damaged, and a new fender and baffle plate are to be installed, alignment of

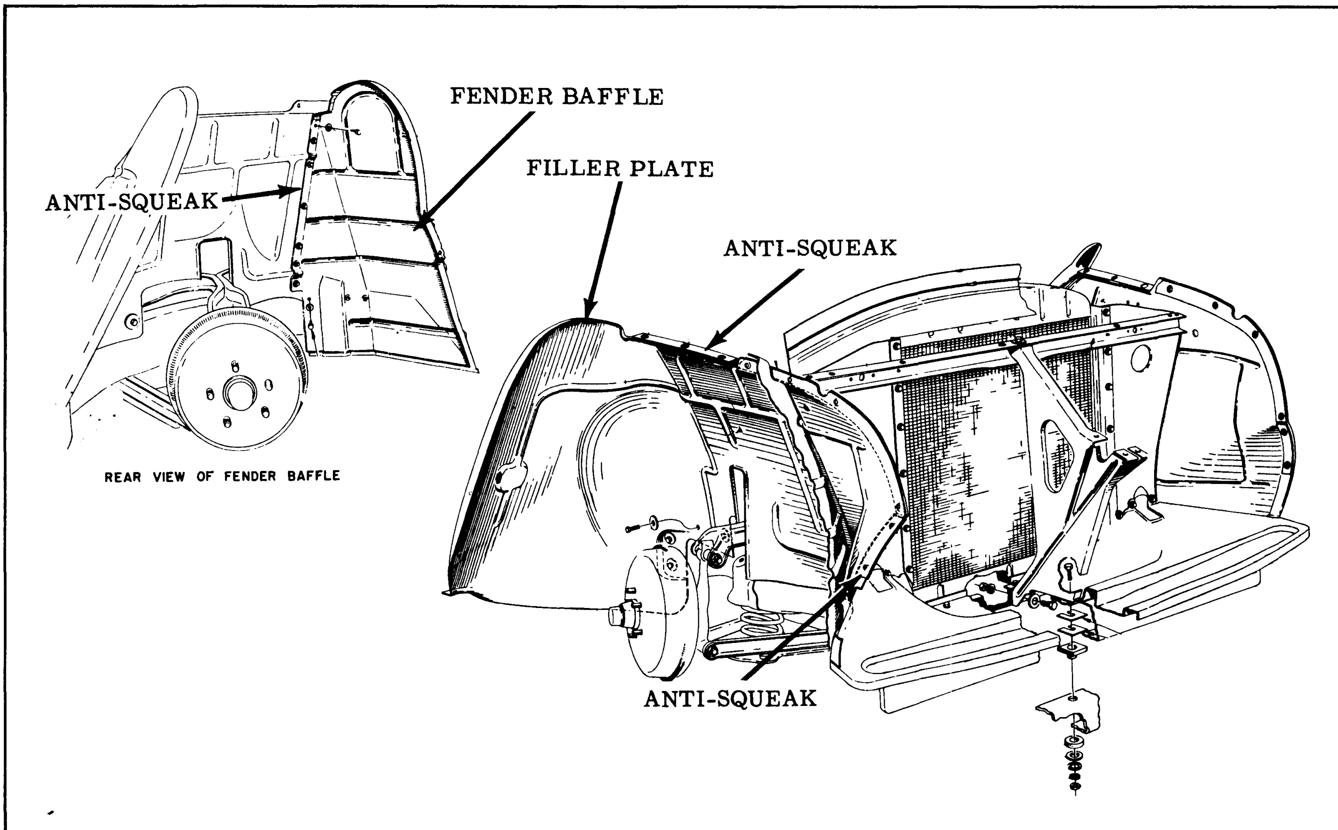


Fig. 16-9 Filler Plate and Baffle Attachment

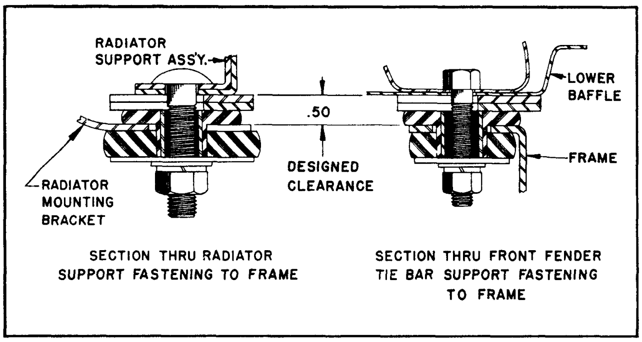


Fig. 16-10 Sheet Metal Supports

mounting holes is made easier by attaching the baffle to the filler plate first. After the fender has been installed, the baffle plate can be bolted to the fender.

RADIATOR (See Cooling System)

RADIATOR CORE SUPPORT BAFFLES FIG. 16-11

The top, left, and right radiator baffles can be removed without removing any other sheet metal parts. After removing all attaching screws, the radiator side baffles may be removed by lifting them straight up. To remove the lower radiator baffle, the bumper assembly and fender tie bar support must be removed.

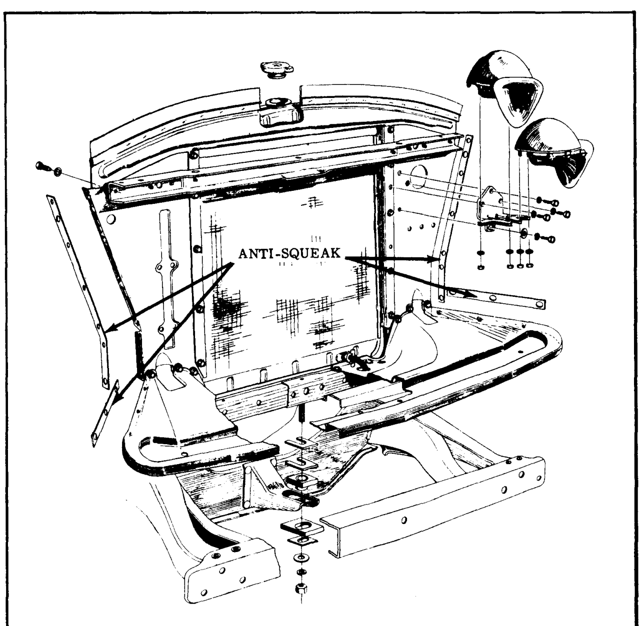


Fig. 16-11 Core Support Baffles

HOOD ORNAMENT AND EMBLEM

Hood Ornament

The hood ornament is fastened to the top of the hood by four stud bolts, lock washers, and nuts. The nuts are accessible from the under side of the hood.

Hood Emblem

The hood emblem is fastened to the front of the hood by four stud bolts and lock nuts. The lock nuts are accessible through holes in the hood support on the under side of the hood.

FRONT FENDER MOLDING

The front fender molding is retained by "T-bolts" and sheet metal nuts on the inside of the fender. The lower diagonal molding on the 98 series is retained by sheet metal clips and screws. Letters and insignia are retained by sheet metal clips. To facilitate removal of moldings, script, or insignia other than the diagonal molding on the "98" series, the fender should be disconnected to gain accessibility.

VENTILATING AND HEATING SYSTEM

AIR CONTROL

Outside fresh air is brought into the driver's compartment through the cowl inlet at the base of the windshield. The flow of air is regulated by air controls located on the right side of the steering column bracket on the lower half of the instrument panel. The "LEFT" control regulates the air coming directly into the driver's side of the compartment, and the "RIGHT" control (only installed on cars equipped with heaters or the optional right side air intake vent) regulates the air which flows through the heater unit or the optional vent assembly.

NOTE: THE RIGHT AIR CONTROL MUST BE OPEN FOR HEATER OPERATION AND THE SUMMER VENT DOOR

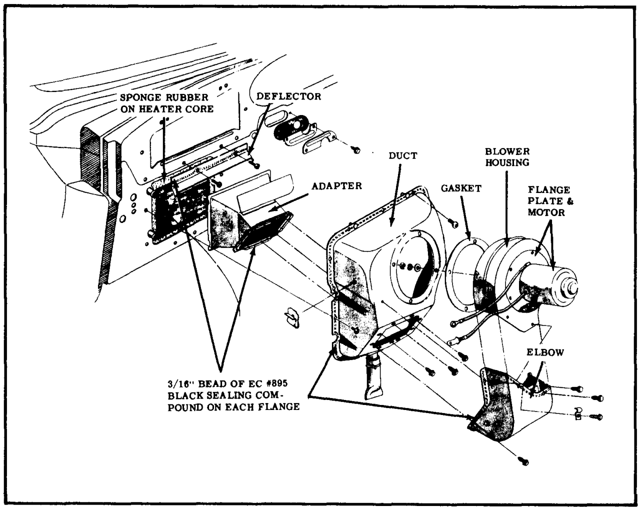


Fig. 16-12 Blower and Duct Assembly

(LOCATED ON FRONT OF HEATER ASSEMBLY) MUST BE CLOSED FOR DEFROSTER OPERATION.

BLOWER AND DUCT ASSEMBLY FIG. 16-12

When replacing the duct assembly, scrape off old sealing compound to insure good seating, place a 3/16" bead of 3M sealer (EC-895) or equivalent sealing compound, around entire duct assembly flange.

REMOVE AND INSTALL BLOWER MOTOR

The blower motor may be removed for servicing or replacement without removing entire blower assembly as follows:

1. Disconnect motor wire from connector on right side of duct assembly.
2. Disconnect ground wire from duct assembly.
3. Remove motor mounting flange plate to blower assembly screws (See Fig. 16-12) and remove motor.

To replace, reverse sequence of operations.

REMOVE AND INSTALL HEATER CORE

1. Disconnect blower motor wire from connector in right side of duct assembly and route through dash into driver's compartment.

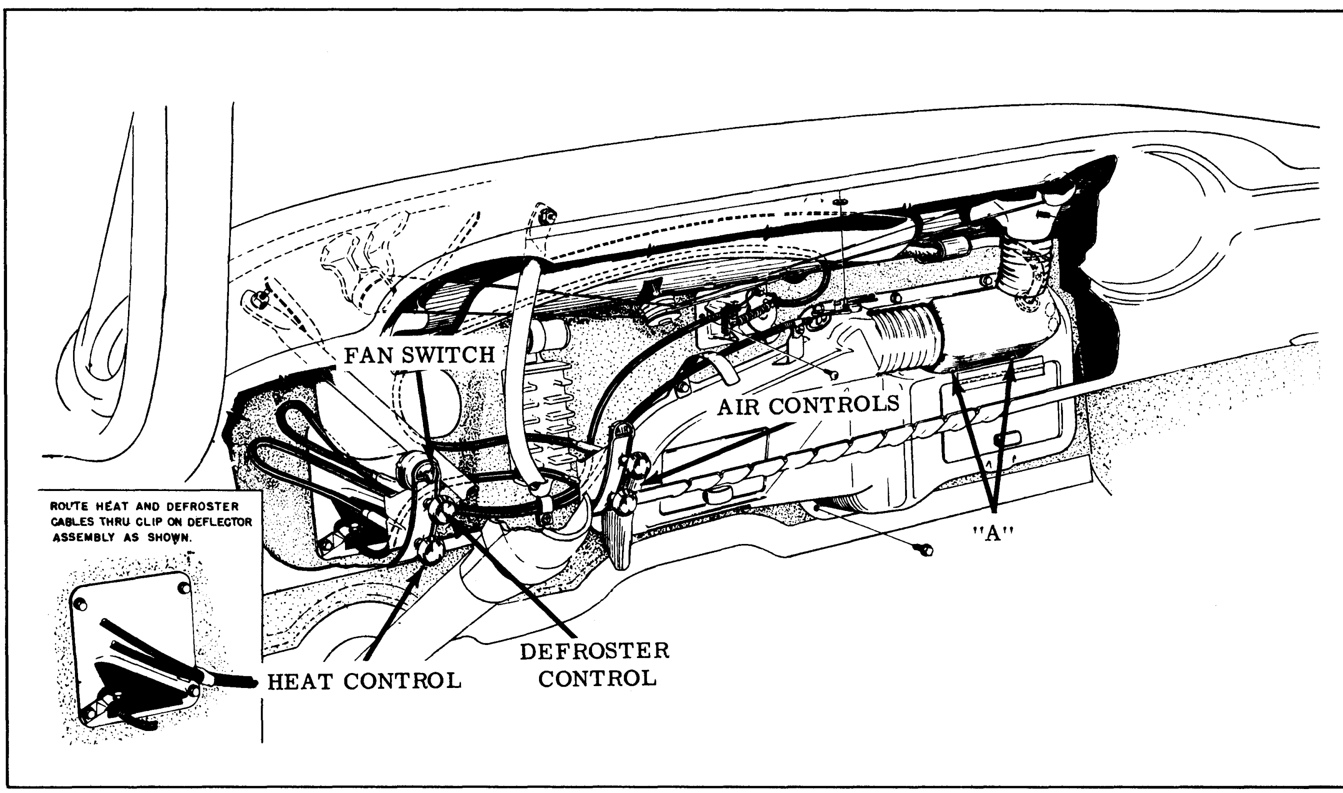


Fig. 16-13 Heater and Defroster

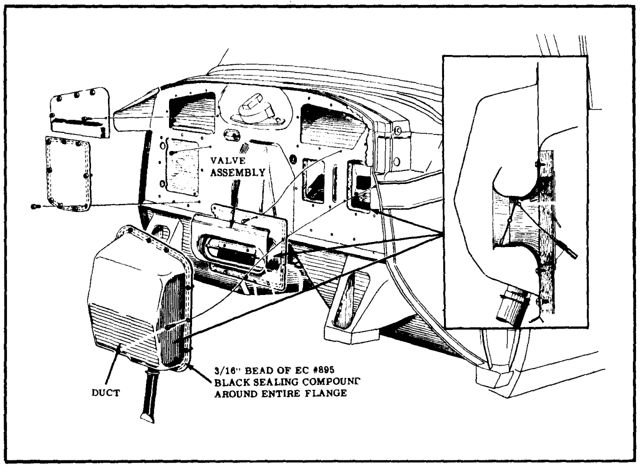


Fig. 16-14 Ventilating Duct Assembly

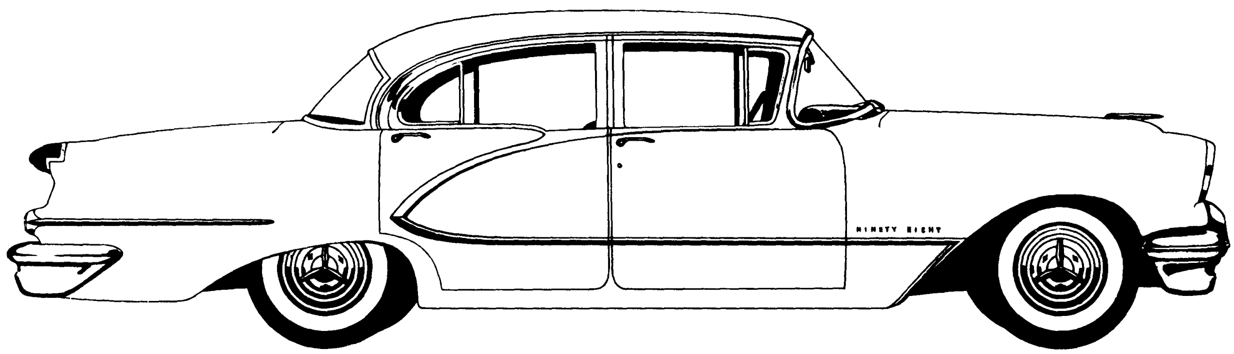
REMOVE AND INSTALL LEFT VENTILATING DUCT ASSEMBLY Fig. 16-14

The assembly is removed by taking out the duct assembly flange to dash hex head screws. Before replacing, clean old sealing compound from dash to insure good seating; then place a 3/16" bead of 3M sealer (EC-895) or equivalent, around entire duct assembly flange.

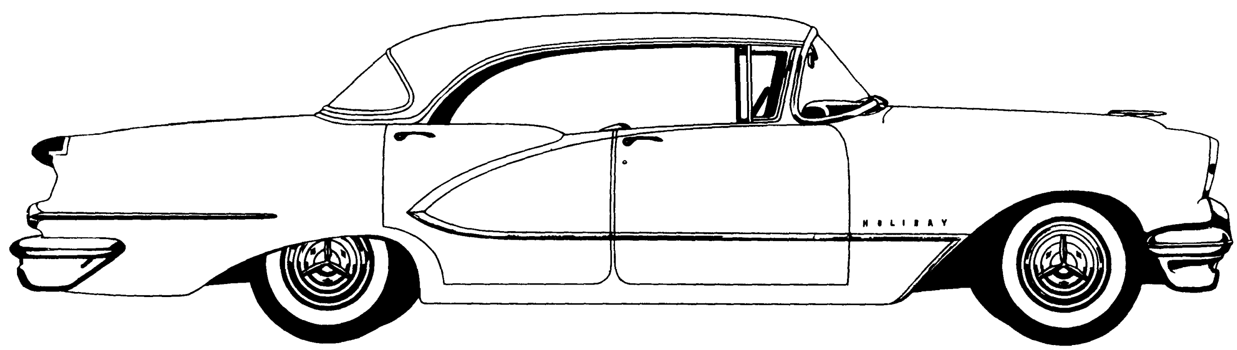
If car is equipped with Autronic-Eye, all wiring leading to units mounted on left hand duct assembly must be disconnected. After reassembling duct assembly, be sure wiring terminals are connected at proper places.

2. Disconnect hoses from heater core.
3. Free wiring harness from clips behind instrument panel.
4. Remove defroster control cable from bracket on top of heater case and remove wire from butterfly valve lever.
5. Remove defroster outlet to heater case Phillips head screws, "A", Fig. 16-13, and free defroster outlet from heater case leaving hose connections intact.
6. Remove heater case flange to dash hex head screws (See Fig. 16-13) and remove heater.
7. Remove core shroud to heater case flange screws and remove core shroud and core from heater case.
8. Remove core shroud to core Phillips head screws, located on each side of shroud opening, and remove core from core shroud. To reach the screws on the side, it is necessary to push aside slightly the rubber molding on the core shroud.

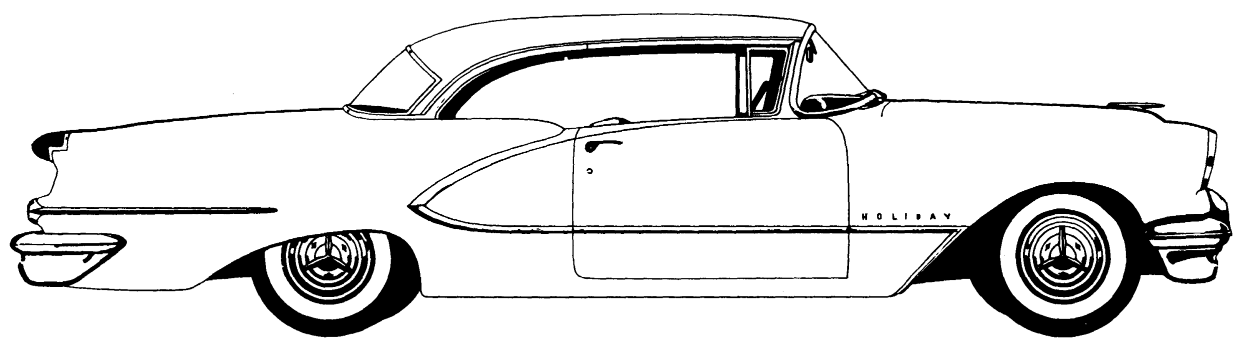
To replace, reverse sequence of operations.



98 4-DOOR SEDAN (DS)



98 DELUXE HOLIDAY SEDAN (DHS)



98 DELUXE HOLIDAY COUPE (DHC)

BODY

CONTENTS OF SECTION 17

The information contained in this section pertains to adjustments and minor service operations which will aid the mechanic in new car conditioning and normal servicing adjustments. For unit replacement and major service repair information and procedure, refer to "Fisher Body Service News".

DOOR OUTSIDE HANDLE

REMOVE AND INSTALL

All Models (Except Front Door, 4 Door Holiday)

1. Raise door window, then remove garnish molding and door trim pad.
2. Remove tape or rubber grommet covering access hole, then insert screwdriver through holes "A" and "B" to remove handle attaching screws. (See Fig. 17-1)
3. Remove door handle and gasket from outside of door.

To install, apply cup grease to the end of push button shaft "1" and reverse above procedure. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

Front Door, 4 Door Holiday

1. Raise door window and remove finishing molding, door trim pad and access hole cover.
2. Disengage retaining clip from adjusting nut at "C", then detach connecting rod (with nut) from lock lever. (See Fig. 17-2)
3. Remove handle attaching screws, then remove handle and connecting rod from door. Disconnect rod from handle.

To install, reverse the above procedure. Adjust nut "C" so that door handle bell crank just contacts handle push button shaft. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

DISASSEMBLE AND ASSEMBLE (HANDLE REMOVED) FIG. 17-3

All Models

1. Front door handle, 4 door holidays -

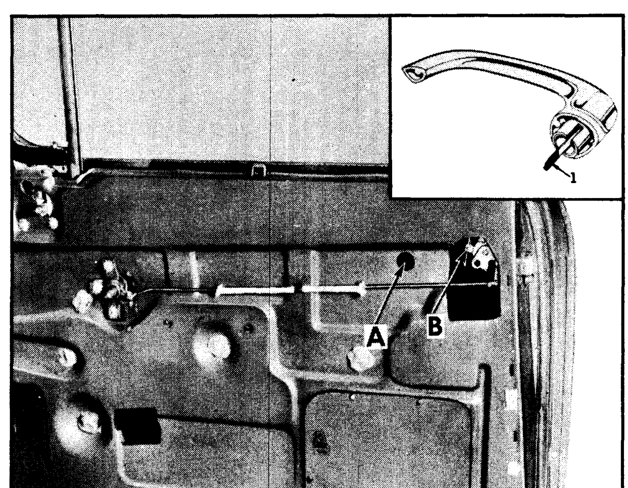


Fig. 17-1 Handle Removal (All Exc. Ft. Dr. HS)

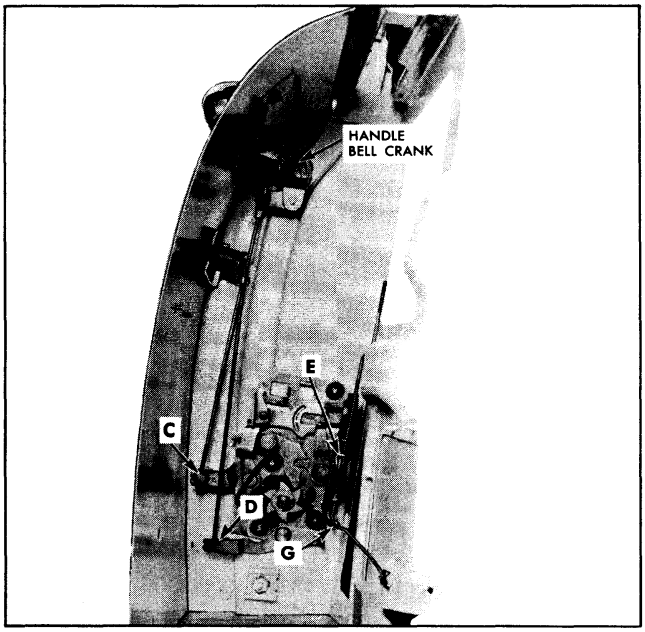


Fig. 17-2 Handle Removal (Ft. Dr. HS)

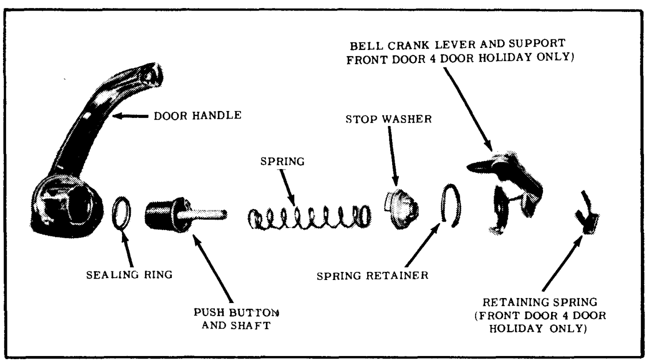


Fig. 17-3 Handle Assembly

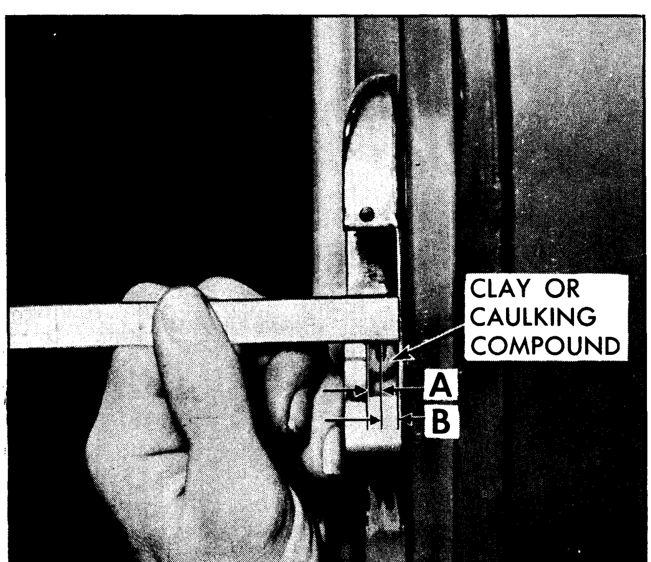


Fig. 17-4 Checking Lock and Striker

Remove retaining spring, then remove bell crank lever and support.

2. All models - Remove spring retainer, then remove stop washer, spring, push button and shaft and sealing ring.

To assemble, reverse the above procedure.

DOOR LOCK STRIKER

ADJUSTMENT

1. To adjust striker, loosen striker plate attaching screws and shift striker and adjusting plates to desired position, then tighten screws.
2. To determine if door lock extension engages the striker plate properly, proceed as follows:

   NOTE: The door should be properly aligned before making the following check.

   Apply modeling clay or body caulking compound in the door lock striker, then close the door. Measure the impression as shown in Fig. 17-4. If dimension "A" is less than 3/16", install spacer between the striker and adjusting plates. Dimension "B" should never be less than 1/8".

   NOTE: If necessary to install spacer 1/8" or thicker, substitute special striker screws (1/8" longer than standard screws).

DOOR LOCK CYLINDER

REMOVE AND INSTALL

All (Except 4 Door Holiday)

1. Pry retaining clip (opposite lock bolt next to door outer panel) out sufficiently to disengage lock cylinder assembly and remove assembly from door.

To install, reverse removal procedure.

Four Door Holiday

1. Remove door trim pad and large access hole cover.
2. Disengage lock cylinder connecting rod

spring retaining clip "D". (See Fig. 17-2)

3. From outside of door pry out retaining clip "I" (Fig. 17-7) sufficiently to allow removal of lock cylinder with attached connecting rod from the door.
4. Remove connecting rod from pawl.

To install, reverse removal procedure. Seal door inner panel as outlined in DOOR INNER PANEL SEALING.

DISASSEMBLE AND ASSEMBLE FIG. 17-5

1. Remove cylinder assembly from door.
2. Remove retaining clip, then remove pawl.

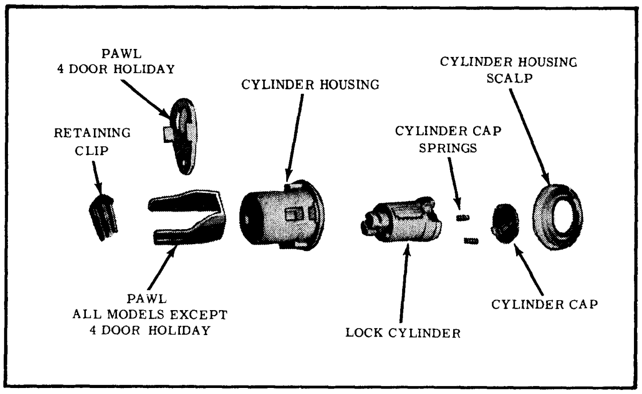


Fig. 17-5 Lock Cylinder Assembly

3. Carefully bend open four cylinder housing scalp tabs and remove scalp.

   NOTE: Scalp is under spring tension. After scalp is removed, observe position of springs and cap so that they can be reinstalled in the same relative positions.
4. Remove cylinder from cylinder housing.

To assemble, reverse the above procedure.

FRONT DOOR LOCK ASSEMBLY

REMOVE AND INSTALL

All Models (Except 4 Door Holiday)

1. Remove door trim pad.
2. Remove remote control attaching screws "A" and the connecting rod

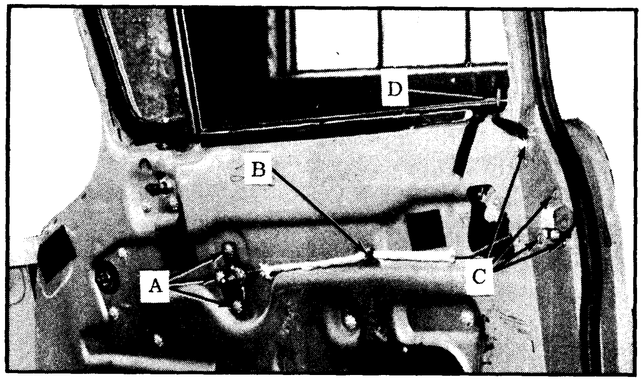


Fig. 17-6 Lock Removal (All Except HS)

for clip "B". (See Fig. 17-6) Disengage remote control from connection rod and connecting rod from lock assembly.

3. Remove large access hole cover.
4. (a) On two and four door sedan styles, remove nut securing lower end of glass run channel.

   (b) On convertibles, remove door glass and glass run channel.
5. Remove four screws "C" securing lock assembly to door lock pillar and remove lock assembly through access hole.

To install, reverse removal procedure. Seal inner panel as outlined in DOOR INNER PANEL SEALING.

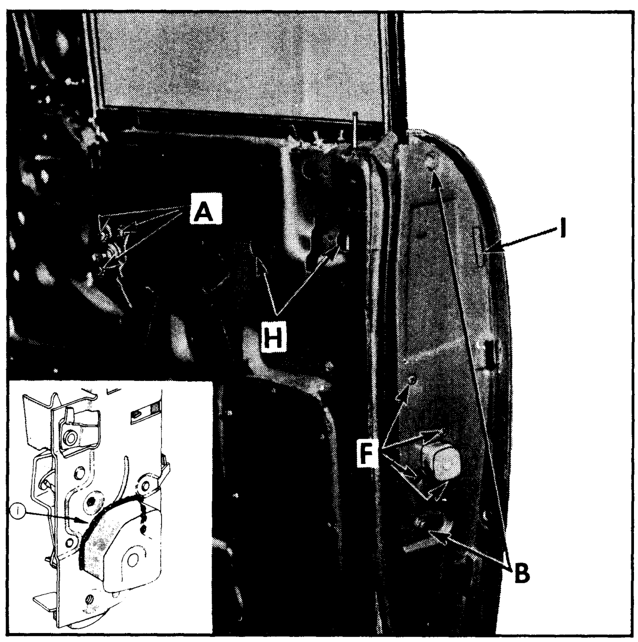


Fig. 17-7 Lock Removal (HS)

4 Door Holiday

1. Raise door window. Remove door trim pad and access hole cover.
2. Remove door lock remote control attaching screws "A" and detach control from connecting rod. (See Fig. 17-7)
3. Remove glass run channel attaching screws "B". Lower channel from behind window frame and remove from door.
4. Through access hole, detach outside handle connecting rod adjusting nut "C" (See Fig. 17-8) and lock cylinder connecting rod at "D".

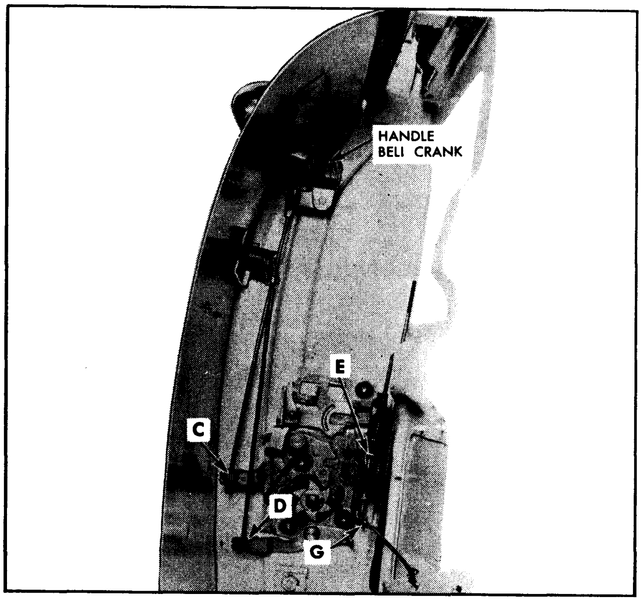


Fig. 17-8 Front Door Lock Connecting Rods

5. Remove inside locking rod clip at "E" and detach rod from lock.
6. Remove lock attaching screws "F" from face of door lock pillar. (See Fig. 17-7) Detach remote control connecting rod from lock at "G" (See Fig. 17-8), then remove lock assembly from door.

To install, reverse above procedure. Apply a ribbon of caulking compound "1" to the lock assembly as shown in Fig. 17-7 inset. Adjust nut "C" (Fig. 17-8) so that outside door handle bell crank just contacts the handle push button shaft. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

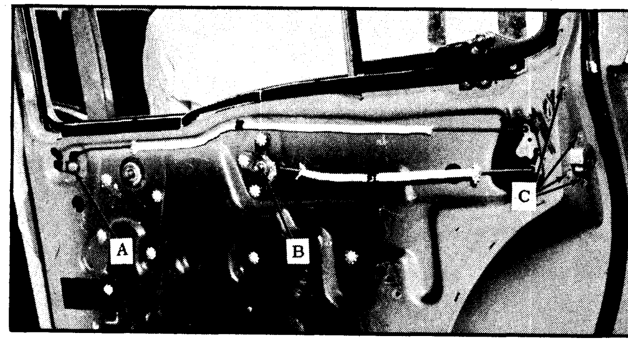


Fig. 17-9 Rear Door Lock Removal (All Except HS)

REAR DOOR LOCK ASSEMBLY

REMOVE AND INSTALL

Four Door Sedan

1. Remove door trim pad.
2. Remove lever "A", remote control assembly "B", and remote control and inside locking control connecting rods from door inner panel. (See Fig. 17-9)
3. Remove lock attaching screws "C", then remove lock assembly.

To install, reverse removal procedure.

Four Door Holiday

1. Raise door window. Remove door trim pad and access hole cover.
   NOTE: On doors equipped with electric window lifts, the regulator attaching screw at access hole cover must be removed to remove cover.
2. Remove inside locking rod lever screw "D" and detach lock-to-lever connecting rod at "D". (See Fig. 17-10)
3. Disengage remote control connecting link retaining clip at "E" and detach connecting link from remote control.
4. Remove 3 door lock attaching screws "F", from face of door lock pillar.
5. Move lock towards hole "G" in inner panel so that connecting rod and link can be detached from lock at hole "G".
6. Remove door lock through access hole.

To install, first apply a ribbon of caulking compound on the door lock facing at the top and side joints of the lock bolt cover, then reverse removal procedure.

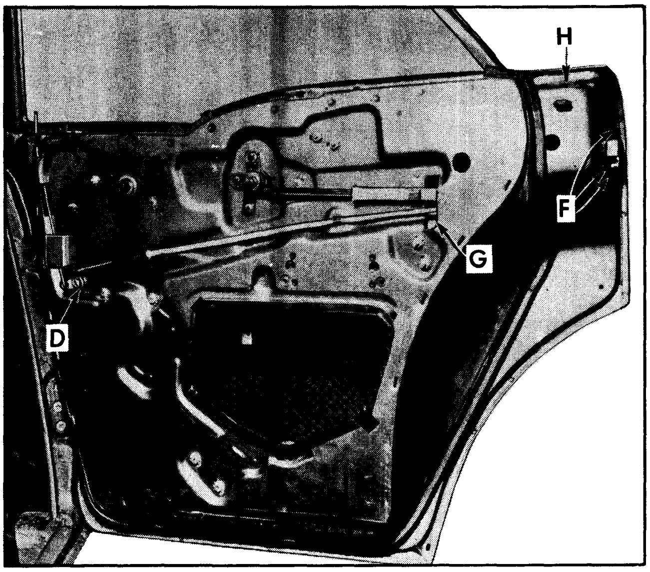


Fig. 17-10 Rear Door Lock Removal (HS)

REAR DOOR LOCK FREE WHEELING ADJUSTMENT

Four Door Sedan FIG. 17-11

To place the rear door lock in free wheeling, remove the top lock attaching screw and insert a wire hook to engage the loop at the top of the remote control connecting link. The lock can then be placed in free wheeling or restored to normal operation as desired.

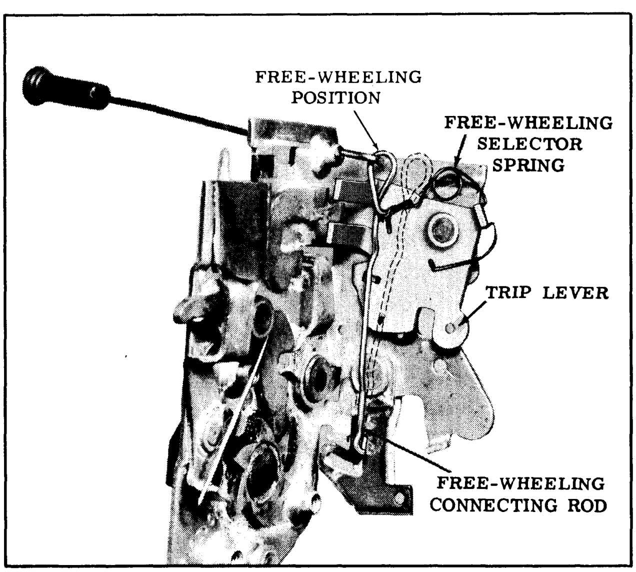


Fig. 17-11 Free Wheeling Adjustment (All Except HS)

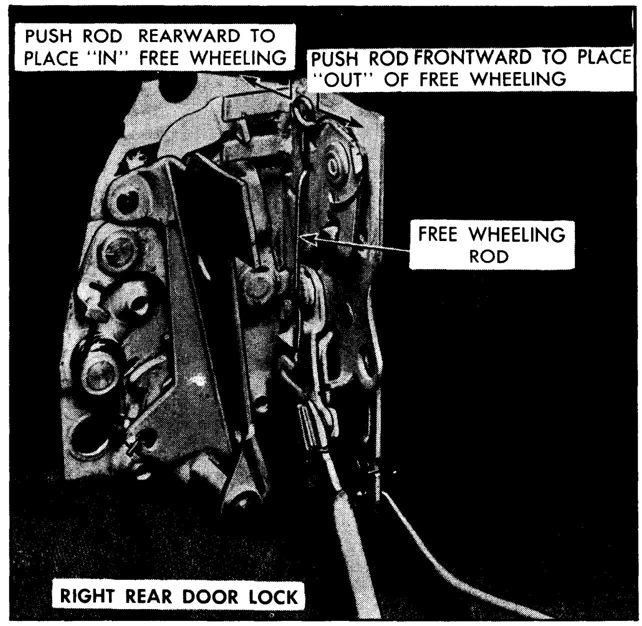


Fig. 17-12 Free Wheeling Adjustment (HS)

Four Door Holiday

1. Operate inside locking rod to the unlocked position.
2. Remove plug from access hole indicated at "H" in Fig. 17-10; then insert suitable tool and push rod rearward to place lock "in" free wheeling, or push rod forward to place "out" of free wheeling. (See Fig. 17-12)
3. Check operation of lock.

DOOR ALIGNMENT

Provisions for door alignment in the form of cage nuts and anchor plates are provided at the door and adjacent hinge pillars.

NOTE: When checking the door for misalignment, remove the door lock striker from the body pillar to allow the door to hang free on its hinges; then check the spacing at the sides and top of the door. Procedure for adjusting door is outlined below.

FRONT DOOR HINGES FIG. 17-13

1. Remove door lock striker.
2. The door can be adjusted up or down

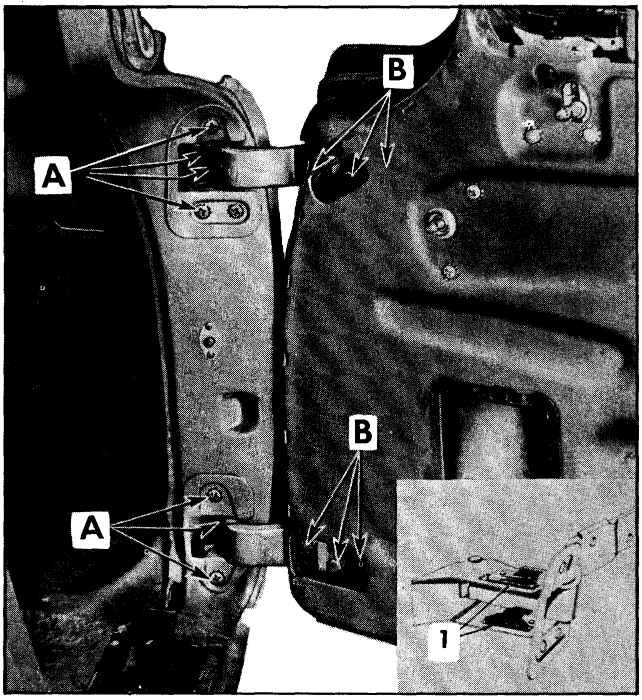


Fig. 17-13 Front Door Hinge Adjustment

and in or out at the front body hinge pillar. To adjust door, proceed as follows:

a. Scribe location of hinge boxes on pillar.
b. Loosen hinge bolts "A" at body pillar.
c. Shift door to desired position, then tighten bolts.

3. The door can be adjusted up or down and fore or aft at door attaching side of hinge straps. To adjust door, proceed as follows:
   a. Remove door trim pad.
   b. Scribe location of hinge strap on door.
   c. Loosen hinge bolts "B" at door, then shift door to desired position.
   d. Tighten bolts and reinstall door trim pad.
4. Install striker and adjust as outlined in DOOR LOCK STRIKER, ADJUSTMENT.
5. On holidays and convertibles, check front door window and ventilator for alignment. If necessary to adjust, refer to DOOR GLASS ADJUSTMENTS.

   NOTE: The frictional areas of the door hinge "hold open" clips "1" contacted by the hinge straps must be lubricated periodically for ease of operation and prevention of frictional noises. (See inset Fig. 17-13)

   Whenever a hinge is removed, coat all attaching surfaces of hinges with sealer as indicated in shaded areas of Fig. 17-14 at "1". In addition, apply extra sealer on surfaces indicated by X, to obtain water-tight seal.

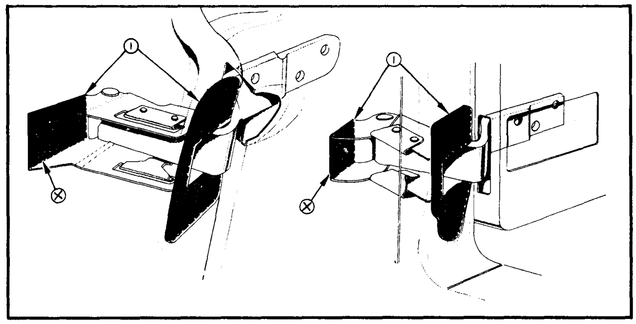


Fig. 17-14 Front Door Hinge Sealing

REAR DOOR HINGES (ALL EXCEPT 4 DOOR HOLIDAY) FIG. 17-15

An up and down adjustment is provided at "A" and an in and out adjustment is provided at the hinge to center body pillar at "B". In addition, waterproof shims can be installed between the center pillar and hinge strap to adjust the door forward or rearward. To adjust rear door, proceed as follows:

1. Remove door lock striker.
2. If adjustment is being performed at center hinge pillar, remove hinge cover plates.
3. For in and out or up and down adjustment, loosen bolts "A" and "B", depending on adjustment desired; then, shift door to desired position and tighten bolts.
4. For rearward adjustment, prop door and proceed as follows:
   a. Remove bolts "B" at upper or lower hinge. (It is easier to adjust one hinge at a time).
   b. Cement a full waterproof shim to hinge strap and reinstall bolts.
5. For forward adjustment, loosen bolts "B" and install a partial waterproof

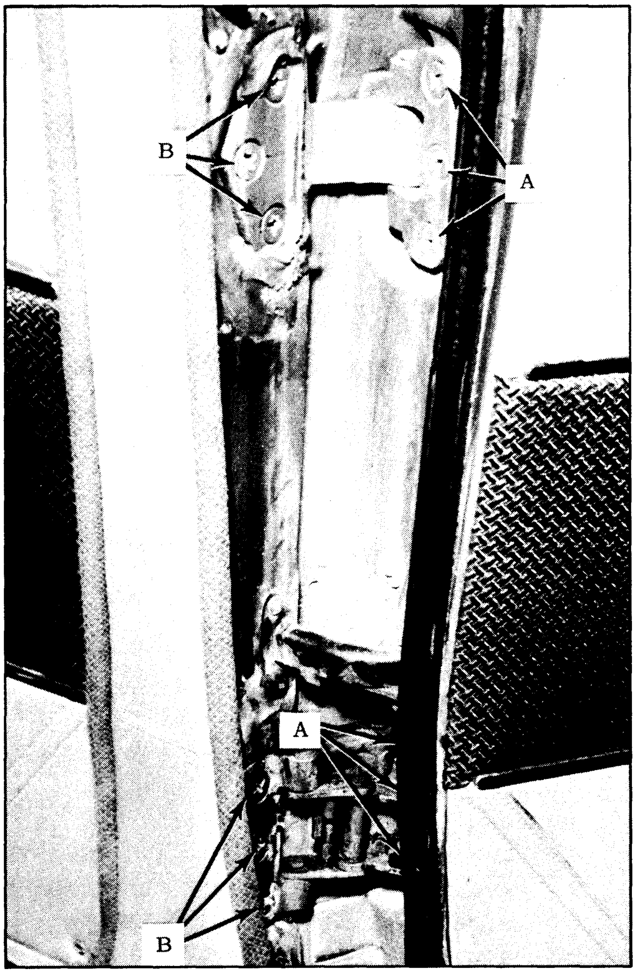


Fig. 17-15 Rear Door Hinge Adjustment (All except HS)

shim at inner edge of hinge strap, then tighten bolts.

6. Install striker and adjust as outlined in DOOR LOCK STRIKER ADJUSTMENT.
7. Seal hinges as specified in Sealing Rear Door Hinge.

Sealing Rear Door Hinges

Whenever hinges are removed, hinges must be weather sealed with medium-bodied sealer or body caulking compound by applying sealer to attaching surfaces of hinge straps or corresponding surfaces of door hinge pillar or center hinge pillar as indicated at "1". (See Fig. 17-16)

Before cover plates are installed, seal hinges with medium-bodied sealer or body caulking compound as outlined below:

1. At top and bottom of hinge at "1"; use sufficient sealer to obtain flush condition with top of hinge and surface of

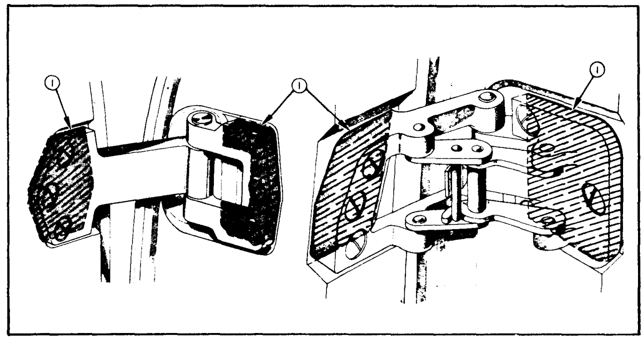


Fig. 17-16 Rear Door Hinge Sealing

pillar completely filling opening in this area. (See Fig. 17-17)

2. To underside of hinge cover plates at "2", across both top and bottom and extending along outer edge.
3. Install hinge cover plates and clean off excess sealer.

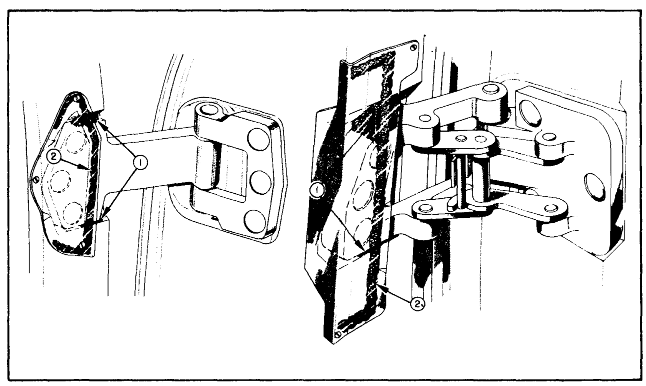


Fig. 17-17 Cover Plate Sealing

REAR DOOR HINGES (4 DOOR HOLIDAY) FIG. 17-18

Due to the center pillar upper hinge support, the rear door hinge adjustments are performed in a different manner than on other sedan styles. "In" and "out" adjustment is provided at the door hinge pillar while "up" and "down" adjustments can be made at the center body pillar. In addition, waterproof shims can be installed between the door hinge pillar and hinge straps to adjust the door "rearward".

1. Remove door lock striker.
2. If adjustment is being performed at center body hinge pillar, remove lower hinge cover plate.

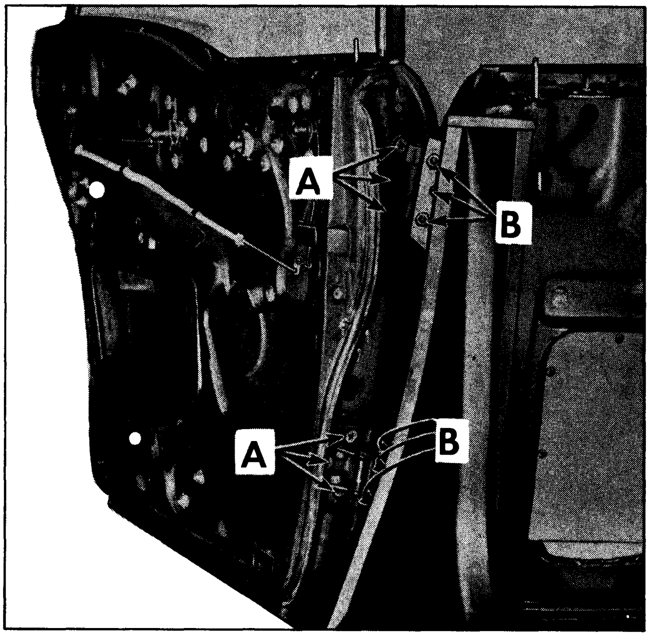


Fig. 17-18 Rear Door Hinge Adjustment (HS)

3. For "in" and "out" adjustment, loosen hinge attaching bolts "A" at door hinge pillar; adjust door as required and tighten bolts. (See Fig. 17-18)
4. For "up" and "down" adjustment, loosen hinge attaching bolts "B" at center pillar; adjust door as required and tighten bolts.
5. For "rearward" adjustment, prop door and remove upper or lower hinge attaching bolts "A" at door hinge pillar. (It is easier to adjust one hinge at a time.) Cement a full waterproof shim to hinge strap and reinstall bolts.

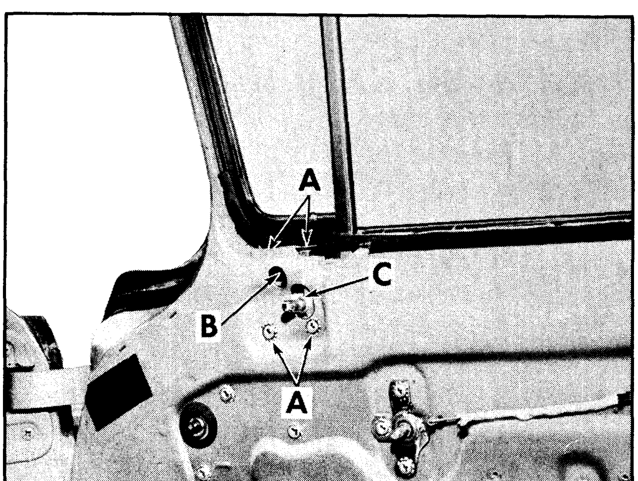


Fig. 17-19 Ventilator and Regulator

6. Seal hinges and/or cover plates specified in Sealing Rear Door Hinges, then reinstall hinge cover plates.
7. Install striker and adjust as outlined in DOOR LOCK STRIKER ADJUSTMENT.
8. Check door window and side roof rail weatherstrip for alignment. If necessary adjust as outlined in DOOR GLASS ADJUSTMENTS.

DOOR GLASS ADJUSTMENTS

FRONT DOOR VENTILATOR AND REGULATOR

All (Except Holidays and Convertibles) FIG. 17-19

1. The lower end of the ventilator division channel can be adjusted in or out, or fore or aft for alignment with door window glass. To adjust lower end of channel, proceed as follows:
   a. Remove door trim panel.
   b. Loosen adjusting stud nut on door inner panel at lower end of division channel.
   c. Turn adjusting stud "in" or "out" and position channel "fore" or "aft" as required, then tighten nut.
2. Excessive "play" (flutter) of the ventilator at the pivot shaft when the ventilator is in the open position can be corrected by tightening screw indicated at "B".

   NOTE: Screw should be tightened carefully to avoid stripping threads in spiral gear shaft.
3. The operating effort required to open or close the ventilator can be slightly increased or decreased by adjusting the friction clamp screw indicated at "C".
4. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

Holidays and Convertibles FIG. 17-20

1. The door ventilator assembly can be adjusted "in" or "out" and tilted "fore" or "aft" for alignment with the door

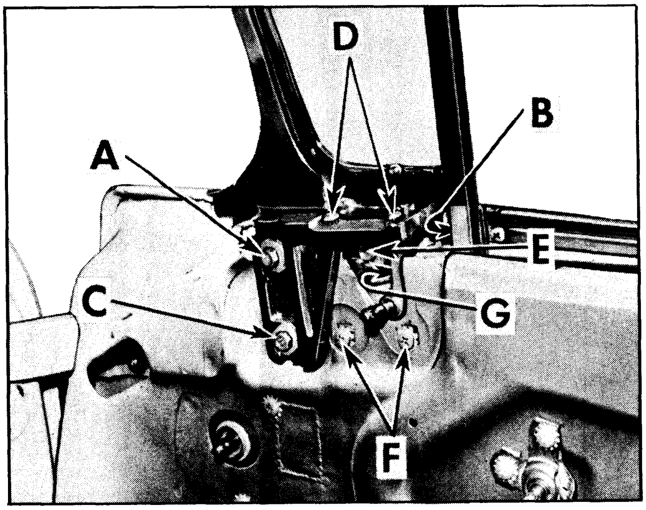


Fig. 17-20 Ventilator and Regulator (HC & DCR)

window glass, and on 4 door holidays, alignment with the side roof rail weatherstrip. To adjust ventilator, proceed as follows:

a. Remove door trim panel.
b. Loosen attaching bolt "A", adjusting stud nut "C", and adjusting stud nut at lower end of division channel.
c. To adjust ventilator assembly in or out, turn adjusting stud "C" and adjusting stud at lower end of division channel "in" or "out" as required.
d. To tilt ventilator assembly "fore" or "aft," remove screw "B" and loosen ventilator regulator attaching screws "F", and adjust ventilator assembly to desired position.
e. Tighten ventilator and ventilator regulator attaching parts.

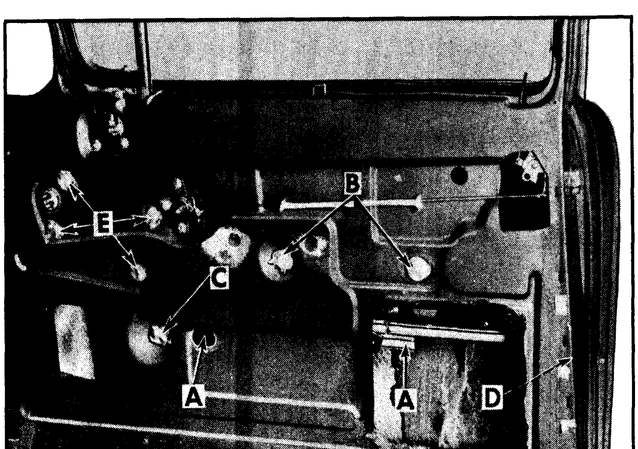


Fig. 17-21 Door Glass Adjustment (All Exc. Holidays & DCR)

2. Excessive "play" (flutter) of the ventilator at the pivot shaft, when the ventilator is in the open position, can be corrected by tightening screw indicated at "E".
3. The operating effort, required to open or close the ventilator, can be slightly increased or decreased by adjusting friction clamp screw indicated at "G".
4. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

FRONT DOOR WINDOW GLASS

All Models (Except Holidays and Convertibles) FIG. 17-21

To relieve a binding door glass caused by the misalignment of the glass with the glass run channels, proceed as follows:

1. Loosen stationary cam rear attaching screw "B" and adjust rear end of cam channel "up" or "down" as required. then tighten screw. This adjustment will correct a condition where the door glass is "cocked" in the glass run channels.
2. Loosen the ventilator division channel lower adjusting stud nut at "C", then turn stud "in" or "out", or position lower end of division channel "fore" or "aft," whichever is required, then tighten nut.
3. Loosen the glass run channel lower attaching nut "D" at the lock pillar, and position channel "in" or "out" as required, then tighten nut.
4. Seal door inner panel as specified in DOOR INNER PANEL SEALING.

Holidays and Convertibles FIG. 17-22

NOTE: It may take one or a combination of adjustments outlined below to correct a misaligned door glass. In addition, it may be necessary to adjust the door ventilator assembly as outlined under FRONT DOOR VENTILATOR AND REGULATOR.

1. To adjust upward limit of glass travel, proceed as follows:
   a. Remove door belt finishing molding.

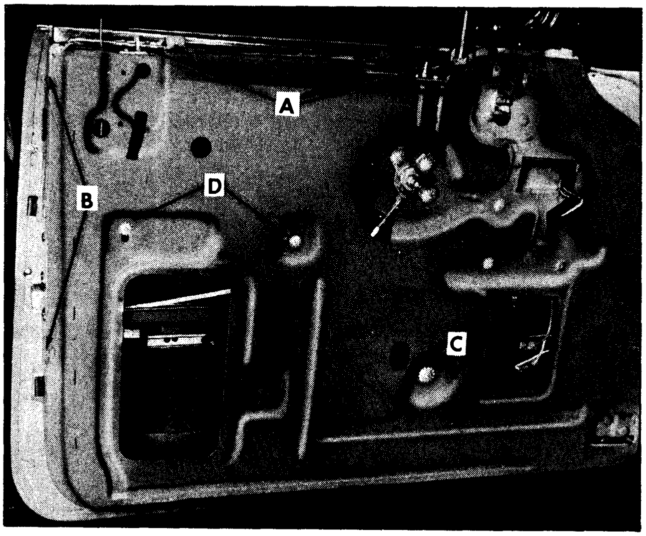


Fig. 17-22 Door Glass Adjustment (Holidays and DCR)

b. Turn stop or stops, indicated at "A", up or down as required.

2. To adjust door glass "in" or "out," proceed as follows:

NOTE: To perform this and the following adjustments, the door trim pad will have to be removed.

a. Loosen glass run channel attaching screws "B" and adjusting stud nut "C". Turn adjusting stud and position glass run channel at door lock pillar as required, then tighten screws and nut.

3. To correct a door glass which is "cocked" in the glass run channels, proceed as follows:

a. Loosen stationary cam rear attaching screw "D" and raise or lower rear end of cam as required, then tighten screw.

4. Operate door glass "up" or "down" to check adjustment(s), then seal door inner panel as specified in DOOR INNER PANEL SEALING.

REAR DOOR VENTILATOR AND REGULATOR

1. The lower end of the division channel can be adjusted "in" or "out" at the adjusting stud "C" at the lower end of the channel. (See Fig. 17-24)
2. The amount of effort required to open or close the ventilator can be increased or decreased by adjusting the nut on the lower pivot shaft as shown in the inset at "C", Figure 17-23.

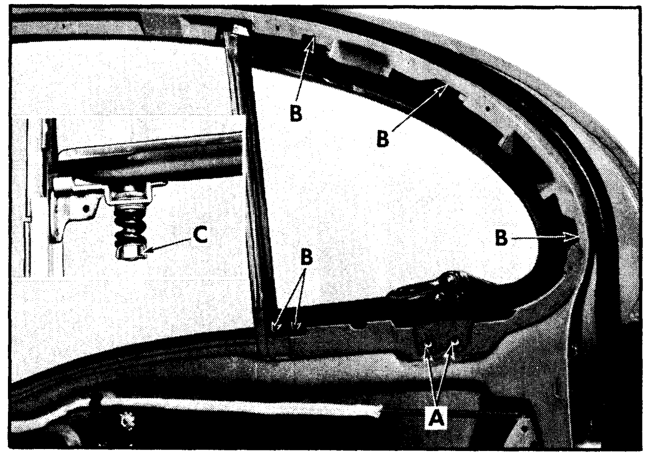


Fig. 17-23 Rear Door Ventilator Adjustments

REAR DOOR WINDOW GLASS

All (Except 4 Door Holiday) FIG. 17-24

1. To correct a condition where the window is "cocked" in the glass run channels, loosen the stationary cam rear attaching screw "B" and adjust cam "up" or "down" as required, then tighten screw.

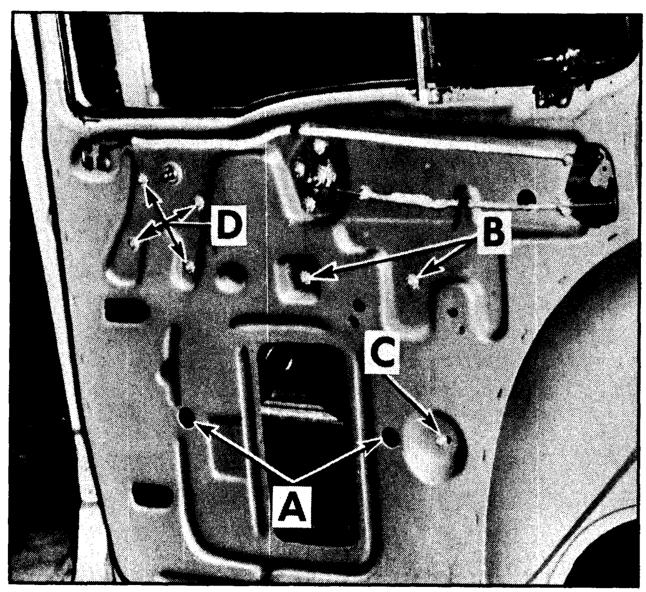


Fig. 17-24 Rear Door Glass Adjustments (All Except HS)

2. To correct a condition where the door glass is binding due to misalignment of the lower end of the ventilator division channel, loosen the adjusting stud nut "C" and turn adjusting stud "in" or "out" as required, then tighten nut.

REAR DOOR WINDOW GLASS FIG. 17-25

4 Door Holiday

The following rear door adjustments are divided into four groups, each dealing with a specific phase of window adjustment.

NOTE: The rear door assembly should be properly aligned before adjusting the rear door window.

A. Alignment of rear door window frame weatherstrip with front door window frame.
  1. To adjust window "fore" or "aft", proceed as follows:
     a. Loosen window female wedge plate screw through access hole "A".
     b. Loosen regulator lift arm stop screw "B", operate window to desired position, then move stop tight against lift arm and retighten stop screw "B".
     c. Tighten female wedge plate screw by operating window to FULL "UP" position, then back window "off" slightly (approximately 1/16" to 1/8"). Position female wedge plate tight to male wedge plate and tighten screw through access hole "A".

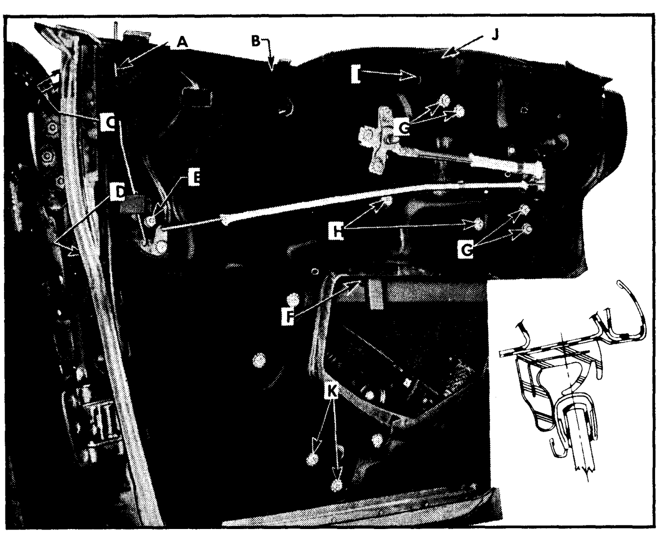


Fig. 17-25 Rear Door Glass Adjustment (HS)

  2. To adjust LOWER FRONT of window "in" or "out" proceed as follows:
     a. Loosen window male wedge plate screws "C" on hinge pillar.
     b. Loosen window support screw "D" and front guide stud nut "E".
     c. Adjust stud "in" or "out" as required, then retighten stud nut "E" and screw "D".
     d. With window in FULL "UP" position tighten male wedge plate screws at "C".

B. Contact of window upper frame with the side roof rail weatherstrip. (See inset Fig. 17-25)
  1. To adjust TOP of window frame "in" or "out" proceed as follows:
     a. Loosen male wedge plate screws "C", then loosen center guide shoe lock nut "F".
     b. Adjust center guide shoe "in" or "out" as required, then retighten lock nut "F".
     c. With window in FULL "UP" position tighten wedge plate screws "C".
  2. To adjust REAR of window upper frame "in" or "out" proceed as follows:
     a. Loosen rear guide upper and lower stud nuts "G".
     b. Adjust both studs the same amount "in" or "out" as required, then tighten nuts "G".
  3. To adjust FRONT of window "up" or "down" proceed as follows:
     a. Loosen male wedge plate screws "C" and inner panel cam front screw "H".
     b. Position FRONT of window "up" or "down" as required, then retighten cam screw "H".
     c. With window in FULL "up" position tighten wedge plate screws "C".
  4. To adjust REAR of window "up" or "down" proceed as follows:
     a. Loosen window lower sash channel cam screw through access hole "I".
     b. Adjust REAR of window "up" or

"down" as required, then tighten cam screw at "I".

5. To limit the "up" travel of REAR of window adjust window stop at "J".

C. Limiting window downward travel for flush alignment at belt line.

1. To limit the "down" travel of the REAR of the window, adjust the bumper, located at the rear end of the lower window frame.
2. To limit the "down" travel of the FRONT of the window proceed as follows:
   a. Loosen window front guide attaching screws "D", "E", and "K".
   b. Loosen male wedge plate screws at "C".
   c. Adjust guide "up" or "down" as required, then tighten screws "D", "E", and "K".
   d. With window in "up" position tighten wedge plate screws "C".

DOOR INNER PANEL SEALING FIG. 17-26

Whenever work is performed on the door where the sealing is disturbed, the area must be resealed before the door trim pad is reinstalled.

NOTE: The following sealing operations refer to a 4 door holiday however the procedure is applicable to all body styles.

1. Apply waterproof body tape over access hole for window lower sash channel cam screws.

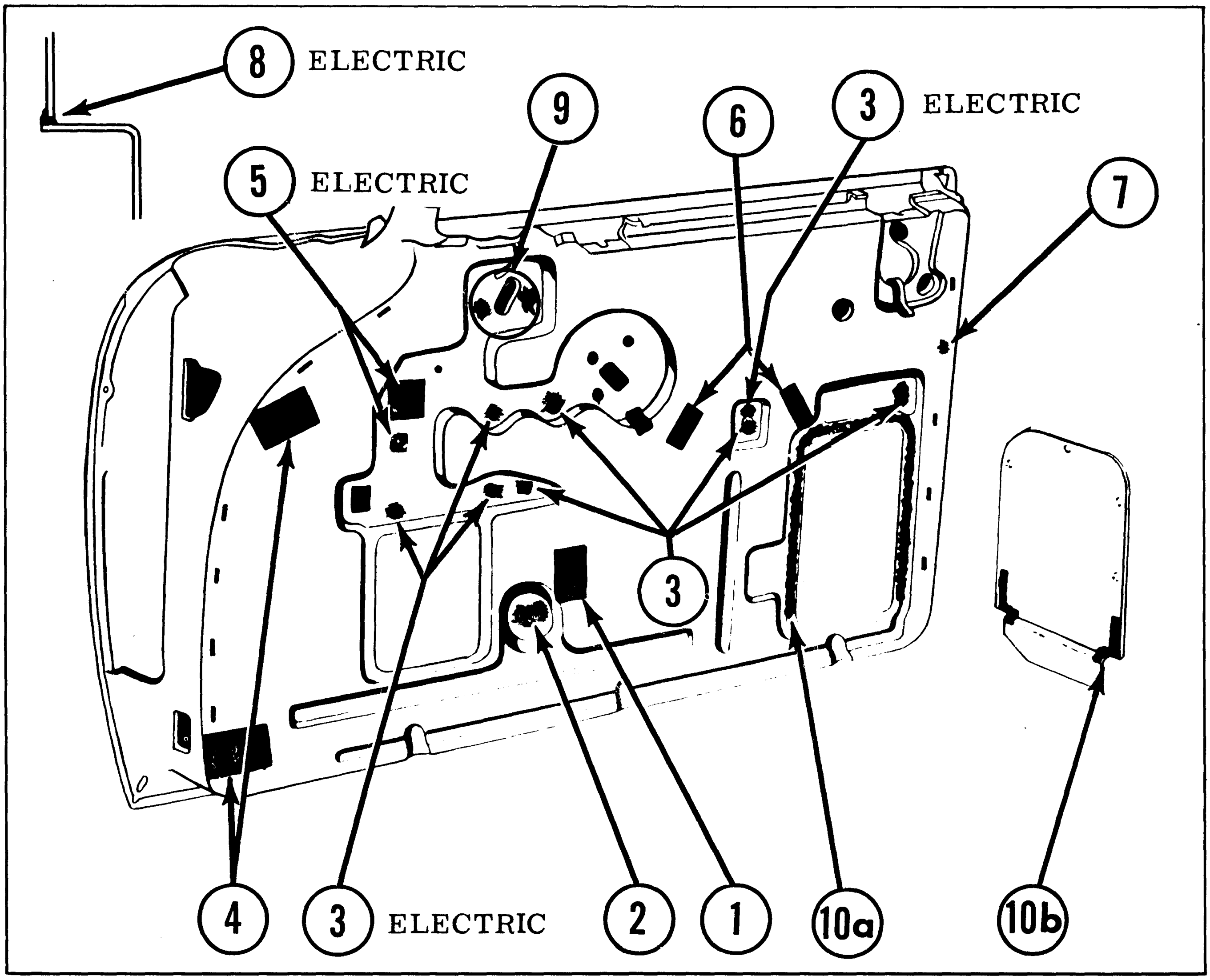


Fig. 17-26 Door Inner Panel Sealing

2. Apply body caulking compound to seal the ventilator division channel lower attaching hole.
3. Apply body caulking compound to seal the window regulator and door inner panel cam attaching holes.
4. Apply waterproof body tape over the upper and lower hinge access holes. In addition, on all styles except 4 door holidays, apply tape over door lock access hole.
5. On doors equipped with electrically-operated windows apply waterproof body tape over the manual regulator attaching hole and over the manual regulator spindle hole.
6. Apply waterproof body tape over arm rest attaching holes.
7. Apply body caulking compound over trim assembly clips slots.
8. On doors equipped with electrically-operated windows apply body caulking compound along the joints of the switch hole cover and door inner panel across the top and down the sides to the attaching flange. Caulking compound should be worked into the opening to insure a good seal.
9. Apply body caulking compound over the ventilator regulator attaching screws.
10. Prior to installing the access hole covers:
    a. Apply a ribbon (approximately 3/16" diameter) of medium-bodied sealer across the top and down the side flanges of the access hole opening to provide a seal between the cover and door inner panel.
    b. Apply a ribbon of medium-bodied sealer to the contacting surface of the cover at the lower corners.
    c. After access hole cover is installed, seal lower corners of cover at offset with medium-bodied sealer.

DOOR WEATHERSTRIP

REPLACEMENT

NOTE: Weatherstrip must be attached within 3 minutes after applying cement.

1. After the old weatherstrip has been removed, clean the sealing area around the door.
2. If the door drain hole sealing strips were removed, cement the strips to the door as shown in Figure 17-27.
3. For Sedans (All, Except 4 Door Holidays):
    a. Apply 3M Weatherstrip Adhesive along top of door header, front door cove area, rear door lock pillar, and along bottom of door where the weatherstrip ends (butt joint).
    b. Starting at the bottom center of the door, attach the weatherstrip using Tool J-5757 to install clips into retaining holes.
4. For Holiday and Convertible Coupes:
    a. Apply 3M Weatherstrip Adhesive in cove area of door.
    b. Install upper portion of weatherstrip to ventilator frame, then using Tool J-5757 to install clips, complete installation of weatherstrip.
5. For 4 Door Holidays:
    a. Apply 3M Weatherstrip Adhesive along sealing areas of door.
    b. Install weatherstrip to door, then bend up retaining tabs on bottom of door.
    c. Install stud fasteners and long metal weatherstrip retainer.
6. Trim butt ends of weatherstrip so that they match evenly, then cement ends together.
7. On weatherstrip with wire clip retainers, apply medium-bodied sealer (by reaching through access hole) to the wire clip retainers along the bottom of the door.
8. Install auxiliary weatherstrip to front door as follows:
    a. Apply 3M Weatherstrip Adhesive to the surface of the front door hinge pillar contacted by the weatherstrip attaching surface.
    b. Install stud fasteners to weatherstrip, then install fasteners and lower portion of weatherstrip to hinge pillar to align weatherstrip with drain hole. Install remainder

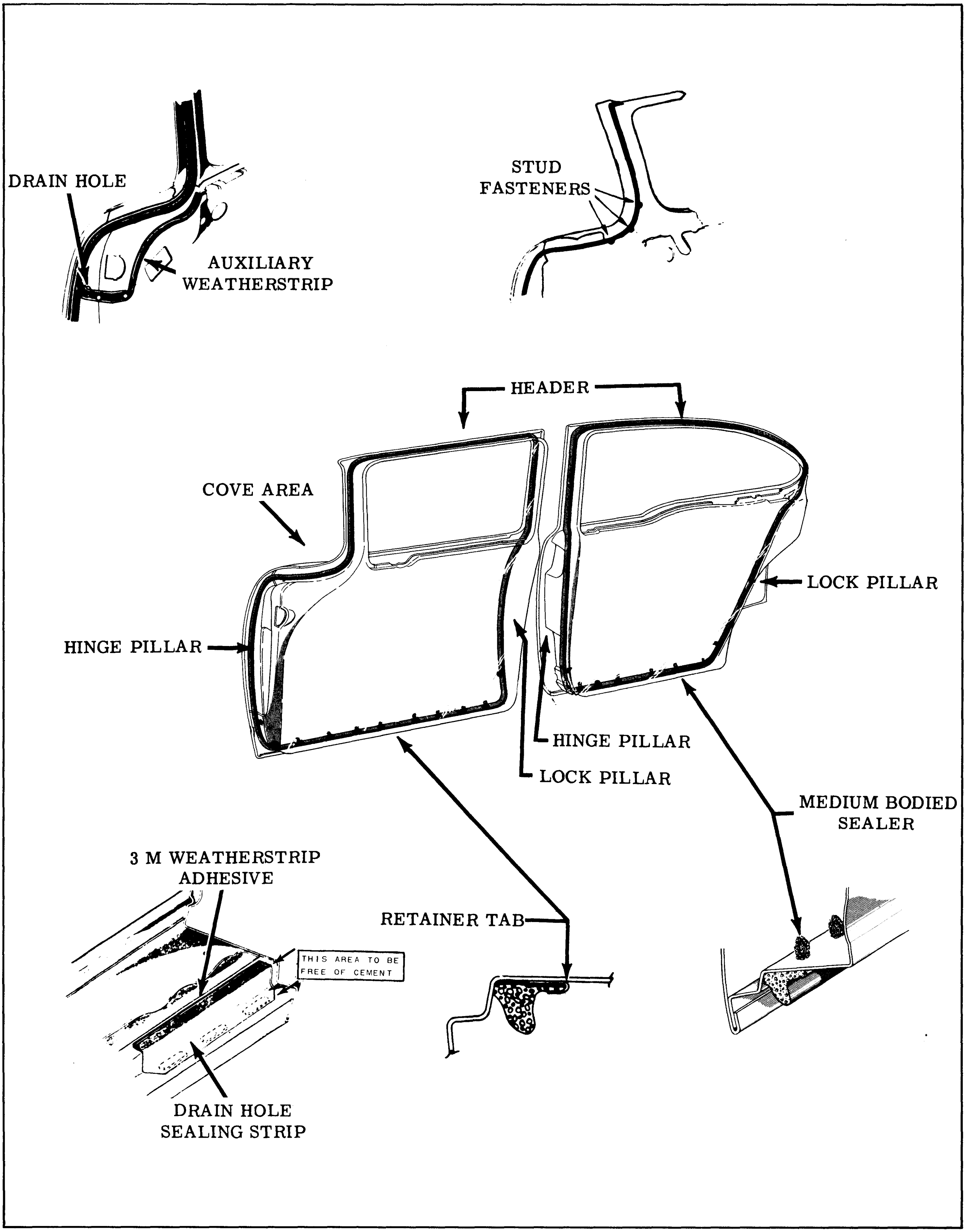


Fig. 17-27 Door Weatherstrip

of weatherstrip to pillar as shown in illustration.

NOTE: Weatherstrip must not cover any portion of drain hole.

c. Firmly press entire length of weatherstrip to hinge pillar to assure a complete cemented bond.

NOTE: Allow as much drying time as possible for weatherstrip to bond before closing door.

REAR QUARTER GLASS ADJUSTMENTS

Manually Operated FIG. 17-28

1. To adjust the rear quarter window "fore" and "aft", loosen the rear guide channel screws "A" and the front guide channel screws "B", then the rear quarter window can be moved "fore" or "aft" due to elongated front and rear guide channel attaching screw holes in the inner panel. When the desired position is obtained, retighten the guide channel attaching screws.
2. To adjust the rear quarter window "in" or "out" at the lock pillar, loosen the upper front guide channel attaching stud nut and turn the adjusting stud "in" or "out" to the desired location. Retighten adjusting stud nut.
3. The "up" travel of the rear quarter window can be adjusted by loosening the rear quarter window stop attaching screw at "C" and sliding the stop to the desired position.
4. The "down" travel of the rear quarter window can be adjusted by loosening the down stop attaching screw on the front guide channel at "D". This stop may be set in any location along the front guide channel.

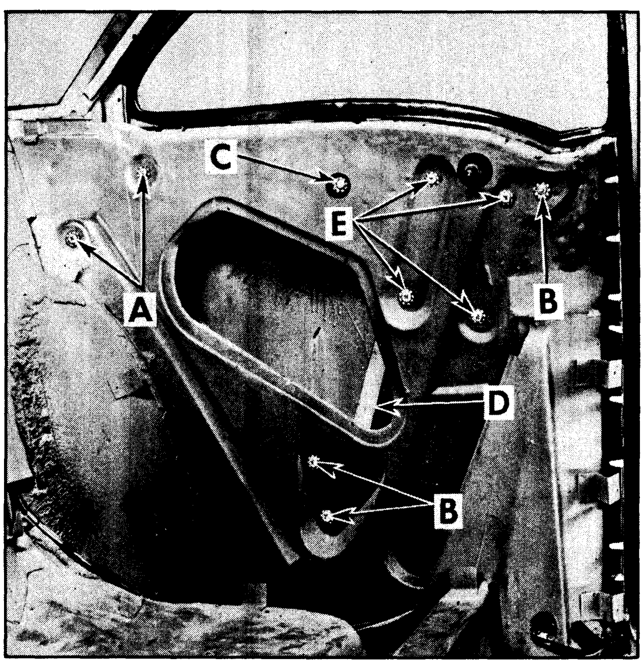


Fig. 17-28 Rear Quarter Glass Adjustment (Manual)

Electrically Operated (Holiday) FIG. 17-29

1. To adjust rear quarter window "fore" or "aft", loosen rear guide channel screws "A" and front guide channel screws "B". Rear quarter window can then be moved "fore" or "aft" due to elongated front and rear guide channel attaching screw holes in inner panel. When desired position is obtained, retighten guide channel attaching screws.
2. To adjust rear quarter window "in" or "out" at lock pillar, loosen upper front guide channel attaching stud nut and turn adjusting stud "in" or "out" to desired location. Retighten adjusting stud nut.

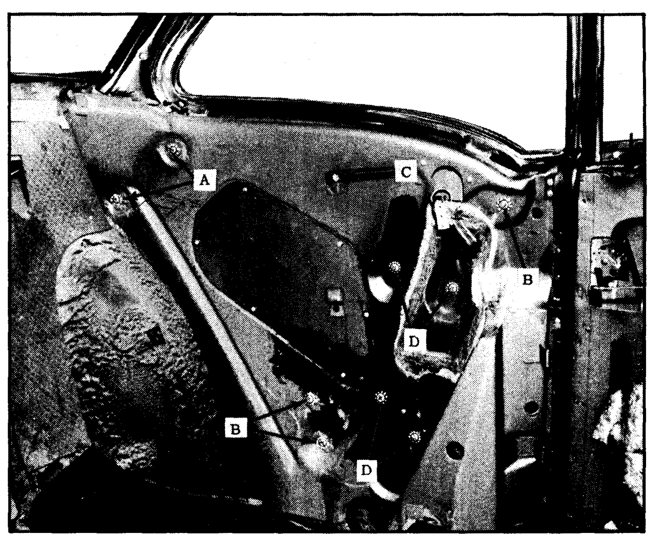


Fig. 17-29 Rear Quarter Glass Adjustment (Holiday-Electric)

3. The "up" travel of the rear quarter window can be adjusted by loosening screw indicated at "C" and adjusting stop as required.
4. The "down" travel of the window can be adjusted by adjusting stop located at lower end of front guide channel. The access hole cover has to be removed to gain access to the stop.

Electrically Operated (Convertible) FIG. 17-30

1. To adjust the rear quarter window "in" or "out", loosen the pivot bolt at "A" and the adjusting stud nuts at "B". Turn the studs "in" or "out" until the desired position of the window is attained. Retighten stud nuts and pivot bolts.
2. To adjust rear quarter window "up" or "down" or "fore" or "aft", loosen the pivot bolt and adjusting stud nuts. Position the window where desired and retighten pivot bolt and adjusting stud nuts.
3. The "up" travel of the window can be adjusted by loosening the stop attaching screws at "C" and moving the stop "up" or "down" as desired. Retighten screws at "C" when adjustment is completed.

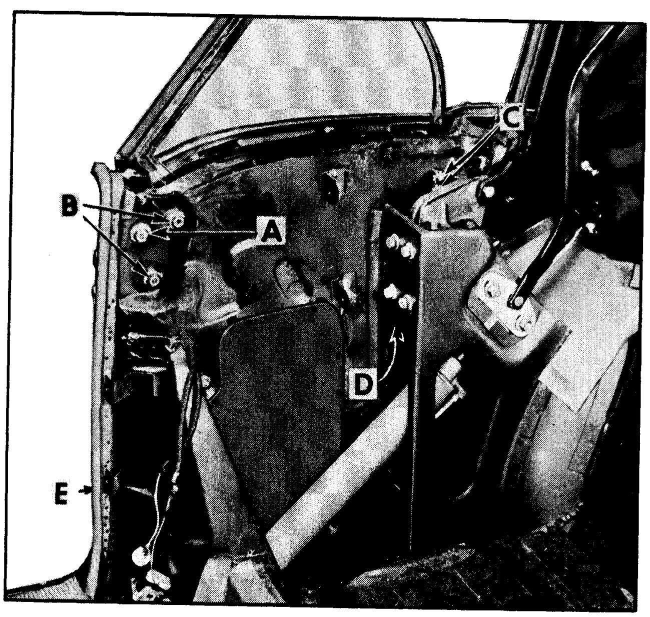


Fig. 17-30 Rear Quarter Glass Adjustments (Convertible - Electric)

4. In connection with the preceding adjustments, it may be necessary to adjust rear quarter window guide channel. To adjust the guide channel, loosen screw "E" at lock pillar and adjusting stud nut at "D". Position the guide channel to the desired location and retighten screw "E" and stud nut "D".

REAR COMPARTMENT LID ADJUSTMENTS

Torque Rod Adjustment FIG. 17-31

The torque rods on the rear compartment lid hinge assemblies can be adjusted to obtain the desired effort required to open and close the lid.

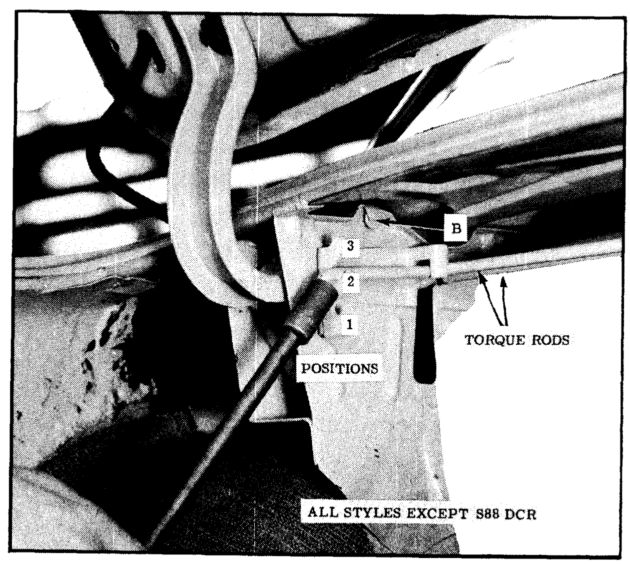


Fig. 17-31 Torque Rod Adjustment

With the torque rod set in position #1, a decrease in the effort required to open the lid can be had by adjusting the torque rod to positions #2 or #3. A corresponding increase in the effort required to close the lid results from this adjustment.

With the torque rod set in position #3, a decrease in the effort required to close the lid can be had by adjusting the torque rod to positions #2 or #1. A corresponding increase in the effort required to open the lid results from this adjustment.

Compartment Lid Alignment Fig. 17-32

1. The rear compartment lid can be adjusted forward or rearward and from side to side in the rear compartment lid body opening through the use of elongated bolt holes in the hinge straps and movable bolt attaching plates in the lid. To adjust, loosen hinge strap retaining bolts "A", shift lid to required position, and tighten bolts "A".
2. Shimming between the hinge strap and rear compartment lid inner panel may also be used to raise or lower the hinge area of the lid in the opening.
   a. To raise lid at hinge area, place a thin shim under forward edge of one or both hinge straps at "B" to obtain desired adjustment.
   b. To lower lid at hinge area, place shims under rear end of lid hinge straps at "C" to obtain the desired adjustment.
3. The rear compartment lid lock striker "D" may be adjusted to obtain proper lid lock engagement.
4. Two screws "E" provide adjustment for alignment of rear compartment lid locating dowel pin.

Rear Compartment Lid Lock Striker Adjustment Fig. 17-33

The rear compartment lid lock striker

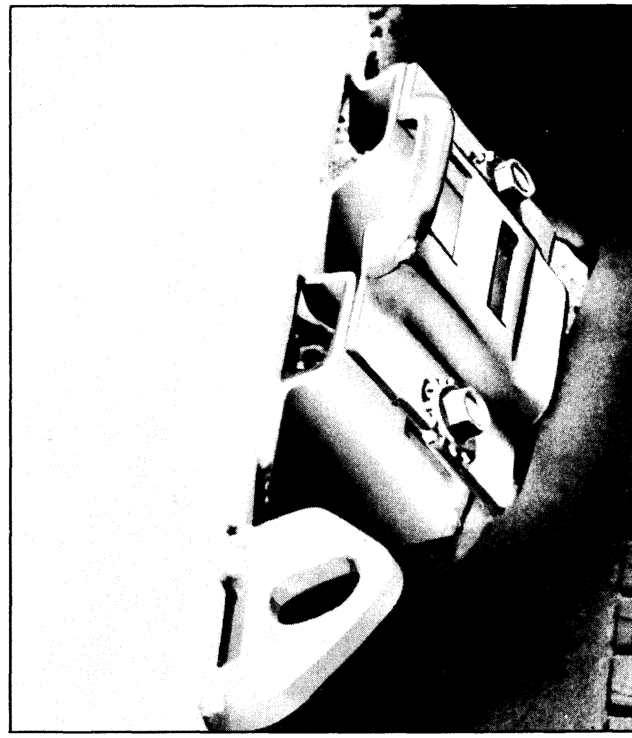


Fig. 17-33 Lid Lock Striker

is mounted to a striker anchor plate at the center line of the body at the rear of the rear compartment lid opening. The beveled anchor plate mounting surface allows the striker, through slotted holes at the attaching points, to be adjusted primarily up and down. At the same time, a slight corresponding rearward and forward adjustment is available. In extreme

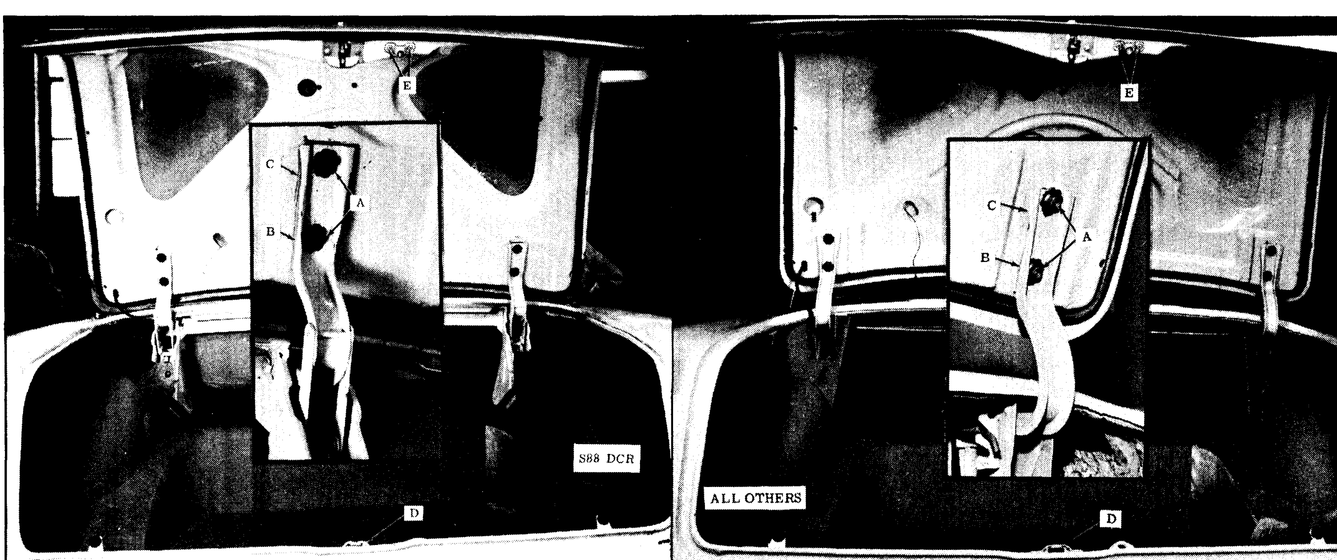


Fig. 17-32 Rear Compartment Lid Alignment

adjustment cases an emergency spacer is available to obtain proper lock bolt and striker engagement.

Lid Lock Bolt and Striker Engagement Check Fig. 17-34

To check the amount of engagement of the rear compartment lid lock bolt with the lock striker, use the following procedure:

1. Insert a small quantity of modeling clay at the bottom of the bolt slot and close lid with a moderate slam.

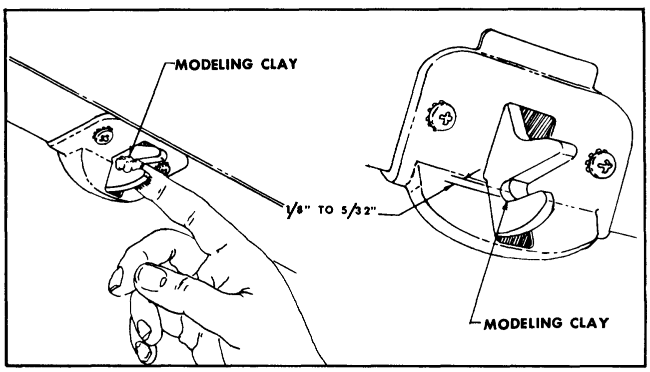


Fig. 17-34 Striker Engagement

2. Open lid and check the amount of engagement of the lock bolt with striker as indicated by the compression of the clay. With a scale, carefully measure the distance between the base of the "U" in the clay to the base of the "U" in the lock bolt. This dimension should be 1/8" to 5/32".
3. Adjust spacer as required and use a spacer which is available for extreme cases of lid lock striker adjustment, if necessary. Tighten all attaching screws.

WINDSHIELD WIPER CABLE

Tension Adjustment Fig. 17-35

Loose cables cause slap or overtravel of wiper blades at end of each stroke. If this condition exists, readjust tension as follows:

1. Depress base of windshield wiper blade

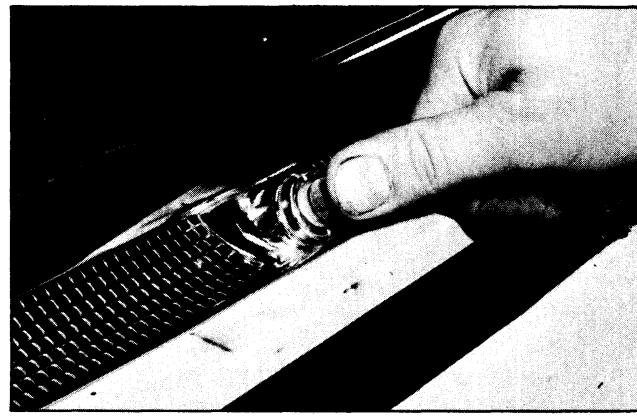


Fig. 17-35 Adjusting Cable Tension

arm assembly or if assembly has been removed, push in end of wiper transmission shaft as shown in illustration.

FLOOR MATS

The following points must be observed when installing or aligning floor mats to insure proper floor mat fit and appearance. All alignment operations should be completed before permanently locating mat under sill plates and accelerator rod grommet.

Fig. 17-36 Retainer Alignment

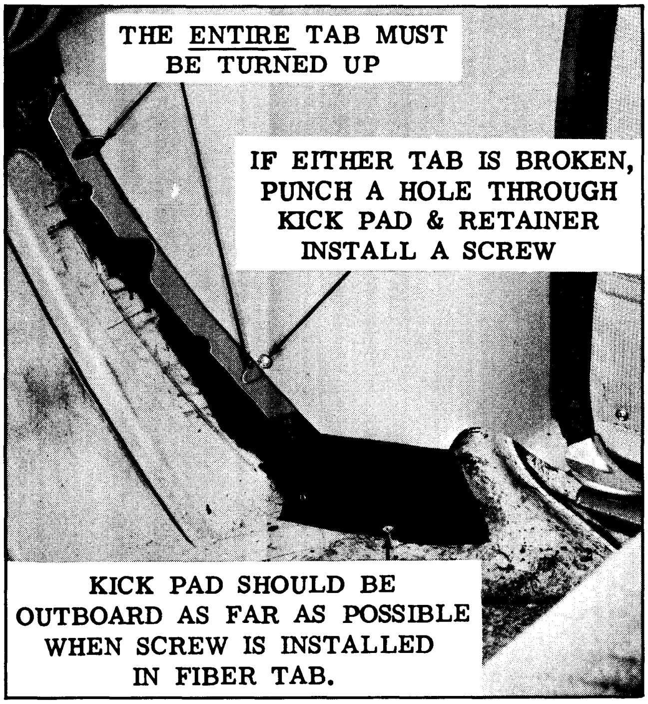


Fig. 17-37 Kick Pad Alignment

1. Check to see that retainer shown in Figure 17-36 is straight up and down. (NOT bent inboard or outboard)
2. Remove all excess sealer around retainer area.
3. Check to insure that retaining tabs are free of sealer and that entire tab is bent up. (See Fig. 17-37)

   NOTE: If the retaining tabs are broken, a screw should be installed through the retainer as shown.
4. After above alignment procedure, it may be necessary to relocate the attaching screw in the fiber tab that attaches to the floor pan. When installing this screw, be sure kick pad is held outboard as far as possible.
5. Position the upper floor mat edge UNDER the dash insulator mat and be sure floor mat is aligned to fit contour of both cowl kick pads.
6. All wrinkles must be smoothed out by hand over transmission "hump" in floor pan.
7. Floor mat must be carefully positioned under accelerator rod, steering column, clutch, and brake pedal grommets. BE SURE ACCELERATOR ROD GROMMET IS COMPLETELY "SNAPPED" INTO RETAINER. If necessary, trim the insulating material on the bottom of the mat a slight amount around the accelerator hole to prevent the retainer from popping off.
8. If car is equipped with power brakes, the "bellows" type dust seal must be positioned over retaining flange on power cylinder. THIS IS ESSENTIAL TO PREVENT FOREIGN MATERIAL FROM ENTERING THE POWER CYLINDER. The rubber grommet should then be positioned over the rubber bellows so that the grommet will be held firmly against the mat. Also, the power brake bracket extends down over the lip on the dash mat insulation that retains the upper edge of the floor mat. It will be necessary to slit the lip on either side of the bracket position and place the mat over lip in order for it to fit without wrinkling.
9. The sill plate attaching screws must be loosened and the edge of the front mat slid under the sill plate.

   NOTE: The rear mat will also be retained by the sill plate and the front mat should rest ON TOP of the rear mat.

BODY BOLTS

To minimize vibration and noise, the body bolts must be properly torqued. Body bolts which are not tightened sufficiently will cause body "chucking" and damage to the insulators. If body bolts are tightened excessively, the cushioning effect of the insulators is impaired resulting in squeaks and body "drumming". Body bolts used with the plain rubber mount must be torqued 15 to 20 ft. lbs., and body bolts used with the metal sleeve type rubber mount must be torqued 25 to 30 ft. lbs. For various body mount locations and usage, refer to Figs. 17-38, 17-39 and 17-40.

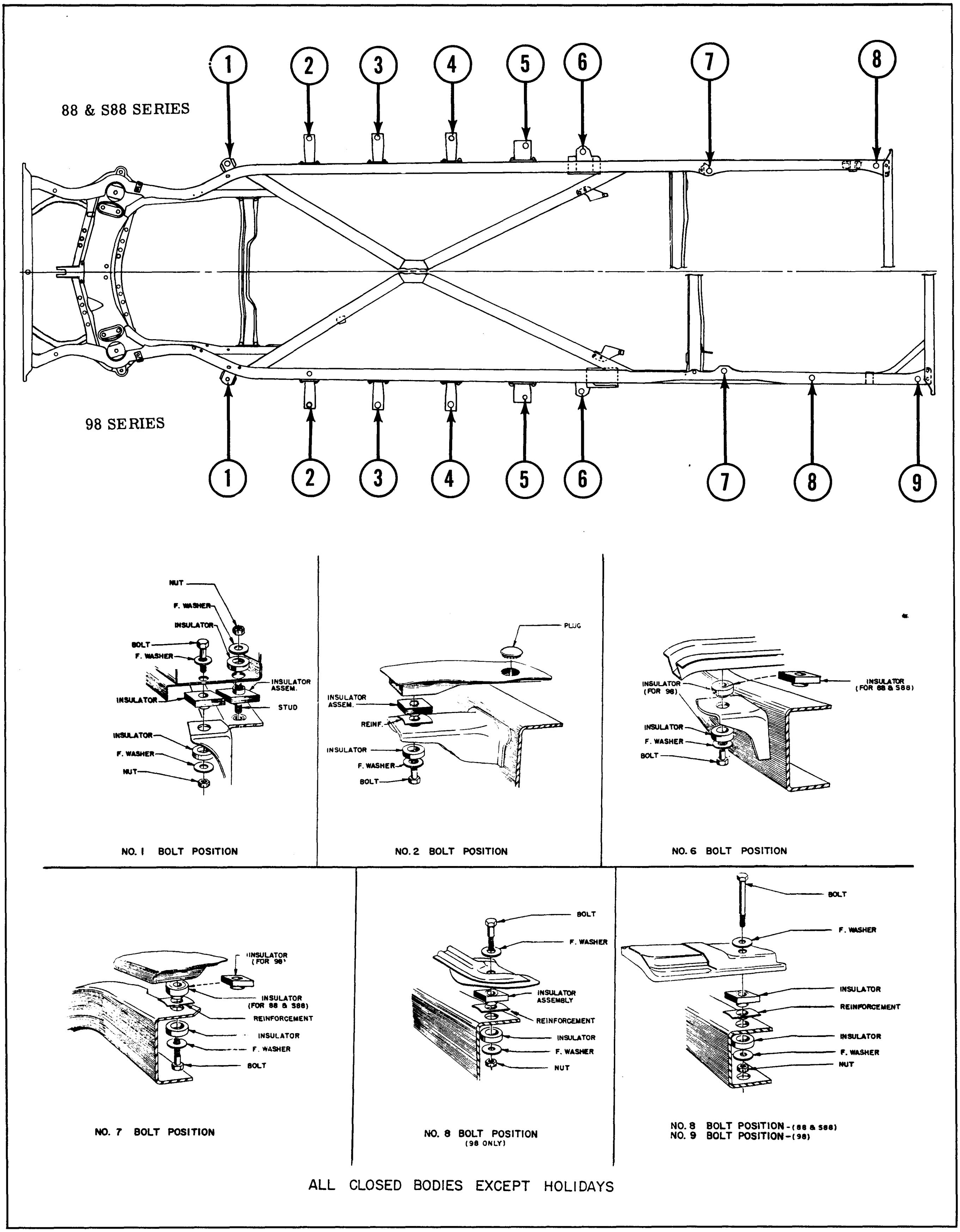


Fig. 17-38 Body Mount Locations and Usage

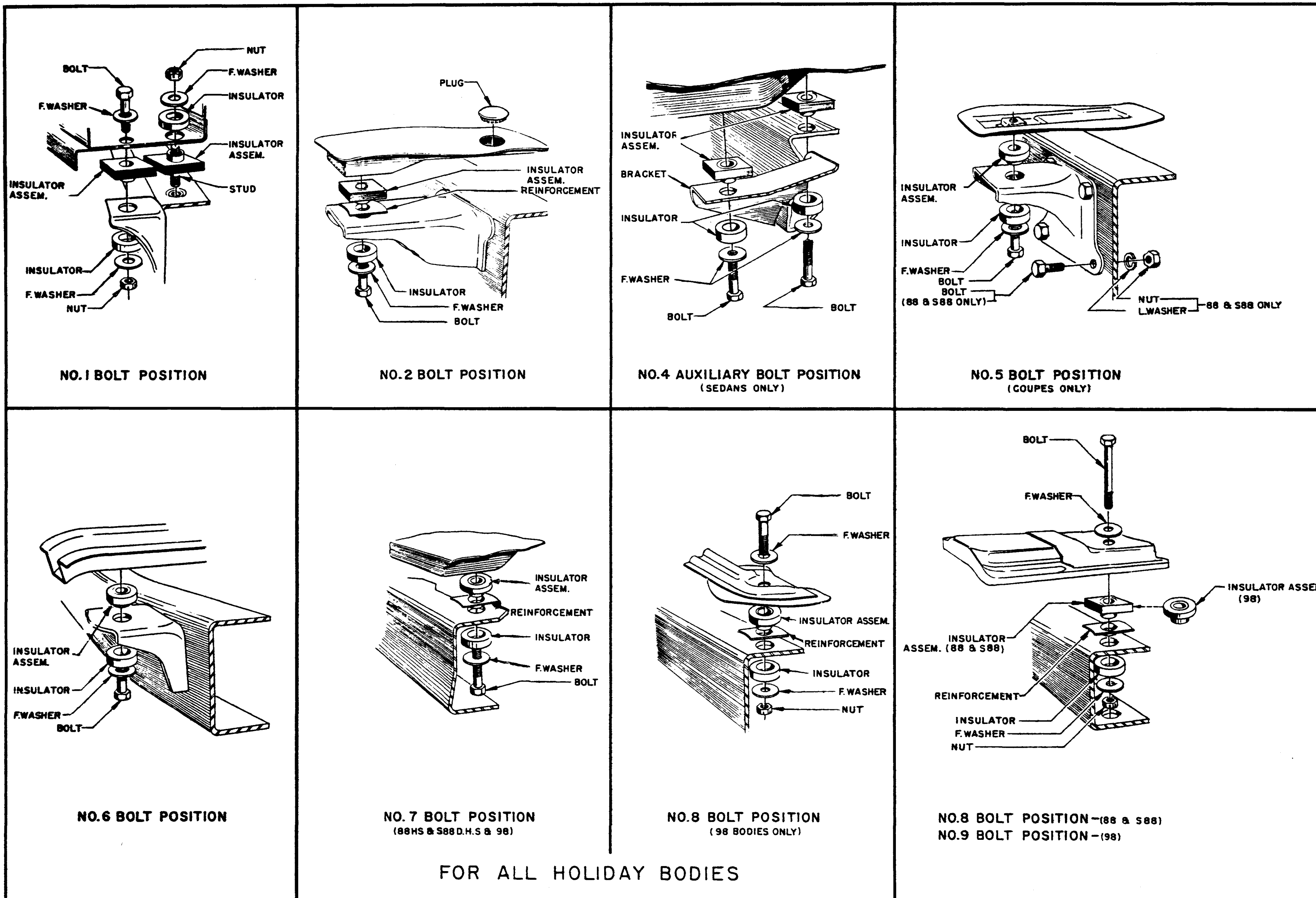


Fig. 17-39 Body Mount Locations and Usage

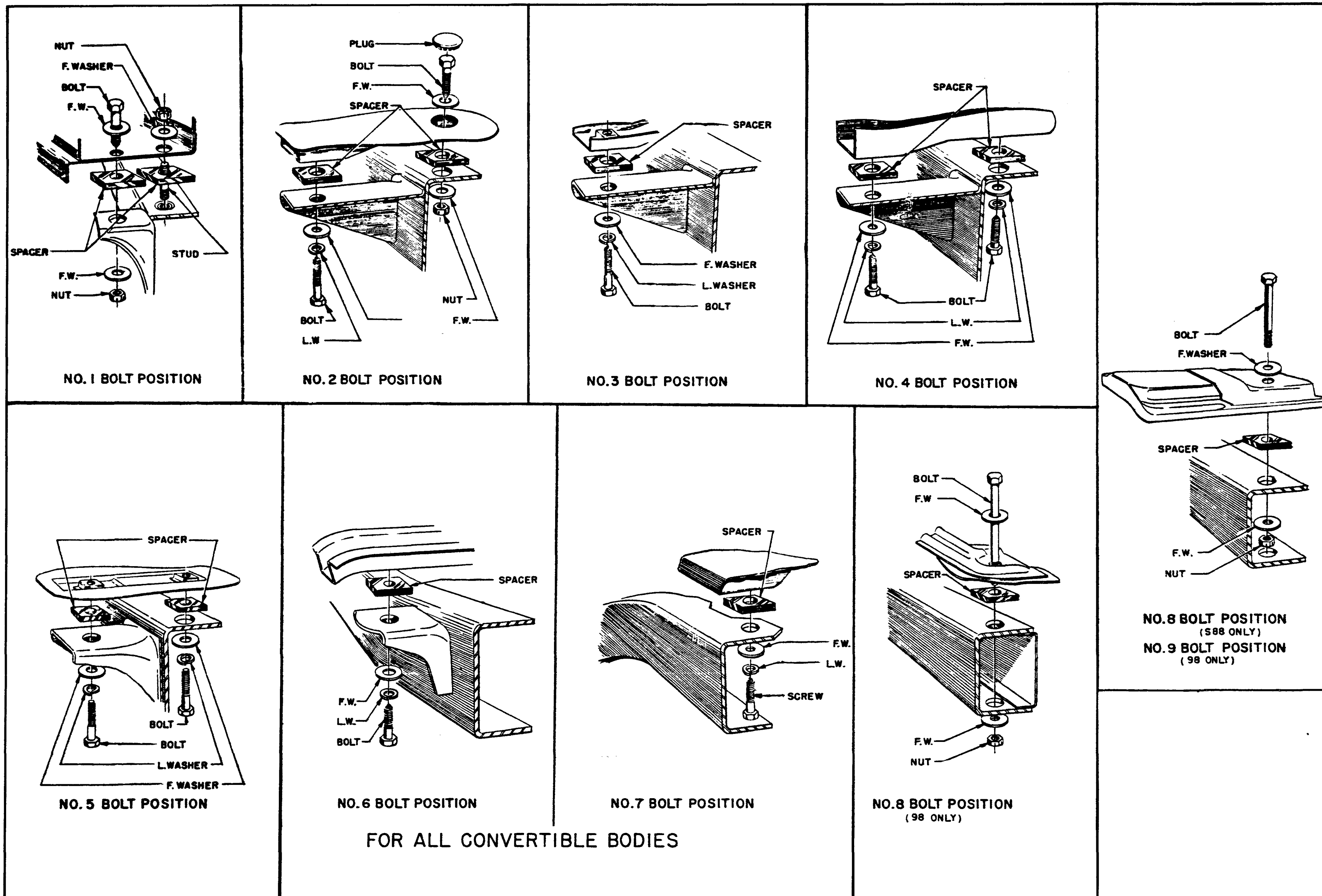
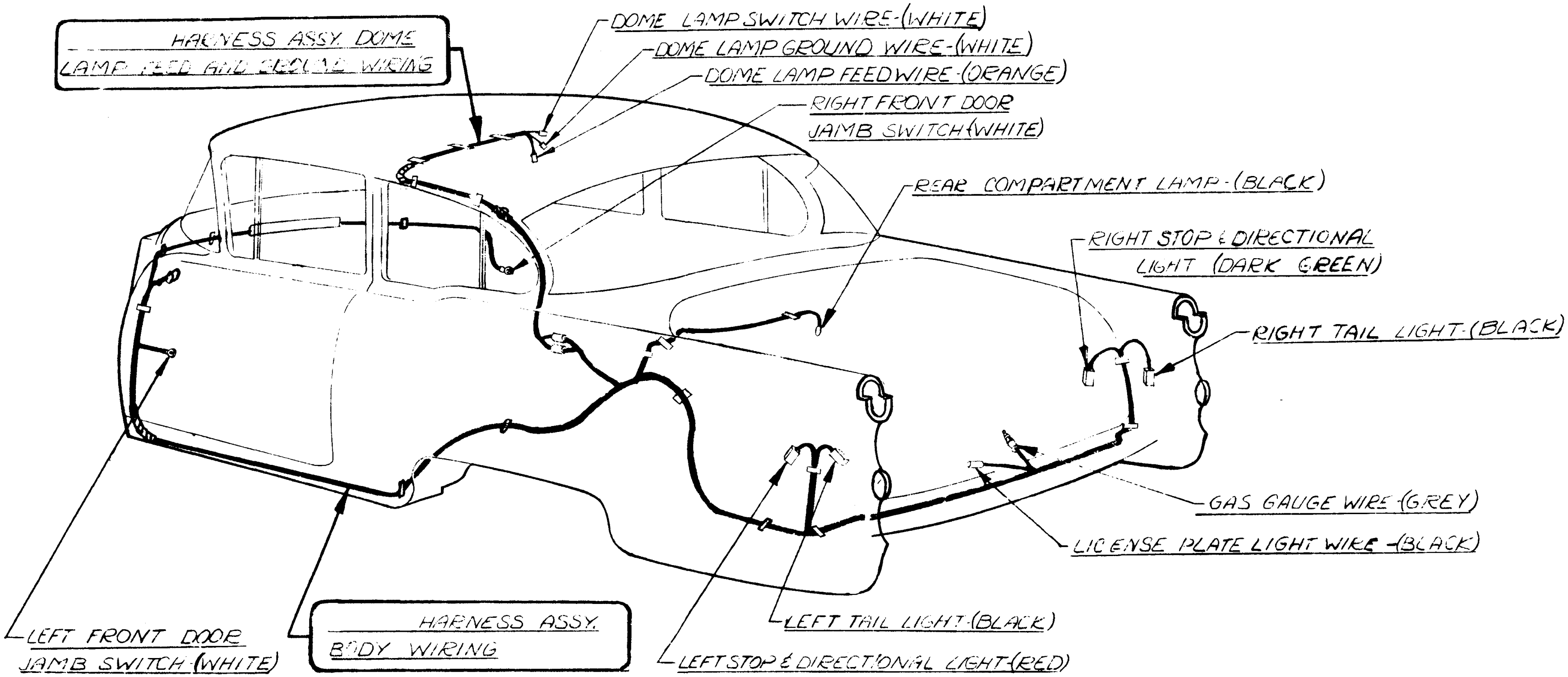
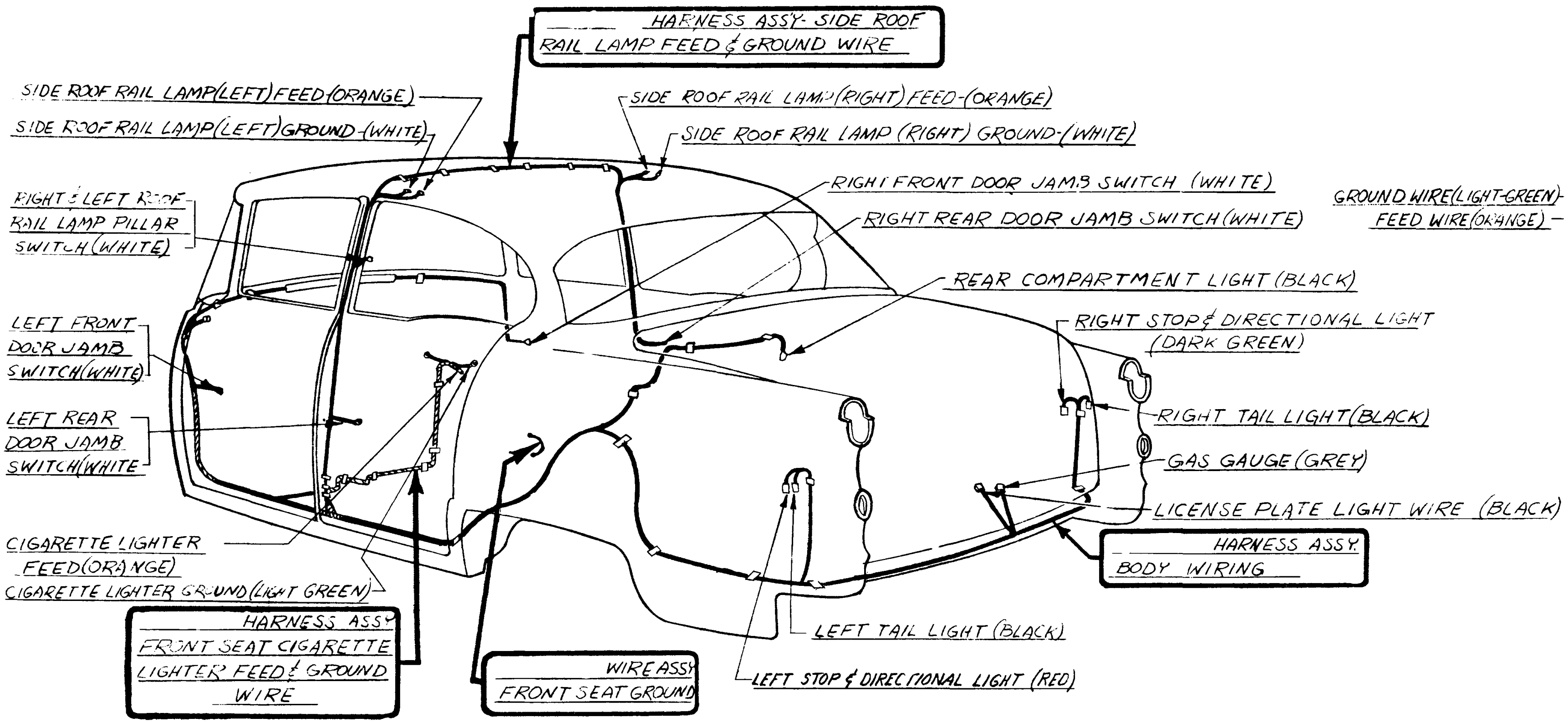


Fig. 17-40 Body Mount Locations and Usage



2 DOOR SEDAN

Fig. 17-41 Body Wiring Diagram



4 DOOR SEDAN

Fig. 17-42 Body Wiring Diagram

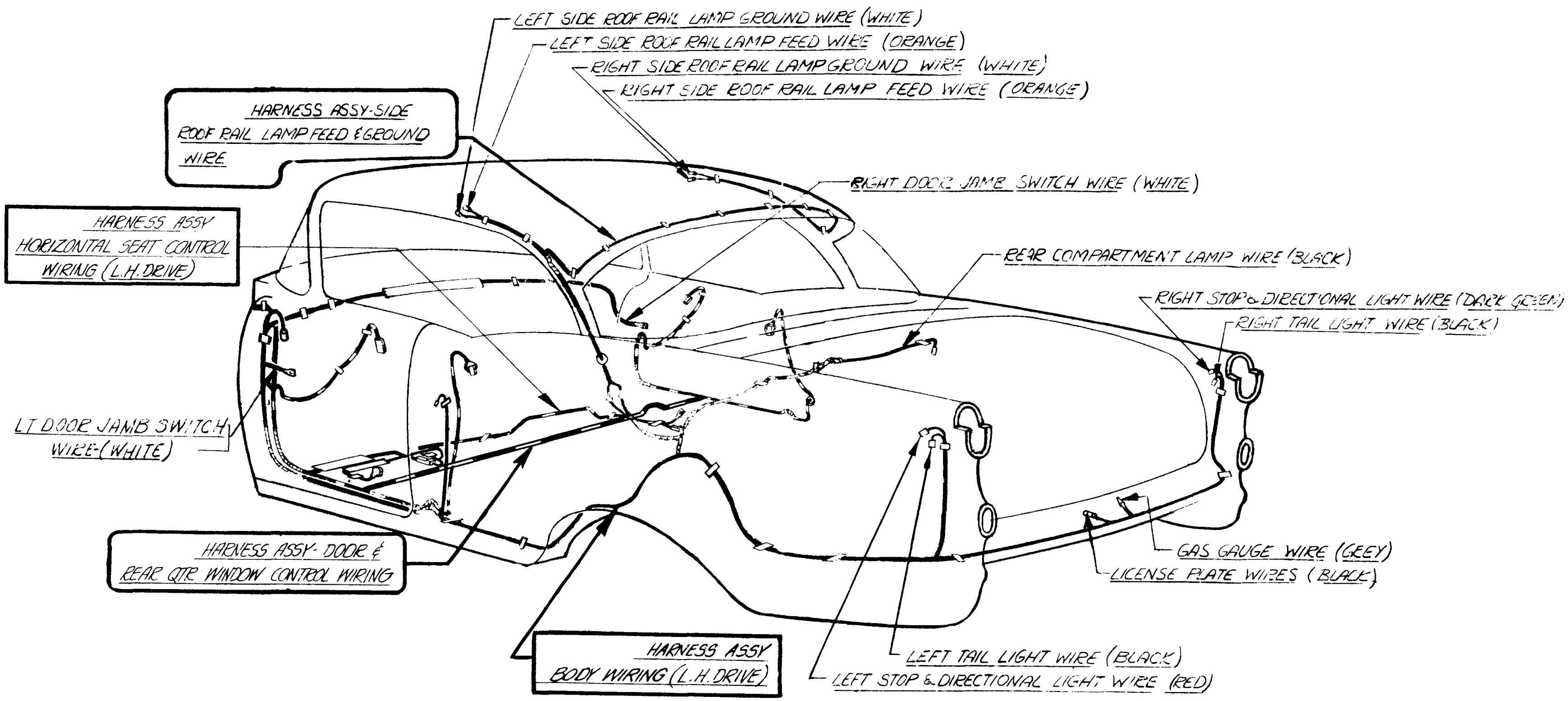
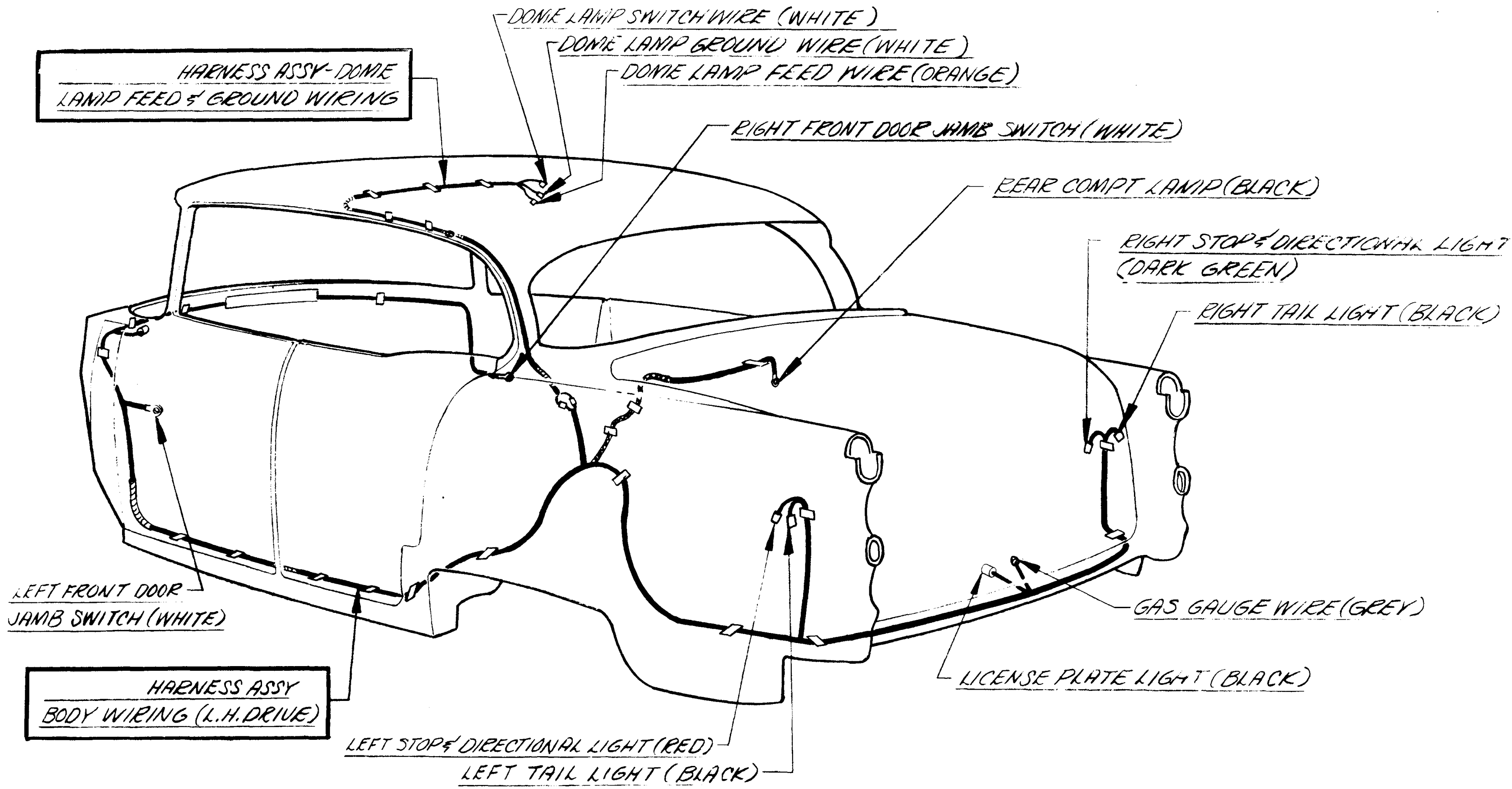


Fig. 17-43 Body Wiring Diagram



HOLIDAY SEDAN

Fig. 17-44 Body Wiring Diagram

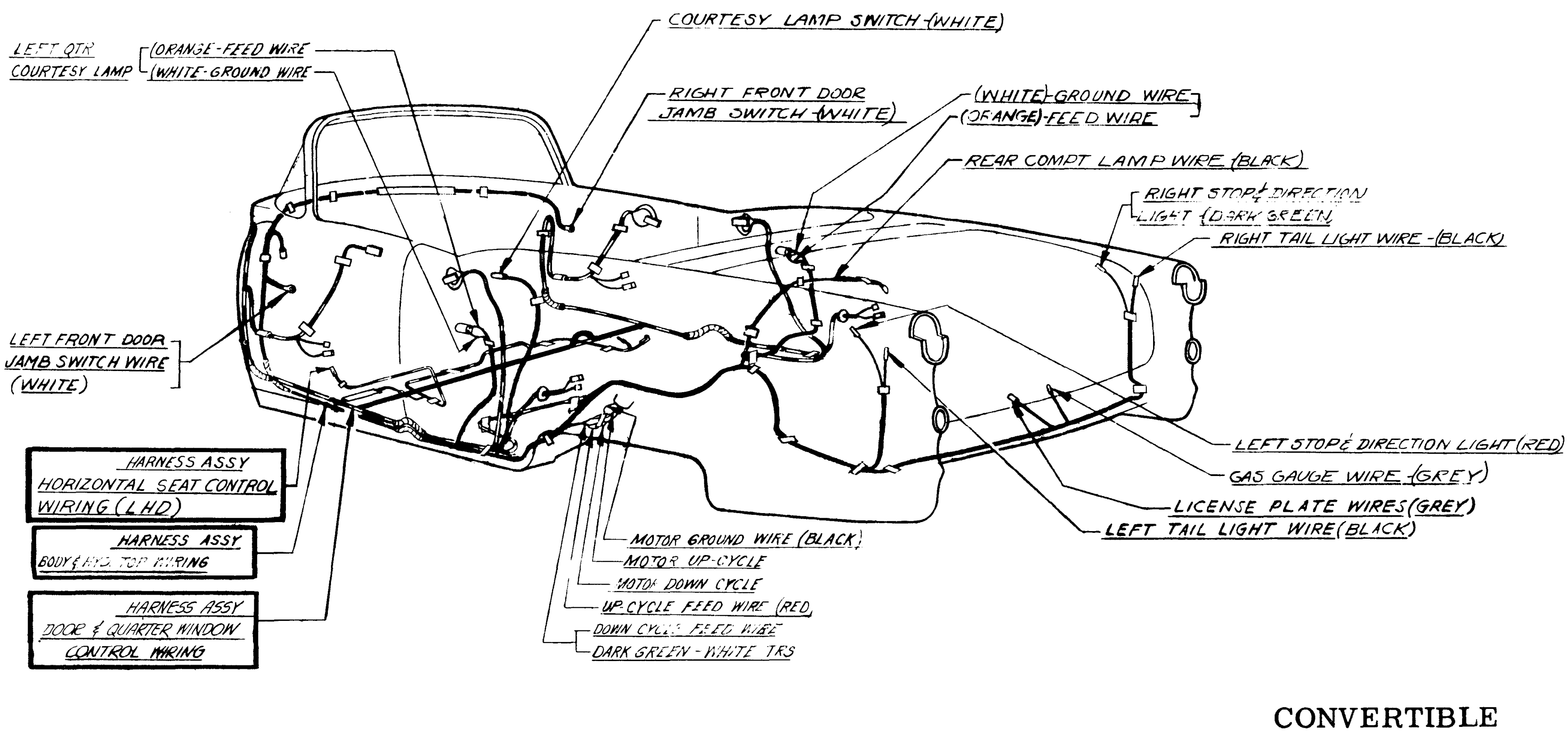


Fig. 17-45 Body Wiring Diagram