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AMERICAN MOTORS CORPORATION

1955

TECHNICAL SERVICE MANUAL

MECHANICAL

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TECHNICAL SERVICE MANUAL

for the 1955 "HORNET" "WASP" and "RAMBLER" SERIES

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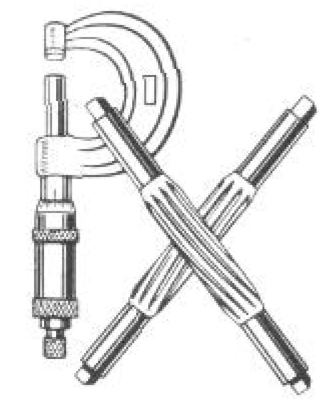

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ENGINE 6 CYLINDER

ENGINE SECTION

(6 Cylinder)

ENGINE IDENTIFICATION

The engine number is located on the upper left hand forward portion of the cylinder block on the "Hornet" and "Wasp" Series.
The engine number on the "Rambler" Series is located on a machined surface on the right side of the engine block just above the exhaust pipe.

Letter Identification, Size of Bore, Main Bearings and Connecting Rod Bearings

In the machining of cylinder .blocks and crankshafts, it is sometimes necessary to machine the cylinder bores to .010" oversize, and the crankshaft main bearing journals or crank pins to 0.10" undersize.
These engines are marked with a three letter code. The code is stamped adjacent to the engine number. The letters are decoded as follows:

First Letter	Size of Bore
Second Letter	Size of Main Bearings
Third Letter	Size of Connecting Rod Bearings
Letter "A"	Standard
Letter "B"	.010" Undersize
Letter "C"	.010" Oversize

Engines (after Number F-2814 or M-3616) that are not marked are standard in all respects.

CYLINDER HEAD AND GASKET

Whenever a cylinder head is removed, inspect the mating surfaces on the cylinder head and block for cleanliness and squareness with a straight edge.

Coat the gasket with a non-hardening gasket paste and locate the gasket on the cylinder block. A pair of guide pins, size 3" x 1/2"-13 "Hornet" and 3" x 7/16"-14 "Wasp" Series, will aid in the installation of the cylinder head (Fig. 1).

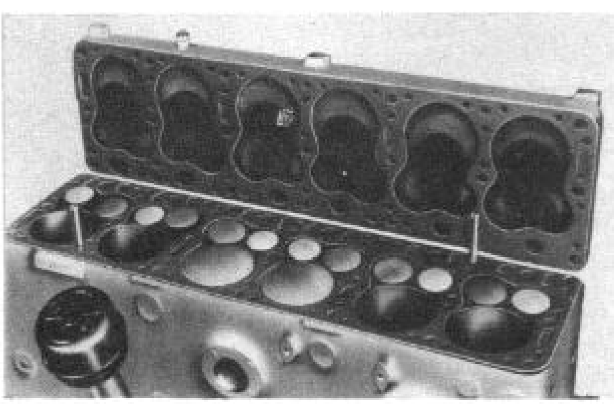


FIGURE 1—*Guide Pin Installation to Install Cylinder Head*

Be sure that a sealing compound is used on all cylinder head cap screws, "Hornet" and "Wasp" Series, and the studs on "Rambler" Series, as they connect to water passages in the cylinder head.

Tighten the cap screws or stud nuts with a torque wrench in a uniform manner, following the sequence shown in Figures 2 and 3.

The "Hornet" Series, with aluminum cylinder head, cap screws should be drawn up to 75-80 foot pounds of torque with engine at room temperature.

The "Wasp" Series, with cast iron cylinder head, cap screws are drawn up to 60-65 foot pounds of torque with engine at normal operating temperature. With aluminum cylinder head, tighten to 60-65 foot pounds of torque with engine at room temperature.

Tighten the "Rambler" Series stud nuts to 57-60 foot pounds torque with engine at normal operating temperature.

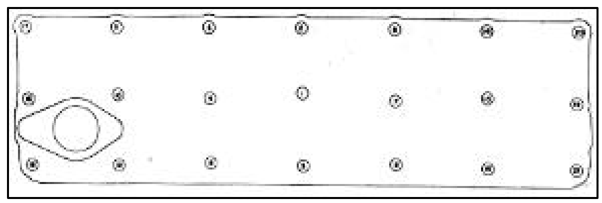


FIGURE 2—*"Hornet" and "Wasp" Series Cylinder Head Tightening Sequence*

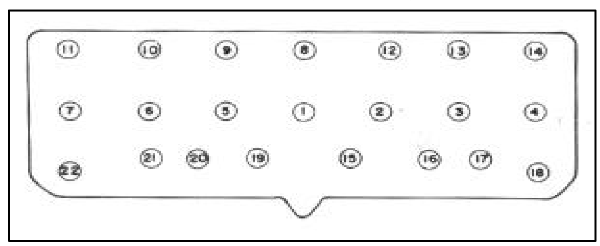


FIGURE 3—*Cylinder Head Tightening Sequence "Rambler" Series*

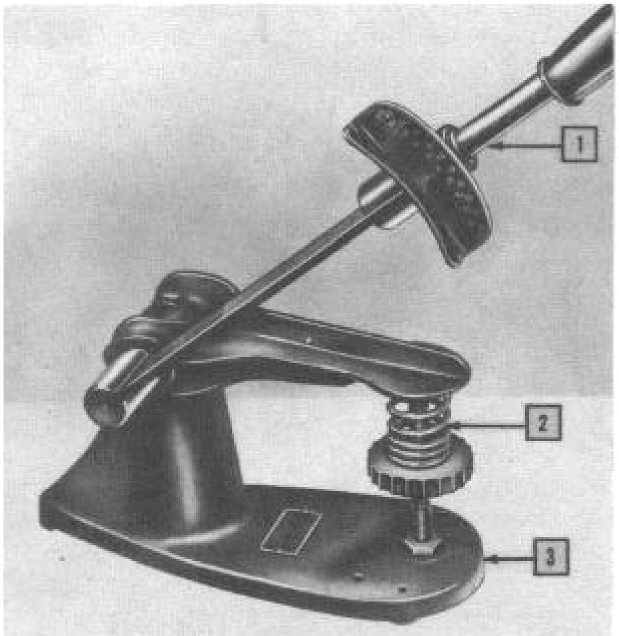
VALVES

Valve Springs

Whenever valve springs are removed, they should be tested according to the specifications listed below, using a valve spring tester (Fig. 4). Any spring not within the specifications should be replaced.

Valve Spring Specifications

Series	"Hornet"	"Wasp"	"Rambler"
Valve Spring Approximate Free Height	2-1/2"	2-3/16"	2-5/32"
Valve Spring Pressure Valve Closed	73-81 Lbs. @ 2-1/2"	40-48 Lbs. @ 1-61/64"	37-41 Lbs. @ 1-3/4"
Valve Open	153-165 Lbs. @ 1-27/32"	16-124 Lbs. @ 1-19/32"	75-82 Lbs. @ 1-7/16"

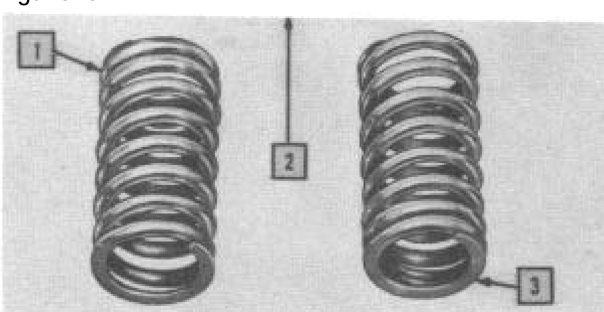


1. Torque Wrench
2. Valve Spring Tester
3. Valve Spring

FIGURE 4—*Valve Spring Tester*

Valve Spring Position

The valve springs are installed with the closed coils toward the head of the valve as shown in Figure 5.



1. Correct Position, Closed Coils Up
2. Arrow Points to the Valve Seat
3. Incorrect Position, Closed Coils Down

FIGURE 5—*Correct Position of the Valve Spring*

Valve Spring and Valve Removal

The valve springs and valves can be removed after the manifolds (where necessary), cylinder heads, and valve covers are removed.

"Hornet" 6 and "Wasp" Twin-H-Power

To remove the intake and exhaust manifolds as an assembly with the carburetors, required additional clearance can be obtained by removing the 5/8" nut from the top of the front engine supports and loosening the rear supports. The engine may then be moved slightly upward and to the left.

To assist in the installation of valve locks, Tool J-1953 can be used on the "Hornet" and "Wasp" Series (Fig. 6).

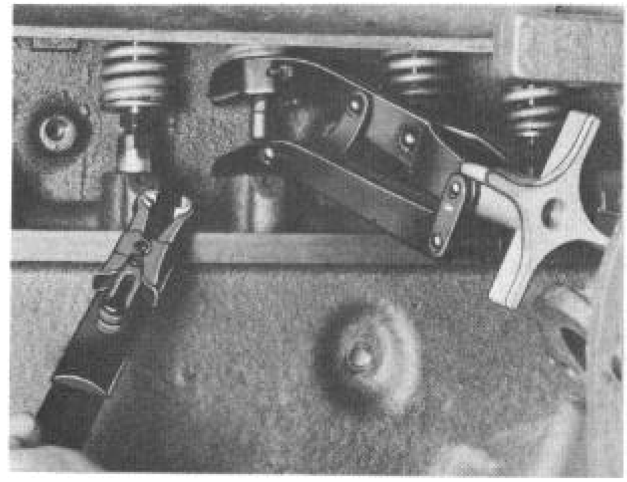


FIGURE 6—*Valve Lock Installation "Hornet" and "Wasp" Series*

"Wasp" Hi-Torque 6

Clearance permits removal of the manifolds without movement of the engine.

"Rambler" Series

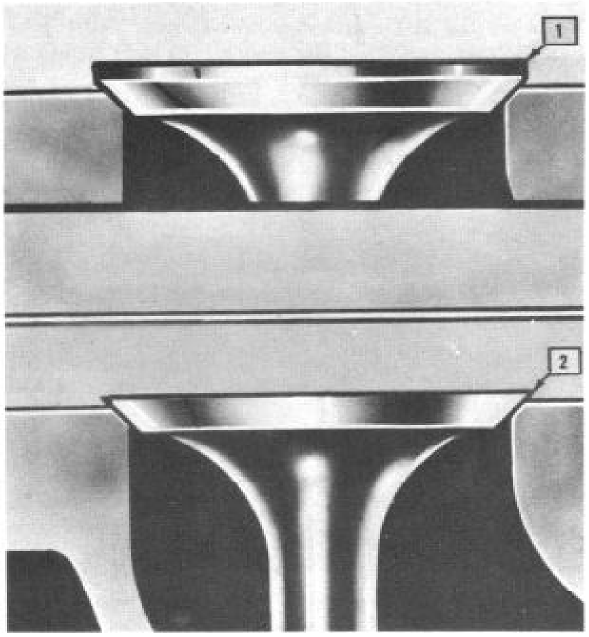
Exhaust pipe mounted to side of engine need not be removed.
Valve Spring Compressor J-4487 ("C" Type) will facilitate valve spring removal and replacement on the "Rambler" Series.

Valve Adjustment

After removing the intake and exhaust manifold assembly and valve covers, the valves on the "Hornet" and "Wasp" can be adjusted to a cold setting clearance of .010" "go"-.011" "no-go" on the intake valves and .014" "go"-.015" "no-go" on the exhaust valves.
The "Rambler" valves are adjusted without removal of the exhaust pipe to a cold setting clearance of .016" intake valves and .018" exhaust valves.

Valve Refacing

It is important when refacing valves that just enough material be ground off to clean up the face.
The valve should be replaced if there is less than approximately 1/16" material, "Hornet" and "Wasp" Series and 1/3
2" "Rambler" Series, left on outer diameter of the valve head known as the valve head margin. A heavy margin aids in the dissipation of heat and helps avoid valve warpage (Fig. 7).
The "Hornet" Series intake and exhaust valve seat and face angle is ground to 45°.



1. Correct Valve Refacing
2. Incorrect Valve Refacing

FIGURE 7—*Correct Valve Refacing*

The "Wasp" Series intake valve seat and face angle is 45°. The exhaust valve seat and face angle is 46°.

The "Rambler" Series intake and exhaust valve face angle is 44°. The valve seat angle is 45°.

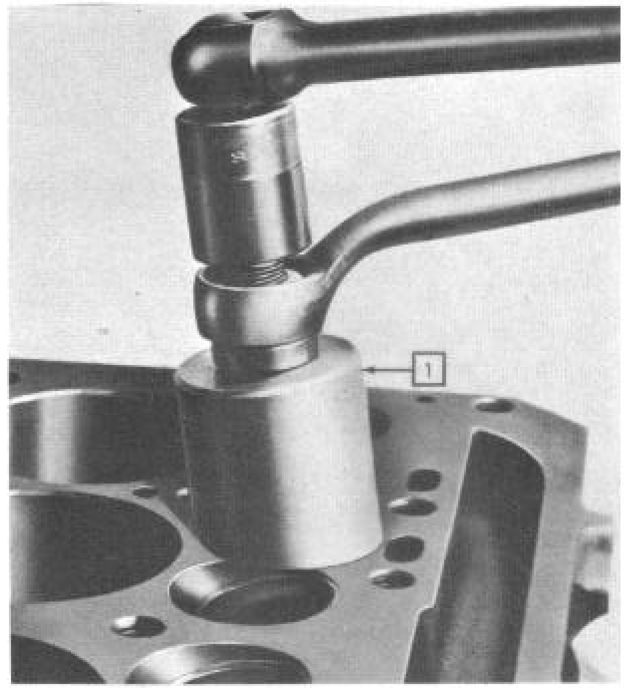
Valve Guides

"Hornet" Series valve stem to guide clearance is .0015"-.003" Intake, .002"-.004" Exhaust; "Wasp" Series .001"-.003" Intake, .002"-.004" Exhaust; "Rambler" Series .0018"-.0033" Intake and Exhaust.
Replace the guides when these clearances are exceeded. Check valve stem diameters to determine whether or not proper stem to guide clearance exists.
Stem diameters are:

	"Hornet"	"Wasp"	"Rambler"
Intake	.3412"-.3422"	.3412"-.3422"	.3407"-.3412
Exhaust	.3402"-.3412"	3402"-.3412"	.3407"-.3412

The valve guides can be removed through the valve seat opening with a puller. "Rambler" Series Tool J-2814, illustrated in Figure 8, can also be adapted to the "Hornet" and "Wasp" Series by using the spacers from their respective guide installing tools.

The "Hornet" Series valve guides are installed with Tool J-883-A (Pilot J-883-8 or 9) to insure that the guides are driven to the correct depth of 1-3/32 for the exhaust guides, 1-7/16" intake guides, from the top of the guide to the top face of the block (Fig. 9).



1. Valve Guide Removing Tool J-2814

FIGURE 8—*Removing Valve Guides "Rambler" Series*

FIGURE 9—Installing Valve Guides

The "Wasp" Series valve guides are installed with Tool J-883-A (Pilot J-883-101. The guides are inserted to a depth of 1%9" from the top of the guide to the top face of block.

Use Tool J-1429-A to install the "Rambler"

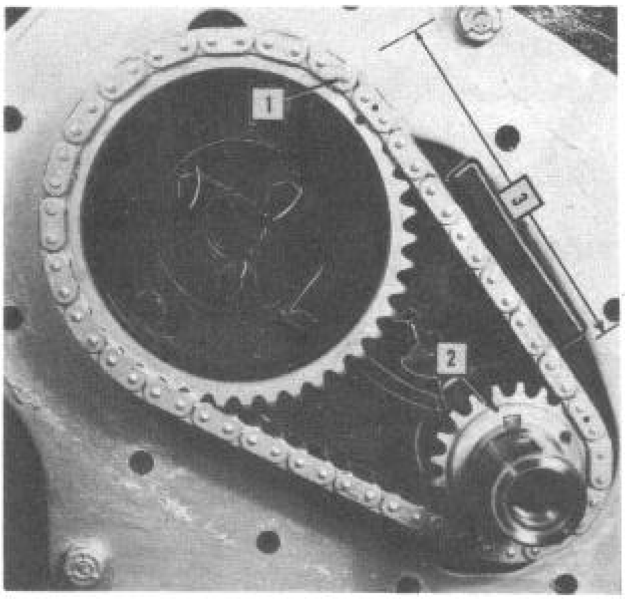
Series valve guides. Drive the guides flush with the opening of the guide bore in the block.

Valve Timing

Valve timing is determined by the relation between the sprocket on the camshaft and the sprocket on the crankshaft.

"Hornet" and "Wasp" Series

When installing timing assembly, line up the marked teeth on the sprockets with the marked links on the chain. Correct installation will result in locating 7 links or 14 pins between marks on sprockets as illustrated in Figure 10.



1. Marked Tooth on Camshaft Sprocket
2. Marked Tooth on Crankshaft Sprocket
3. 7 Links or 14 Pins

FIGURE 10—Correct Timing Chain Installation "Hornet" and "Wasp" Series

"Hornet" Series

Valve timing can be checked without dismantling the engine.

With the engine at room temperature, locate No. 1 piston at U.D.C. exhaust stroke. Install a dial indicator on No. 1 cylinder exhaust valve head through spark plug opening. Crank engine slowly until dial indicator indicates valve has seated.

Place a chalk mark on the flywheel, through the ignition timing mark opening in line with the lower ledge of opening.

Crank engine backwards to expose both the chalk mark and U.D.C. mark on flywheel. (This is only possible if timing is correct or early.) With a pair of dividers, measure the distance between the U.D.C. mark and chalk mark on the inner timing mark radius (5.06" flywheel radius).

This distance should be 21/4" plus or minus 1/s" for valve lash errors. One tooth off timing on crankshaft sprocket will affect this dimension by plus or minus 1-31/64". One tooth off on camshaft sprocket will affect this dimension by plus or minus 13/16".

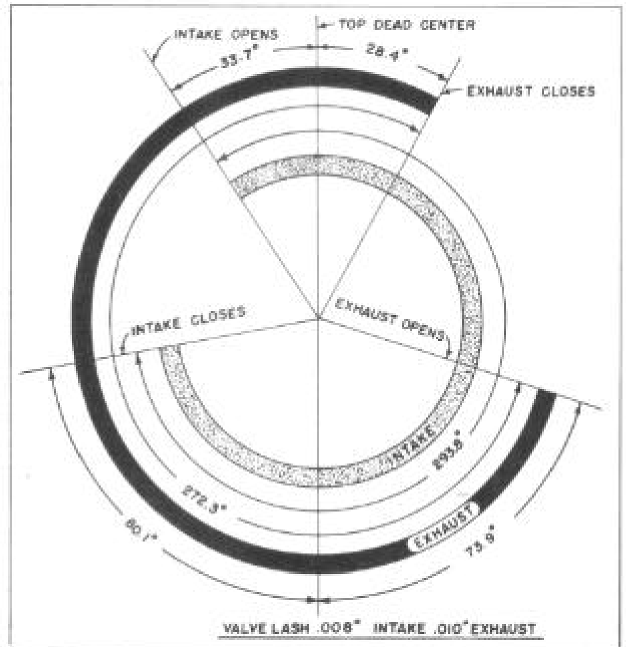


FIGURE 11—*Valve Timing Diagram "Hornet" Series*

"Wasp" Series

To check valve timing on the "Wasp" Series, crank engine until No. 1 piston is at T.D.C. exhaust stroke.

Install a dial indicator on No. 1 cylinder exhaust valve head through spark plug opening. Crank engine slowly until dial indicator indicates valve has seated.

Place a chalk mark on outer edge of vibration damper below pointer.

Measure distance from chalk mark back to U.D.C. No. 1 mark with steel scale located around circumference of damper. This distance should be approximately 13/4" (with cold valve lash .015") plus or minus 1/8" for valve lash errors. If the camshaft sprocket is off one tooth, it will affect the dimension by plus or minus 1%2". If the crankshaft sprocket is off one tooth, the dimension will be affected by plus or minus 13/16".

"Rambler" Series

When installing timing assembly, line up the marked teeth adjacent to each other on a center line drawn through the center of the camshaft and the center of the crankshaft (Fig. 13).

Before installing the timing chain cover, check the correct installation of the timing chain; locate the marked tooth of the camshaft sprocket

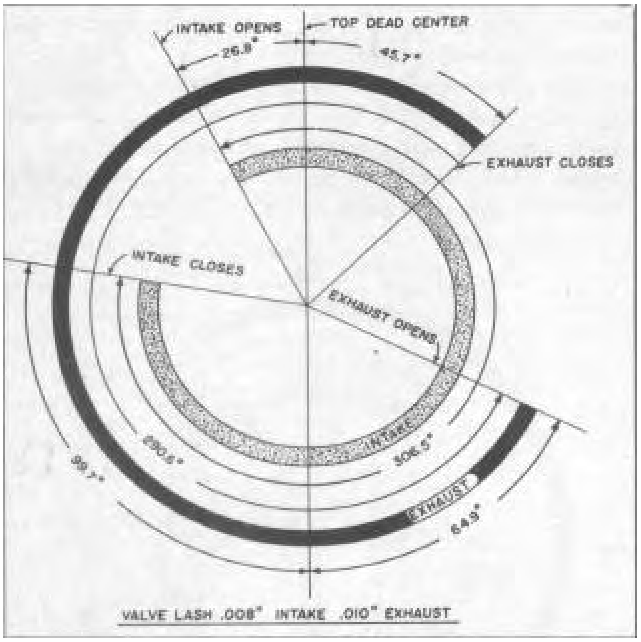


FIGURE 12—*Valve Timing Diagram "Wasp" Series*

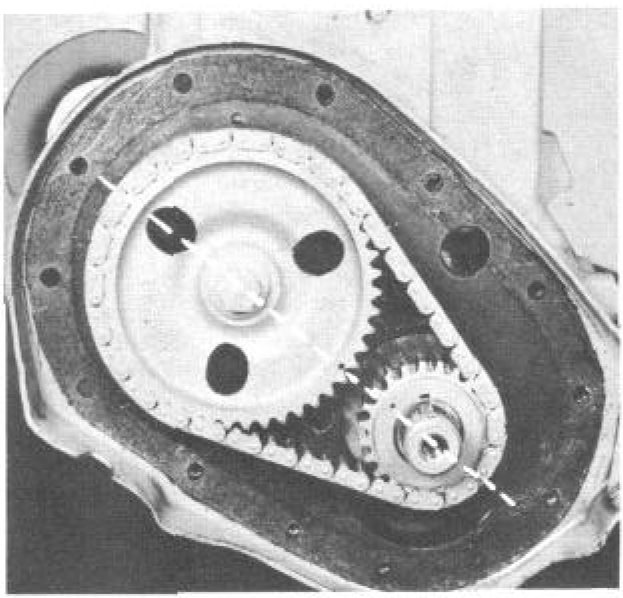
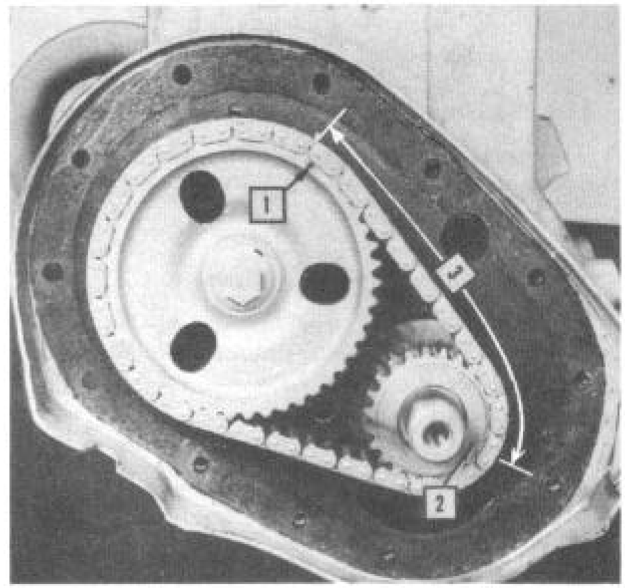


FIGURE 13—*Place Marked Teeth on Center Line When Installing Sprockets and Chain "Rambler" Series*

at approximately the one o'clock position. This should place the marked tooth of the crankshaft sprocket where it begins to mesh with the chain (Fig. 14). Count the number of links between the marked teeth of both sprockets. There should be 91/2 links or 19 pins.

Valve timing may be inspected by locating the No. 6 piston on T.D.C. in firing position. Then set valves on the No. 1 cylinder to .003" clearance. Slowly rock the crankshaft back and forth.



2. Marked Tooth on the Crankshaft Sprocket
3. 91/2 Links or 19 Pins

FIGURE 14—Correct Timing Chain Installation "Rambler" Series

If the timing is set properly, the exhaust valve should open before the D.C. mark on the vibration damper lines up with the pointer. Note this distance. The intake valve should open an equal distance after the D.C. mark passes the pointer.

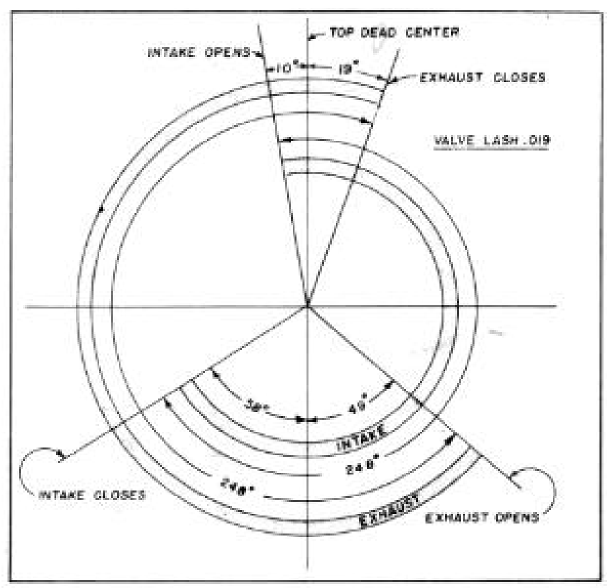


FIGURE 15—*Valve Timing Diagram "Rambler" Series*

TIMING CHAIN COVER "Hornet" and "Wasp" Series

The timing chain cover oil seal is a leather chevron design, spring loaded, to contact the seal surface of the vibration damper under pressure.

Tool J-2776 is used to remove and install the timing chain cover oil seal (Figs. 16 and 17):

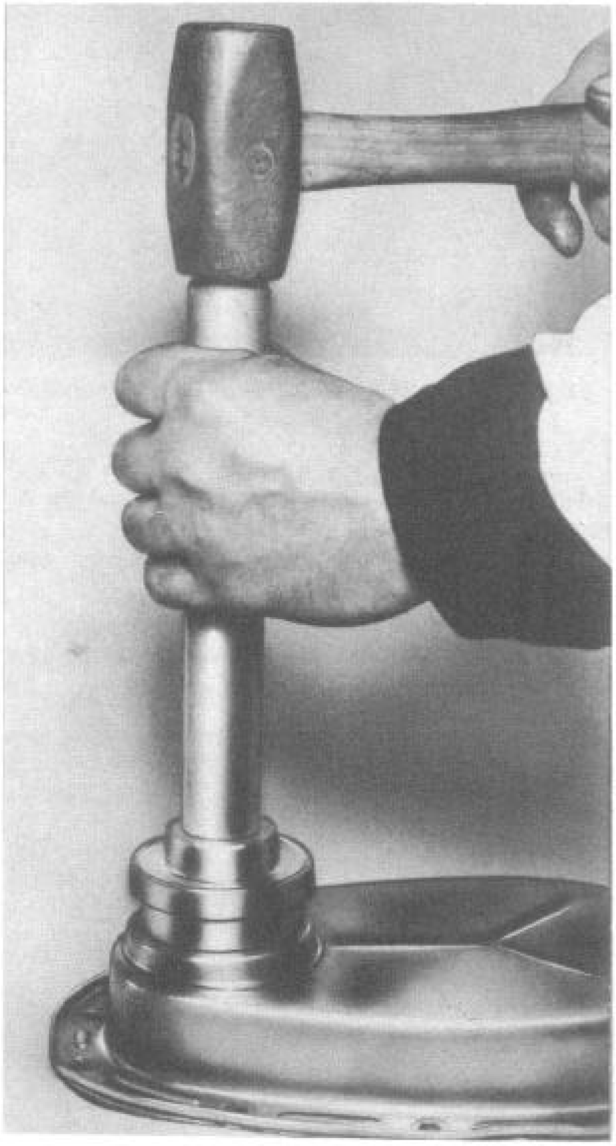


FIGURE 16—*Removing Timing Chain Cover Oil Seal—"Hornet" and "Wasp" Series*

Insert the collar so that slot in collar engages depression in cover. Support the cover when driving out the seal with the straight side of the driver.

NOTE: *The tool head is reversible on the handle. The side with the tapered pilot is used for installing the seal and the large size for removal. Before installing a new oil seal, apply a coating of white or red lead in the well of the timing cover. Install the oil seal in cover using tapered pilot side of tool (Fig. 17). With J-872-5, handle screw in opposite end of tool, and with an arbor press or soft hammer, press the seal tightly into place. After seal is installed, recheck to make certain that the lip of leather is in good condition and not curled over.*

FIGURE 17—*Installing Timing Chain Cover Oil Seal—"Hornet" and "Wasp" Series*

"Rambler" Series

The timing chain cover is provided with a felt seal to prevent the leakage of oil around the front crankshaft pulley hub. To prevent damage to this seal, it is important that the cover be properly aligned when installing the vibration damper. This is accomplished by leaving the cover to block screws loose until the vibration damper has been partially installed. Then tighten the cover screws.

At time of installation of a new seal, the rubber section of the seal must be installed to the rear of the cover.

The oil seal installed in the timing chain cover is replaced by driving the old one out from the rear and installing a new seal and retainer from the front.

An oil slinger is used inside the timing chain cover.

The slinger is held in place by the crankshaft sprocket and vibration damper.

CAMSHAFT AND BEARINGS

The camshaft is supported by four steel shelled, babbitt lined bearings which have been pressed into the block and line reamed. The camshaft bearings are step bored being larger at the front bearing than at the rear to permit easy removal and installation of the camshaft. All camshaft bearings are lubricated under pressure through drilled passages in the cylinder block.

To simplify camshaft removal on the "Hornet" and "Wasp" Series, remove the radiator core and grille assemblies and intake exhaust manifold. Then raise the front of the engine slightly.

On cars equipped with air conditioning and all "Rambler" Series, the engine should be removed for camshaft removal.

The engines should also be removed from the car if camshaft bearing replacement and/or line reaming is contemplated.

Camshaft Bearing Oil Clearances

"Hornet"	.0015"-.002"
"Wasp"	.0005"-.0015"
"Rambler"	.001"-.002"

Camshaft Removal

"Hornet" and "Wasp" Series

Remove the radiator, radiator grille, fan assembly, and intake and exhaust manifolds.

Pull the vibration damper pulley assembly after removing retaining cap screw. Use Puller J-676-C for the "Hornet" Series (Fig. 18) and J-5371 "Wasp" Series (Fig. 19).

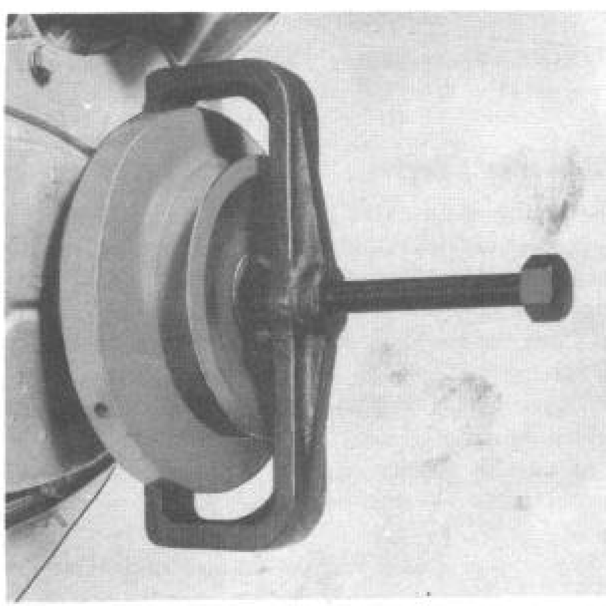


FIGURE 18—Removing Vibration Damper Assembly "Hornet" Series

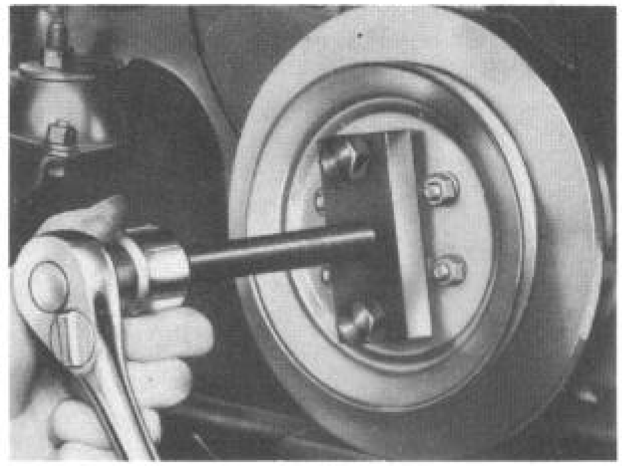


FIGURE 19—*Removing Vibration Damper Assembly "Wasp" Series*

Locate engine with timing assembly lined up as shown in Figure 10.

Remove timing chain cover and cut safety wire from camshaft sprocket mounting bolts.

Remove camshaft sprocket and chain assembly.

Use Puller 1-471 to remove crankshaft sprocket (Fig. 20) if a gear change is to be made.

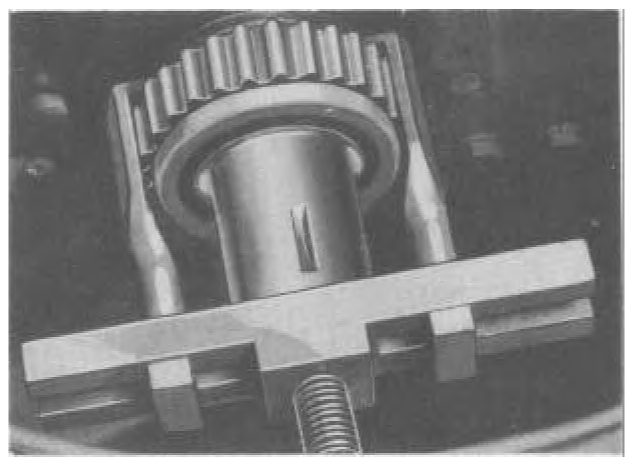


FIGURE 20—*Removing Crankshaft Sprocket*

Remove valve side covers and raise valves and springs sufficiently to install tools 1-1612-3-A tappet holders (Fig. 21). Remove oil spout on the "Wasp" Series and spout and chain silencer on the "Hornet" Series.

Remove camshaft thrust plate.

Remove camshaft.

To reinstall the crankshaft sprocket, if removed, use Driver J-5369 (Fig. 22):

"Rambler" Series

Remove engine from the car. Remove fan assembly and cylinder head. Remove valve tappet covers and vibration damper. Remove valves and valve springs;

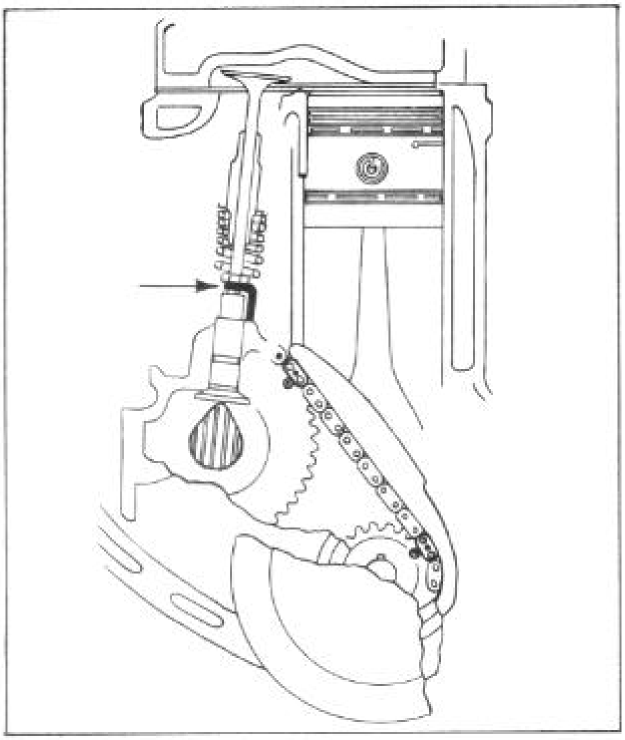


FIGURE 21—*Tool J-1612-3A Tappet Holders*

FIGURE 22—Installing Crankshaft Sprocket "Hornet" and "Wasp" Series

retain tappets with wire.

Remove timing chain cover and oil slinger.

Position engine with timing marks on a center line (Fig. 12). Remove camshaft sprocket retaining screw. Remove timing chain and sprockets. The sprockets can be pryed off of the shafts.

Remove camshaft thrust plate and camshaft.

Camshaft End Play

The camshaft end play is obtained between the front surface on the camshaft bearing and the camshaft thrust plate. When excessive end play occurs, a change in thrust plate will restore the correct end play.

End Play: .003"-.005" "Hornet" and "Wasp" Series .004"-.006" "Rambler" Series

The camshaft end play can be checked with a feeler gauge between the rear of the camshaft sprocket and the front surface of the camshaft thrust plate. A dial indicator can also be used for checking the end play of the camshaft.

PISTONS

"Hornet" and "Wasp" Series

The pistons are aluminum alloy cam ground with taper ground skirt.
Ring grooves are provided for four piston rings, two compression and two oil control rings. One oil control ring is installed below the piston pin while two compression rings and one oil control ring are above the pin. The rings are positioned and retained in a limited working area by pins installed in the piston ring grooves.

"Rambler" Series

The pistons are aluminum alloy cam ground having a larger diameter measured at right angles to the piston pin hole and taper ground skirt. A steel strut for structural strength and to control expansion is located in the pin boss structure.
Ring grooves are provided for four rings above the piston pin, two compression and two oil control rings. The piston pin is off-set from the center axis toward the thrust side of the cylinder.
To insure proper installation of off-set pin, a notch is cast in top of piston. Piston must be installed in the engine with the notch toward the front.

Piston Removal

Piston removal is accomplished from the top of the engine. However, before removing the pistons, the ring ridges in the cylinder bores must be removed. Failure to remove the ridge at the top of the cylinder bore will very often result in piston ring breakage and damage to the piston groove land. If cylinder taper exceeds .009", bore must be trued up and oversize pistons and rings used.

Fitting Pistons
"Hornet" and "Wasp" Series

The pistons are fitted by the use of a spring scale and feeler tape for a clearance of .002" under a three to four pound pull. (Parts must be clean, dry, and at room temperature.)

"Rambler" Series
The piston is fitted so that each piston will support its own weight in any portion of the cylinder with all parts clean and dry. Piston

to bore clearance is .0006" to .0012".

PISTON RINGS

The pistons are fitted with four piston rings, two compression and two oil control rings.
A chrome plated upper ring is used to resist corrosion.
Before assembling the rings to the piston, carbon must be cleaned from all ring grooves. The oil drain holes in the oil ring grooves must be cleared. Care must be exercised not to remove metal from the grooves, since that will change their depth, nor from the lands, since that will change the ring groove clearance and destroy ring to land seating.

Checking Ring Groove Clearance

Side groove clearance is measured with a feeler gauge. Roll the rings around the piston in the grooves in which they operate. Check for freedom all the way around.
The groove clearances are listed below by ring number with the top ring as number one.

Ring Number	1	2	3	4
"Hornet"	.002"-.004"	.002"-.004"	,001"-.003"	..001"-.003"
"Wasp"	.002"-.004"	.002"-.004"	.001"-.003"	.001"-.003"
"Rambler"	.002"-.004"	.002"-.004"	.002"-.004"	.002"-.004"

Checking Ring Gap Clearance

Piston ring gap clearance is measured in the bottom of the cylinder near the end of the ring travel area. To square the ring in the bore for checking gap clearance, place the ring in the bore. Then, with an inverted piston, push the ring down near the lower end of the ring travel area. When other than standard ring sizes are used, rings should be individually fitted to their respective bores.
The ring gaps for fitting rings are listed below:

"Hornet"	.006"-.014"
"Wasp"	.004"-.009"
"Rambler"	.010"-.020"

Piston Ring Installation

Removal of glaze from the cylinder wall for quicker ring seating can be accomplished by various methods. If the expanding flexible type hone is used, do not use more than 10 strokes (each stroke down and return) to recondition a cylinder wall.
Successful ring installation depends upon cleanliness in handling parts and while honing the cylinder walls. The engine bearings and lubrication system must be protected from abrasives.
Rigid type hones are not to be used to remove cylinder glaze as there is always a slight amount of taper in cylinder walls after the engine has been in service.

Rings must be installed on pistons with a ring installation tool to prevent distortion and ring breakage.
Detailed instructions in service ring packages must be followed.

"Hornet" and "Wasp" Series

Four piston rings are used; three rings are located above the piston pin and one below the pin. The rings are pinned in place to prevent movement (Figs. 23 and 24).

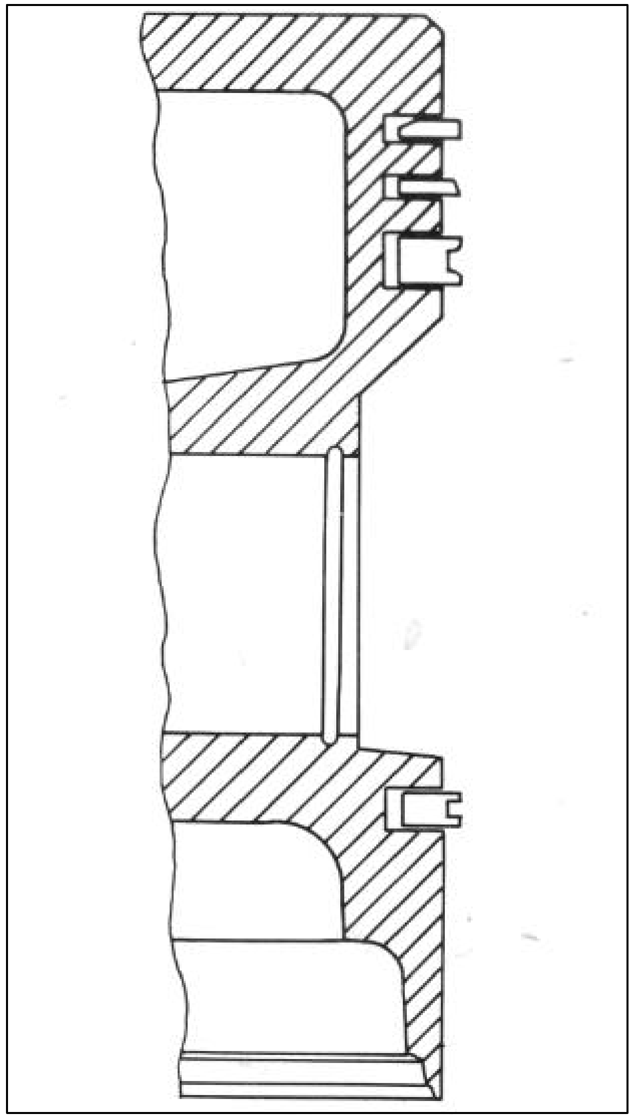


FIGURE 23—***Ring Arrangement "Hornet" Series***

The rings are notched on the inner diameter at the gap slot. The width of the notch is .125". Approximately .075" is at one end of the ring and .050" at the other end. This off-setting of the notch enables a single pin pressed in from the top of the piston to locate the three top rings without having the gaps on adjacent rings aligned (Fig. 25).

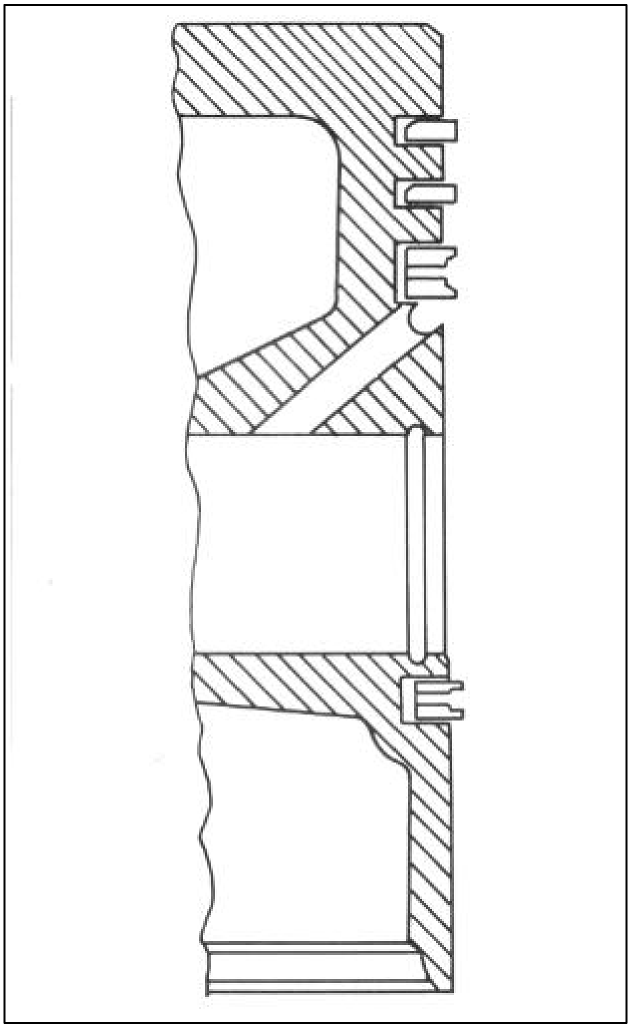


FIGURE 24—*Ring Arrangement "Wasp" Series*

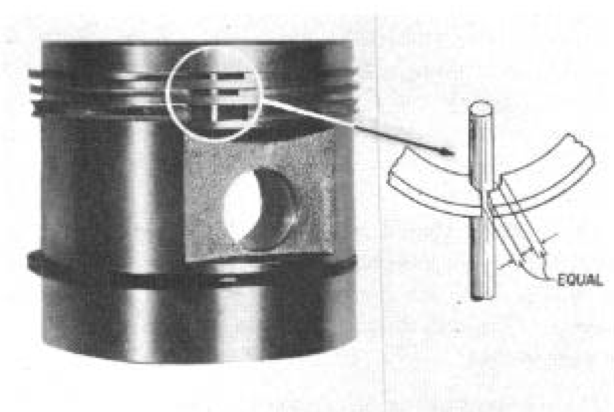


FIGURE 25—Pinning of Piston Rings "Hornet" and "Wasp" Series

The end gap is equal to the backlash of the ring notch on pin. Therefore, if the ends of a ring are filed to obtain the correct ring end gap, the notch has to be filed enough to provide the backlash in equal amount.

CAUTION: *Because of the backlash clearance requirement, it is suggested that no ring be filed to fit a bore size smaller than the ring size.*

"Rambler" Series

The two compression and two oil control rings are located above the piston pin. The compression rings are of the "twist" design with an inner groove installed to the top of piston. A conventional oil control ring is used in the third ring groove.

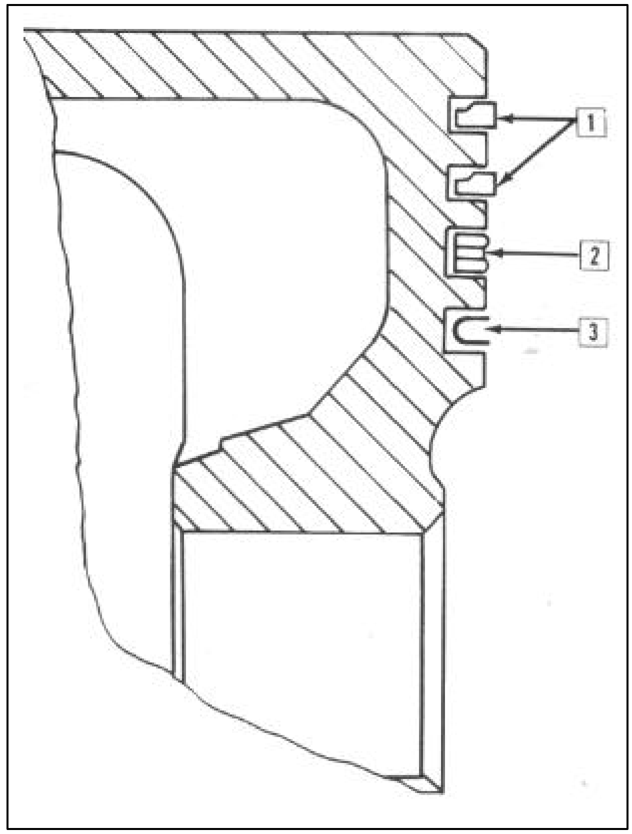


FIGURE 26—Ring Installation "Rambler" Series

The "U" flex oil control ring used in the lower oil control ring groove, as original equipment, differs from all other rings. The normal free diameter of this ring is 1/8" to 3/1_6" larger than the bore diameter in which it is installed. Installation is outlined in Figures 27, 28, 29, and 30.

Before installing piston in engine, arrange ring gaps 180° apart, being sure no gap is over the piston pin.

Service Ring Sets

For service ring replacement, follow detailed instructions enclosed in the ring package.

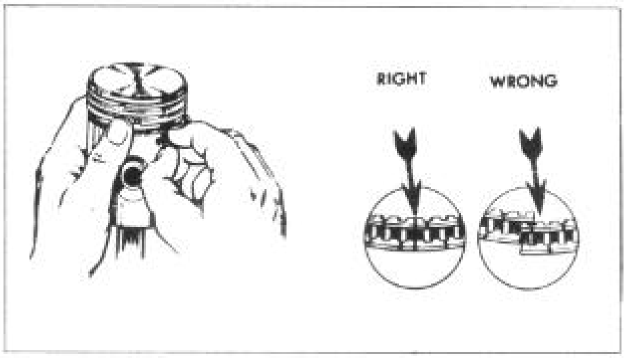


FIGURE 27—Step 1—Place "U" Flex Ring in Bottom of Oil Ring Groove. Lubricate all Rings and Piston Skirt with a Light Grade Engine Oil. Butt Ends of "U" Flex Ring Together

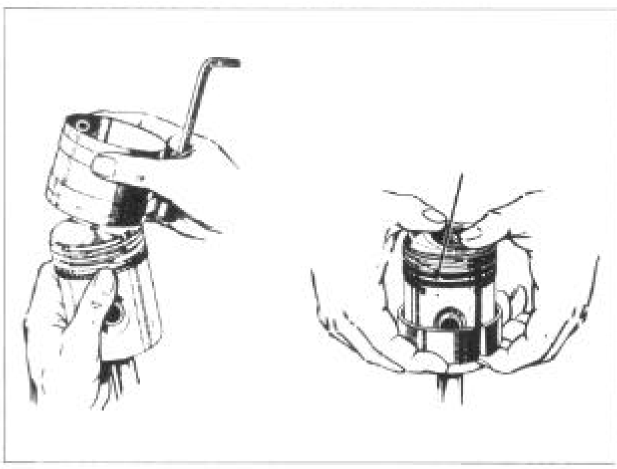


FIGURE 28—Step 2—Keep Ends of "U" Flex Ring Butted Together and Place Compressor Over Piston, Either a Constricting Band or Split Sleeve Type Compressor can be Used

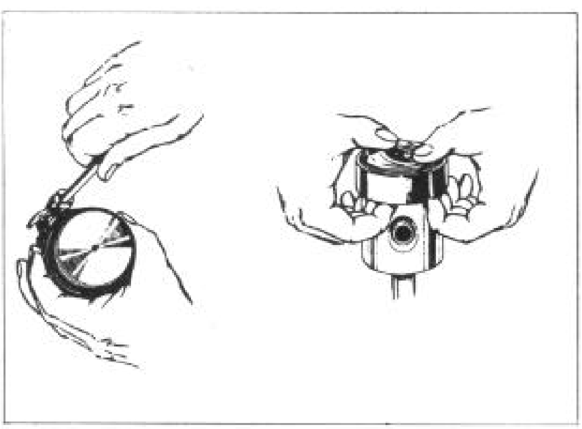
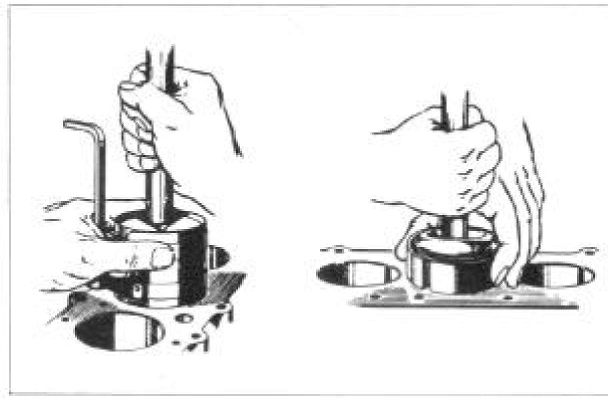


FIGURE 29—Step 3—Tighten Ring Compressor if Band Type is Used. If Sleeve Type is Used, BE SURE THAT IT IS NOT PULLED HIGHER THAN THE TOP OF THE PISTON. However, it Should be Drawn up High Enough to Cover all of the Rings



Rests Squarely on Top of Block, and Push or Tap Piston into Cylinder

CAUTION: *If Piston Does not Enter Cylinder without Excessive Force, Remove Piston Assembly and Examine Rings for Ring Interference.*

PISTON PINS

"Hornet" and "Wasp" Series

Full floating type piston pins are used. They are retained in the piston by two circular lock rings, one at each end of the pin. The piston pin fit in the connecting rod bushing is a hand push fit at room temperature (70°).

The piston pin fit in the piston is a hand push fit in a heated piston. Heat piston in water or electric furnace to 200°F.

The piston pin bushings are steel back bronze. To remove and replace, press out old bushing, using burnisher block tool J-2950 and remover J-2948 for the "Hornet" Series, and J-2951 and J-2948 "Wasp" Series. Install new bushing with same tools making sure oil holes in bushing and rod are in alignment. Burnish bushing with block J-2950 and burnisher J-2791 "Hornet" Series, and J-2951 and J-2949 "Wasp" Series (Fig. 31).

The bushing should be reamed .0003" larger than its matching pin diameter. Check the fit by holding the piston with the connecting rod in a horizontal position. The rod should just turn on the pin under its own weight.

The standard piston pin dimensions are:

	Length	Diameter
"Hornet"	2.942" — 2.932"	.9687" — .96845"
"Wasp"	2.4375" + or —.005"	.7499" + .000" —.00025"

"Rambler" Series

The piston pin is locked in place in the connecting rod by means of a locking bolt (Fig. 32).

To fit the piston pin, hone the connecting rod to fit the pin. Then hone the piston to allow a thumb press

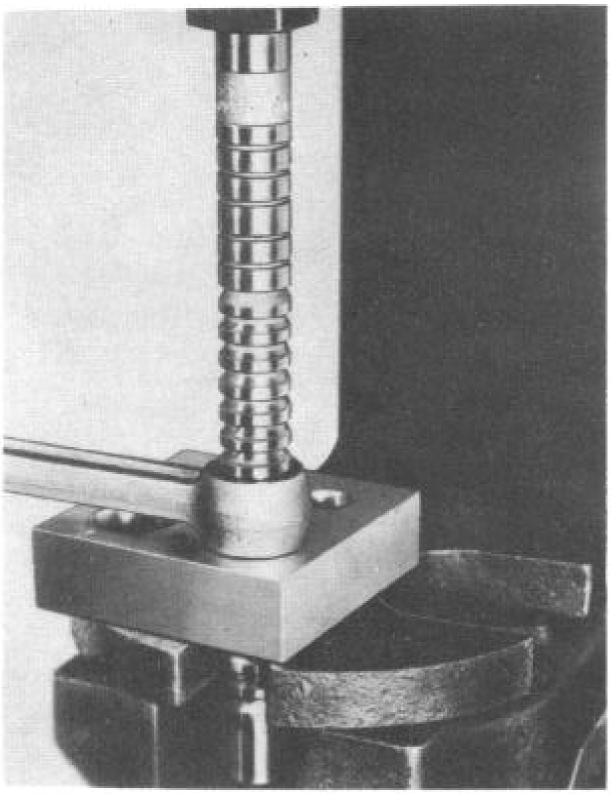
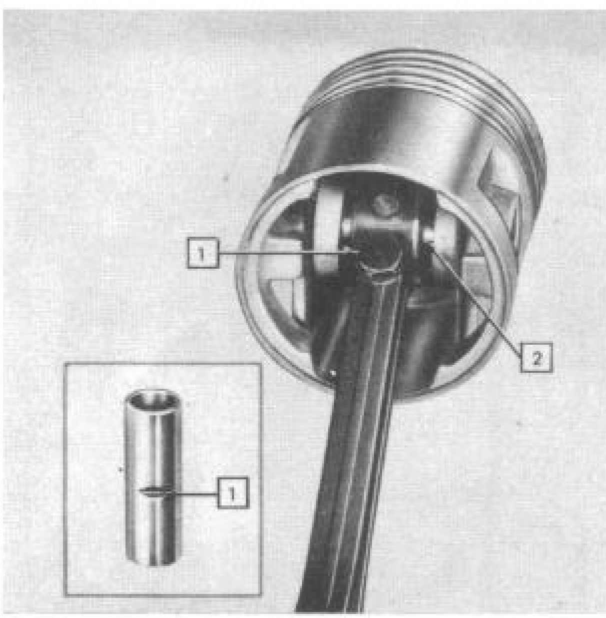


FIGURE 31—*Burnishing Connecting Rod Bushing "Hornet" and "Wasp" Series*



1. **Locking Bolt and Notch**
2. **Piston Pin**

FIGURE 32—*Piston Pin "Rambler" Series*

fit or .0002" maximum loose fit in piston at room temperature (70°F.).

The standard piston pin dimensions are: Length 2.755", Diameter .8598"-.8595".

Tighten piston pin clamp screw to 18-22 foot pounds torque.

CONNECTING RODS

"Hornet" and "Wasp" Series

The connecting rods have oil squirt holes to provide cylinder wall lubrication, at low and idle speed, to the thrust side of the cylinders. An oil hole on the top of the rod supplies lubrication to the piston pins.

When installing connecting rods, the squirt hole is toward the camshaft side (thrust side) of the engine.

The cylinder location numbers are stamped on the connecting rod and caps during initial assembly.

"Rambler" Series

Two oil squirt holes are provided in the upper rod cap section for cylinder wall lubrication at low and idle speeds.

The notch on the top perimeter of the piston and the identification boss on the connecting rod (Fig. 33) must be installed to the front of the engine.

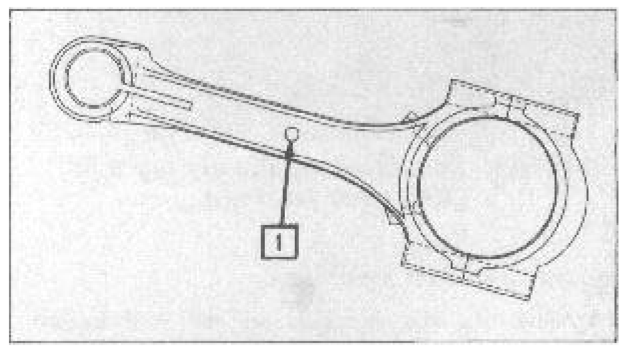


FIGURE 33—*Connecting Rod Identification Boss "Rambler" Series*

The connecting rods are stamped by cylinder number location during initial assembly. Always assemble the rods and caps with the cylinder location numbers on the same side.

Connecting Rod Alignment

Whenever new rings are installed or new piston pins are replaced, it is necessary to align the connecting rods and pistons, as assemblies, to insure true operation in the cylinder bore.

Misaligned rods will cause uneven piston and ring wear which will result in oil consumption and noise. The connecting rod should be inspected for a twisted or bent condition (Figs. 34 and 35).

Always bend beyond the true alignment position and then bend back to straighten so the stresses and strains in the rod material are relieved. If the stresses are not relieved, the rod will not hold its alignment after installation in the engine.

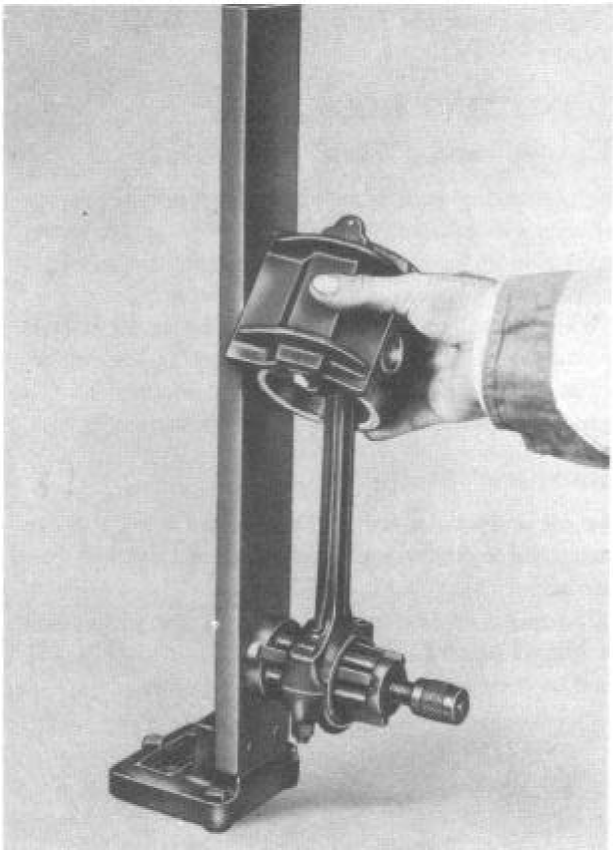


FIGURE 34—*Checking Connecting Rod Alignment for Twist*

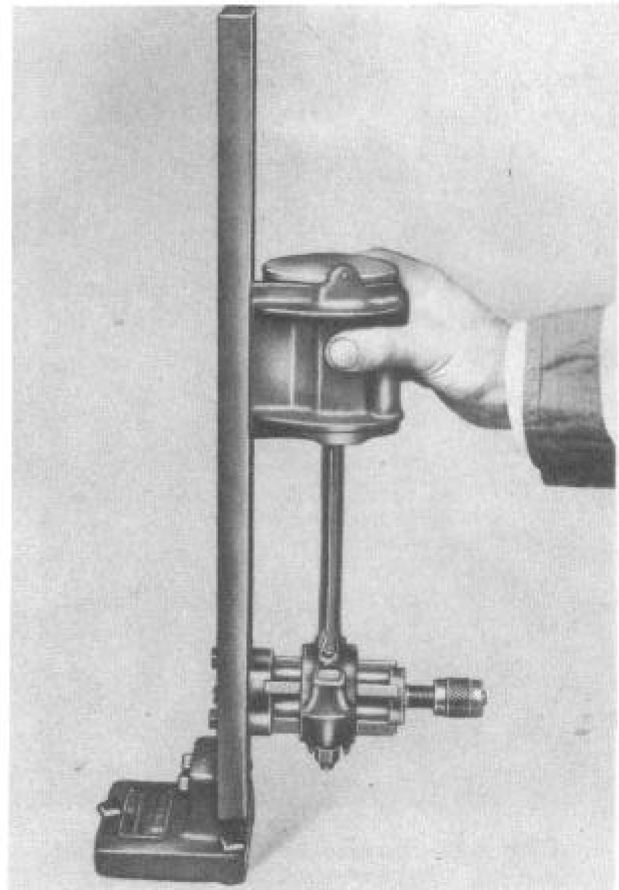


FIGURE 35—*Checking Connecting Rod Alignment for Bend*

Connecting Rod Bearings

The connecting rod bearings are the steel backed babbitt lined precision type. They are installed as pairs in connecting rod and cap.

CAUTION: *Never file a connecting rod or cap to adjust bearing clearance.*

If the bearing clearance is excessive, the correct connecting rod undersize bearing set must be installed. The correct connecting rod bearing clearance is .0005" to .0015" "Hornet" and "Wasp" Series and .001" to .0015" on "Rambler" Series.

To determine the amount of bearing clearance, use a piece of Plastigage in the bearing cap as shown in Figure 36. Then tighten the cap to the torque specification to compress the gauge.

Remove the bearing cap and calibrate the width of the Plastigage with the scale furnished as shown in Figure 37.

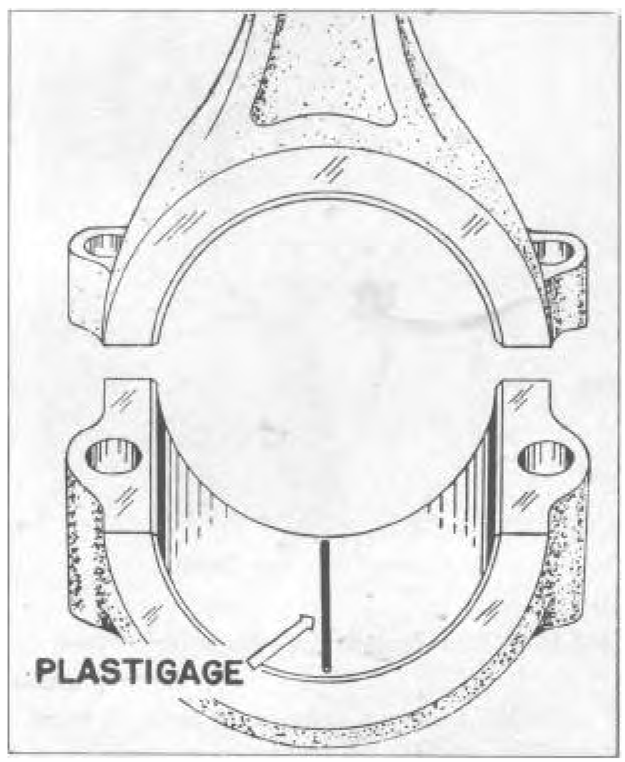


FIGURE 36—*Plastigage in Place in the Bearing Cap*

Connecting Rod Bearing Caps

It is important that the connecting rod cap bolt nuts be drawn up to the correct tension.

Tighten to:

"Hornet"	40-45 Ft. Lbs.
"Wasp"	40-50 Ft. Lbs.
"Rambler"	27-30 Ft. Lbs.

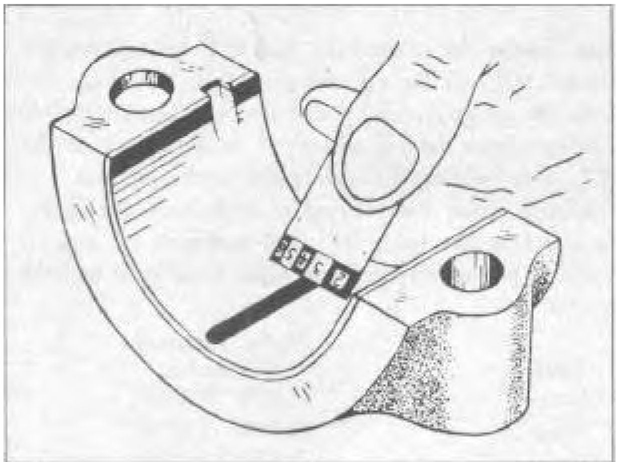


FIGURE 37—*Measure the Width of the Plastigage Scale*

Reduce torque 15 per cent if threads are oily

The notches on the lower and upper rod caps should be to the same side of engine with the squirt hole on upper cap to camshaft side of engine on the "Hornet" and "Wasp" Series.

The cylinder numbers are to the camshaft side of the engine and the identification mark (Fig. 33) to the front of engine on the "Rambler" Series.

Connecting rod side clearance:

"Hornet" and "Wasp"	.007" — .013"
"Rambler"	.005" — .015"

CRANKSHAFT

"Hornet" and "Wasp" Series

The crankshaft is supported by four main bearings with the end thrust taken at the No. 3 bearing position.

The crankshaft, flywheel, and vibration damper are balanced as individual units. Complete engine assemblies are then balanced with all reciprocating parts in motion.

Replacement of vibration damper or flywheel can be accomplished without rebalancing the complete assembly.

"Rambler" Series

The crankshaft is supported by four main bearings with the end thrust taken at the front main bearing location.

The component parts of the crankshaft assembly are individually balanced; then rebalanced as an assembly.

Replacement of vibration damper or flywheel can be accomplished without rebalancing the complete assembly.

Crankshaft. Main Bearings

Main bearings are of the precision type having a steel back with a babbitt lining. The bearings are not adjustable. Shims should never be used and the bearing caps should never be filed.

When either half of a bearing requires replacement, a complete set should be installed. To replace the upper half of a bearing, remove the bearing cap of the bearing to be replaced. Then loosen all of the other bearing caps and insert a small pin in the crankshaft oil hole. The head of the pin should be large enough so that it will not fall into the oil hole, yet thinner than the thickness of the bearing (Fig. 38).

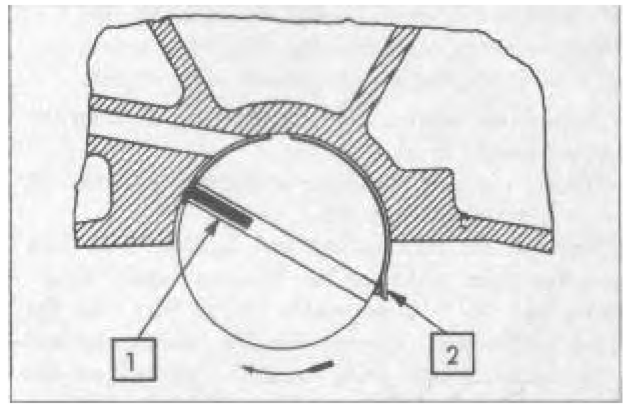


FIGURE 38—*Removing Main Bearing Insert*

With the pin in place, rotate the shaft so that the upper half of the bearing will rotate in the direction of the locating tongue on the bearing.

Tool J-2955 will greatly facilitate front and rear bearing cap removal on the "Hornet" and "Wasp" Series (Fig. 39).

CAUTION: *Care must be exercised on removal of the front main bearing cap because if the front engine end plate gasket is damaged, a replacement requires the removal and replacement of timing assembly and front engine end plate.*

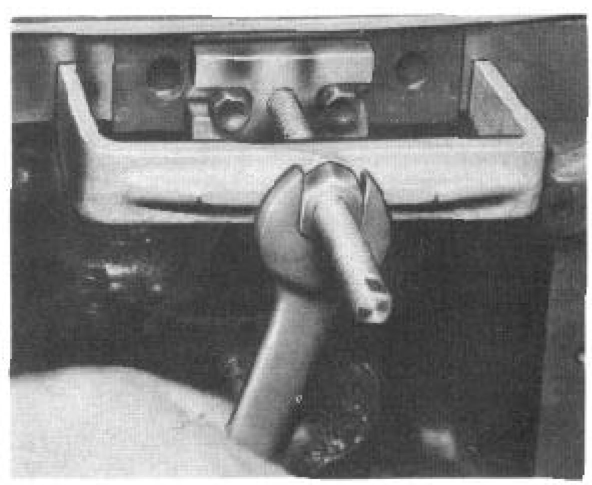


FIGURE 39—*Removing Front Min Bearing Cap with Tool J-2955 "Hornet" and "Wasp" Series*

Crankshaft Main Bearing Clearance

The standard clearance of .0005" to .0015" on the "Hornet" and "Wasp' Series and .001" to .0015" "Rambler" Series can be accurately checked by the use of Plastigage.

NOTE: When checking bearing clearance with the engine in such a position that the bearing caps support the weight of the crankshaft and fly-wheel, keep all main bearing caps tight except the one being checked. Support the weight o f the crankshaft with a jack.

Remove the bearing cap and wipe the oil from the bearing insert.

Place a piece of Plastigage across the full width of the bearing insert (Fig. 36).

Reinstall the bearing cap and tighten 75-80 foot pounds torque (dry) on the "Hornet" and "Wasp" Series and 66-70 foot pounds torque (dry) on the "Rambler" Series. Then remove the bearing cap and with the graduated scale, which is printed on the plastigage envelope, measure the width of the flattened plastigage at its widest point (Fig. 37). The number within the graduation indicates the clearance in thousandths of an inch. Install the proper size bearing liners (inserts) to bring the clearance to standard. Before installing crankshaft or main bearing inserts, the journals must be inspected for condition and dimensions.

Main Bearing Journals

Main journals can be measured without removing the crankshaft from the engine block.

There are various gauges for this use, one of which is shown in Figure 40.

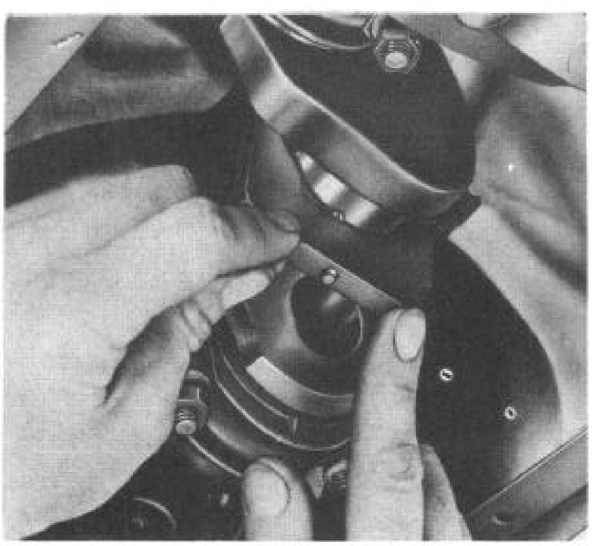


FIGURE 40—Measuring Main Bearing Journal

To operate this gauge, remove the main bearing cap and place the gauge against the crankshaft journal

Then release the plunger so that it is up against the journal and lock the adjusting screw in position. Remove the gauge carefully and double the micrometer reading across the pin and anvil in the center of the "V". This reading is the diameter of the journal.

Always check the journal at both ends for taper. Then rotate the shaft 90° and measure for out-of round. The out-of-round and taper limit is to be held to .001".

Series	Main Journal Diameter
"Hornet"	2.4988"-2.4998"
"Wasp"	2.4988"-2.4998"
"Rambler"	2.4791"-2.4798"

Series	Connecting Rod Bearing or Crankpin Diameter
"Hornet"	2.1244"-2.1254"
"Wasp"	1.937" -1.938"
"Rambler"	2.0948"-2.0955"

Main bearing caps are recessed into the engine block and line reamed. Therefore, it is not practical to replace them in the field.

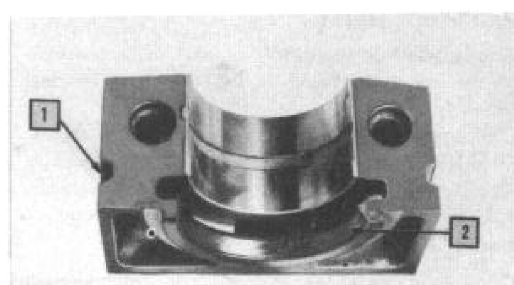
Crankshaft End Play

The "Hornet" and "Wasp" Series end thrust of .003" to .009" is taken at the No. 3 main bearing. The "Rambler" Series end thrust of .003" to .008" is taken at the flanged front main bearing.

MAIN BEARING OIL SEALS
"Hornet" and "Wasp" Series

The rear main bearing oil seal is a metal backed neoprene lined seal made in two identical halves. The upper half can be removed without removing the crankshaft by removing the rear main bearing cap and applying pressure against the metal part of the seal with a 1/4" brass rod. At the same time, rotate the flywheel to assist in removing the seal.

At time of installation of the seals, coat the groove of the seal with non-hardening sealer.



1. Packing Groove
2. Oil Seal

FIGURE 41—*Rear Main Bearing Oil Seal "Hornet" and "Wasp" Series*

After the rear main bearing cap is replaced, cotton waste must be driven into the vertical packing holes to seal the side of the cap. A punch smaller in diameter than the vertical holes and at least 4" long will facilitate the packing of the cotton waste. Enough packing must protrude to seal between the pan gasket and bearing cap.

The front main bearing cap has both a horizontal and a vertical seal to prevent external oil leakage. This packing seals from leakage between the engine front end plate gasket and the bearing cap. The vertical grooves are packed before the horizontal grooves (Fig. 42).

FIGURE 42—*Front Bearing Cap Oil Seal Groove Locations "Hornet" and "Wasp" Series*

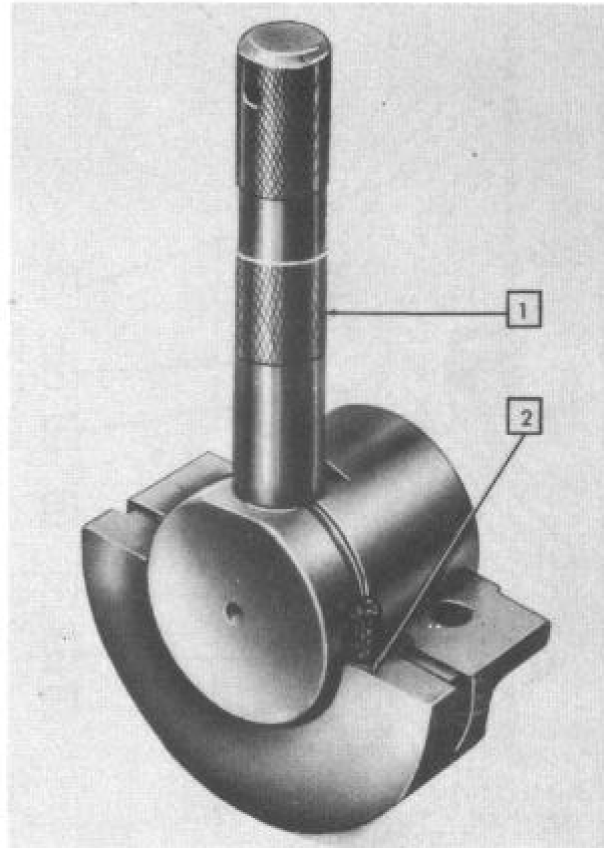
"Rambler" Series

A hemp packing and "L" shaped neoprene rubber type rear main bearing oil seals are used. A special tool J-1610 is required to install the hemp packing (Fig. 43) . To properly replace upper hemp packing, the crankshaft must be removed.

VIBRATION DAMPER

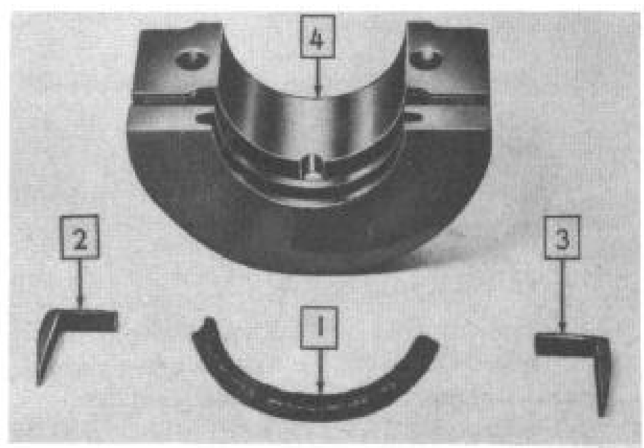
"Hornet" Series

The vibration damper (Fig. 45) on the "Hornet" Series has two punch marks for alignment to maintain proper balance when the damper is disassembled for replacement of rubber discs.



1. **Oil Seal Installing Tool J-1610**
2. **Point at which Packing is Cut Flush**

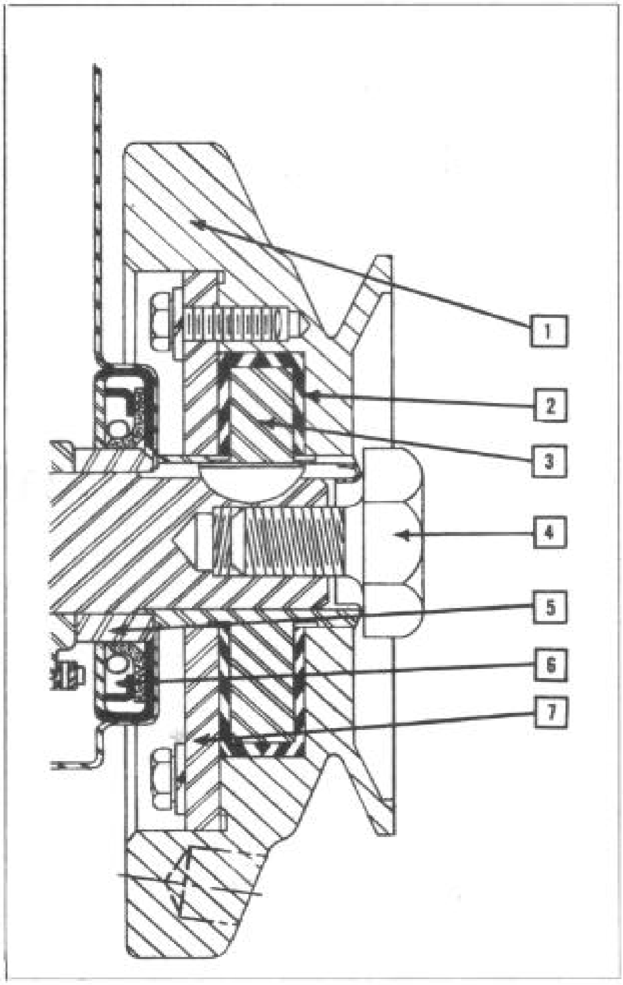
FIGURE 43—*Installing Hemp Packing Oil Seal in Rear Main Bearing Cap "Rambler" Series*



1. **Hemp Packing**
2. **Cap Side Seal**
3. **Cap Side Seal**
4. **Main Bearing Cap**

FIGURE 44—*Rear Main Bearing Cap and Seals "Rambler" Series*

Pulley Remover J-676-C and Replacer J-483 will facilitate removal and replacement operations (Fig. 18).



1. Outer Member
2. Rubber Discs
3. Inner Member
4. Damper Cap Screw
5. Spacer
6. Oil Seal
7. Retainer Plate

FIGURE 45—*Vibration Damper "Hornet" Series*

Tighten damper cap screw to 100-120 foot pounds torque.

"Wasp" Series

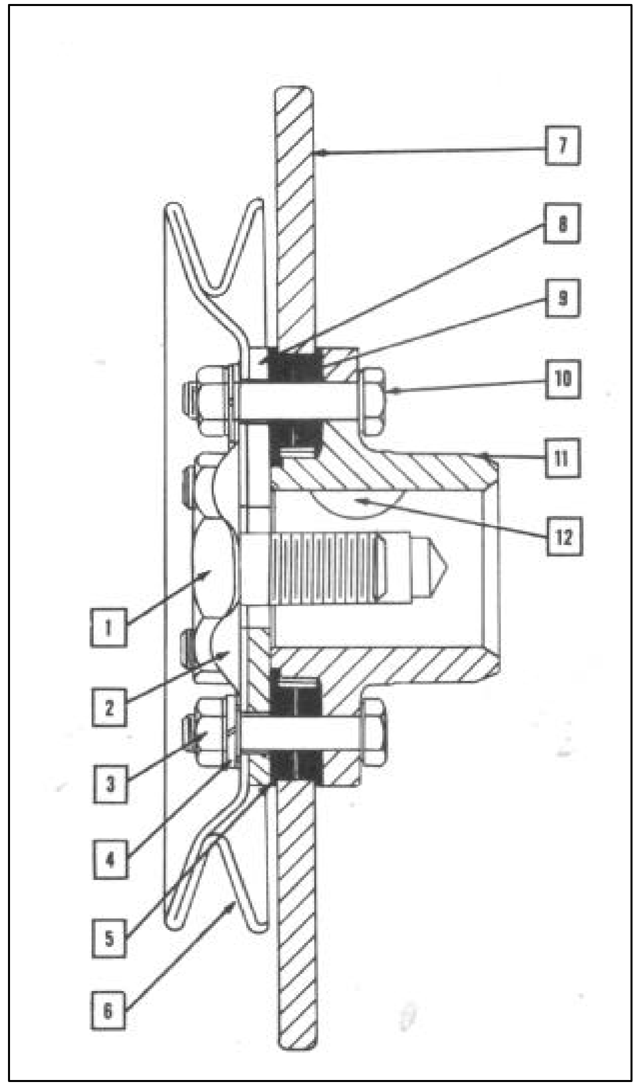
The vibration damper has an off-set screw location to insure proper reassembly for balance in the event disassembly was made to replace rubber cushions.

Pulley Remover J-5371 and Replacer J-5369 will facilitate removal and replacement operations (Fig. 19)

Tighten damper cap screw to 80-90 foot pounds torque.

"Rambler" Series

The vibration damper is not adjustable. The screws that retain the rubber are drawn up to a point where the shoulders will limit the tension of the rubber blocks (Fig. 47).



1. Damper Cap Screw
2. Cap Screw Lock
3. Nut
4. Lockwasher
5. Front Damper Cushion
6. Damper Pulley
7. Damper
8. Damper Cover Plate
9. Rear Damper Cushion
10. Pulley to Damper Screw
11. Hub
12. Key

FIGURE 46—*Vibration Damper "Wasp" Series*

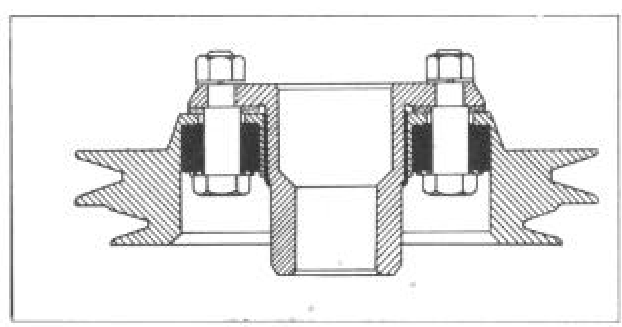


FIGURE 47—*Vibration Damper "Rambler" Series*

Tighten damper cap screw to 100-110 foot pounds torque

STARTER RING GEAR

With the exception of the flywheel, as used with the automatic transmission, which is a steel stamping, the starter ring gear can be replaced by placing the flywheel in an arbor press with steel blocks equally spaced around the gear and pressing the flywheel through, or the ring gear can be broken with a chisel.

To install the new starter ring gear, first heat it to expand the inside diameter so that it can be pressed over the flywheel.

SHAFT PILOT BEARING

The pilot bearing for the shaft is located at the center of the rear end of the crankshaft. This is an oil impregnated bronze bearing. It is pressed into the end of the crankshaft. This bearing does not require any lubrication after assembly. When assembled in service, it is advisable to place a small amount of high melting point grease on the end of the shaft as it is installed into the bearing. Bearings being installed must be of the correct size for the series and type of transmission.

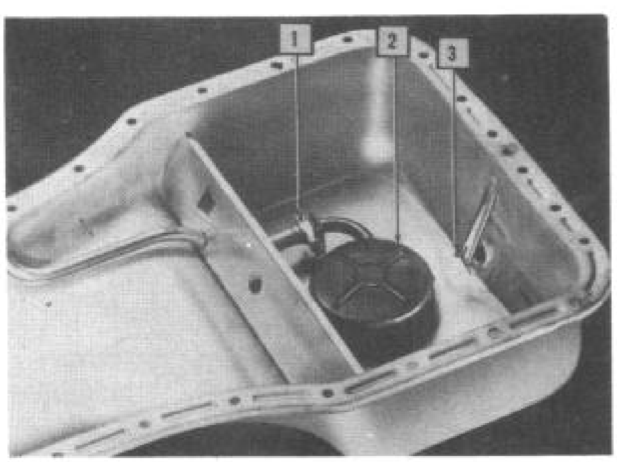
LUBRICATION SYSTEM

The lubrication system is of the full pressure type with all vital moving parts receiving lubrication under pressure except the piston pins.

"Hornet" and "Wasp" Series

The pressure is supplied by a positive displacement rotor type oil pump mounted on the right lower side of cylinder block and driven from a gear cut on the camshaft.

The oil is drawn through the floating oil intake screen (Fig. 48) to the intake side of the oil pump.



1. Swivel Connectlon
2. Intake Screen
3. Drain Plug Outlet

FIGURE 48—*Oil Intake Screen Assembly "Hornet" and "Wasp" Series*

Oil under pressure passes the plunger of the oil relief valve assembly and fills the main horizontal oil gallery from which it is directed through drilled passages to lubricate the camshaft bearings, tappet assembly, main and connecting rod bearings, cylinder walls, and timing assembly.

Piston pins are lubricated by oil "throw-off" from rotating parts and wiping action of piston rings.

Before removing the oil pump, position the engine crankshaft so that No. 1 cylinder piston is at T.D.C. exhaust stroke and No. 6 cylinder piston is at T.D.C. on compression stroke.

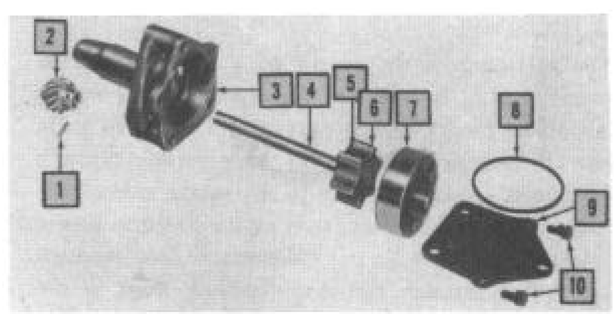
Upon disassembly of the oil pump, remove the oil pump cover and use a brass drift to mark an indexing point of one lobe and notch on rotor and internal gear or outer rotor to insure relationship for reassembly.

Measure the clearance between a lobe and notch opposite the reference mark. This clearance should be .010" or less. If more than .010", replace both rotors and shaft.

Place a straight edge across the pump body between the screw holes. Use a feeler gauge to measure the clearance between the top of the rotors and the straight edge. This clearance should be .004" or less. If the clearance is greater than this limit, the pump body must be replaced.

With the outer rotor pressed against one side of the pump body, measure the clearance between this rotor and the body on the opposite side. If this clearance is more than .008", replace the pump body.

The pump cover plate must be smooth and not worn from the rotors. Place a straight edge across the cover. If a .002" feeler can be inserted between the cover and the straight edge, the cover is worn and must be replaced.



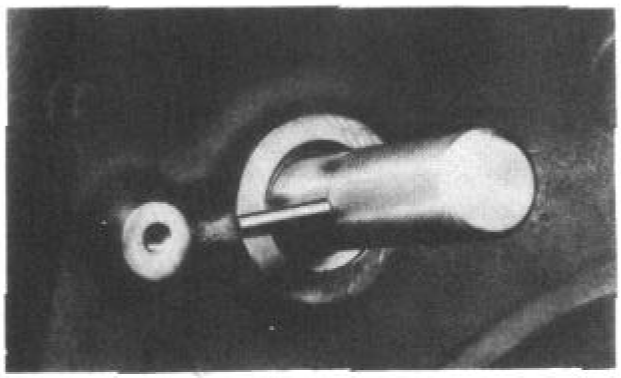
1. Oil Pump Drive Gear Pin
2. Oil Pump Drive Gear
3. Oil Pump Body
4. Oil Pump Shaft
5. Oil Pump Inner Rotor
6. Inner Oil Pump Rotor Lobe
7. Outer Oil Pump Rotor
8. Oil Pump Cover Gasket
9. Oil Pump Cover
10. Oil Pump Cover Screws

FIGURE 49—*Oil Pump Assembly "Hornet" and "Wasp" Series.*

In the event the engine crankshaft was not moved, replacement of the oil pump presents no problem. However, if the crankshaft was moved, the following procedure can be used to insure basic distributor timing location inasmuch as the distributor is driven by the oil pump shaft.

Crank the engine until the No. 1 cylinder piston is on T.D.C. exhaust stroke and No. 6 is on T.D.C. in firing position.

Install Aligning Tool J-2794 so that the guide pin indexes with the distributor mounting screw hole (Fig. 50).



Install the oil pump, indexing the slot in the pump shaft with the tang on aligning tool, and push out the tool.

Install distributor with rotor aligned with terminal in distributor cap which leads to No. 6 cylinder spark plug.

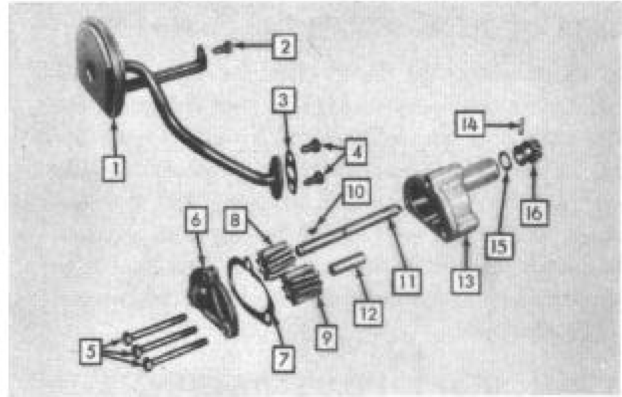
"Rambler" Series

The oil pump is mounted on the right hand side of the cylinder block. It is of the positive displacement gear type.

The oil pump is driven off of a gear cut on the camshaft and in turn drives the distributor by means of an off-set tang which is part of the oil pump main shaft. Oil is drawn from the oil pan reservoir through a fixed inlet screen assembly to the intake side of the oil pump. The oil is discharged under pressure past a relief valve in the main oil gallery and then through holes drilled through the main bearing webs to the crankshaft and camshaft main bearing locations. The crankshaft drillings provide lubrication from the main bearings to the connecting rod bearings. The front camshaft bearing permits oil to flow onto the timing gear and chain assembly.

The valve tappets and piston pins are lubricated by crankshaft oil "throw-off" and vapors.

CAUTION: *Always maintain a tight connection between the oil pump inlet flange and oil inlet hole located on the right side at the bottom of the cylinder block*



1. Screen and Retainer
2. Bolt
3. Inlet Tube Gasket
4. Bolts
5. Cap Screws
6. Oil Pump Cover
7. Gasket
8. Drive Gear (In Pump)
9. Idle Gear
10. Key
11. Oil Pump Drive Shaft
12. Oil Pump Idle Shaft
13. Oil Pump Body
14. Oil Pump Drive Gear Pin
15. Thrust Washer
16. Oil Pump Drive Gear

FIGURE 51—*Oil Pump "Rambler" Series*

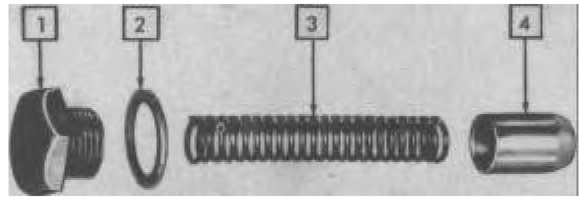
The position of the oil pump drive gear keyway should be noted before removal of oil pump. Installing in the same location will prevent disturbance of distributor timing. In the event the crankshaft has been moved, crank the engine until No. 1 cylinder is at T.D.C. in firing position. The keyway will be located at approximately the three-thirty o'clock position, viewed from the lower section of the pump body.

Oil Pressure Relief Valve

The oil pressure relief valve consists of a plunger, spring, and retainer.

The valve is located on the left side of the cylinder block on the "Hornet" and "Wasp" Series and the right side of the cylinder block on the "Rambler" Serieas.

The oil pressure relief valve is not adjustable. A setting of 40 P.S.I. for the "Hornet" and "Wasp" Series and 50-58 P.S.I. for the "Rambler" Series is built into the tension of the spring.



1. Housing Plug
2. Gasket
3. Spring
4. Plunger

FIGURE 52—*Oil Pressure Relief Valve "Rambler" Series*

ENGINE SPECIFICATIONS

Series	"Hornet"	"Wasp"	"Rambler"
Type	L-Head	L-Head	L-Head
No. Cylinders	6	6	6
Bore	3-13/16"	3"	3W'
Stroke	41/2"	43/4"	41/4"
Compression Ratio			
(Standard)	7.5:1	7.5:1	7.32:1
(Optional)		8.0:1	
Piston Displacement	308 Cu. In.	202 Cu. In.	195.6 Cu. In.
Compression Pressure at Cranking Speed	100 P.S.I. Min.	100 P.S.I. Min.	120 P.S.I.
Horsepower	160 @ 3800 R.P.M.	115 @ 4000 R.P.M.	90 @ 3800 R.P.M.
Twin Carburetor	170 @ 4000 R.P.M.	126 @ 4000 R.P.M.	
Engine Lubrication	Pressure	Pressure	Pressure

VALVE SPECIFICATIONS

Series	"Hornet"	"Wasp"	"Rambler"
Stem Diameter			
Intake	.3412"-.3422"	.3412"-.3422"	.3407"-.3412"
Exhaust	.3402"-.3412"	.3402"-.3412"	.3407"-.3412"
Stem to Guide Clearance			
Intake	.0015"-.003"	.001"-.003"	.0018"-.0033"
Exhaust	.002"-.004"	.002"-.004"	.0018"-.0033"
Head Diameter			
Intake	1.831"	1.495"-1.505"	1.594"
Exhaust	1.556"	1.390"-1.400"	1.343"
Seat Angle			
Intake	45°	45°	45°
Exhaust	45°	46°	45°
Valve Face Angle			
Intake	45°	45°	44°
Exhaust	45°	46°	44°
Valve Spring Free Height	2-1/2"	2-1/2"	2-1/2"
Valve Spring Pressure			
Valve Open	153-165 Lbs. @ 1-27/32	116-124 Lbs. @ 1-13/32"	75-82 Lbs. @ 17/16"
Valve Closed	73-81 Lbs. @ 23/16"	40-48 Lbs. @ 1-61/64"	37-41 Lbs. @ 1-3/4"
Spring Retainer Lock	Split Two Piece	Split Two Piece	Single Horseshoe
Tappet Clearance			
Cold Setting Intake	.010" "Go" .011" "No-go"	.010" "Go" .011" "No-go"	.016"
Exhaust	.014" "Go" .015" "No-go"	.014" "Go" .015" "No-go"	.018"

OIL SYSTEMS

Series	**"Hornet"**	**"Wasp"**	**"Rambler"**
Oil Pump Type	Rotor	Rotor	Gear
Normal Oil Pressure	40 P.S.I. @ 30 M.P.H.	40 P.S.I. @ 30 M.P.H.	30 P.S.I. @ 20 M.P.H.
			12 P.S.I. Min. @ 600 Engine R.P.M.
Oil Pressure Release	40 P.S.I.	40 P.S.I.	50-58 P.S.I.
Engine Oil Refill Capacity	7 Qts.	5 Qts.	4 Qts.

CRANKSHAFT AND BEARINGS

Series	**"Hornet"**	7 "Wasp"	"Rambler"
Bearing Type	Replaceable	Replaceable	Replaceable
No. of Main Bearings	4	4	4
Main Bearing Clearance	.0005"-.0015"	.0005"-.0015"	.001"-.0015"
Diameter	24988"-2.4998"	2.4988"-2.4998"	2.4791"-2.4798"
Shaft End Play	.003"-.009"	.003"-.009"	.003"-.008"
End Thrust Taken By	No. 3 Main Bearing	No. 3 Main Bearing	Front Main Bearing
Bearing Cap Adjustment	75-80 Ft. Lbs. (Dry)	75-80 Ft. Lbs. (Dry	66-70 Ft. Lbs. (Dry)

PRODUCTION PISTON RINGS

Series	**"Hornet"**	**"Wasp"**	**"Rambler"**
No. Rings Per Piston	4	4	4
End Gap (Except "U" Flex Ring)	.006"-.014"	.004"-.009"	.010"-.020"
Compression Ring Side Clearance in Ring Groove	.002"-.004"	.002"-.004"	.002"-.004"
Oil Ring Side Clearance in Ring Groove	.001"-.003"	.001"-.003"	.002"-.004"

CONNECTING ROD AND BEARING

Series	**"Hornet"**	**"Wasp"**	**"Rambler"**
Bearing Type	Replaceable	Replaceable	Replaceable
Bearing Clearance	.0005"-.0015"	.0005"-.0015"	.001"-.0015"
Crankpin Diameter	2.1244"-2.1254"	1.937"-1.938"	2.0948"-2.0955"
Bearing End Play	.007"-.013"	.007"-.013"	.005"-.015"
Bearing	40-45 Ft. Lbs. (Dry)	40-50 Ft. Lbs. (Dry)	27-30 Ft. Lbs. (Dry)

TUNE-UP DATA

Series	Plug Gap	Tappet Clr. Cold Int.	Tappet Clr. Cold Exh.	Distributor Point Gap	Dwel Angle	Igniton Timing
"Hornet"	.032"	.10" "Go" .11" "No-go"	.14" "Go" .15" "No-go"	.020"	38°	T.D.C. at Idle Speed
"Wasp"	.032"	.010 "Go" .11" "No-go"	.14" "Go" .15" "No-go"	.020"	38°	T.D.C. at Idle Speed
"Rambler"	.030"	.016"	.018"	.018"-.024"	31°-37°	4° A.T.D.C. at Idle Speed

Engine Idle Speed—Transmission in Neutral, Air Conditioning on.
"Hornet" and "Wasp" 540-560 R.P.M. (Standard Transmission)
575 R.P.M. (Overdrive Transmission)
490-510 R.P.M. (Hydra-Matic)
"Rambler" 500-550 R.P.M. (Standard and Overdrive)
475 R.P.M. (Hydra-Matic)
500 R.P.M. (With Air Conditioning on)

Compression Pressure at Cranking Speed —
"Hornet" and "Wasp" 100 P.S.I. Minimum
"Rambler" 120 P.S.I.

Spark Advance (See Electrical Section—Distributor)

Firing Order-1, 5, 3, 6, 2, 4

Positive Battery Terminal Grounded

Coil—Secondary Terminal Tower, Negative Polarity

Breaker Point Spring Tension—
"Hornet" and "Wasp" 17-20 Ounces
"Rambler" 17-21 Ounces

Spark Plugs-
"Hornet"—Champion H-11 Torque 25 Ft. Lbs. (Aluminum Head)
"Wasp"—Champion H-10 Torque 30 Ft. Lbs. (Cast Iron)
25 Ft. Lbs. (Aluminum Head)
"Rambler"—Auto-Lite A-7 Torque 30 Ft. Lbs. (Cast Iron)

Cylinder Head—Nut or Cap Screws Torque Specifications—
"Hornet"-75-80 (Cold)
"Wasp"-60-65 (Operating Temperatures) Cast Iron (Cold) Aluminum
"Rambler"-57-60 (Operating Temperature)

ENGINE TORQUE TIGHTENING CHART
(Foot Pounds Dry)

Description	"Hornet"	"Wasp"	"Rambler"
Cylinder Head	*75-80	*60-65	57-60
Exhaust Pipe Clamp Nut			10-15
Exhaust Manifold	20-35	20-30	
Intake Manifold	12-15	12-15	
Oil Pan Bolt	15-20	15-20	15-20
Timing Chain Cover	15-20	15-20	15-20
Piston Pin Clamp Screw			18-22
Connecting Rod Cap Nuts	40-45	40-50	27-30
Crankshaft Main Bearing Cap Screws	75-80	75-80	66-70
Vibration Damper Retaining Screw	100-120	80-90	65-70
Flywheel Retaining Cap Screw or Nuts	40-45	40-45	100-110
Camshaft Sprocket Screw	20-30	20-30	50-55

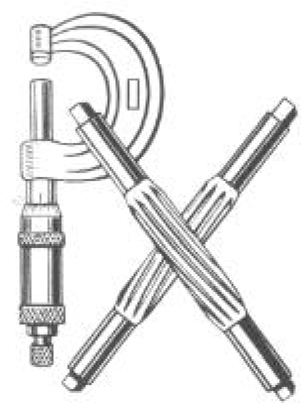
*Aluminum cylinder heads are tightened at room temperature (70° F.).

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes of informatin on Page. No.

HUDSON

TECHNICAL SERVICE MANUAL



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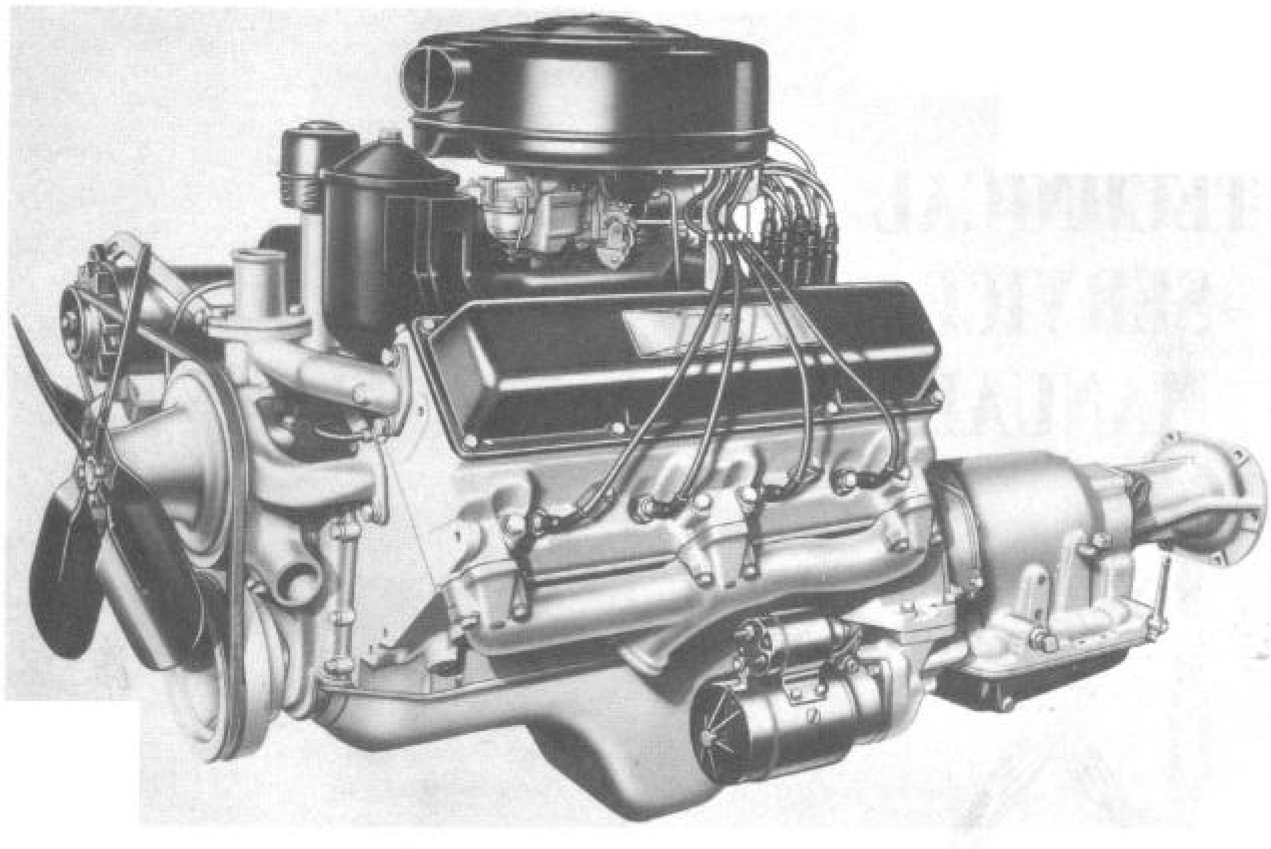


FIGURE 1—*V-8 Engine Assembly*

ENGINE IDENTIFICATION

The engine number is located at the right rear upper corner of the cylinder block below the rear exhaust manifold port (Fig. 2)

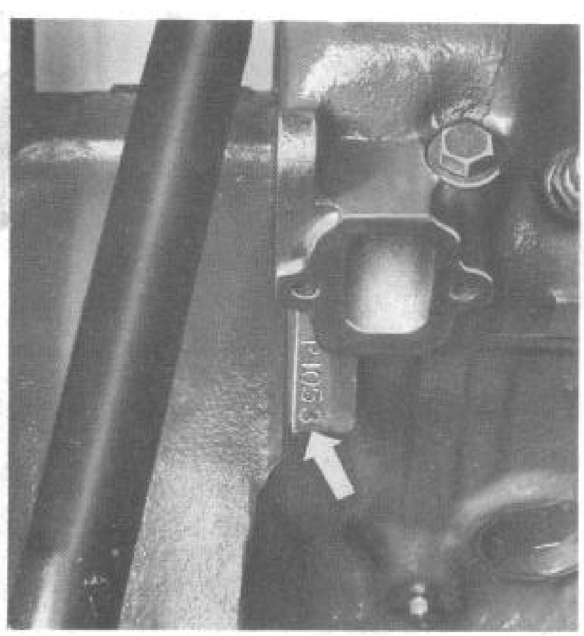


FIGURE 2—Engine Number Location

CYLINDER HEAD AND GASKET

After thoroughly cleaning the top surface of the block and the bottom surface of the cylinder head, inspect each for smooth and flat surfaces with a straight edge.

The cylinder block surface has two sleeve locating dowels to assist in lining up and holding position of cylinder head and gasket during installation or removal.

Coat the gasket with a non-hardening gasket paste. For convenience in removing and installing the cylinder head, use Tool J-4159 (Fig. 3).

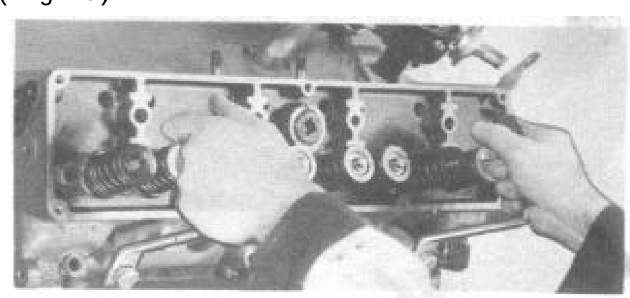
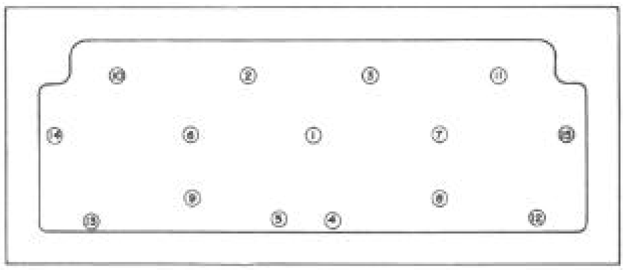


FIGURE 3—*Removing or Installing Cylinder Heads with Tool I-4159*

After installing the push rods, rocker arm assembly, and cylinder head cap screws, tighten them evenly.

Then retighten to 55 to 60 foot pounds with torque wrench following the sequence outlined in Figure 4.



55-60 Ft. Lbs.

ROCKER ARM AND SHAFT ASSEMBLY

The rocker arm shaft assembly is secured to the cylinder head with four long cylinder head and rocker arm shaft retaining cap screws. The rocker arm shafts axe hollow, plugged at each end, serving as oil galleries for rocker arm, push rod end, and valve stem lubrication.

The oil pressure supply for the left hand bank rocker arm assembly is taken from the left main oil gallery at the front camshaft bearing. The oil under pressure through connecting passages in cylinder block and cylinder head enters around the undercut stem area of. the front rocker arm shaft mounting cap screw upward into the rocker arm shaft.

The right bank rocker arm assembly lubrication pressure is taken from the vertical oil gallery passages at the rear camshaft bearing oil passage through the cylinder head and block to the rear rocker arm shaft retaining cap screw.

Two different rocker arms are used to accommodate the angle from the rocker arm shaft support to the valve stems. However, the rocker arm shaft assemblies are interchangeable from cylinder bank to cylinder bank.

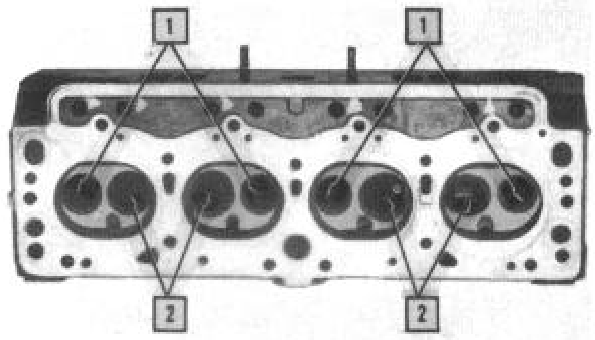
FIGURE 5—*Valve Rocker Arm Assembly*

VALVES

Figure 6 illustrates the valve arrangement.

Valve Springs

Whenever valve springs are removed, they should be tested according to the specifications listed below. Use valve spring tester and replace all springs not within specifications.



1. Exhaust Valves
2. Intake Valves

FIGURE 6—*Valve Arrangement*

Intake or Exhaust Valve Spring:

Valve Closed	78-86 Lbs. @ 1-3/4"
Valve Open	158-172 Lbs. @ 1-3/8"

Valve springs are installed with the inactive (closed) coils against the cylinder head.

The valve spring retainer serves the dual purpose of holding the valve and spring together and providing a valve stem oil seal. The seal is moulded onto the retainer. At valve service periods, the valve spring retainers should be replaced to insure good oil control at this point.

Tool J-5988 will facilitate removal of the valves from the cylinder head (Fig. 7). The half conical shaped valve locks can be removed after compressing the spring.

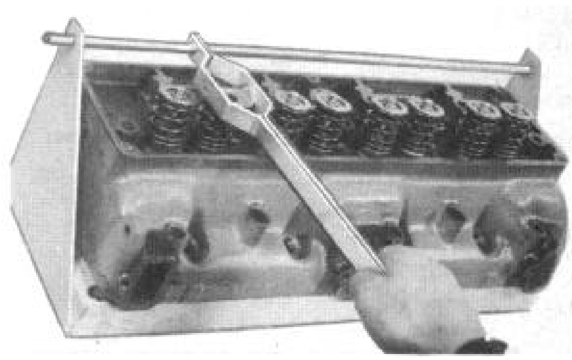


FIGURE 7—*Removing Valves from Cylinder Head*

Valve Stem to Guide Clearance

Valve guides are cast integrally with the cylinder head. The valves are replaced with oversize stem valves when excessive stem to guide clearance develops (Fig. 8). For service, valves with oversize stems are supplied in .003", .010", .020', and .030".

A special set of valve guide reamers (J-6042) are available to fit the various size valves to their guide.

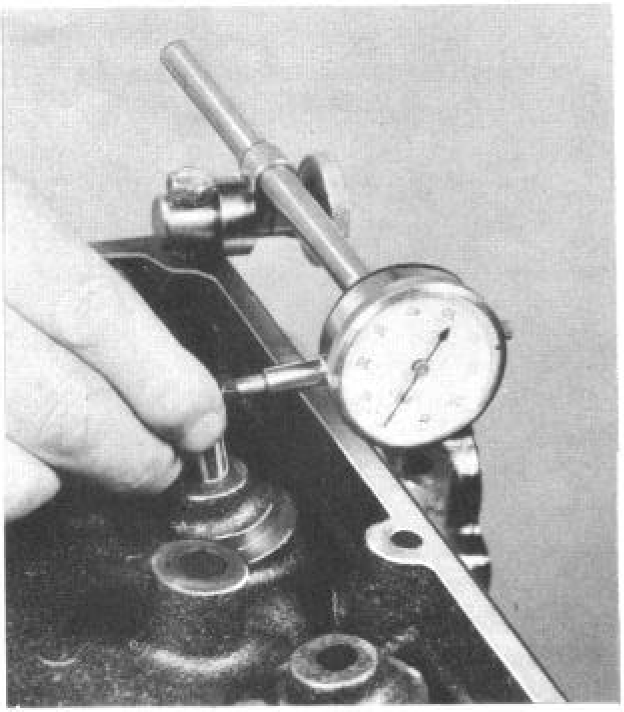


FIGURE 8—*Checking Valve Stem to Guide Clearance Limits—.004" Intake, .005" Exhaust*

Valve Refacing

The intake valves are faced to a 30° angle and the exhaust valves to a 45° angle. Valves may be refaced until remaining margin is down to 1/32"; then the valve must be replaced.

The valve stem tip when worn can be resurfaced and rechamfered. However, never remove more than .010".

Valve Seat Refacing

Grind the valve seats to the following specifications:

Seat Angle	
Intake Valve	30°
Exhaust Valve	45°
Seat Width	
Intake Valve	3/64"
Exhaust Valve	5/64"

Narrowing stones should be used to obtain the proper seat widths when required.

Control seat runout to a maximum of .002" (Fig. 9).

Valve Tappets and Push Rods

11222

The hydraulic valve tappet consists of a body, plunger, plunger return spring, check valve assembly, push rod socket, and lock ring (Fig. 10).

The tappet operates in a guide bore which has an oil passage drilled into the adjoining main oil galleries.

When the tappet is on the heel of the cam lobe, the plunger return spring indexes an oil hole undercut in the plunger with the oil supply admitted through the tappet body. Oil

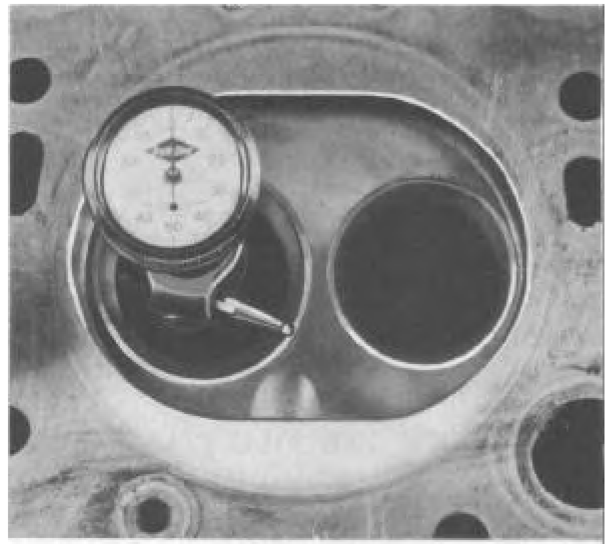


FIGURE 9—*Checking Valve Seat Runout*

FIGURE 9—Checking Valve Seat Runout

under pressure flows into the body through the check valve assembly maintaining the tappet fully charged. This cycle of operation occurs when tappet leaks off some oil during the normal valve opening events. Opening movement of the cam lobe causes tappet body movement, closing the check valve and transmitting "zero-lash" movement of the push rod to open the cylinder valve.

The valve tappets should be cleaned and serviced at time of engine overhaul or whenever excessive noise exists.

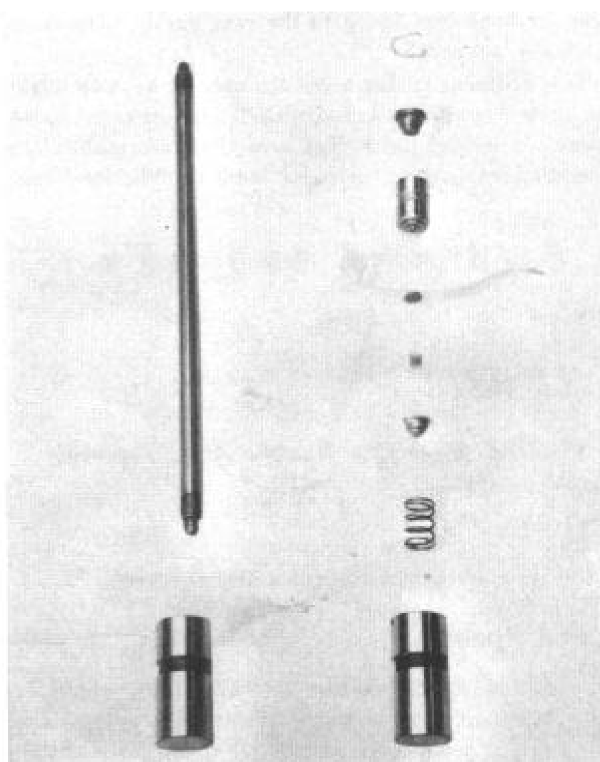
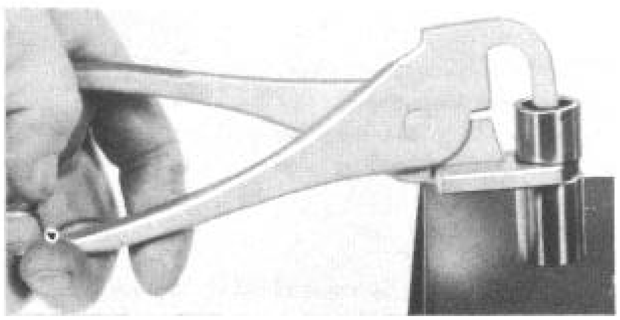


FIGURE 10—*Valve Push Rod and Tappet*

When removing the tappets, they must be kept in an order that will insure replacement in their respective operating bores in the engine because they are select fitted to that bore. Keep each tappet component group by itself as all detail components are select fitted to one another in manufacturing. Only complete tappet assemblies are supplied for service replacement.

The tappet assembly should be cleaned in a solvent to remove all varnish or leaded deposits. After cleaning, the tappet must be "leak-down" tested to insure its "zero-lash" operating ability. Kerosene should be used for this test. Test the tappet by filling the body with kerosene and then install the plunger return spring, plunger assembly, and push rod socket. Leave out snap ring for test. Insert the tappet in tappet test tool J-5978, and check it for "leak-down" by squeezing the handles together (Fig. 11) .



If the tappet leaks down rapidly or collapses immediately, it must be rechecked and/or replaced with a complete new tappet assembly. The normal tappet will take approximately 10 seconds or more to "leak- down" with kerosene. After testing tappets, they should be prelubricated and assembled in the engine without an oil charge. They will normally charge themselves in 3 to 8 minutes of engine operation.

Tappet Noise

A loud clicking noise is usually the result of the plunger stuck down below its operating position or a check valve held open. A light clicking noise is usually the result of excessive "leak-down" caused by wear or slight leakage at the check valve and its seat.

An intermittent noise at tappet is the result of dirt or chips stopping the check valve or a lack of oil flow into the body because of dirt. A general tappet noise is in most cases due to a lack of oil volume or pressure.

The normal tappet plunger operating range is .140" to .170".

Valve Timing

The correct valve timing is established by the relation between the sprocket on the camshaft and the sprocket on the crankshaft.

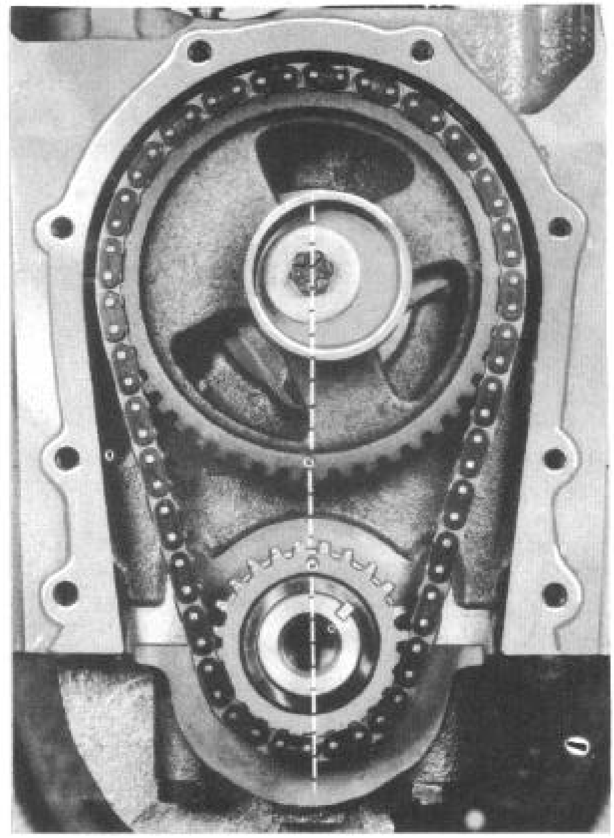


FIGURE 12—*Properly Installed Timing Assembly*

To obtain the correct valve timing, index the "0" marks on camshaft and crankshaft sprockets on a line drawn vertically through the center line of each shaft (Fig. 12) . To check the assembly, rotate the crankshaft until the timing mark on camshaft sprocket is on a horizontal line at either the 3 or 9 o'clock position. Count the number of links or pins on the timing chain between timing marks. You should have 101/2 links and/or 21 pins between timing marks. Each' link contains two pins.

To make an external check of valve timing, remove the cylinder head covers and spark plugs. Crank the engine until No. 6 cylinder piston in right bank is on T.D.C. on compression stroke. This places No. 1 cylinder piston on T.D.C. on the exhaust stroke valve overlap position. Rotate the crankshaft counterclockwise. 90°.

Install a dial indicator on the number one intake valve rocker arm push rod end (Fig. 13). Crank the engine slowly in direction of rotation (clockwise) until the dial indicator indicates push rod movement. The hydraulic lifter should be fully charged for this check.

At the time the dial indicator moves, the ignition timing mark on the vibration damper should align with the 14° (approx.) position on the degree quadrant section of the timing assembly cover. If more than 1/2" variance

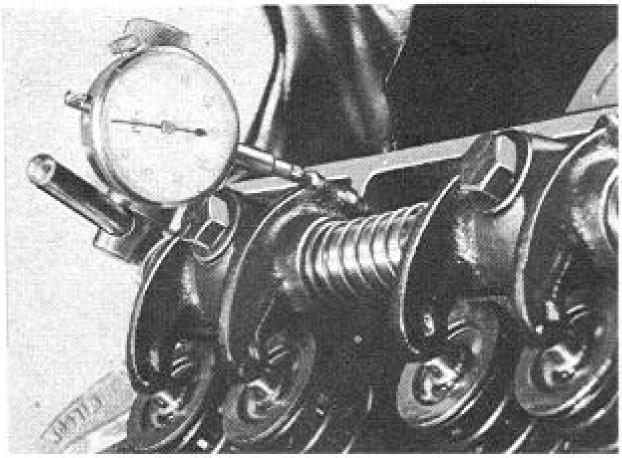


FIGURE 13—*Installation of Dial Indicator for External Valve Timing Check*

in either direction is evident, remove the timing chain cover and inspect timing chain installation. Replace timing chain if over chain deflection exists.

TIMING CHAIN COVER

The timing chain cover is a die casting incorporating an oil seal at the vibration damper hub.

To remove the timing chain cover, first remove the oil filter pressure line, water pump and manifold, fuel pump assembly, and vibration damper.

The oil seal can be pryed out of the cover and a new one installed with seal installing tool J-5983 (Fig. 14).

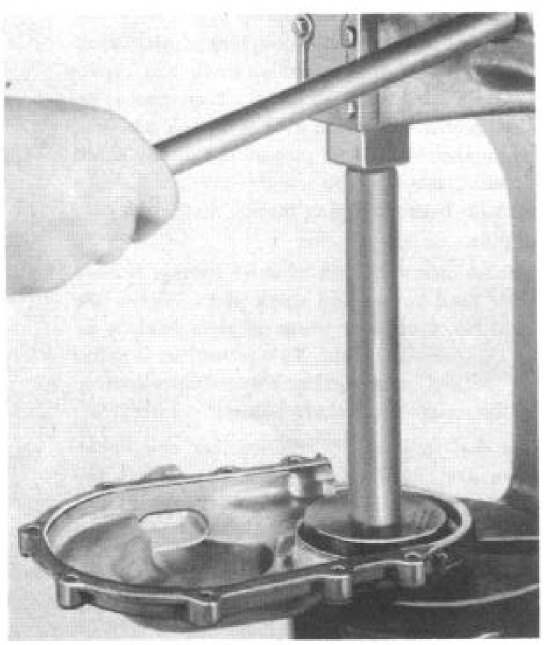


FIGURE 14—*Installation of Timing Chain Cover Seal*

To prevent damage to this seal, it is important that the cover be properly aligned when installing the vibration damper. This is accomplished by leaving the cover to block screws loose until the vibration damper has been partially installed. Then tighten the cover screws.

An oil slinger is used inside the timing chain cover. The slinger is held in place by the crankshaft sprocket, and the vibration damper hub.

CAMSHAFT AND BEARINGS

The camshaft is supported by five steel shelled, babbitt lined bearings which have been pressed into the block and line reamed. The camshaft bearings are step bored, being larger at the front bearing than at the rear, to permit easy removal and installation of the camshaft. All camshaft bearings are lubricated under pressure.

The oil for lubrication is supplied through connecting drilled passages from the intermediate main bearing locations and from the main oil galleries to the front and rear camshaft bearing locations.

Camshaft End Play

The camshaft end thrust is controlled by the front surface of the camshaft bearing and the rear surface of the thrust plate, and the rear hub surface of the camshaft sprocket and the front surface of the thrust plate.

The end play tolerance is .004" to .006".

Camshaft Removal

Remove cylinder head covers, ignition plug wires, rocker arm assemblies, intake manifold, and carburetor. Remove water pump and water distribution manifold. Remove upper oil breather and tappet assembly cover. Remove inner oil baffle cover. Remove push rods, keeping them in their relative operational positions. Remove hydraulic tappets and keep in relative operational positions. Remove fuel pump, vibration damper, and timing chain cover. Crank engine until timing marks line up on a vertical line with shaft centers (Fig. 12).

Remove oil shedder, fuel pump eccentric, crankshaft sprocket, camshaft sprocket, and timing chain assembly (Figs. 15 and 16). Timing sprockets can be pryed off with ease. Remove the camshaft retainer and thrust plate and the end thrust spacer (Figs. 17 and 18).

PISTONS

Slipper type, tapered skirt, cam ground, pistons are used. They are of aluminum alloy, steel reinforced for controlled expansion.

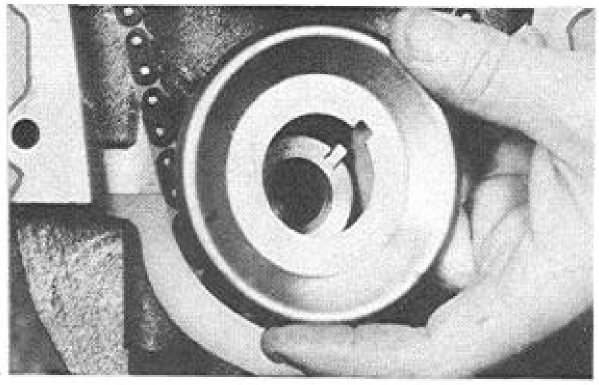


FIGURE 15—*Timing Chain Cover Oil Shedder*

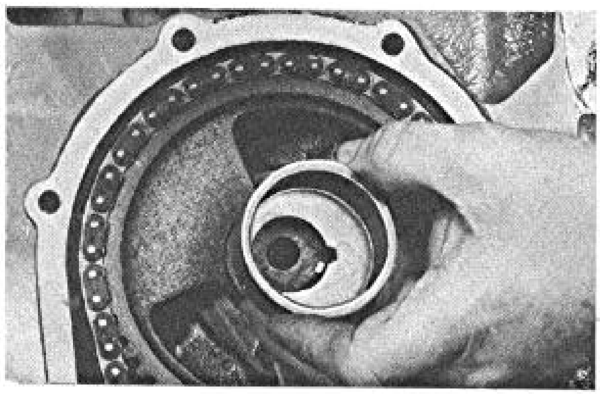


FIGURE 16—*Fuel Pump Drive Eccentric*

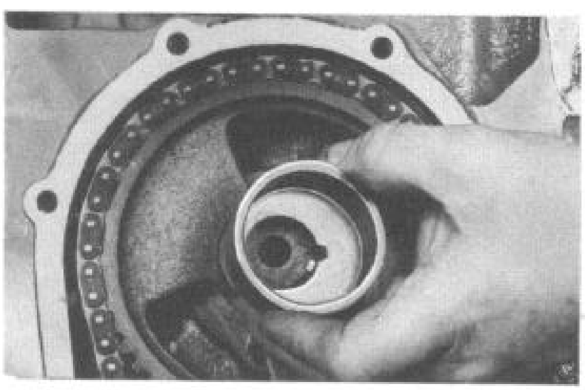


FIGURE 17—*Camshaft Retainer and Thrust Plate*

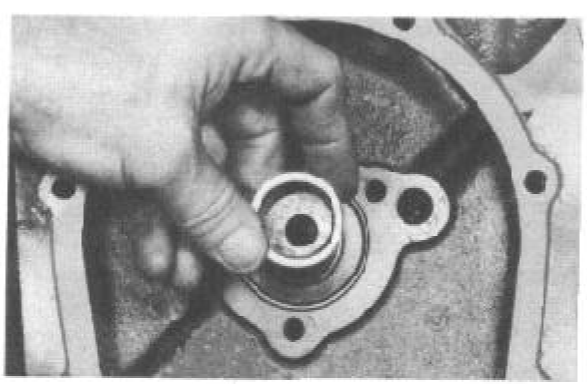
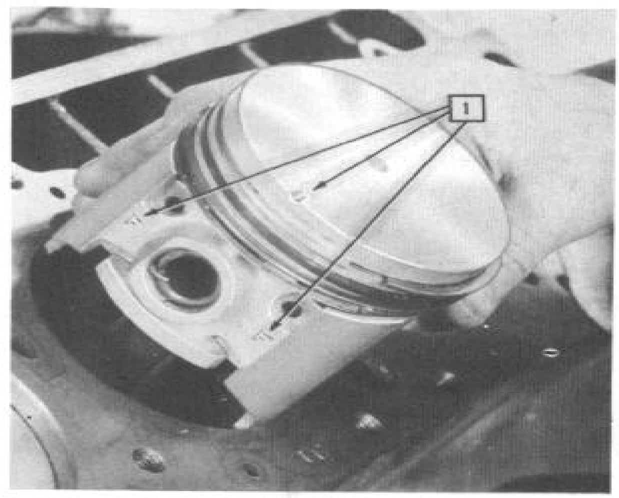


FIGURE 18—*Camshaft End Thrust Spacer*

The ring belt area provides for three piston rings, two compression and one oil control ring above the piston pin.

The pistons are removed from the top of cylinder bore after removing ring ridge.
The piston pin boss is "offset" from the piston center line to place it nearer the thrust side of the cylinder. To insure proper installation of the piston in the bore, a notch is cast in the piston top, and letters "F" cast in the pin boss structure at the front (Fig. 19).



1. Notch and "F" letter to Front of Engine

FIGURE 19—*Correct Piston Position*

The piston to bore clearances are .021" to .027" at top land, .001" to .0015" top of skirt, and .000" to .0015" bottom of skirt (Fig. 20).

PISTON PINS

Full floating type piston pins are mounted in a split bronze bushing at the connecting rod upper end and retained by lock rings in piston pin bosses. Prior to fitting a new piston pin, the bronze connecting rod bushing is pressed into place and burnished with components of tool J-6055 (Fig. 21). Be sure oil hole in bushing lines up with oil hole drilled in rod.

The burnishing operation is required to prevent the bushing from turning in the rod end while honing or reaming to fit piston pin.

The piston pin should be a palm press fit in rod bushing at room temperature and a palm press fit in a piston heated in water to about 200°F. When pin is properly fitted to rod, rod will fall by its own weight when located in a horizontal position and held by the piston pin.

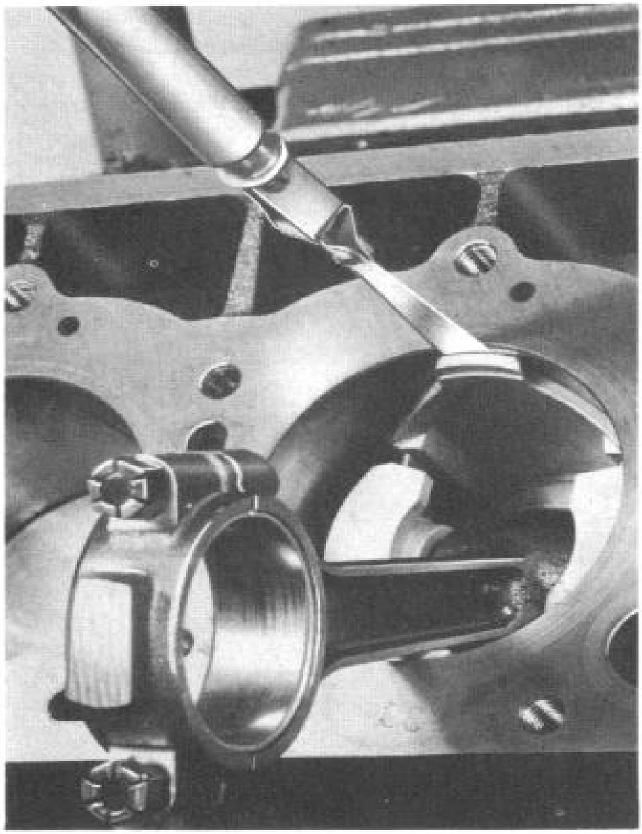


FIGURE 20—*Measuring Clearance at Bottom of Piston Skirt*

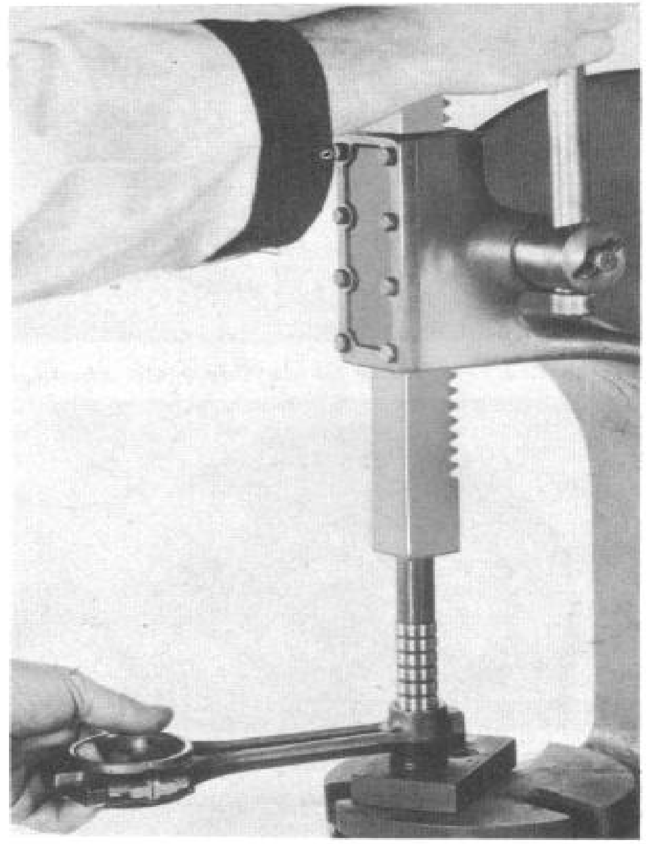


FIGURE 21—*Burnishing Piston Pin Bushing*

PISTON RINGS

A three ring piston is used. The two compression and one oil control rings are located above the piston pin boss.

Before assembling the rings to the piston, carbon must be cleaned from all ring grooves. The oil drain holes in the oil ring grooves must be cleared with the proper size drill. Care must be exercised not to remove metal from the grooves, since that will change their depth, nor from the lands, since that will change the ring groove clearance and destroy ring to land seating.

Checking Ring Groove Clearance

Side clearance between land and piston ring should be .0015" to .005". Roll the ring around the groove in which it is to operate. It must fit freely at all points.

Checking Ring Gap Clearance

Piston ring gap or joint clearance is measured in the bottom of the cylinder near the end of the ring travel area. To square the ring in the bore for checking joint clearance, place the ring in the bore. Then with an inverted piston, push the ring down near the lower end of the ring travel area.

When other than standard ring sizes are used, rings should be individually fitted to their respective bores for a gap clearance of .010" to .018".

Piston Ring Installation

Removal of glaze from the cylinder wall for quicker ring seating can be accomplished by various methods. Where an expanding type hone is used, do not use more than ten strokes (each stroke down and return) to recondition a cylinder wall.

Successful ring installation depends upon cleanliness in handling parts and while honing the cylinder walls. The engine bearings and lubrication system must be protected from abrasives.

Rigid type hones are not to be used to remove cylinder glaze as there is always a slight amount of taper in cylinder walls after the engine has been in service.

Rings must be installed on the pistons with a ring installing tool to prevent distortion and ring breakage.

For service ring replacement, follow the detailed instructions enclosed in the ring package.

Prior to installing the piston and connecting rod assembly into engine, the piston ring gaps are to be

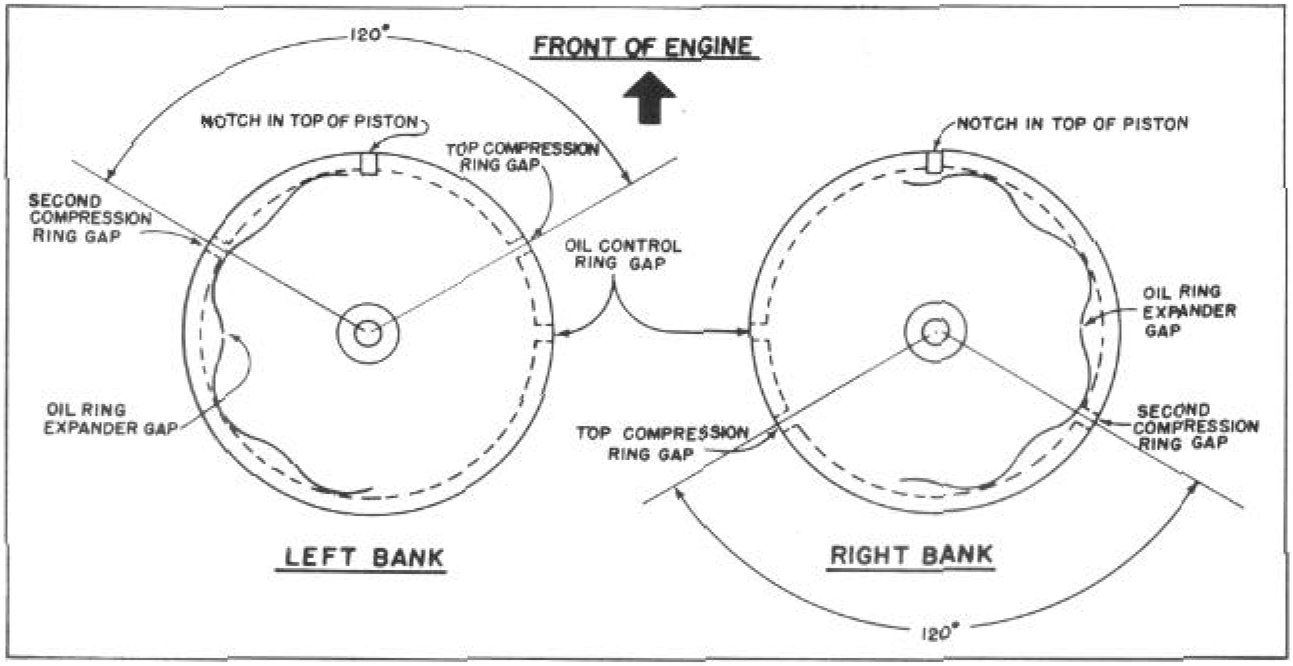


FIGURE 22-*PISTON RING GAP LOCATION*

arranged so that the gap for the oil ring expander is to the outside of the block and oil ring gap is toward the inside of the block. The gaps on the compression rings as shown in Figure 22 are 120° apart. Do not locate a ring gap over the piston pin boss.

CONNECTING RODS

Connecting rods are the "I" beam drop forged steel type. The connecting rods are stamped with the cylinder numbers in which they are assembled. The numbers are opposite the squirt holes and toward the outside of the banks in which they are located.

The squirt holes from connecting rods in one bank lubricate the cylinders in the opposite bank.

The connecting rod squirt holes are located in the parting surface of the bearing cap (Fig. 23).

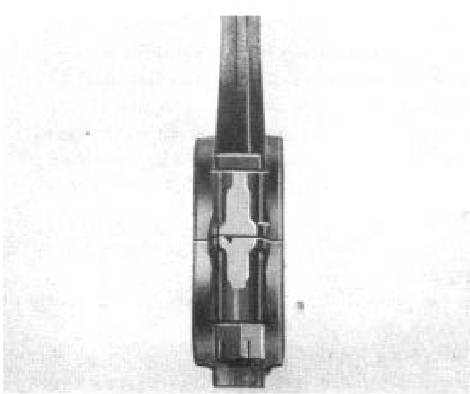


FIGURE 23—*Connecting Rod Squirt Hole Location*

The cylinders are numbered 1, 3, 5, 7 in the left bank of engine from front to rear, and even numbers 2, 4, 6, 8 in the right bank, front to rear as viewed from driver's seat.

Two connecting rods are mounted, side by side, on each crankpin. The side clearance is .003" to .011" Fig. 24).

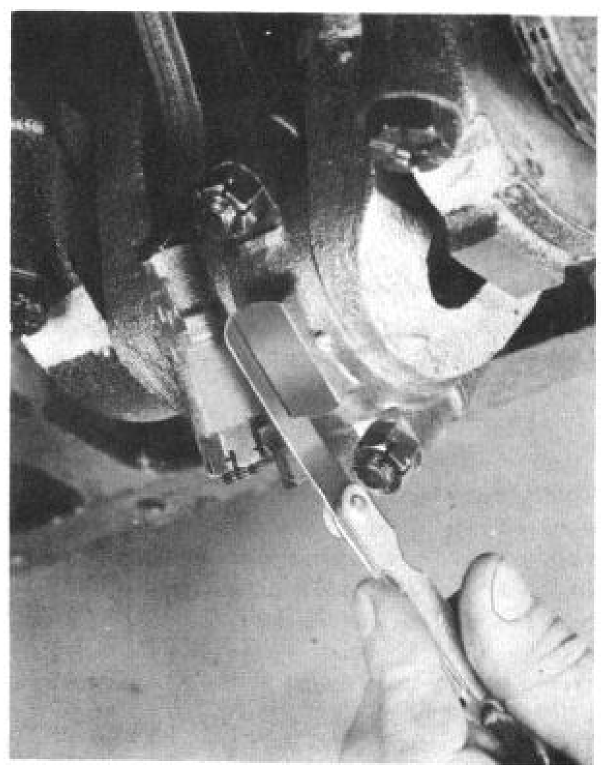


FIGURE 24—Checking Connecting Rod Side Clearance

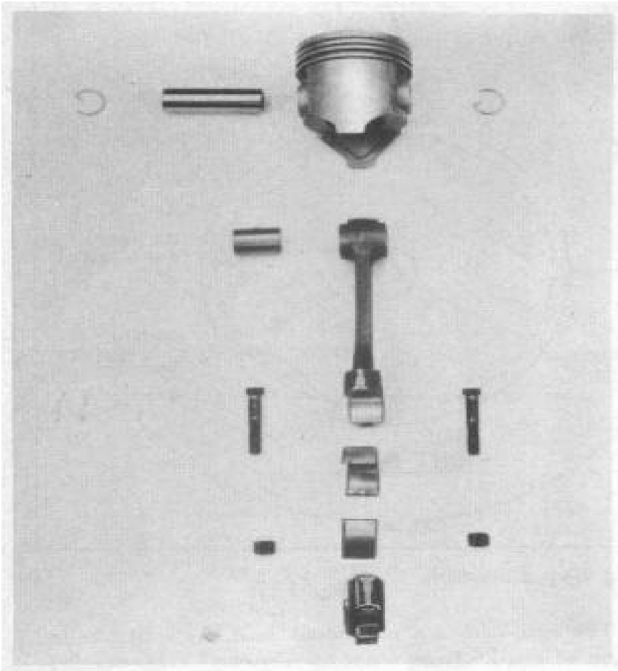


FIGURE 25—*Piston and Connecting Rod Assembly*

Connecting Rod Alignment

Whenever new rings are installed or new piston pins are replaced, it is necessary to align the connecting rods and pistons as assemblies to insure true operation in the cylinder bore.

Misaligned rods will cause uneven piston and ring wear which will result in oil consumption. The connecting rod should be inspected for a twisted or bent condition.

Connecting Rod Bearings

The connecting rod bearings are the steel-backed, babbitt lined precision type. They are installed as pairs in the connecting rod and cap.

CAUTION: *Never file a connecting rod or cap to adjust bearing clearance.*

To determine the amount of bearing clearance, use a piece of Plastigage in the bearing cap. Then tighten the cap to torque specifications to compress the gauge. Remove the bearing cap and calibrate the width of the Plastigage with the scale furnished.

If the bearing clearance is excessive, the correct undersize bearing insert (pair) should be installed in the connecting rod.
The correct connecting rod bearing clearance is .0005" to .0025".

It is important that the connecting rod bearing cap bolt nuts be drawn up to 40 to 45 foot pounds torque.

CRANKSHAFT

The crankshaft is a precision steel cast shaft having five main journals, four crankpins, and provided with an oil stinger at rear journal inboard of the rear oil seal.

The component parts of the crankshaft assembly are individually balanced, and then the complete engine assembly is balanced as a unit. Replacement of crankshaft, flywheel, or vibration damper can be accomplished without rebalancing the complete assembly.

Main Bearing Journals

Main bearing journals can be measured without removing the crankshaft from the engine block. Various gauges are available for this purpose. Always check both ends of the journal to note the taper. Then rotate the shaft 90° and measure for out of round.

The main bearing diameter is 2.500" and should not taper or be out of round more than .002".

Crankshaft Main Bearings

Main bearings are of the precision type having a steel back with a babbitt lining. The bearings are not adjustable. Shims should never be used and the bearing caps should never be filed.

When either half of a bearing requires replacement, a complete set should be installed. To replace the upper half of a bearing, remove the bearing cap of the bearing to be replaced. Then loosen all of the other bearing caps and insert a small pin about 1/2" long in the crankshaft oil hole. The head of this pin should be large enough so that it will not fall into the oil hole, yet thinner than the thickness of the bearing.

With the pin in place, rotate the shaft so that the upper half of the bearing will rotate in the direction of the locating tongue on the bearing.

Crankshaft Main Bearing Clearance

The standard clearance of .0005" to .0025" can be accurately checked by the use of Plastigage.

NOTE: **When checking bearing clearance, with the engine in such a position that the bearing caps support the weight of the crankshaft and flywheel, keep all main bearings tight except the one being checked. Support the weight of the crankshaft with a jack.**

Remove the bearing cap and wipe the oil from the bearing insert.
Place a piece of Plastigage across the full width of the bearing insert.
Reinstall the bearing cap and tighten 90 to 95 foot pounds torque. Then remove the bearing cap and with the graduated scale, which is printed on the Plastigage envelope, measure the width of the flattened Plastigage at its widest point. The number within the graduation indicates the

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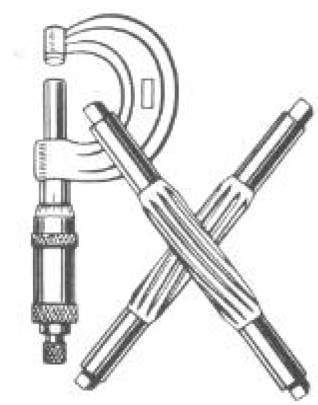

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FAN BELT........................... 4

COOLING SYSTEM

COOLING SYSTEM

WATER PUMP

"Hornet" and "Wasp" Series

The water pump is a centrifugal type utilizing a nonadjustable packless type seal. The shaft and sealed double row ball bearings are an integral assembly.
The water pump discharges into a brass water distributing tube to provide uniform coolant circulation around the valves.

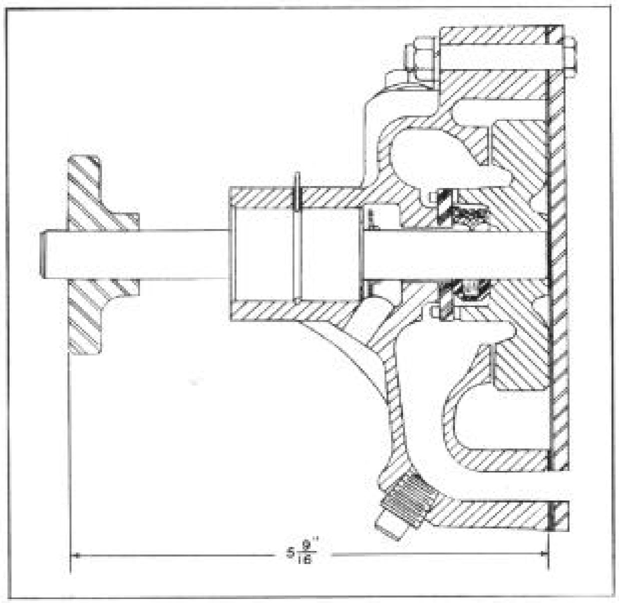


FIGURE 1—*Water Pump Assembly "Hornet" 6 Series*

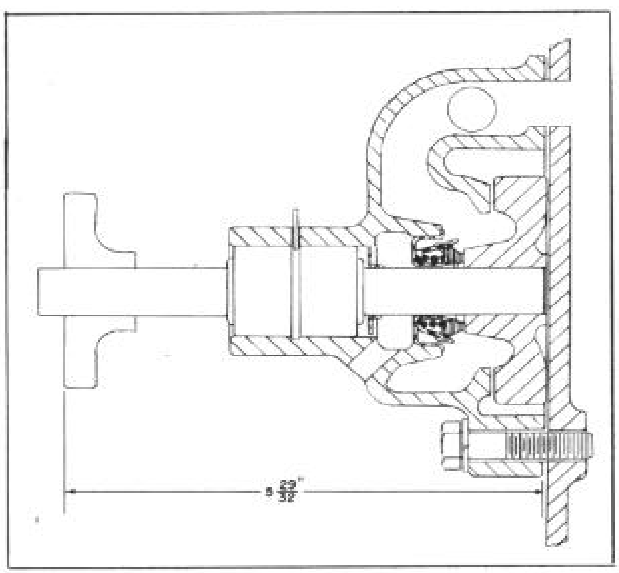


FIGURE 2—*Water Pump Assembly "Wasp" Series*

The "Hornet" V-8 water pump impeller housing is cast integrally with the water distribution equalizing manifold. The single inlet

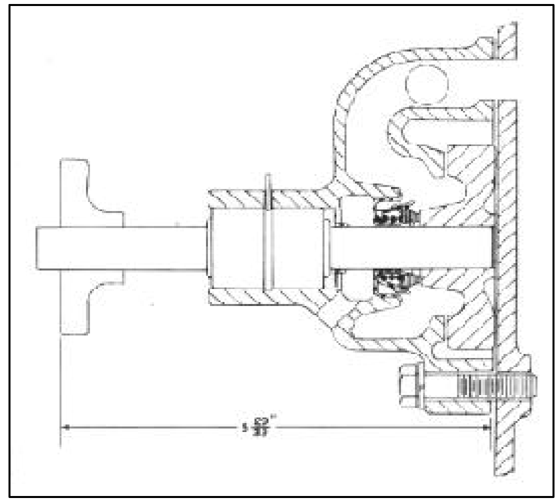


FIGURE 3—*Water Pump Assembly "Hornet" V-8 Series*

is connected to the Ultramatic transmission oil cooler, while the pump discharges into the equalizing manifold. Dual outlets on the manifold supply a balanced flow of coolant to both cylinder banks.

"Rambler" Series

The water pump is a centrifugal blade type utilizing a factory packed, sealed-in cartridge shaft seal. The seal gland springs hold the seal tight to the shaft.

The seal cartridge is non-adjustable and serviced as an assembly only. It is mounted and sealed in the pump body by means of a rubber "0" ring.

The "0" ring permits self-alignment of the pump shaft as well as absorbing radial loads imposed by the hydraulic forces of the impeller.

The seal gland spring chamber serves as a lubricant reservoir for the shaft and bushing lubricant (Fig. 4).

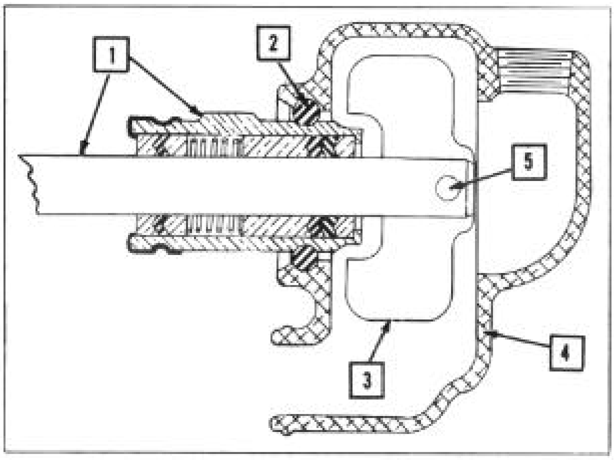
Water Pump Disassembly and Assembly "Hornet" 6 and "Wasp" Series

Remove the pump shaft retainer, cover, and gasket.

Support the pump in water pump holding fixture J-2778. Press the pump shaft and bearing assembly, complete with the pulley hub, from the pump using the shaft driver.

NOTE: *The holding fixture is provided with adjustable studs to permit leveling the pump on the fixture. A slotted adapter is placed between the lower part of the body to support the body and prevent possible fracture.*

The bore in the pump body must be cleaned before reassembly.



2. Seal Housing Rubber Retaining Ring
3. Impeller
4. Pump Body
5. Impeller Rivet

FIGURE 4—*Water Pump Assembly "Rambler" Series*

The bore must be inspected for scoring and wear. Inspect the seal surface in the pump body; if rough, reface; if scored, replace body.

Inspect the pump body impeller area; if the impeller has been scraping the body, it indicates excessive end thrust movement. Replace the complete pump.

Inspect the bearings, turning slowly by hand while applying hand thrust load. The bearing and shaft assembly must be replaced if drag or roughness is noted.

The bearing and shaft assembly must be replaced if the metal end seals are loose and may be turned by hand, the shaft is worn, or the spring retainer groove is worn.

Press the shaft and bearing assembly into the pump body. Press the outer ring of the bearing, not the shaft.

Lubricate the hub end of the shaft with castor oil and install by supporting the hub flange and pressing on the impeller end of the shaft.

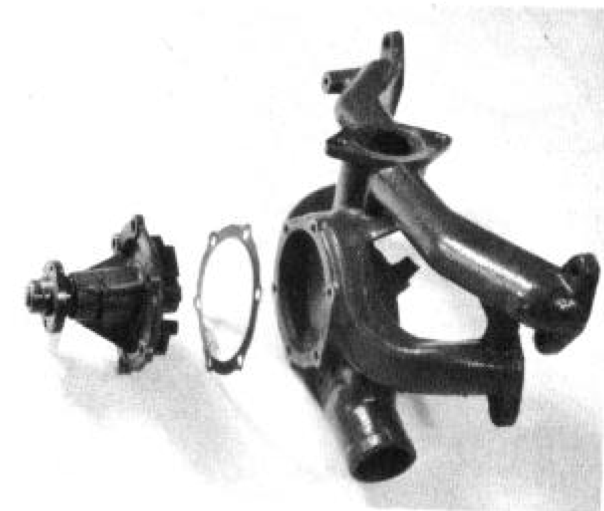
The front face of the pulley hub should be 5%6" on the "Hornet" 6 Series and 52%2" on the "Wasp" Series as shown in Figures 1 and 2.

Lubricate the impeller end of the shaft with castor oil. Assemble the seal, carbon washer, and retainer in the impeller. Press the impeller on the shaft supporting the shaft at the pulley hub end. The impeller must protrude .007" to .017" beyond the cover face of the pump body.

Install a new pump shaft assembly retainer and the pump body cover.

"Hornet" V-8 Series

The pump is attached to the equalizing manifold with cap screws and copper sealing washers (Fig. 5).



Assembly "Hornet" V-8 Series

"Rambler" Series

The water pump impeller is installed in the slotted end of the pump shaft and retained by a tubular brass rivet.

A removable plug in the pump body permits the removal, by drill or punch, and installation of the rivet.

The seal and shaft assembly may be pulled from the pump housing after the rivet is removed.

To prevent damage to the cartridge seals or loss of lubricant, do not remove the cartridge from the shaft.

Position the "0" ring on the edge of the seal cartridge and press the cartridge squarely into the pump housing.

NOTE: Do not lubricate the "0" ring, groove in the pump body, or surface of seal cartridge to facilitate assembly of seal in body.

Insert the impeller in the housing, through the outlet, and install it on the pump shaft. Fasten the impeller to the shaft with a new rivet. Peen the rivet, working through the access hole in the housing while supporting the pump shaft.

Install a new gasket when assembling the pump to the cylinder block. Apply gasket seal to the gasket.

RADIATOR

The radiator is a conventional vertical flow type with the expansion tank located on top of the tube section. Although the capacities remain essentially the same, radiators, with increased fin area, are used on models equipped with air conditioning.

Water or anti-freeze solution should, whenever possible, be added to the radiator only when the system is cool. Coolant should be added to barely cover the tubes of the core. This precaution will prevent constant loss of coolant due to expansion when heated.

The Weather Eye valve should be fully open when refilling or flushing the system. The engine must be idling during the refilling idling during the refilling operation to prevent trapped air interferring with the circulation or Weather Eye operation.

A drain cock is provided on the lower tank of the radiator to drain the cooling system.

On the "Hornet" V-8 Series, two cylinder block pipe plug drains are also provided, one on the left side lower center, and the other on the right side lower rear.

ELECTRICAL Capacities

"Hornet" V-8 Series	28 Qts.
"Hornet" 6 Series	19-1/2 Qts.
"Wasp" Series	14 Qts.
"Rambler" Series	12 Qts.

Radiator Filler Cap

The cooling system radiator filler cap is an atmospheric vented cap. The atmospheric vent valve closes only if there is, a coolant vapor flow through the vent valve of .4 to .7 cubic feet per minute. When the vent valve closes, the system will become pressurized 61/4 to 73/4 pounds per square inch. Pressurizing the cooling system increases the boiling point of the coolant.
On models equipped with air conditioning, the pressure cap pressurizes the cooling system 12 to 15 pounds per square inch.

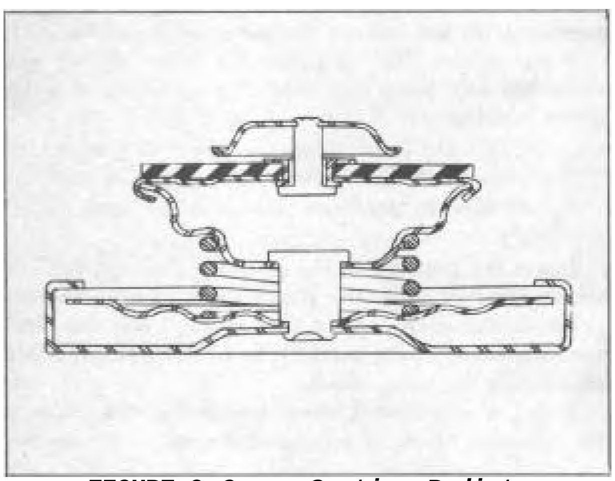


FIGURE 6—*Cross Section Radiator Filler Cap*

THERMOSTAT

"Hornet" 6, "Wasp", and "Rambler" Series

A thermostat is located in the cylinder head water outlet housing to insure proper engine operating temperatures for maximum economy and engine life. Always use a thermostat as an engine may be overcooled as well as over-heated.

"Hornet" V-8 Series

The thermostat is located in the coolant distribution manifold outlet. A restricted passage permits the coolant to circulate through the water pump and cylinder block when the thermostat is closed, thus by-passing the radiator core.

All Series

NOTE: *The thermostat should be checked whenever the cooling system is serviced and particularly at the time of installation of antifreeze solution.*

FAN ASSEMBLY

"Hornet" and "Wasp" Series

An "X" type fan is attached to a hub on the water pump shaft. When equipped with air conditioning, a five blade fan is used.

"Rambler" Series

A four blade fan is mounted on an adjustable bracket on the front of the engine block. When equipped with air conditioning, a five blade fan is used.

Fan Belt Adjustment

"Hornet" 6 and "Wasp" Series

The fan belt is adjusted by moving the generator on its mounting bracket to obtain a deflection of approximately 3/4" inward at a point midway between the water pump and generator pulleys.

"Hornet" V-8 Series

The fan belt is adjusted by moving the generator on its mounting bracket to obtain a deflection of approximately 1/2" inward at a point midway between the water pump and generator pulleys.

"Rambler" Series

The fan belt is adjusted by moving the fan assembly in a horizontal plane. The fan belt should be adjusted so that upon application of 25 pounds pressure, at a point midway between the fan and generator pulleys, it will deflect approximately 1/2".

All Series

It is important that the proper tension of the fan belt is maintained to insure efficient operation of the cooling and electrical systems. Too much tension will cause excessive wear on the fan and generator bearings.

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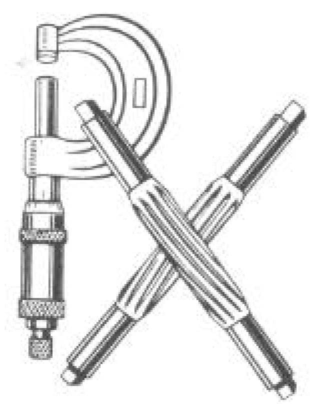

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ELECTRICAL

ELECTRICAL SECTION

BATTERIES (Auto-Lite)
The battery is a three cell, six volt unit with adequate storage capacity for the normal requirements of the car.

CAUTION: *Always connect positive terminal to ground.*

Specifications
"Hornet" Series
CT-1-15, 20 Hrs. 105 A.H., 20 Min. 133 Amps. 15 Plate.

"Wasp" and "Rambler" Series
1M-100, 20 Hrs. 100 A.H., 15 Plates.

Connecting Cables
Use only genuine replacement cables to insure the proper ground connections. Undersize cables reduce starting ability. Always apply vaseline to the hold-down clamp, nuts, and terminal connections when the battery is installed.

Servicing of Battery
The battery should be inspected every month or every 1,000 miles. The addition of distilled water, particularly in cold weather, should be made just before operating the car above charging speed. This insures mixture of the water with the acid.

Be sure that the height of the liquid in each cell is not less than 3/8" and not more than 1/2" over the top of the separators.

Battery Testing
At regular intervals, each cell of the battery should be tested with a hydrometer. The battery should register not less than 1.250 specific gravity in climates where freezing occurs, and not less 1.225 under more moderate conditions.
CAUTION: When replacing a battery in the carrier, do not tighten the hold-down clamp wing nuts excessively. It is unnecessary and will cause distortion of the battery case.

Discharge Causes
Following are a few of the factors that contribute to the discharge of a battery in use:

Improper regulator settings.
Oxidized regulator contact points.
Loose or corroded battery terminals.
High resistant ground connections.
Short circuits in wiring and terminal blocks.

GENERATOR (AUTO-LITE)
"Hornet" and "Wasp" Series
The Auto-Lite Model GGW-4801-F Generator used on the "Hornet" V-8 and Model GGW-4802-B used on the "Hornet" 6 and "Wasp" Series are six volt, two brush, shunt units with a ball bearing supporting the armature at the drive end and a bronze bushing at the commutator end (Fig. 1).

A fan integral with the pulley forces air through the generator to cool the armature. The generator output is regulated by the correct settings of the current and voltage regulator.

Lubrication
At time of regular chassis lubrication intervals, add 3 to 5 drops of medium engine oil to the oiler at the top of the drive end head. Fill the commutator end oil pocket with medium engine oil.

At overhaul, pack ball bearing 1/2 full with high temperature non-fibre grease and soak bronze bearing and felts in medium engine oil.

Maintenance
A periodic inspection should be made of the charging circuit. The intervals between these checks will vary depending upon the type of service. Dirt, dust, and high speed operation are factors which contribute to increased wear of the bearings, brushes, etc. Under normal conditions, an inspection of the generator should be made every 5000 miles.

A visual inspection should be made of all wiring to be sure that there are no broken wires and that all connections are clean and tight. Special attention should be paid to the ground connections at the battery, generator, and regulator.

If the commutator is dirty or discolored, it can be cleaned by holding a piece of No. 00 sandpaper against it while turning the armature slowly. Blow the sand out of the generator after cleaning the commutator. If the commutator is rough or worn, the generator should be removed from the engine, the armature removed, and the commutator turned down.

The brushes should slide freely in their holders. If the brushes are oil soaked or if they are worn to less than one-half of their original length, they should be replaced.

Check the brush spring tension of 35. to 53 ounces with a spring scale. To check, hook the scale in the hole in the end of the brush arm. Pull the scale on a line parallel to the face of the brush and take the reading just as the arm leaves the brush.

If the tension is excessive, the brushes and commutator will wear very rapidly. If the tension is low, arcing between the brushes and commutator will result in reduced output.

Overhaul Procedure
At periods of approximately 25,000 miles of operation, the charging circuit should be thoroughly checked and the generator removed from the engine and reconditioned.

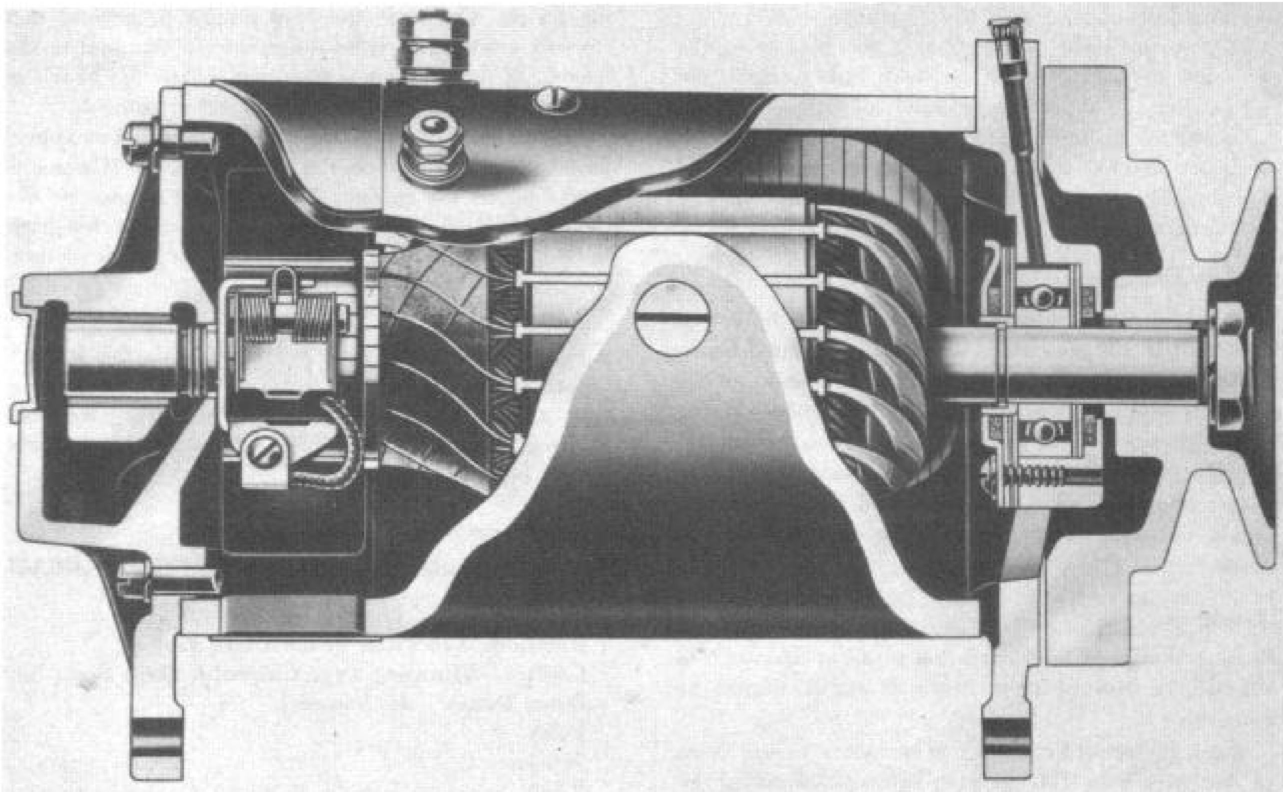


FIGURE ***1—Generator Auto-Lite Model GCW-4801-F***

Wiring

Be sure all connections are clean and tight and that there are no broken wires. The wiring should be inspected visually and then checked electrically. To check, connect an ammeter between the battery terminal of the regulator and the lead removed from this terminal. Run the engine at a medium speed and turn on lights or accessories to obtain a generator output of 10 amperes.

At this 10 ampere charging rate, a voltage reading should be taken with a 10 volt voltmeter between the following points:

Generator frame to battery ground post—.03 volt maximum

Battery ground post to regulator base—.03 volt maximum

Battery post to regulator "B" terminal—.1 volt maximim

Generator "armature" terminal to regulator "armature" terminal—.1 volt maximum

Generator "field" terminal to regulator "field" terminal—.05 volt maximum

If readings higher than these are obtained, the cause should be located and corrected.

Armature

The armature should be visually inspected for mechanical defects.

If the commutator is rough or worn, it should be turned down in a lathe. After turning the commutator, the mica should be undercut to a depth of 1/32". When undercutting the mica, the cut should be square and free from burrs. The maximum eccentricity of the commutator is not to exceed .0005".

For testing armature circuits, it is advisable to use a set of test probes consisting of a lamp in series with two test points and connected to a 110 volt lighting circuit.

To test armatures for ground, connect one point of a set of test probes to the core or shaft (not on bearing surfaces) and touch a commutator segment with the other probe. If the lamp lights, the armature winding is grounded and the armature should be replaced.

To test for shorted armature coils, a growler is necessary. Place the armature on the growler and hold a thin steel strip on the armature core. The armature is then rotated slowly by hand and if a shorted coil is present, the steel strip will vibrate.

Field Coils

Using the test probes, check the field coils for both opens and grounds.

To test for open coils, connect the probes to the two leads of each coil. If the lamp fails to light, the coil is open and should be replaced.

To test for grounds, place one probe on the generator frame and the other on the field coil terminals. If a ground is present, the lamp will light and the coil should be replaced.

Brush Holders

With test probes, check the insulated brush holder to be sure it is not grounded. Touch the insulated brush holder with one probe and a convenient ground on the commutator end plate with the other probe. If the lamp lights, it indicates a grounded brush holder.

Inspect the brush holders for distortion and improper alignment. The brushes should slide freely and should be perfectly in line with the commutator segments.

Brushes

Brushes that have been subjected to oil or are worn to one-half or less of their original length should be replaced.

When replacing brushes, it is necessary to seat them so that they have 100 per cent surface contacting the commutator. The brushes should be sanded to obtain this fit. This can be done by drawing a piece of No. 00 sandpaper between the commutator and brush and against the brush holder. Do not sand too much as it merely shortens brush life. After sanding the brushes, blow the sand and carbon dust out of the generator. The generator should then be run under load long enough to secure a perfect brush fit. Generators are not to be tested for output until after the brushes are seated.

Assembly of Generator

Pack the ball bearing 1/2 full with a high melting point grease and soak the felts in medium engine oil before assembly.

Generator Test

After the generator is assembled and the brushes are properly fitted, the generator should be bench tested under conditions of speed, voltage, current, and temperature as near as possible to its operation on the engine before installation.

To check the field coil draw, connect a battery and ammeter in series with the field coils and connect a voltmeter across the field coil terminals. Adjust the voltage to the specified value and read the ammeter which should be within the limits specified.

Any other reading indicates faulty field coils or connections.

Check the motorizing draw. Connect an ammeter and battery in series with the armature terminal and the frame. Complete the field circuit to ground and connect a voltmeter from the armature terminal to the frame. If the reading is too high, check the bearings and armature for binding and correct alignment.

Check the output with generator connected as above. Drive the generator on the test bench, or if none is available, on the engine. If the output cannot be obtained or if the speed is too high, inspect for high resistance connections and for improper brush seating.

Polarizing Generator

All generators should be polarized with the battery before running. This can be done by using a jumper wire momentarily from the negative battery terminal to the armature terminal of the generator with the field circuit completed to ground.

Generator Specifications
Auto-Lite Model GGW-4801-F and GGW-4802-B

Volts - 6
Rotation—Clockwise at the Drive End
Control—Vibrating Type Current-Voltage Regulator Rated Output-45 Amperes
Poles - 2
Brushes - 2
Brush Spring Tension-35 to 53 Ounces with new brushes. Measure with scale hooked in the hole in the end of the brush arm. Pull on a line perpendicular to the top of the brush and take the reading just as the arm leaves the brush.
End Play—.003" to .010"
Ground Polarity—Positive
Field Coil Draw-1.6 to 1.7 amperes at 5 volts. Measure from armature to field terminals.
Motorizing Draw-5.0 to 5.5 amperes at 5 volts. Have field terminal grounded to frame and measure from armature termi nal to a ground on the frame.
Output Tests (Cold) —6.4 Volts, 0 Amperes at 870 to 970 R.P.M.; *8.0 Volts, 45 Amperes at 1925 to 2125 R.P.M. (Hot) —6.4 Volts, 0 Amperes at 950 to 1050 R.P.M.; *8.0 Volts, 45 Amperes at 2350 to 2550 R.P.M.
*Do not operate at more than 45 Amperes for any length of time as to do so may result in burned armature and field windings.

VIBRATING CURRENT-VOLTAGE REGULATORS (Auto-Lite)
"Hornet" and "Wasp" Series

The Auto-lite Model VBE-6101-A regulators are used with shunt type generators and have three units each with a separate function to perform. These units are the circuit breaker unit, the voltage regulator unit, and the current limiting regulator unit.

Circuit Breaker

The circuit breaker consists of an electromagnet and a set of contacts. The contacts are mounted with one on a stationary bracket and the other on a movable armature which is controlled by the electromagnet. The movable contact is mounted on a spring arm so that as the contacts open and close a slight wiping action is produced.

The electromagnet of the circuit breaker has two windings, one, the shunt coil which is connected across the generator output like a voltmeter and the other a series coil connected in series with the generator output like an ammeter. These two coils are wound in the same direction so that when the generator is charging the battery, the magnetism of the series coil increases the total magnetism. When the battery discharges back through the generator, the magnetism of the series coil is reversed and the magnetism of the two coils is opposed. This results in a decreased pull on the armature and spring action opens the contacts.

The sequence of operation of the circuit breaker unit is as follows:

When the generator is not running, the contacts are open. When the generator is started, the voltage builds up at the armature terminal and in the shunt coil and as soon as it reaches the value for which the circuit breaker is calibrated, there is sufficient magnetism created by the shunt coil to pull down the armature, closing the contacts which automatically connects the generator to the battery. With the contacts thus closed, the current in the series coil is flowing from the generator to the battery or in the same direction as the current in the shunt coil, so that the pull on the armature is increased by the magnetism of the series coil.

When the engine is stopped and the generator speed decreases, the voltage falls, and as soon as the generator voltage drops below the battery terminal voltage, the current flows from the battery to the generator, reversing the direction of current in the series coil so that the magnetism created by the series coil opposes and reduces the magnetism of the shunt coil. This reduces the pull on the armature to a point where spring action opens the contacts.

Voltage Regulator

The function of the voltage regulator is to hold the generated voltage at a predetermined value as long as the circuit values allow the voltage to build up to the operating voltage.

The electromagnet of the voltage regulator unit has a winding of many turns of fine wire and is connected across the charging circuit so that the system voltage controls the amount of magnetism.

The contacts of the voltage regulator unit are connected in the generator field circuit so that the field circuit is completed through the contacts when they are closed and through a resistor when the contacts are opened. When the voltage rises to a predetermined value, there is sufficient magnetism created by the regulator winding to pull the armature down. This opens the contacts and inserts resistance in the field circuit of the generator, thus reducing the field current. The generated voltage immediately drops which reduces the pull on the armature to the point where the spring closes the contacts. The output again rises and the cycle is repeated.

These cycles occur at high enough frequencies to hold the generated voltage at a constant value and will continue as long as the voltage of the circuit is high enough to keep the voltage regulator in operation. With the addition of a current load great enough to lower the battery voltage below the operating voltage of the unit, the contacts will remain closed and the generator will maintain a charging rate as limited by its speed or the current limiting regulator.

Due to the effect of heat on the operating characteristics of regulator windings, it is necessary to compensate for the changes in coil resistance when the regulator is operating under varying temperature conditions. This is accomplished through the use of a nickel iron magnetic by-pass on the voltage regulator unit. This shunt by-passes some of the magnetic flux when the unit is cold and allows most of the flux to act on the armature when the unit is hot. Thus, when the coil is hot and not as efficient, the magnetic shunt reduces the amount of flux needed to vibrate the armature.

The compensation is usually more than enough to offset the changes in regulator coil resistance due to heat. The excess compensation allows the regulator to operate at higher voltages under cold operating conditions than under hot conditions. This is necessary as it requires a higher voltage to charge a battery with its internal resistance increased by low temperature.

Current-Limiting Regulator

The function of the current-limiting regulator is to limit the output of the generator to its maximum safe output.

The electromagnet of the current regulator unit consists of a winding of heavy wire that is connected in series with the generator output. When the generator output reaches a predetermined value, the current in the winding produces enough magnetism to overcome the spring tension and pull the armature down. This opens the contacts and inserts resistance in the field circuit of the generator. With the field current reduced by the resistance, the generator output falls and there is no longer enough magnetism to hold the contacts open. As soon as the spring closes the contacts, the output rises and the cycle is repeated. These cycles occur at high enough frequencies to limit the output to a minimum fluctuation.

VIBRATING CURRENT-VOLTAGE REGULATOR SPECIFICATIONS
(AUTO-LITE VBE-6010-A)

Volts	6
Ground Polarity	Positive
Carbon Resistors	Two used—R1 marked 38, Resistance 34.5 to 42 Ohms. R2 marked 7, Resistance 6.5 to 8 Ohms.
Cutout Relay	Resistance of voltage windings 29.8 to 33 Ohms. Armature Air Gap .031" to .034". Contact Point Gap .015" Minimum. Contacts Close 6.3 to 6.8 Volts. Contacts Open 4.1 to 4.8 Volts after a charge of 23 Amperes.
Current Limiting Regulator	Armature Air Gap .048" to .052". Operating Amperage after 15 minutes run at 10 Amperes.

Temp. F.	40°	60°	70°	80°	100°
Amperes	55 Max.	53 Max.	52 Max.	51 Max.	49 Max.

After an additional 15 minutes run on current regulator with voltage reduced .2 to .4 volts below the V.R. operating figure.

Temp. F.	40°	60°	70°	80°	100°
Amperes	46-50	44-48	43-47	42-46	40.44

Voltage Regulator	Resistance of winding 10.8 to 12 Ohms. Armature Air Gap .048" to .052". Operating Voltage—Figures given for a unit in normal operation and charging at 23 Amperes. Allowable variation ± .15 Volts.

Temp. F.	50°	60°	70°	80°	90°	100°	110°	120°
Volts	7.41	7.38	7.35	7.32	7.29	7.27	7.24	7.21

The current regulator unit is built with a bi-metal hinge on the armature. This hinge exerts an additional tension on the armature when the unit is cold and in- creases the current necessary to vibrate the contacts. This increases the available output when the generator and regulator are cold without danger of overheating under prolonged operation.

Operation Test

Check the wiring to see that it is properly connected to the generator.

Make sure the generator operates correctly without the regulator in the circuit.

Remove the armature and battery leads from the regulator and connect an ammeter between them. Remove the field lead from the regulator and while operating at idle speed, touch the field lead to the regulator base. Increase the speed slowly, noting the charging rate. DO NOT INCREASE THE OUTPUT ABOVE THE RATED OUTPUT OF THE GENERATOR. If the generator output will not build up, inspect the wiring harness for shorts and opens and remove the generator for an overhaul.

Make sure the regulator is the correct type for use with the generator.

Check the specific gravity and terminal voltage of the battery. If the battery is not up to specifications, substitute temporarily for test purposes a fully charged battery of the same type and capacity.

Inspect the wiring between the generator, regulator, and battery for broken wires and high resistance connections. Pay special attention to the ground conneCLions at all three units.

Connect a reliable ammeter with one ampere graduations in series with the regulator "B" terminal and the lead removed from this terminal. Run the generator at a medium speed and turn on lights or accessories until the ammeter shows one-half of the maximum charging rate. At this charging rate, measure the voltage drop between the following points using an accurate voltmeter graduated in .1 volt divisions. The voltmeter should not show a reading above the maximum noted.

Generator "A" terminal to regulator "A" terminal—.1 volt max.

Generator "F" terminal to regulator "F" terminal-.05 volt max.

Battery terminal to regulator "B" terminal—.1 volt max.

Regulator ground screw to generator frame—.03 volt max.

Regulator ground screw to battery ground post—.03 volt max.

Generator frame to battery ground post—.03 volt max.

Circuit Breaker (End Unit—with Heavy Wire Winding)

Connect a reliable ammeter in series with the regulator "B" terminal and the lead removed from the terminal. Connect an accurate volt-

-meter from the regulator "A" terminal to the regulator base and place a reliable thermometer near the regulator (about 2" from the regulator cover but not touching the regulator).

Disconnect the field lead from the regulator "F" terminal and insert a variable resistance (3 amp.-50 ohm capacity) between the lead and the regulator terminal.

Run the generator at about 1000 generator R.P.M. Insert all the resistance in the field circuit. Then slowly reduce the resistance, noting the voltage reading just before the change caused by the closing of the circuit breaker. Increase the charging rate to the figure specified for the regulator being tested. Then reduce the charging rate by inserting resistance in the field circuit. Note the voltmeter and ammeter reading just before the circuit breaker opens and the ammeter reading drops to zero. The closing voltage and the opening voltage or current should be within the limits specified.

An accurate method for noting the exact instant of opening or closing of the circuit breaker is to connect a headphone (2000 ohms or higher) to the battery and armature terminals of the regulator. When the contacts open or close, a click will be heard in the headphone.

Before adjusting circuit breaker opening or closing voltage, check the armature air gap .031" to .034"; contacts should be open and the armature against the upper stop (Fig. 2). Measure the gap with the gauge as near to the hinge as possible.

To adjust the closing voltage, change the armature spring tension by bending the hanger at the lower end of the spring (Fig. 3). Increase the spring tension to raise the closing voltage or decrease the tension to lower the voltage.

To adjust the opening voltage, raise or lower the stationary contact keeping the contacts perfectly aligned (Fig. 4). Increasing the contact gap lowers the opening voltage. Change the contact gap by expanding or contracting the stationary contact bracket, keeping the contacts aligned. Do not adjust the gap between the contacts to less than the specified minimum.

Voltage Regulator (End Unit—with Fine Wire Winding)

Connect the ammeter as noted above and connect the voltmeter from the regulator "B" terminal to the regulator base. Remove the variable resistance from the field circuit.

Operate the generator at one-half maximum output for 15 minutes to make sure the regulator is at normal operating temperature. Have the cover on the unit during this warm-up period and when taking readings.

Stop the engine. Then bring it up to approximately 2500 generator R.P.M. Adjust the amperage to one- half maximum output by turning on lights or accessories and then note the voltmeter reading. This reading should be within the limits specified for the voltage regulator operation.

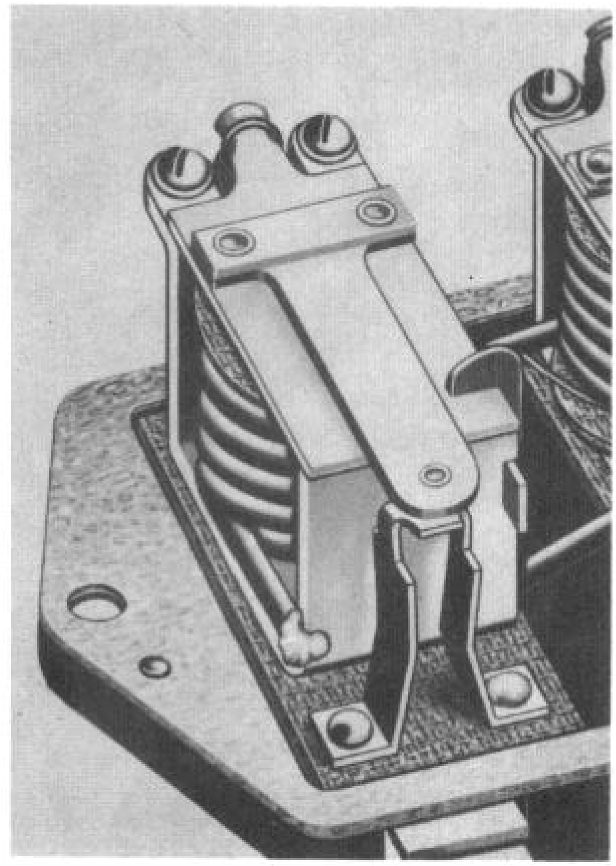


FIGURE 2—*Circuit Breaker Armature Stop. for Control of Air Gap*

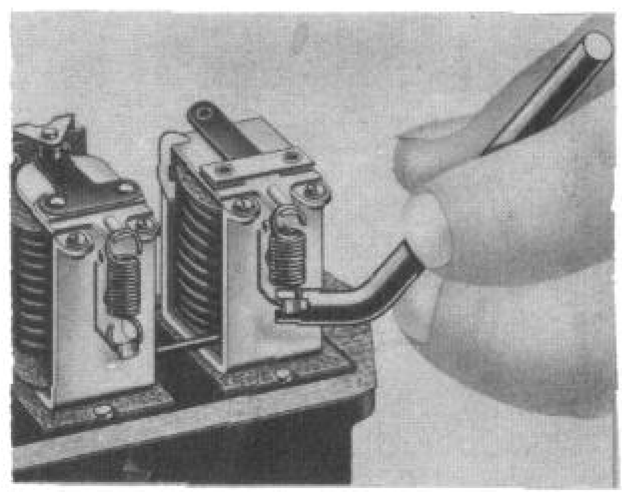


FIGURE 3—*Adjusting the Circuit Breaker Closing Voltage*

Before adjusting operating voltage, check voltage relay armature air gap .048" to .052"; contacts should be closed with a high limit gauge in place (Fig. 5) and open with a low limit gauge on the contact side and next to the brass armature stop pin.

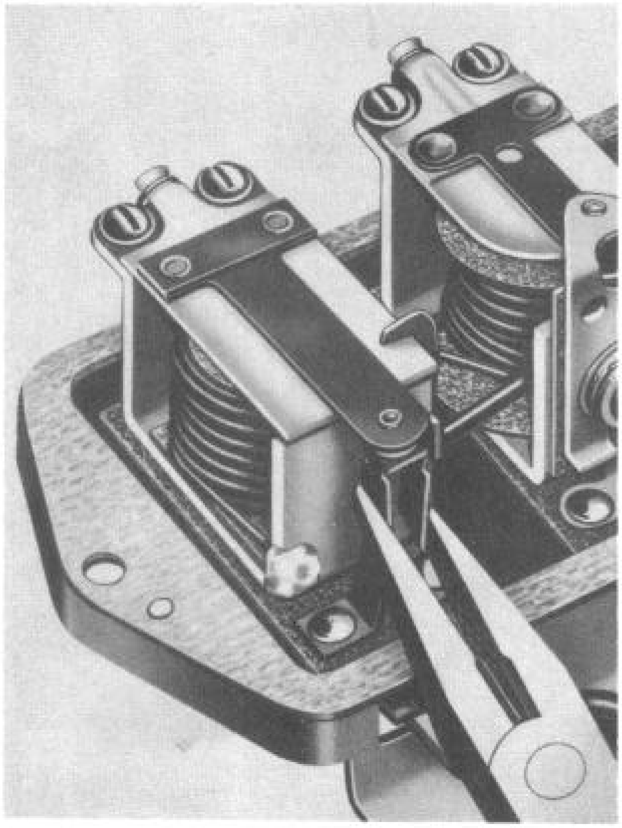


FIGURE 4—***Adjusting the Circuit Breaker Opening Voltage***

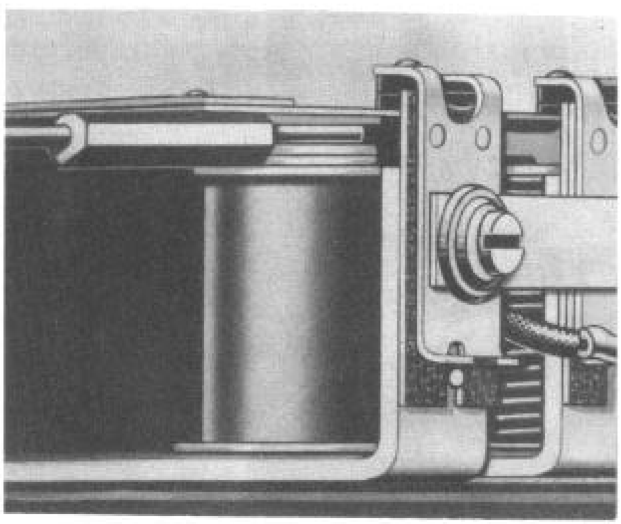


FIGURE 5—***Checking Voltage Relay Armature Air Gap***

To adjust the operating voltage, change the armature spring tension by bending the hanger at the lower end of the armature spring. After each adjustment stop the engine; then restart it. Bring it up to speed and adjust the current before taking a reading.

In order to obtain an accurate indication of the operation of the voltage regulator unit, connect a headphone (2000 ohms or higher) between the "F" terminal and ground to pick up the sound of the opening and closing of the contacts. The clicks should be regular and clear without irregularities or missing. If the tone is not clear and regular, remove the regulator cover and inspect the contacts. The contacts should be flat and not burned excessively and should be aligned to make full face contact. If the contacts require cleaning, refer to subject "Contacts."

Current Regulator (Center Unit—with Heavy Wire Winding)

Connect the regulator and instruments as described above for the voltage regulator and run the generator at approximately 3000 generator R.P.M. Turn on lights and accessories so that the generator must charge at its maximum rate. The ammeter should show a reading within the limits specified.

Before adjusting the operating amperage, check armature air gap .048" to '.052". Contacts should be closed with a high limit gauge in place (Fig. 5) and open with a low limit gauge on the contact side and next to the brass armature stop pin.

To adjust the operating amperage, change the armature spring tension by bending the hanger at the lower end of the armature spring. After each adjustment. stop the engine; then restart it. Bring the engine up to speed and take an ammeter reading. Have the cover on the unit when taking readings.

In order to obtain an accurate indication of the operation of the current regulator unit connect a headphone (2000 ohms or higher) between the regulator "F" terminal and ground to pick up the sound of the opening and closing of the contacts. The clicks should be clear and regular without irregularities or missing. If the tone is not clear and regular, remove the regulator cover and inspect the contacts. The contacts should be flat and not burned excessively and should be aligned to make full face contact. If the contacts require cleaning, refer to subject "Contacts."

Contacts

Inspect the contacts on all three units. In normal use, the contacts will become gray in color. If the contacts are burned or dirty or if they are not smooth, file the contacts with a No. 6 American Swiss cut equalling file. Move the file parallel and lengthwise to the armature (Fig. 6).

File just enough so that the contacts present a smooth surface toward each other. It is not necessary to remove every trace of burning. After filing, dampen a piece of linen or lintless bond tape in refined carbon tetrachloride and draw the tape between the contacts. Repeat with a dry piece of tape. Use clean tape for each set of contacts.

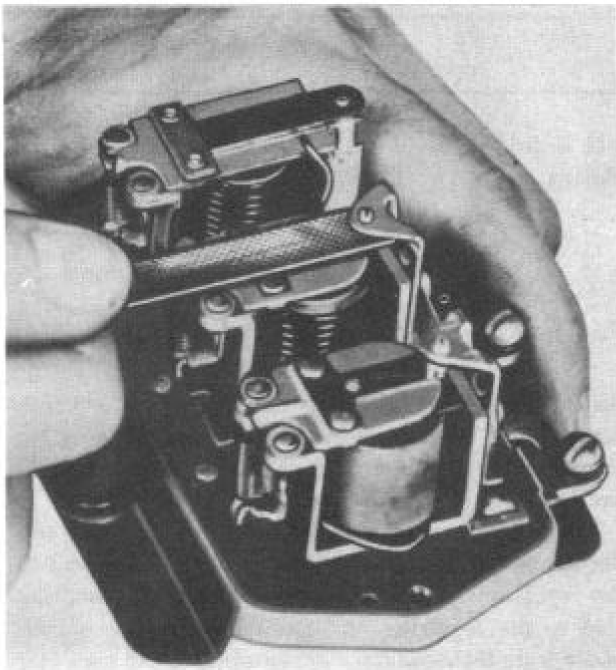


FIGURE 6—*Cleaning Contact Points*

Recheck

Operate the unit at one-half maximum output for 5 minutes with the cover on the regulator. Repeat the testing procedure for all units as described in the preceding paragraphs. Be sure cover is on regulator when taking readings.

Quick Checks

LOW CHARGING RATE WITH A FULLY CHARGED BATTERY: A fully charged battery and a low charging rate indicates normal regulator operation.

A further check of the regulator operation can be made by using the starting motor for 5 to 10 seconds with the ignition primary circuit open. Then start the engine and operate at a generator speed of 2500 to 3000 R.P.M. The charging rate should rise to its maximum value, then taper off to a minimum charge as the battery becomes charged.

HIGH CHARGING RATE WITH A FULLY CHARGED BATTERY: This usually is an indication that the voltage regulator is not operating correctly. The high voltage will cause the battery to gas excessively and will shorten the life of the ignition contacts and in general will have a detrimental effect on all connected load.

Connect an ammeter in series with the regulator "B" terminal and the lead removed from the terminal. Run the generator at a medium speed and perform the following operations. After each test is completed, reconnect whatever leads have been opened.

OPERATION	EFFECT	CAUSE AND REMEDY
Disconnect the field lead at the generator.	Output should drop to zero. Output does not drop.	Shorted field circuit in regulator or in wiring harness. See operation below.
Disconnect the field lead at the regulator.	Output should drop to zero. Output does not drop.	Shorted field in regulator. See operation below. Shorted wiring harness. Repair or replace wiring harness.
Remove the regulator cover and hold the voltage regulator contacts open.	Output should drop to zero. Output does not drop.	Regulator contacts sticking, regulator out of adjustment or regulator inoperative. Check for high resistance. Check operation. Clean contacts. Shorted field circuit in the regulator. Clean the regulator contacts and inspect the regulator visually for incorrect wiring between units and shorted leads.
Operate the units at one-half maximum output and measure the voltage drop from the regulator base to the generator frame.	Voltage reading should be below .03 volts. Voltage reading above .03 volts.	Ground circuit O.K. Inspect ground circuit for poor connections and eliminate the high resistance.

OPERATION	EFFECT	CAUSE AND REMEDY
Connect a headphone from the regulator field terminal to the base and hold the current regulator contacts closed.	A steady beat should be heard. An unsteady beat is heard. No beat is heard.	Voltage regulator operating. Reset regulator. Dirty or sticking contacts. Clean contacts. Inoperative voltage regulator unit. Remove regulator for an overhaul.

LOW BATTERY AND A LOW OR NO CHARGING RATE: Check all wiring for loose connections, frayed insulation, and high resistance connections and correct any fault.
Make sure the generator operates correctly without the regulator in the circuit. Remove the "A" and "B" leads from the regulator and connect an ammeter between them. Remove the field lead from the regulator and while operating at idle speed, touch the field lead to the regulator base. Increase the speed slowly, noting the charging rate. Do not increase the output above the rated output of the generator. If the generator output will not build up, inspect the wiring harness for shorts and opens and remove the generator for an overhaul.

Connect an ammeter between the battery lead and the regulator "B" terminal. Connect the field lead to the regulator "F" terminal and connect the armature lead to the regulator "A" terminal. Connect a voltmeter from the regulator "A" terminal to the regulator base. Operate the generator at a medium speed and perform the following tests:

OPERATION	EFFECT	CAUSE AND REMEDY
Read the voltmeter.	Voltage should build up. Voltage does not build up.	Open series circuit. Regulator out of adjustment, field circuit open, grounded series circuit.
Remove the regulator cover and with the generator operating at a medium speed, hold the circuit breaker contacts closed.	Ammeter should indicate charge. No generator output.	Open circuit breaker shunt winding, incorrect setting of circuit breaker or dirty contacts. Clean contacts and reset circuit breaker. If there is still no charge, the series windings are open and the regulator should be removed for an overhaul. If the circuit breaker cannot be set, the shunt coil is open and the regulator should be removed for an overhaul.
Run the generator at idle speed and momentarily connect a jumper from the "F" terminal to the regulator base.	Voltage should build up. Voltage does not build up.	Open field circuit or regulator out of adjustment. Grounded series circuit. Remove regulator for an overhaul.
Operate at a medium speed with the jumper removed. Remove the regulator cover and hold the voltage regulator contacts closed.	Voltage should build up. Voltage does not build up.	Voltage regulator contacts burned or dirty or incorrect regulator setting. Clean the contacts and adjust the regulator. Test again. If the voltage still does not build up, see test operation below.

OPERATION	EFFECT	CAUSE AND REMEDY
Remove the regulator cover and hold the current regulator contacts closed.	Voltage should build up. Voltage does not build up.	Current regulator contacts burned or dirty or incorrect regulator setting. Clean the contacts and adjust the regulator. Test again. If the voltage still does not build up, remove the regulator for an overhaul.

GENERATOR (DELCO-REMY)
"Rambler" Series

The Delco-Remy generator model 1102815 is used with Air Conditioning equipment and model 1100021 on the "Rambler" Series without Air Conditioning.

The generators are a six volt 4.630 inch diameter frame size, two brush shunt unit with a ball bearing supporting the armature at the drive end and a bronze bushing in the commutator end. It is force draft ventilated by means of a fan mounted behind the drive pulley which rotates with the armature shaft. The generator output is regulated by the correct settings of the current and voltage regulator.

Lubrication

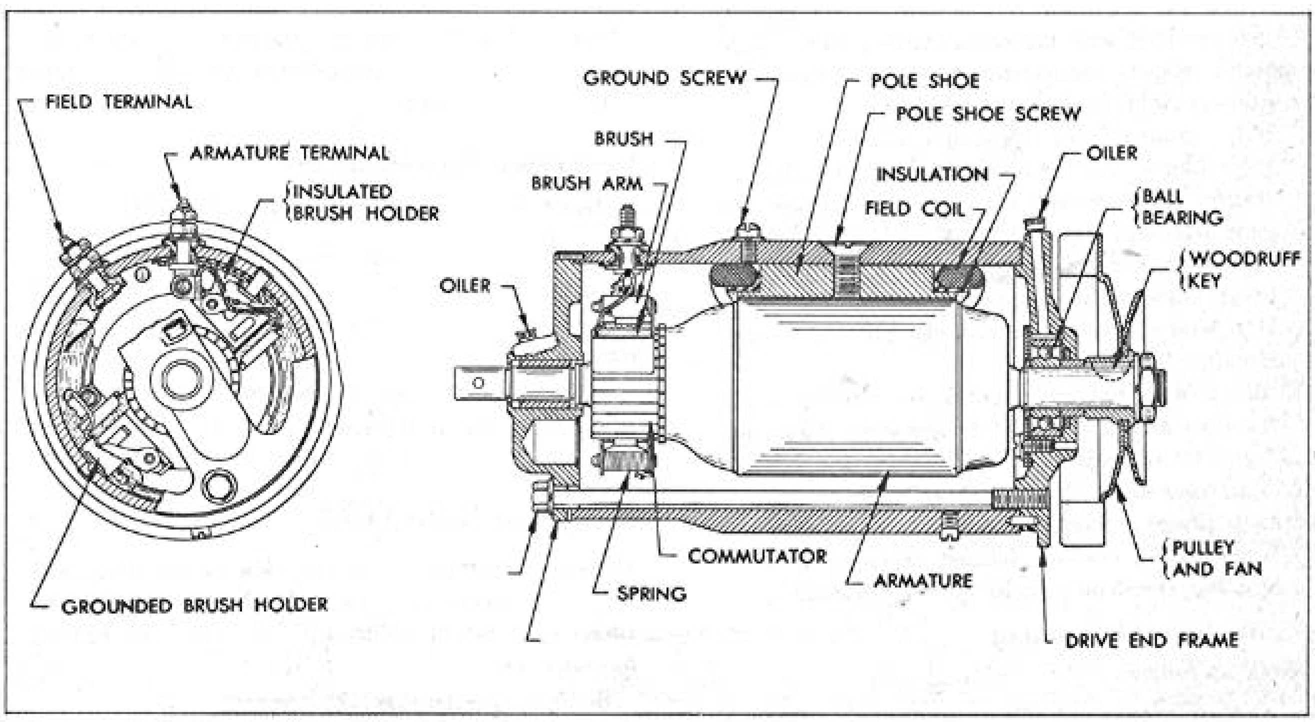
The two hinge cap oilers should be supplied with 10 to 20 drops of light engine oil every 5,000 miles of operation. Do not oil excessively. NEVER OIL COMMUTATOR.

Inspection

The generator should be removed and disassembled to inspect the commutator and brushes at regular intervals. If the commutator is dirty, it may be cleaned with No. 00 sandpaper. Blow out all dust after cleaning. NEVER USE EMERY CLOTH TO CLEAN COMMUTATOR. If the commutator is rough, out of round, or has high mica, it should be turned down in a lathe and the mica undercut %2".

Worn brushes should be replaced. Brushes should be free in their holders.
Check the brush spring tension which should be 28 ounces.

At regular intervals, (actual mileage or time depending on the type of operation) the generator should be disassembled for a thorough cleaning and inspection of all parts. Never clean the armature or fields in any degreasing tank, or with grease dissolving materials, since these may damage the insulation. The ball bearing should be cleaned



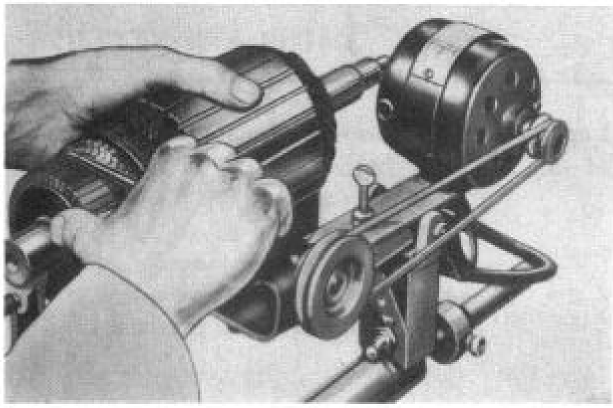


FIGURE 8—*Undercutting Mica*

and repacked with a good grade of ball bearing grease. The commutator should be trued in a lathe and the mica undercut if necessary.

All wiring and connections should be checked. Rosin flux should be used in making soldered connections. Acid flux must never be used on electrical connections.

Checking Inoperative Generator

Several conditions which may require removal of the generator from the engine and further checking of the generator are no output, unsteady or low output, excessive output or noisy generator.

No Output

Remove the generator, disassemble, and check for sticking or worn brushes and burned commutator bars. Burned bars, with other bars fairly clean, indicate open circuited armature coils. Then reassemble the generator. If the brushes are making a good contact with the commutator and the coinmutator appears satisfactory, use test leads and continuity light and check as follows:

Raise ground brush through cooling vent openings. Check with test points from "A" terminal to frame. Light should not light. If it does, the generator is grounded; raise the other brush from commutator and check field commutator and brush holder to locate ground.

If generator is not grounded, check field for open circuit.

If the field is not open, check for shorted field. Field draw at six volts, 80° temperature should be 1.87 to 2.00 amperes on Model 1102815 and 1.85 to 2.03 amperes on Model 1100021. Excessive current draw indicates a shorted field.

If trouble has not been located, remove the armature and check on growler for short circuit.

Unsteady or Low Output

Check as follows:

Check drive belt tension.

Check brush spring tension and brushes for sticking.

Inspect commutator for roughness, grease and dirt, dirt in slots, high mica, out of round, or burned bars. With any of these conditions, the commutator must be turned down in a lathe and mica undercut. In addition, when burned bars indicate an open circuit, the open circuit condition must be eliminated or the armature replaced.

Excessive Output

Excessive output usually results from grounded generator field—grounded either internally or in the regulator. Opening the field circuit (disconnecting lead from "F" terminal of regulator or generator) with the generator operating at a medium speed, will determine which unit is at fault. If the output drops off, the regulator is causing the condition. If the output remains high, the field is grounded in the generator either at the pole shoes, leads, or at the "F" terminal.

Noisy Generator

Noisy generator may be caused by loose mounting or drive pulley, worn, dry, or dirty bearings, or improperly seated brushes.

Installation Caution

After the generator is reinstalled on the engine, or at any time after leads have been disconnected and then reconnected to the generator, a jumper lead should be connected MOMENTARILY between the BATTERY and ARMATURE terminals of the regulator before starting the engine. This allows a momentary surge of current from the battery to the generator which correctly polarizes the generator with respect to the battery it is to charge.

Generator Specifications

Delco-Remy Generator Model 1102815

Armature rotation—clockwise viewing the drive end 45 amperes at 8.0 volts at 2450 Generator R.P.M. (maximum output controlled by setting of current regulator unit).

Brush spring tension-28 ounces.

Field current at six volts (at 80°F.) 1.87 to 2.00 amperes.

Delco-Remy Model 1100021

Armature rotation—Clockwise viewing the drive end —35 amperes at 8.0 volts at 2650 Generator R.P.M. (maximum output controlled by setting of current regulator unit).

Brush spring tension-28 ounces.

Field current at six volts (at 80°F.) 1.85 to 2.03 amperes.

CURRENT AND VOLTAGE REGULATORS (Delco-Remy)

The Delco-Remy Models 1118828 and 1118841 (six volt) current and voltage regulators (Fig. 9) are designed for operation with a positive grounded battery and have the following specifications:

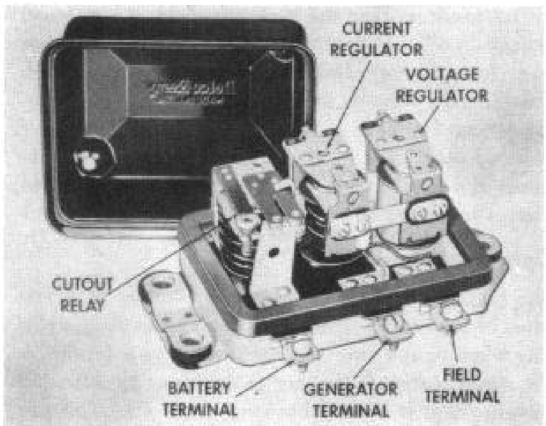


FIGURE 9—*Current and Voltage Regulator*

Specifications
"Rambler" Series with Air Conditioning (Delco-Remy Model 1118828)

Cut-Out Relay

Air Gap	.020"
Point Spacing	.020"
*Closing Voltage Range	5.9-6.7 Volts
Adjust to	6.4 Volts

Current Regulator

Air Gap	.075"
*Current Setting Range	42-47 Amperes
Adjust to	45 Amperes

Voltage Regulator

Air Gap	.075"
*Voltage Setting Range	6.9-7.4 Volts
Adjust to	7.2 Volts

"Rambler" Series without Air Conditioning (Delco-Remy Model 1118841)

Cut-Out Relay

Air Gap	.020"
Point Spacing	.020"
*Closing Voltage Range	5.9-6.7 Volts
Adjust to	6.4 Volts

Current Regulator

Air Gap	.075"
*Current Setting Range	34-39 Amperes
Adjust to	38 Amperes

Voltage Regulator

Air Gap	.075"
*Voltage Setting Range	6.9-7.4 Volts
Adjust to	7.2 Volts

NOTE: *Adjustment need not be made if check shows value within range given. When adjustment is necessary, adjust to specified value.*

*Current and voltage specifications apply only at operating temperatures. Operating temperature shall be assumed to exist after not less than 15 minutes of continuous operation with a charge rate of 8 to 10 amperes.

Construction and Operation (Delco-Remy Current and Voltage Regulators)

The regulator (Fig. 9) consists of a cut-out relay, a voltage regulator, and a current regulator unit. The cutout relay closes the generator-to-battery circuit when the generator voltage is sufficient to charge the battery. and it opens the circuit when the generator slows down or stops. The voltage regulator unit is a voltage-limiting device that prevents the system voltage from exceeding a specified maximum and thus protects the battery and other voltage-sensitive equipment. The current regulator unit is a current-limiting device that limits the generator output so as not to exceed its rated maximum. Figure 10 is a wiring diagram of this regulator in the charging circuit.

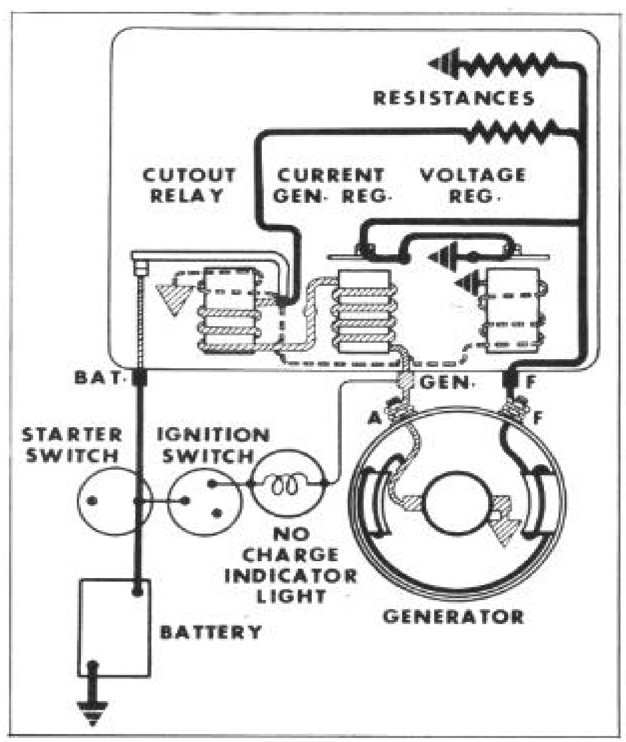


FIGURE 10—*Schematic Drawing of Charging Circuit*

Cut-Out Relay

The cut-out relay has two windings, a series winding of a few turns of heavy wire and a shunt winding of many turns of fine wire. The shunt winding is connected across the generator so that generator voltage is impressed upon it at all times. The series winding is connected in series with the charging circuit so that all generator output passes through it. The relay core and windings are assembled into a frame. A flat steel armature is attached to the frame by a flexible hinge so that it is centered just above the end of the core. The armature contact points are located just above the stationary contact points. When the generator is not operating, the armature contact points are held away from the stationary points by the tension of a flat spring riveted on the side of the armature.

Cut-Out Relay Action

When the generator voltage builds up a value great enough to charge the battery, the magnetism induced by the relay windings is sufficient to pull the armature toward the core so that the contact points close. This completes the circuit between the generator and battery. The current which flows from the generator to the battery passes through the series winding in a direction to add to the magnetism holding the armature down and the contact points closed.

When the generator slows down or stops, current begins to flow from the battery to the generator. This reverse flow of current through the series winding causes a reversal of the series winding magnetic field. The magnetic field of the shunt winding does not reverse. Therefore, instead of helping each other, the two windings now magnetically oppose so that the resultant magnetic field becomes insufficient to hold the armature down. The flat spring pulls the armature away from the core so that the points separate; this opens the circuit between the generator and battery.

Voltage Regulator

The voltage regulator unit has a shunt winding consisting of many turns of fine wire which is connected across the generator. The winding and core are assembled into a frame. A flat steel armature is attached to the frame-by a flexible hinge so that it is just above the end of the core. The armature contains a contact point which is just beneath a stationary contact point. When the voltage regulator unit is not operating, the tension of a spiral spring holds the armature away from the core so that the points are in contact and the generator field circuit is completed to ground through them.

Voltage Regulator Action

When the generator voltage reaches the value for which the voltage regulator unit is adjusted, the magnetic field produced by the winding overcomes the armature spring tension, pulls the armature down, and the contact points separate. This inserts resistance into the generator field circuit. The generator field current and voltage are reduced. Reduction of the generator voltage reduces the magnetic field of the regulator shunt winding.

The result is that the magnetic field is weakened enough to allow the spiral spring to pull the armature away from the core, and the contact points again close. This directly grounds the generator field circuit, causing generator voltage and output to increase. The above cycle of action again takes place, and the cycle continues at a rate of many times a second, regulating the voltage to a predetermined value.

Current Regulator

The current regulator has a series winding of a few turns of heavy wire which carries all generator output. The winding and core are assembled into a frame. A flat steel armature is attached to the frame by a flexible hinge so that it is just above the core. The armature has a contact point which is just below a stationary contact point. When the current regulator is not operating, the tension of a spiral spring holds the armature away from the core so that the points are in contact. In this position, the generator field circuit is completed to ground through the current regulator contact points in series with the voltage regulator contact points.

Current Regulator Action

When the generator output reaches the value for which the current regulator is set, the magnetic pull of the winding overcomes armature spring tension, pulls the armature down and opens the contact points. This inserts a resistance into the generator field circuit. The generator output and field current are reduced. Reduction of the current output reduces the magnetic field of the current regulator winding. The result is that the magnetic field is weakened enough to allow the spiral spring to pull the armature up and the contact points close again. This directly grounds the generator field circuit, causing the generator output to again increase. This cycle is repeated many times a second, limiting the generator output so as not to exceed its rated maximum.

Resistances

The current and voltage regulator unit circuits use two common resistors. One is inserted in the field circuit when either the current or voltage regulator unit operates. The second resistor is connected between the regulator FIELD terminal and the cut-out relay frame, which places it in parallel electrically with the generator field coils. The sudden reduction in field current occurring when either the current or voltage regulator contact points open, is accompanied by a surge of induced voltage in the field coils as the strength of the magnetic field changes. These surges are partially dissipated by the two resistors, thus preventing excessive arcing at the contact points.

Regulator Polarity

Some regulators are designed for use with negative grounded batteries while other regulators are designed for use with positive grounded batteries. Using the wrong polarity regulator on an installation will cause the regulator contact points to pit badly and give very short life. As a safeguard against installation of the wrong polarity regulator, regulators designed for positive grounded systems have copper plated current and voltage regulator armatures while regulators for negative grounded systems have cadmium plated armatures.

Regulator Maintenance

Mechanical checks and adjustments (air gaps, point spacing) must be made with battery disconnected and regulator preferably off the vehicle.

CAUTION: *The cut-out relay contact points must never be closed by hand with the battery connected to the regulator. This would cause a high current to flow through the units which would seriously damage them.*

Electrical checks and adjustments may be made either on or off the vehicle. The regulator must always be operated with the type generator for which it was designed.

The regulator must be mounted in the operating position when electrical settings are checked and adjusted, and it must be at operating temperature.

After regulator removal for any tests or adjustments, the generator on the vehicle must be repolarized after leads are connected but before the engine is started as follows:

Repolarizing Generator

After reconnecting leads, momentarily connect a jumper lead between the "Gen" and "Bat" terminals of the regulator. This allows a momentary surge of current to flow through the generator which correctly polarizes it. Failure to do this may result in severe damage to the equipment since reversed polarity causes vibration, arcing, and burning of the relay contact points.

Quick Checks of Generator and Regulator

In analyzing complaints of generator-regulator operation, any of several basic conditions may be found:

FULLY CHARGED BATTERY AND LOW CHARGING RATE: This indicates normal generator- regulator operation. Regulator settings may be checked as outlined in the following sections.

FULLY CHARGED BATTERY AND A HIGH CHARGING RATE: This indicates that the voltage regulator is not reducing the generator output as it should. A high charging rate to a fully charged battery will damage the battery, and the accompanying high voltage is very injurious to all electrical units.

This operating condition may result from—

Improper voltage regulator setting.
Defective voltage regulator unit.
Grounded generator field circuit (in either generator, regulator, or wiring) .
Poor ground connection at regulator.
High temperature which reduces the resistance of the battery to charge so that it will accept a higher charging rate even though the voltage regulator setting is normal.
If the trouble is not due to high temperature, determine the cause of trouble by disconnecting the lead from the regulator "F" terminal with the generator operating at medium speed. If the output remains high, the generator field is grounded either in the generator or in the wiring harness. If the output drops off, the regulator is at fault and should be checked for a high voltage setting or grounds.

LOW BATTERY AND HIGH CHARGING RATE: This is normal generator-regulator action.

Regulator settings may be checked as outlined in the following sections.

LOW BATTERY AND LOW OR NO CHARGING RATE: This condition could be due to—

Loose connections, frayed, or damaged wires.
Defective Battery.
High circuit resistance.
Low regulator setting.
Oxidized regulator contact points.
Defects within the generator.
If the condition is not caused by loose connections, frayed, or damaged wires, proceed as follows:
To determine whether the generator or regulator is at fault, momentarily ground the "F" terminal of the regulator and increase generator speed. If the output does not increase, the generator is probably at fault and it should be checked. If the generator output increases, the trouble is due to:
A low voltage (or current) regulator setting.
Oxidized regulator contact points which insert excessive resistance into the generator field circuit so that output remains low.
Generator field circuit open within the regulator at the connection or in the regulator winding.

BURNED RESISTANCES, WINDINGS, OR CONTACTS: These result from open circuit

operation or high resistance in the charging circuit. Where burned resistances, windings, or contacts are found, always check car wiring before installing a new regulator. Otherwise the new regulator may also fail in the same way.

BURNED RELAY CONTACT POINTS: This is due to reversed generator polarity. Generator polarity must be corrected after any checks of the regulator or generator, or after disconnecting and reconnecting leads.

Cleaning Contact Points

The contact points of a regulator will not operate indefinitely without some attention. It has been found that a great majority of all regulator trouble can be eliminated by a simple cleaning of the contact points plus some possible readjustment. The flat points should be cleaned with a spoon or riffler file. The flat point is in the upper contact bracket so the bracket must be removed for cleaning the points. A flat file cannot be used successfully to clean the flat contact points since it will not touch the center of the flat point where point wear is most apt to occur. NEVER USE EMERY CLOTH OR SANDPAPER TO CLEAN THE CONTACT POINTS.

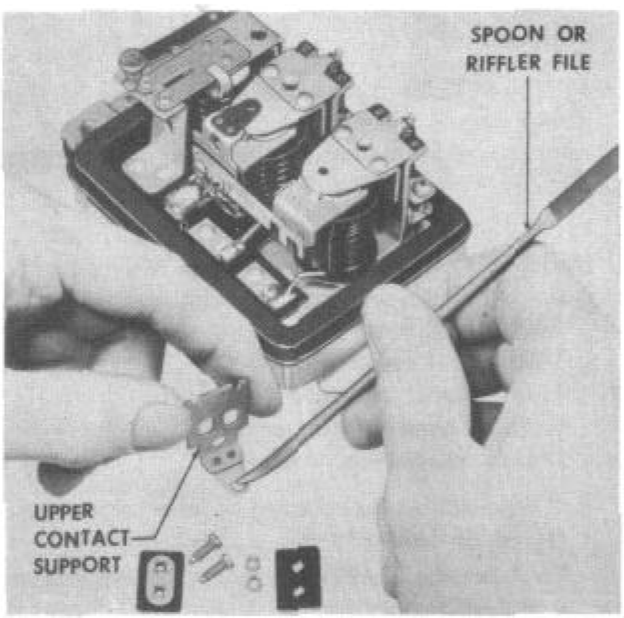


FIGURE 11—*Cleaning Contact Points*

Current and Voltage Regulator Check and Adjustments

Procedure: For best results, the following steps should be taken in the sequence given.
(1) Bring voltage regulator to operating temperature, (2) Check voltage regulator, (3) Check cut-out relay, (4) Bring current regulator to operating temperature, (5) Check current regulator.

Voltage Regulator Check and Adjustments

Two checks and adjustments are required on the voltage regulator: Air gap and voltage setting

Air Gap—Push down on armature until contact points are just touching. Measure air gap between armature and winding core (Fig. 12). Adjust by loosening contact mounting screws and raising or lowering contact mounting bracket as required. Be sure the contact points are aligned and screws securely tightened after adjustment.

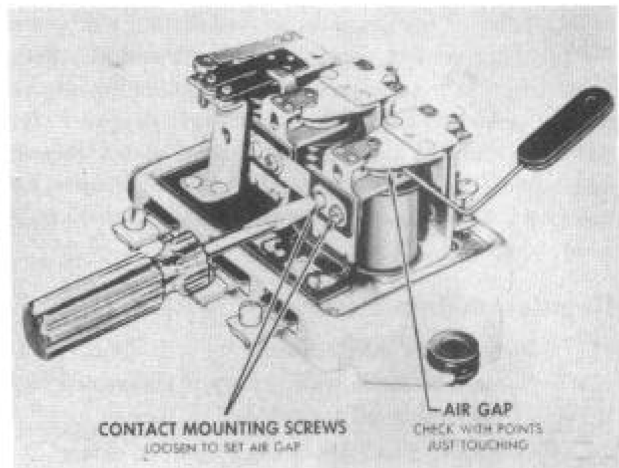


FIGURE 12—*Voltage Regulator Air Gap Check and Adjustment*

Voltage Setting—Fixed 1/4 Ohm Resistance Method

Connect a 1/4 ohm fixed resistor (not less than 25 watts) into the charging circuit at "Bat" terminal of regulator (in series with battery) as in Figure 13.

Connect a voltmeter from regulator "Bat" terminal to ground.

Operate generator at specified speed for 15 minutes. Regulator cover must be in place. (Regulator may now be considered to be at operating temperature.)

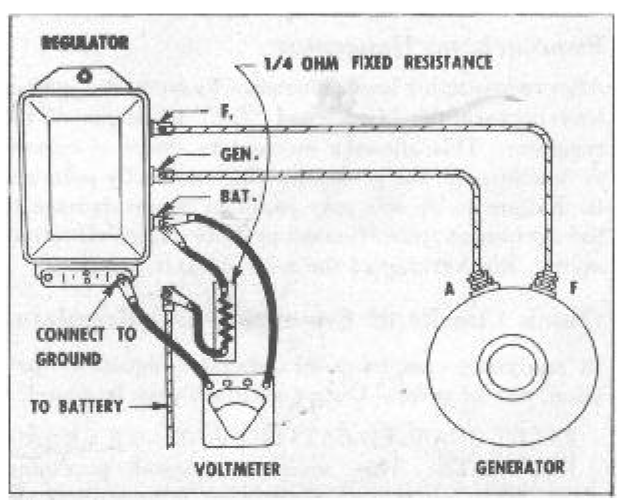


FIGURE 13—*Fixed Resistance and Voltmeter Connections to Check Voltage Regulator Settings*

NOTE: IT IS NOT NECESSARY TO MEASURE THE AMOUNT OF CURRENT FLOWING DURING TESTING AND ADJUSTING. HOWEVER, IT IS IMPORTANT THAT NO ELECTRICAL LOAD OTHER THAN IGNITION BE ON DURING TEST.

Cycle the Generator

Method A-Move voltmeter lead from "Bat" to "Gen" terminal of regulator. Retard generator speed until generator voltage is reduced to 2 volts. Move voltmeter lead back to "Bat" terminal of regulator. Bring generator back to specified speed and note voltage setting.
Method B—Connect a variable resistance into the field circuit, as in Figure 18. Turn out all resistance. Operate generator at specified speed. Slowly increase (turn in) resistance until generator voltage is reduced to 2 volts. Turn off all resistance again and note voltage setting (with voltmeter connected as in Figure 13. Regulator cover must be in place.
To adjust voltage setting, turn adjusting screw (Fig. 14). Turn clockwise to increase setting and counterclockwise to decrease voltage setting.

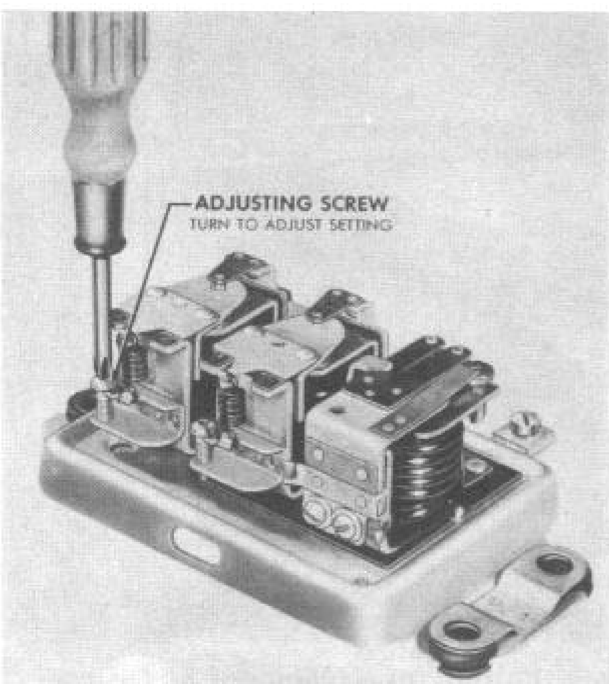


FIGURE 14—*Adjusting Voltage Regulator Setting*

CAUTION: *If adjusting screw is turned down (clockwise) beyond range, spring support may not return when screw is backed off. In such case, turn screw counterclockwise until there is ample clearance between screw head and spring support. Then bend spring support up carefully until it touches the screw head. Final setting of the unit should always be made by increasing spring tension, never by reducing it. If setting is too high, adjust unit below required value and then raise to exact setting by increasing spring tension. After each adjustment and before taking reading, replace the regulator cover and cycle the generator.*

Voltage Setting Variable Resistance Method

Connect a variable resistance (not less than 25 watts) and an ammeter into the charging circuit (in series with battery) at "Bat" terminal of regulator as in Fig 15.

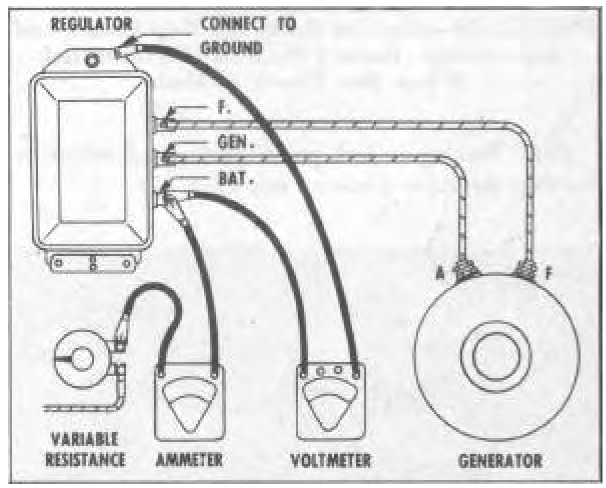


FIGURE 15—*Checking Voltage Regulator with Variable Resistance Method*

Connect a voltmeter from regulator "Bat" terminal to ground (Fig. 15).

Start generator and adjust variable resistance to obtain a current flow of not more than 10 amperes. Operate the generator at specified speed for 15 minutes. Regulator cover must be in place. (Regulator may now be considered to be at operating temperature.) Cycle the generator as explained in "Fixed 1/4 Ohm Resistance Method."

Adjust voltage setting as necessary, as explained in "Fixed 1/4 Ohm Resistance Method."

Cut-Out Relay Checks and Adjustments

The cut-out relay requires three checks and adjustments: Air gap, point spacing and closing voltage. Air gap and point spacing must be made with the battery lead disconnnected from the regulator.

Air Gap—Place fingers on armature directly above core, move armature down until points just close. Measure air gap between armature and center of core (Fig. 16). Make sure that the points close simultaneously. Adjust air gap by adjusting two screws in back of relay and raise or lower armature as required. Tighten screws after adjustment.

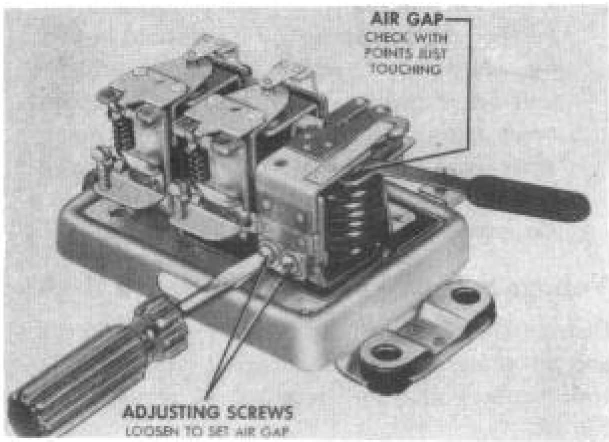


FIGURE 16—*Cut-out Relay Air Gap Check and Adjustment. Battery Must be Disconnected When this Check is Made*

Point Spacing—Check point spacing and adjust by bending the upper armature stop (Fig. 17).

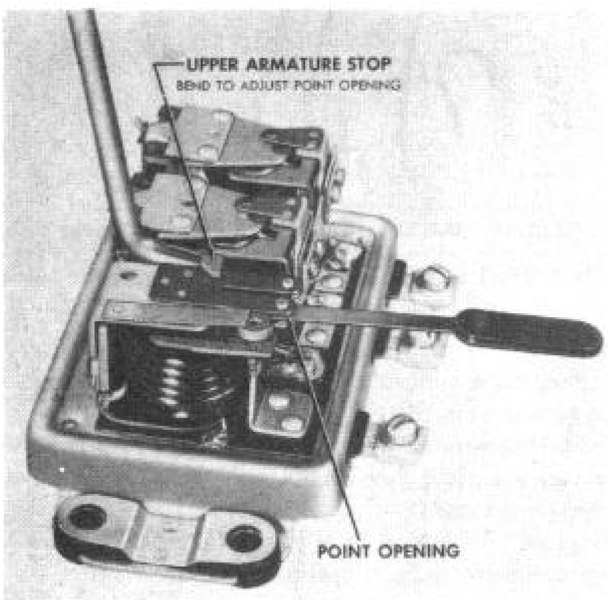


FIGURE 17—*Checking Circuit Breaker Point Opening*

Closing Voltage—Connect regulator to proper generator and battery. Connect voltmeter between the regulator "Gen" terminal and ground (Fig. 18).

Alternate Method: Connect as above but in addition add a variable resistor, 15 ohm-25 watt connected, into the field circuit (Fig. 18). Operate generator at medium speed with variable resistance all in. Slowly decrease (turn out) at the resistance until cut-out relay points close. Note closing voltage. Slowly increase (turn in) resistance to make sure points open.

Adjust closing voltage by turning adjusting screw (Fig. 19). Turn screw clockwise to increase setting and counterclockwise to decrease setting.

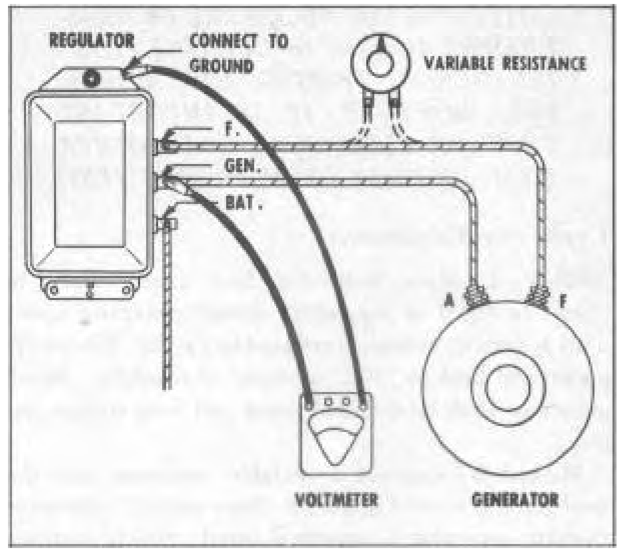


FIGURE 18—*Voltmeter Connections to Check Cut-out Relay Closing Voltage. Variable Resistance may be Connected as Shown for Cycling Generator*

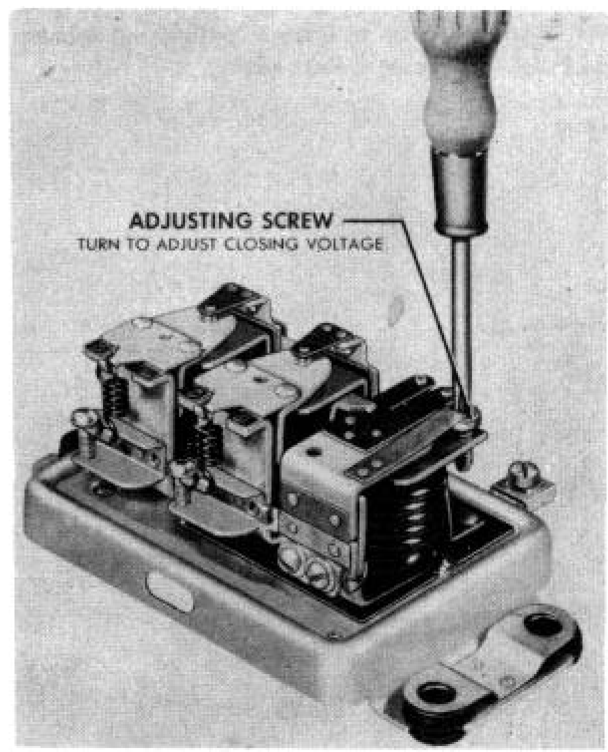


FIGURE 19—*Adjustment of Cut-o*ut Relay Closing Voltage

Current Regulator

Two checks and adjustments are required on the current regulator: Air gap and current setting.

Air Gap—Check and adjust in exactly the same manner as for the voltage regulator.

Current Setting—To check current regulator setting, the voltage regulator unit must be prevented from operating. Several methods for preventing the voltage regulator from operating are available. Regardless of the method used, connect an ammeter into the charging circuit at the regulator "Bat" terminal. The first method listed below should be used for preliminary checks wherever possible since it does not require removal of the regulator cover. The various methods are as follows:

Quick Check Method

Connect ammeter into charging circuit.

Turn on all lights and accessories.

Operate generator at specified speed for 15 minutes with cover in place. (This establishes operating temperature.)

Insert screw driver blade through hole in regulator base (Fig. 20). This shorts out the voltage regulator. (Hold screw driver firmly with blade touching regulator base and shield at same time.)

Cycle generator and note current setting.

Adjust as described for the voltage regulator (Fig. 14).

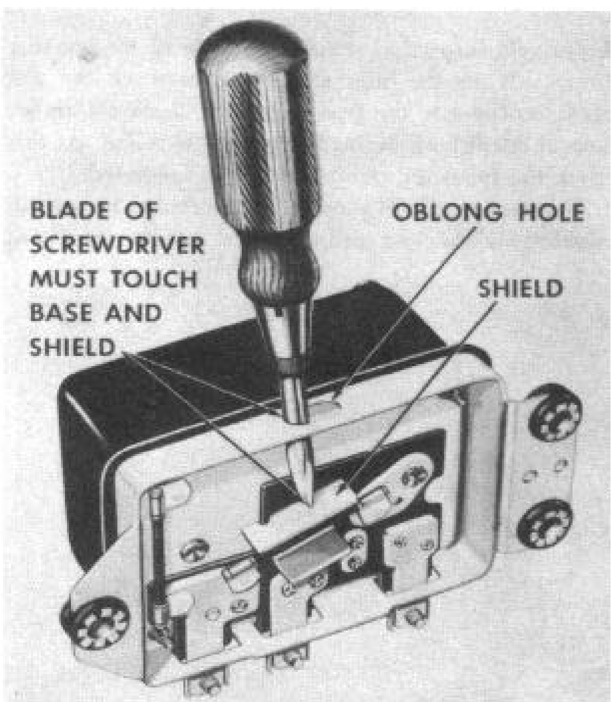


FIGURE 20—Quick Check Method for Cutting Out Voltage Regulator in Order to Check Current Regulator Setting

Load Method

Connect ammeter into charging circuit.

Place load across battery about equal to current regulator setting. Load may be a carbon pile or bank of lights.

Operate generator at specified speed for 15 minutes with cover in place.

Cycle generator and note current setting.

Adjust as described for the voltage regulator (Fig. 14).

Adapting Voltage Regulator Setting For Unusual Conditions

The voltage regulator setting must often be "tailored" to adapt it to the battery and type of service. The ideal setting is that which will keep the battery at or near full charge, with the minimum use of water. The normal setting (value shown in test specifications) will be right for the average service. But if service is above or below average, the setting may be tailored to fit the operation.

Either one of two conditions which may exist will require tailoring: Battery is being overcharged (using too much water) ; Battery remains undercharged (3/4 charge or less).

If the battery is being overcharged, the voltage setting is too high. Reduce the setting about .1 or .2 of a volt at a time and check for improved condition. It rarely will be necessary to lower voltage below 6.9 volts on a 6-volt system.

CAUTION: *Whenever the voltage setting is reduced, the cut-out relay must also be checked and reduced if necessary. It must be at least 5 volt less than voltage regulator setting.*

If the battery is consistently undercharged, the voltage setting may be too low. Increase .1 volt at a time and check for improved condition. It rarely will be necessary to increase voltage more than 7.5. Always he cautious when increasing voltage because of the danger to lights and other accessories during cold weather operation.

NOTE: *Always make sure that the rubber gasket is in place between the cover and base before replacing the cover. The gasket prevents entrance of moisture, dust, and oil vapors which might damage the regulator.*

Before tailoring the voltage setting for either condition, be sure the battery is normal, not sulphated, not permanently damaged due to having been overheated, not operating in too hot a location, or insufficient ventilation.

Temperature Compensation

Voltage regulators are compensated for temperature by means of a bi-metal thermostatic hinge on the armature. This causes the regulator to regulate at a higher voltage when cold which partly compensates for the fact that a higher voltage is required to charge a cold battery.

Reversed Polarity

If the polarity of the generator is reversed, the cut-out relay contact points will vibrate and burn. To make sure the generator has the correct polarity, after reconnecting regulator connecting regulator, momentarily connect a jumper lead between the "Gen" and "Bat" terminals BEFORE STARTING THE ENGINE. The momentary surge of battery current to the generator will correctly polarize the generator.

Radio By-Pass Condensers

The installation of radio by-pass condensers on the field terminal of the regulator or generator will cause the current and voltage regulator contacts to oxidize. Oxidized points cause a high resistance and may result in a low charging rate and a discharged battery. DO NOT CONNECT RADIO BY-PASS CONDENSERS TO THE FIELD TERMINAL OF THE REGULATOR OR GENERATOR. If a condenser has been installed on the field terminal, disconnect the condenser and clean the contact points of both the current and the voltage regulator.

STARTER MOTORS (AUTO-LITE)

The following Auto-Lite Model Starting Motors are four pole, four brush units equipped with a Bendix type inboard type drive on Standard and Overdrive transmission and outboard type drive on Automatic transmission equipped units.

Series	Type Transmission	Model Number
"Hornet" V-8	Ultramatic	MCL-6132
"Hornet" 6	Standard and Overdrive	MCH-6109
	Hydra-Matic	MCH-6306
"Wasp"	Standard and Overdrive	MZ-4167
	Hydra-Matic	MZ-4172

Auto-Lite Starting Motor Specifications

Model	MCH-6306 MCH-6109	MZ-4172 MZ-4167	MCL=6132
No Load Test			
Amperes	65	70	65
Volts	5.5	5.5	5.0
R.P.M	4900	4300	4900
Lock Test			
Amperes	335	280	410
Volts	2.0	2.0	2.0
R.P.M	6 Ft. Lbs.	4.4 Ft. Lbs	8 Ft. Lbs.
Brush Spring			
Tension	42-53 Ozs.	42-53 Ozs.	42-53 Ozs.

Maintenance Procedure

A periodic inspection should be made of the starting circuit. While the interval between these checks will vary according to the type of service, it should, under normal conditions, be made every 5000 miles. At this check the following points should be inspected.

The starting circuit should be inspected to be sure all connections are clean and tight and that the insulation

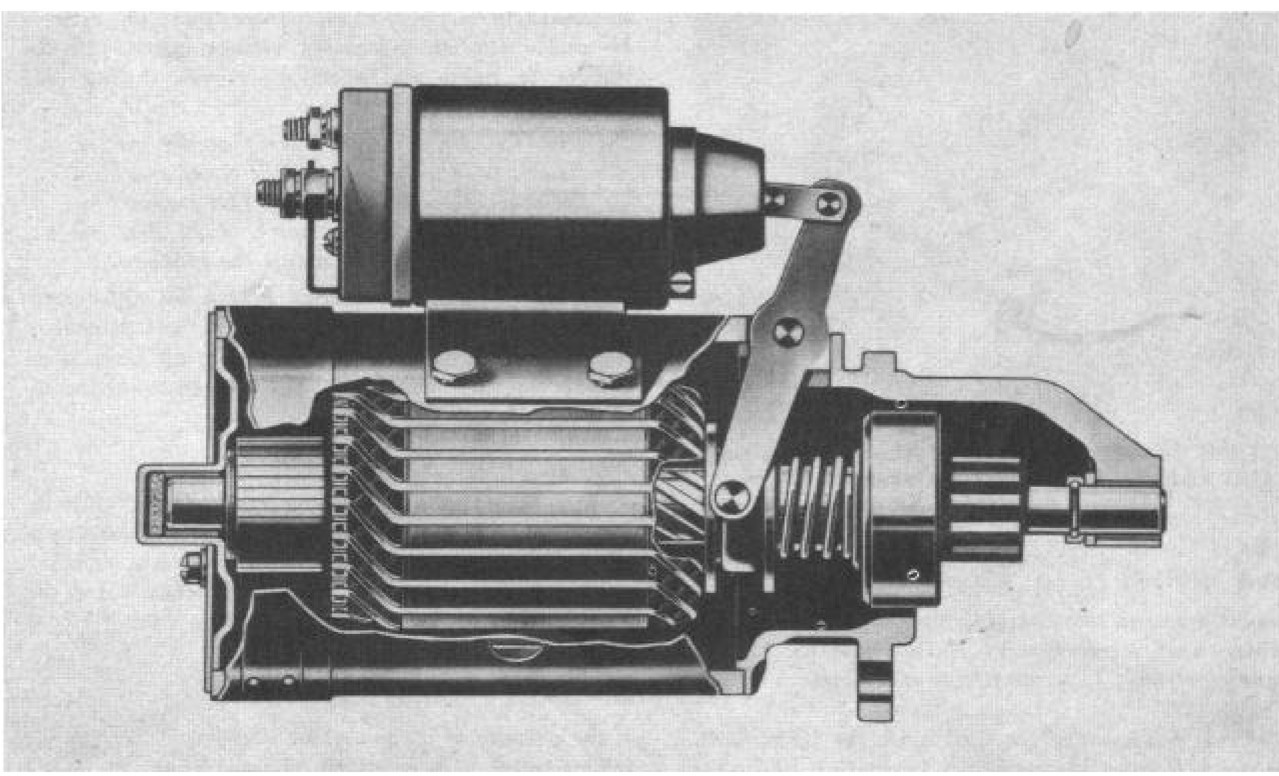


FIGURE 21—*V-8 Series Starting Motor (Ultramatic Transmission)*

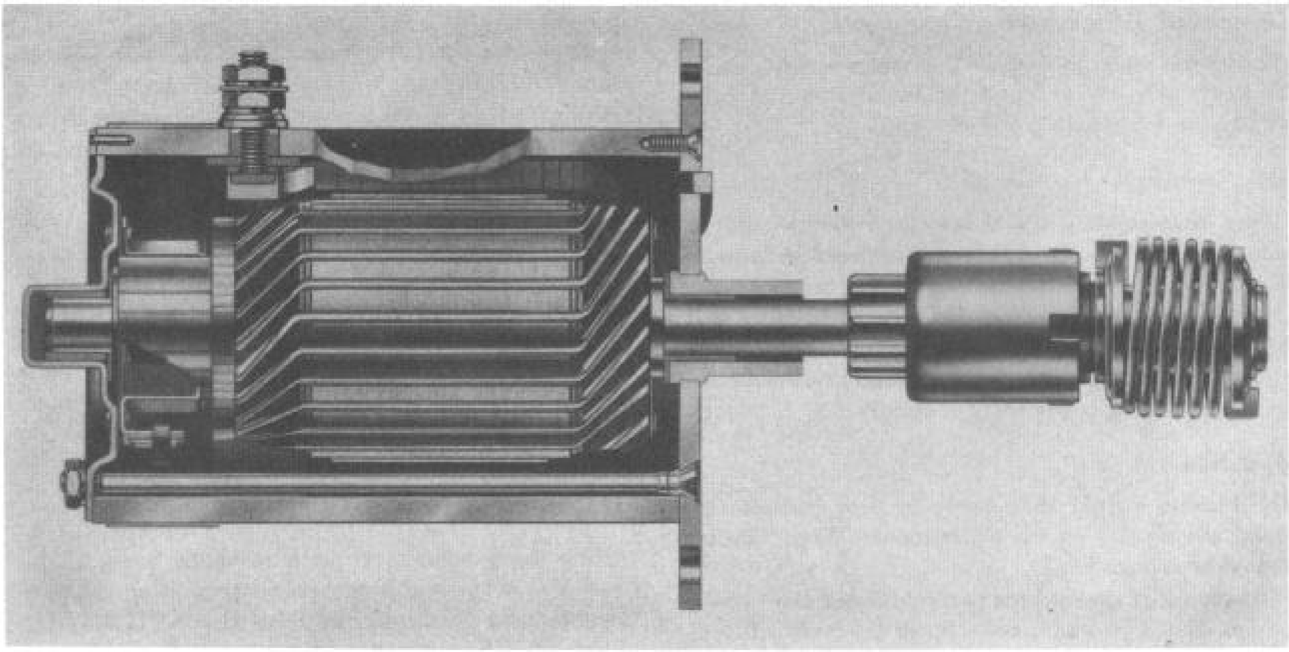


FIGURE 22—*"Hornet" and "Wasp" Series Starting Motor (Standard or Overdrive Transmission)*

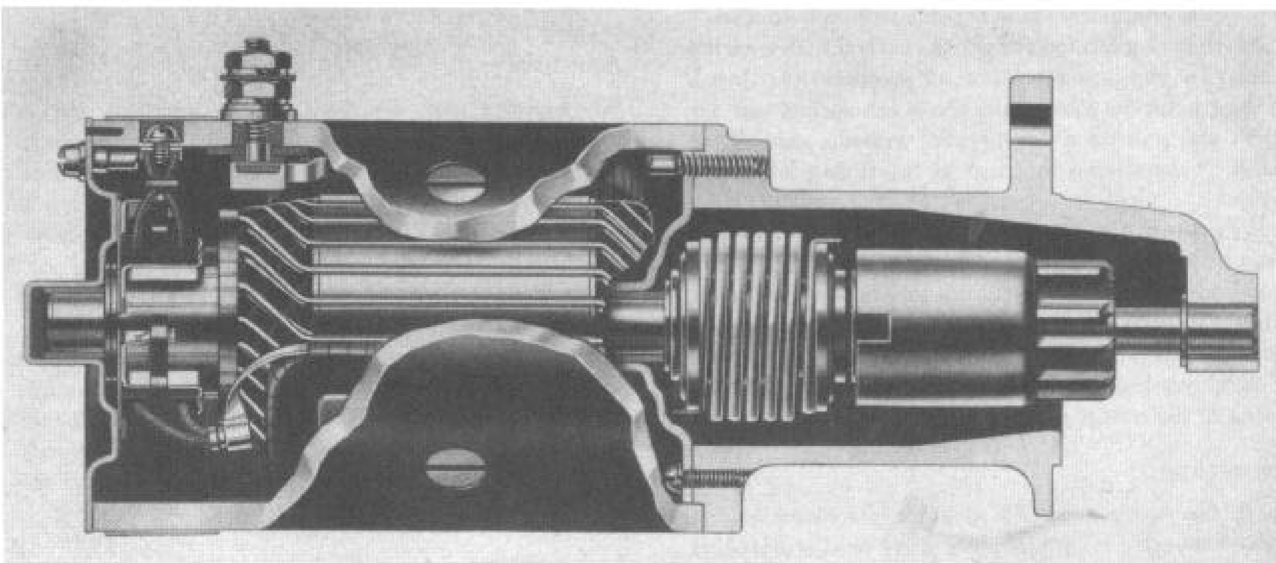


FIGURE 23—*"Hornet" and "Wasp" Series Starting Motor (Hydra-Matic)*

on the wires is not worn or damaged. The starting circuit should be given a voltage loss test to make sure there is no loss of starting motor efficiency due to high resistance connections. In making this check, the voltage loss from the battery terminal to the starting motor terminal should not exceed .30 volts maximum for each 100 amperes. The loss in voltage between the battery ground post and the starting motor frame should not exceed .10 volts maximum for each 100 amperes. If the voltage loss is greater than the above limits, the voltage should be measured over each part of the circuit to locate the resistance causing voltage loss.

If the commutator is dirty or discolored, it can be cleaned with No. 00 sandpaper. Blow the sand out of the motor after cleaning.

Should the commutator be rough or worn, the motor should be removed from the engine for cleaning and reconditioning.

The brushes should slide freely in their holders and make full contact on the commutator. Worn brushes should be replaced.

No on-the-car lubrication is required.

Overhaul Procedure

At periodic intervals, the starting motor circuit should he thoroughly checked and the motor removed from the engine for cleaning and checking.

Disassembly

When disassembling the motor, each part should be removed and cleaned and inspected for wear or damage. The drive should be cleaned and inspected for wear. Bearings should be checked for proper clearance and fit. All insulation should be free from oil and in good condition. The armature, field coils and brushes should be checked for grounds or open circuits.

Brushes

The brushes should slide freely in their holders and make full contact on the commutator. Worn brushes should be replaced.
Brushes that are soldered to the field coil lead should be unsoldered and have the loop in the field coil lead opened. The new brush pigtail should be inserted to its full depth in the loop and then clinched before resoldering. A good soldering must be done to insure no loss of starting motor efficiency due to a poor contact.
Brush spring tension should be checked with a spring scale. To check the tension of reaction type brush springs, hook the scale under the brush spring near the brush and pull on a line parallel with the side of the brush. Take the reading just as the spring leaves the brush.
If the brush spring tension is too low, there will be a loss of efficiency due to poor brush contact. If the tension is too great, the commutator and brushes will wear excessively and have short life. It is, therefore, important that the brush spring tension be kept within 42 to 53 ounces. To change the spring tension twist the spring at the holder with long nosed pliers.

Armature

Check the commutator for wear or discoloration. If the commutator is only slightly dirty or discolored, it can be cleaned with Nos. 00 and 000 sandpaper. Blow the sand out of the motor after cleaning the commutator. If the commutator is rough or worn, the armature should be removed and the commutator turned down in a lathe.
The armature should be visually inspected for mechanical defects before being checked for shorted or grounded coils. For testing armature circuits, it is advisable to use a set of test probes.
To test the armature for grounds, touch one point to a commutator segment, and - touch the core or shaft with the other probe. Do not touch the points to the bearing surface or to the brush surface as the arc formed will burn the smooth finish. If the lamp lights, the coil connected to the commutator segment is grounded.
To test for shorted armature coils, a growler is necessary. The armature is placed against the core and a steel strip held on the armature. The armature is then rotated slowly by hand. If a shorted coil is present, the steel strip will become magnetized and vibrate.

Field Coils

Using test probes, check the field coils for grounds. To test for grounds, place one probe on the motor frame or pole piece and touch the other probe to the field coil terminals. If a ground is present, the lamp will light.
Inspect all connections to make sure they are proper. ly clinched and soldered. Inspect the insulation for evidence of damage.

Brush Holder Inspection

Using test probes, touch each insulated brush holder with one probe and a convenient ground on the commutator end head with the other probe. If the lamp lights, it indicates a grounded brush holder.

Pinion Housing

Inspect housing for cracks and bearing for wear.
Assembly
When assembling absorbent bronze bearings, always use the proper size arbor as these arbors are designed to give the proper bearing fit. Soak the bearing in oil before assembling in the bearing bore.
The pinion end of the armature shaft should be given a light wipe with very light oil when assembling.
Brushes should be correctly installed and connected as previously outlined in order to be sure of proper starting motor efficiency. Proper brush seating should be insured by sanding the brush to fit the commutator. To sand the brush, wrap a strip of No. 00 sandpaper around the commutator and turn the armature slowly in the direction of rotation. Blow the sand out of the motor after sanding.

Lubrication

When the starting motor is overhauled, the bearings should be soaked in oil and the bearing seats should be given a light wipe of oil.

Bench Test

The motor should first be checked to see that the free running voltage and current are within specifications. To test, connect the motor to a battery, ammeter and voltmeter. If the current is too high, check the bearing alignment and end play to make sure there is no binding or interference.
Using a spring scale and torque arm, check the stall torque to see that the motor is producing its rated cranking power. The stall torque will be the product of the spring scale reading and

the spring scale reading and the length of the arm in feet. If the torque is not up to specifications, check the seating of the brushes on the commutator and the internal connections of the motor for high resistance.

The Bendix should be checked for correct operation. The Bendix pinion should be checked to see that it shifts when the motor is operated under "no load".

Over-Running
"Hornet" V-8 Series

Do not dip the in solvent as it cannot be repacked with grease. Clean with cloth dampened in cleaning solvent. Install the on the shaft and make sure it slides easily without binding. Turn the pinion which should rotate smoothly, though not necessarily freely. Reverse the direction of turning a few times. The should instantly lock and unlock. Replace the if it does not act as described or if the pinion is worn or damaged.

Pinion and Switch Adjustments
"Hornet" V-8 Series

With the pinion at rest, measure the distance from the face of the mounting flange to the outer edge of the pinion. This distance should be .834" to .984". Adjust by installing thrust washers on the armature shaft making sure the armature end play is kept between .005" and .030".

Apply voltage to the switch to shift the pinion into the full mesh position and measure the clearance between the pinion and the pinion stop. Adjust to 3/32" ± 1/64" by screwing the switch plunger link screw in or out as required. This adjustment is important as incorrect pinion position can cause insufficient meshing or pounding of the stop and failure of the switch contacts to properly close.

Starting Switch Relay
"Hornet" V-8 Series

Inspect the control wiring between battery, switch and switch relay (Auto-Lite Model HRW 4001A) for breaks, loose terminals and worn insulation. Tighten all connections and make sure the switch is firmly mounted and makes a good ground connection. Check the voltage drop across the switch during normal starting. If the drop is in excess of .20 volts per 100 amperes (Approximately .25 to .50 volts during normal starting) replace the switch. If the switch does not close and open properly when the control button is operated, remove the switch and check its closing and opening voltages on the test bench.

Contacts close 1.5 to 3.0 Volts.
Contacts open 0.5 min. Volts.

Engaging Solenoid
"Hornet" V-8 Series

The over-running engaging solenoid (mounted on the starting motor) specifications are:
Pull in coil 31.5 to 36.0 amperes at 3.0 volts. Hold in coil 8.8 to 10.1 amperes at 3.0 volts.

Starting Switch Solenoid
"Hornet" 6 and "Wasp" Series

Inspect the control wiring between battery, ignition switch, and solenoid for breaks, loose terminals, and worn insulation. Tighten all connections. Be sure the switch is firmly mounted and makes a good ground connection. Check the voltage drop across the solenoid switch during normal starting. If the drop is in excess of .20 volts per 100 amperes (approximately .25 to 1.00 volts during normal starting) replace the switch. If the switch does not close and open properly when the ignition switch is operated, remove the switch and check its closing and opening voltages. Contacts close 3.5 to 4.5 volts. Coil resistance 1.1 ohms plus or minus 8% at 20°C. (68°F.).

STARTER MOTORS (DELCO-REMY)
"Rambler" Series

The "Rambler" Series starting motors are a DelcoRemy Model 1107119 used with standard and overdrive transmission, and Model 1107136 with HydraMatic transmission. They have a no-load speed of 5500 R.P.M. at 70 amperes at 5.65 volts. They develop 11 foot pounds torque at 550 amperes at 3.25 volts. They are four pole, two field, six volt units.

The armature rotates in a bronze bushing at the commutator end and in pinion housing.

The starting motors are lubricated by a hinge cap oiler located on the drive end frame. Every 5000 miles this oiler should be given eight to ten drops of light engine oil. Whenever the starting motor is disassembled or removed from the engine, the oilless bushing in the commutator end should be supplied with a few drops of light engine oil.

The starting motor used with the Hydra-Matic transmission differs only in the length of the starting motor pinion teeth and solenoid switch control from the standard or overdrive transmission starting motor.

Starting Motor Maintenance (Delco-Remy)

Starting motor maintenance may be divided into two sections: normal maintenance, required to assure continued operation of the starting motor, and the checking and repair of inoperative units.

INSPECTION: The cover band should be removed and the commutator and brushes inspected at regular intervals. If the commutator is dirty, it may be cleaned with No. 00 sandpaper. Blow out dust. Never use emery cloth to clean commutator. If the commutator is rough, out of round, or has high mica, it should be turned down on a lathe. The mica should be undercut to a depth of %2 of an inch. Worn brushes should be

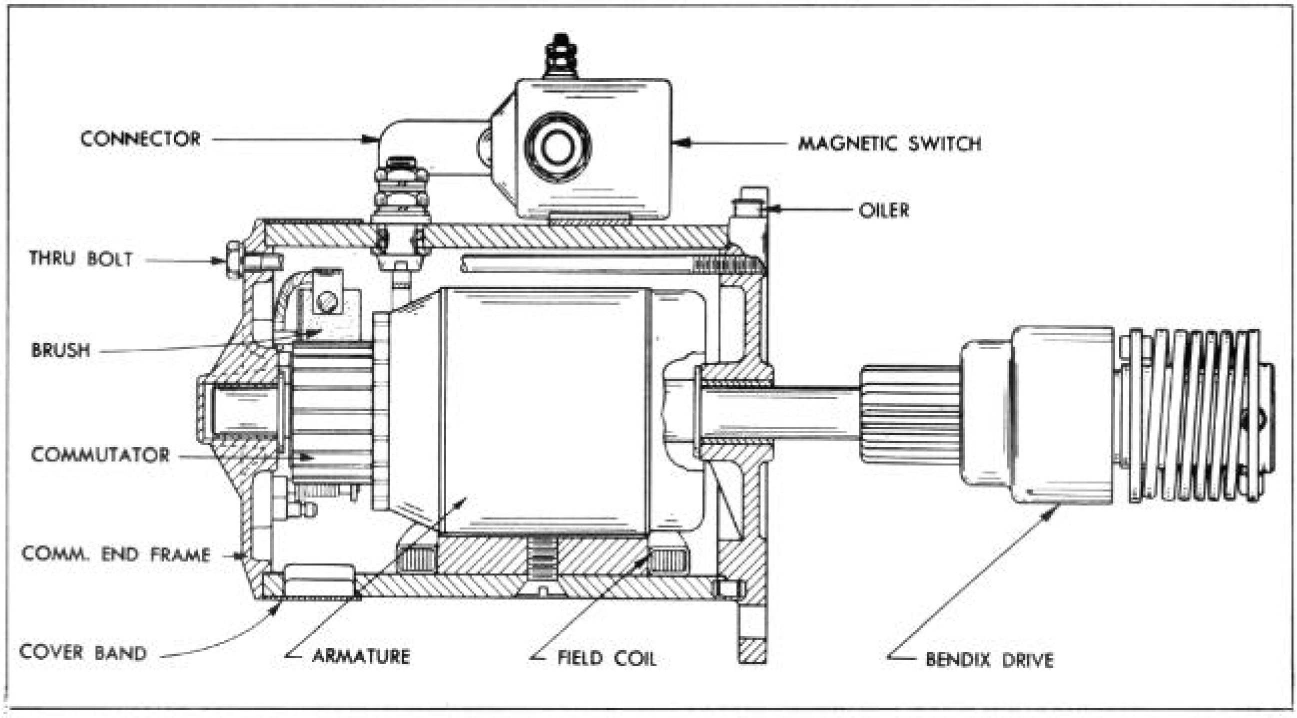


FIGURE 24—*"Rambler" Series Starting Motor (Regular or Overdrive Transmission)*

replaced. If brushes wear rapidly, check for excessive brush tension and roughness or high mica on the commutator. Brush spring tension should be from 24 to 28 ounces.

Starting Motor Disassembly

At regular intervals, (the actual time depending on the type of operation) the starting motor should be disassembled for a thorough cleaning and inspection of all parts. The Bendix drive should be cleaned and oiled with a penetrating oil as any accumulation of dirt on the drive might restrict the free movement of the pinion. Never clean the armature or fields in any degreasing tank, or grease dissolving materials, since these may damage the insulation. The commutator should be trued in a lathe if necessary. Replace all parts showing excessive wear. All wiring connections should be checked. Rosin flux should be used in making soldered connections. Acid flux must never be used on electrical connections. Submit reassembled unit to NO-LOAD and LOCK tests.

Checking of Improperly Operating Starting Motor

If the starting motor does not develop rated torque and cranks the engine slowly or not at all, check the battery, battery terminals and connections, and battery cables.
Corroded, frayed, ,or broken cables should be replaced and loose or dirty connections corrected. The starting motor switch should be checked for burned contacts and the switch replaced if necessary.

If all these are in order, remove the cover band of the starting motor and inspect the brushes and commutator. The brushes should form good contact with the correct brush spring tension. A dirty commutator can be cleaned with a strip of No. 00 sandpaper held against the commutator with a stick while the starting motor operates. NEVER USE EMERY CLOTH TO CLEAN COMMUTATOR. If the commutator is very dirty, or burned, or has high mica, remove the armature from the cranking motor and take a cut off the commutator in a lathe. The mica should be undercut to a depth of 1/32".

If there are burned bars on the commutator, it may indicate open circuited armature coils which will prevent proper cranking. Inspect the soldered connections at the commutator riser bars. An open armature will show excessive arcing at the commutator bar which is open on the no-load test.

Tight or dirty bearings will reduce armature speed or prevent the armature from turning. A worn bearing, bent shaft, or loose field pole screws will allow the armature to drag on the pole shoes causing slow speed or failure of the armature to revolve. Check for these conditions.

If the brushes, brush spring tension, and commutator appear in good condition, the battery and external circuit found satisfactory, and the starting motor still does not operate correctly, it will be necessary to remove the starting motor for no-load and torque checks.

NO-LOAD TEST: Connect the starting motor in series with a battery of the specified voltage and an ammeter capable of reading several hundreds amperes. If an R.P.M. indicator is available, read the armature

R.P.M. in addition to the current draw.
TORQUE TEST: It is advisable to use a high current carrying variable resistance in the circuit so that the specified voltage at the motor can be obtained. A small variation of the voltage will produce a marked difference in the torque developed.

Interpreting Results of No-Load and Torque Tests

Rated torque, current draw, and no-load speed indicates normal condition of starting motor.

Low free speed and high current draw with low developed torque may result from:

Tight, dirty, or worn bearings, bent armature shaft, or loose field pole screws which would allow the armature to drag.

Shorted armature. Check armature further on growler.

A grounded armature or field. Check by raising the grounded brushes and insulating them from the commutator with cardboard and then checking with a test lamp between the insulated terminal and frame. If test lamp lights, raise other brushes from commutator and check fields and commutator separately to determine whether it is the fields or armature that is grounded.

Failure to operate with high current draw:

A direct ground in the switch, terminal, or fields. Frozen shaft bearings which prevent the armature from turning.

Failure to operate with no current draw:

Open field circuit. Inspect internal connections, and trace circuit with a test lamp.

Open armature coils. Inspect the commutator for badly burned bars. An open armature will show excessive arcing at the commutator bar which is open when running free speed.

Broken or weakened brush springs, worn brushes, high mica on the commutator, or other causes which would prevent good contact between the brushes and commutator. Any of these conditions will cause burned commutator bars.

Low no-load speed with low torque and low current draw indicates:

An open field winding. Raise and insulate ungrounded brushes from commutator and check fields with test lamp.

High internal resistance due to poor connections, defective leads, dirty commutator, and causes listed under "Failure to operate with high current draw."

High free speed with low developed torque and high current draw indicates:

Shorted fields. There is no easy way to detect shorted fields since the field resistance is already low. If shorted fields are suspected, replace the fields and check for improvement in performance.

Starting Motor Automatic Drive Unit
"Hornet" 6, "Wasp," and "Rambler" Series

The Bendix Folo-Thru type drive is designed to overcome premature demeshing of the drive pinion from the flywheel ring gear until a predetermined engine speed is reached.

Automatic meshing of the drive pinion with the flywheel ring gear is accomplished in the usual manner by closing the starter switch, and the drive then cranks the engine. In the meantime, a spring loaded detent pin, located in the control nut, has dropped into engagement with a notch in the screwshaft. If the engine fails to continue running due to weak or irregular firing, movement of the control nut in the demeshing direction on the screwshaft is temporarily checked because of the pin engagement in the screwshaft notch.

Due to the design, it is recommended that only a complete drive be used for service replacement.

NOTE: *Do not disassemble the drive under any circumstance. There are two spring loaded pins in the control nut. These springs have different tensions and must be assembled in their respective locations. Otherwise, the drive cannot operate properly.*

If the pinion and barrel assembly is accidentally rotated manually to the fully extended position on the screwshaft, do not attempt to force it in the reverse direction. Proceed to install the drive even though it is fully extended.

When the engine starts, the detent pin in the control nut is released by centrifugal force. The drive pinion is then automatically de- meshed from the flywheel ring gear in the usual manner, and the pinion and barrel assembly returns to the full demeshed position on the screwshaft.

1. Pinion and Barrel Assembly
2. Stop Collar
3. Control Nut
4. Detent Spring
5. Detent Pin
6. Screw Shaft
7. Drive Spring
8. Drive Head
9. Spring Washer
10. Anti-Drift Pin
11. Drift Pin Spring
12. Dentil

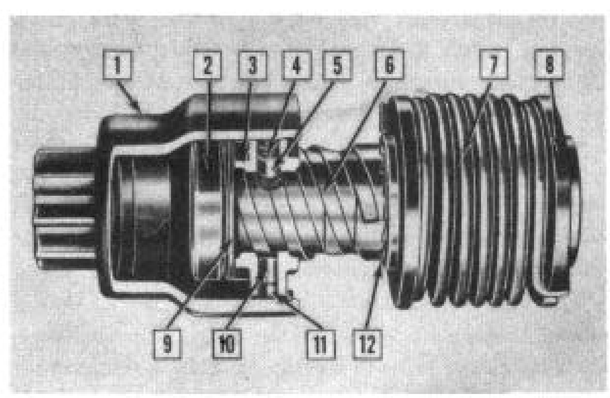


FIGURE 25—Bendix Folo-Thru Drive

The screwshaft on the FOLO-THRU Drive is divided into two sections with a dentil connection between them. Therefore, when the engine is driving the pinion at a greater speed than the driving effort of the starting motor, the pinion and barrel assembly, control nut, and screwshaft over-run the starting motor armature shaft. This over-running serves as a safety factor preventing damage to the starting motor.

When the engine does not continue to run and slows down, the speed of the pinion and barrel assembly, control nut, and screwshaft also decreases. Cranking is automatically resumed immediately after the speed of the over-running parts reaches that of the starting motor armature shaft provided the starter switch has been kept closed.

Intermittent action between over-running and cranking occurs until the engine is firing so that its speed reaches the predetermined rate at which the detent pin is centrifugally forced against the detent spring, thereby compressing it. The detent pin thus becomes disengaged from the screwshaft notch which permits the drive pinion to automatically demesh from the flywheel ring gear.

Drifting of the pinion and barrel assembly towards the flywheel ring gear while the engine is running is prevented by a spring loaded anti-drift pin which engages a slope on the screwshaft. This anti-drift pin, also assembled in the control nut, is identical in design to the detent pin. However, due to the difference in function, the spring tension is not the same. In general, the anti-drift spring is stronger than the detent spring.

The Bendix Folo-Thru Drive should be cleaned and oiled with a penetrating oil, as any accumulation of dirt on the drive might restrict the free movement of the pinion.

IGNITION SYSTEMS

The ignition system consists of the ignition coil, condenser, distributor, high tension wiring, spark plugs, ignition switch, and a source of electrical energy — the battery or generator. There are two circuits in the ignition system. The primary circuit includes the source of electrical energy, the distributor contact points, the condenser, and the primary winding of the ignition coil. The secondary circuit includes the secondary winding of the ignition coil, the rotor, distributor cap, the high tension wiring, and spark plugs.

The primary circuit is completed and broken by the circuit breaker mechanism of the distributor, causing a build-up and collapse of a magnetic field in the ignition coil. The condenser is connected across the distributor contact points. When the points open, the current tries to continue flowing.

Without the condenser, the current would form an arc across the separating points. The condenser prevents this because it has the ability or capacity to store up electrical energy. The current instead of forming an arc, flows into the condenser. Therefore, the condenser brings the current flow to a quick stop. This causes the magnetic field in the coil, sustained by the current flow, to collapse quickly. It is this quick collapse of the magnetic field which induces the high voltage in the secondary coil windings. The high voltage is distributed to the correct cylinder spark plug wire by means of the rotor and distributor cap.

DISTRIBUTORS (AUTO-LITE)
"Hornet" V-8 Series

A dual contact distributor is used on the V-8 series engine for required increased secondary ignition efficiency.

The increased efficiency is a result of better magnetic induction on the secondary coil, through longer operation of the primary coil. This is accomplished by increasing the duration of current flow through the primary coil, between the firing points of the distributor, with dual contacts connected in parallel and staggered around the eight lobe cam. Connected in parallel and staggered around the cam, one set of contacts is actuated later than the other, so the two contact points are in a state of closing and opening. The circuit closing contact is moving toward its closed position, while the circuit opening contact is moving toward its open position. For a brief period, both contacts are then open, opening the primary circuit and causing a spark plug to fire. With this arrangement, the dwell angle is increased considerably, permitting the available voltage from the secondary circuit to be more fully utilized. The dwell angle is the angle of cam rotation through which the primary circuit remains closed. The coil primary offers inductive reactance to a current flow, so some time is required to build the current flow up to its full value in the primary. The dual contacts more adequately provide for this required time.

The distributor is fully automatic with both governor and vacuum control of the timing. The diaphragm is linked to a pin on the upper plate which carries the contacts. This plate is pivoted at one side and rides on flat, absorbent bronze bearings. The timing is changed by the plate movement. The maximum vacuum advance is limited by a stop which is a part of the vacuum chamber linkage.

"Hornet" 6 and "Wasp" Series

The "Hornet" 6 (Model IAT-4203-A) and "Wasp" Series (Model IAT-4202) Auto-Lite Distributors are fully automatic with both governor and vacuum control of the timing. The diaphragm is linked to a pin on the upper plate which carries the contacts. This plate is pivoted at one side and rides on flat absorbent bronze bearings.

The timing is changed by the plate movement. The maximum vacuum advance is limited by a stop which is a part of the vacuum chamber linkage.

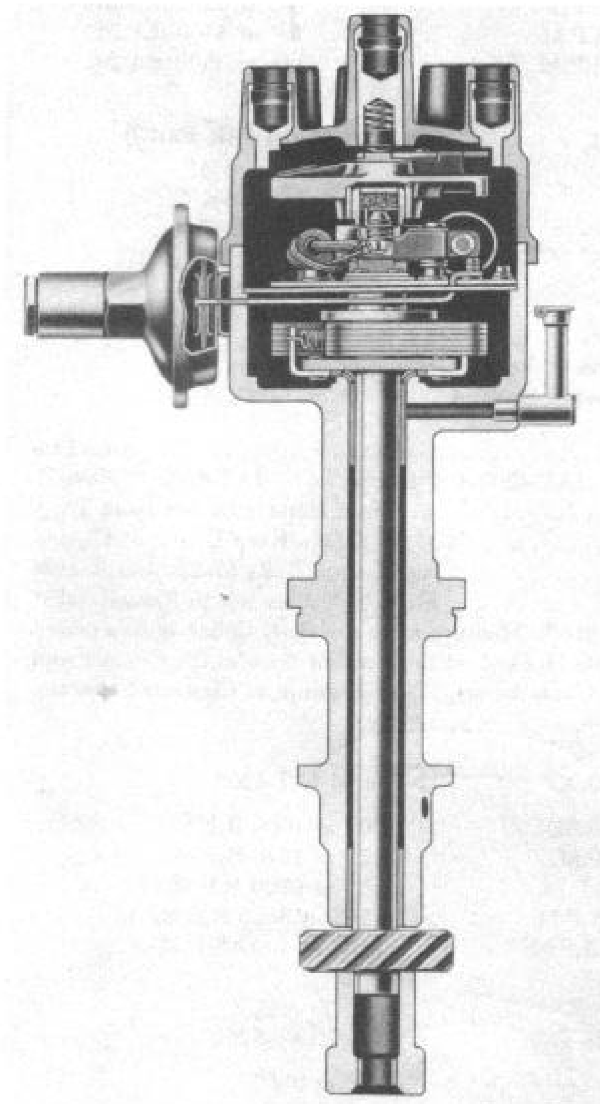


FIGURE 26—*V-8 Distributor Assembly Side Sectional View*

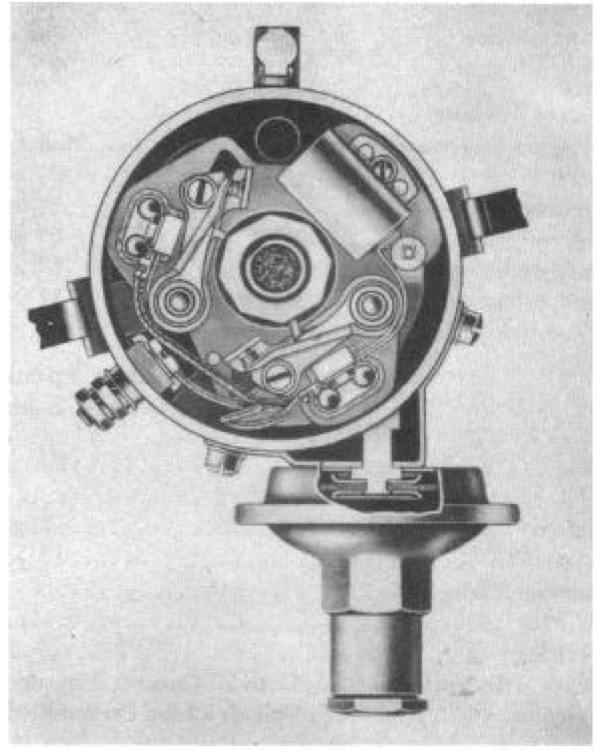


FIGURE 27—*Top View, V-8 Distributor Dual Contact Mounting*

Tune-Up Procedure

Both the primary and secondary circuits of the ignition circuit should be checked individually. Each circuit should be carefully checked for loose connections, damaged insulation or corroded terminals.

As it is not practical to check distributors, replace contacts or make any other adjustments while the unit is installed, it should be removed from the engine and checked on the bench. It is recommended that the unit be periodically removed from the engine and the following points checked.

Distributor Specifications (Auto-Lite)
"Hornet" V-8 Series

Make	Auto-Lite
Model	BK-4001 (Prior to P-6001) —IBK-4001-B (At P-6001)
Rotation	Left Hand (Viewed from top)
Contact Gap	.017" ± .002". Keep Contacts aligned
Condenser Capacity	.25 to .28 Microfarads
Side Play	Shaft Side Play not to exceed .005"
End Play	.00 3" to .010". Measure after the Shaft Collar is Assembled

Breaker Arm Spring Tension.17 to 20 ounces. Measure with Scale Hooked on the Breaker Arm at the Contact and Pull on a Line Perpendicular to the Contact Face. Take Reading as Contacts Separate.

Automatic Advance (Engine Degrees and R.P.M.)	Model IBK-4001	Model IBK-4001-B
Start	0° at 600 R.P.M.	0° at 600 R.P.M.
Intermediate	2° at 650 R.P.M.	2° at 750 R.P.M.

Intermediate	22° at 1200 R.P.M.	16° at 1700 R.P.M.
Intermediate	38° at 2270 R.P.M.	30° at 3300 R.P.M.
Full Advance	40° at 2400 R.P.M.	32° at 3500 R.P.M.

Vacuum Advance

(Engine Degrees and Inches Mercury)	Model IBK-4001	Model IBK-4001-B
Start	0° at 6"	0° at 61/4"
Intermediate	2° at 63/4"	2° at 65/8"
Intermediate	6° at 87/8"	12° at 9"
Intermediate	8° at 91/4"	22° at 121/g"
Full Advance	11° at 10"	24° at 13"

Distributor Specifications (Auto-Lite) "Hornet" 6 and "Wasp" Series

Make	Auto-Lite
Model	IAT-4203-A ("Hornet" 6)—IAT-4202 ("Wasp")
Rotation	Right Hand (Viewed from Top)
Contact Gap	.020" ± .002". Keep Contacts Aligned
Condenser Capacity	.21 to .25 Microfarads
Side Play	Shaft Side Play not to Exceed .005"
End Play	.003" to .010". Measure after the shaft Collar is Assembled
Breaker Arm Spring Tension	17 to 20 Ounces. Measure with Scale Hooked on the Breaker Arm at the Contact and Pull on a Line Perpendicular to the Contact Face. Take Reading as Contacts Separate.

Automatic Advance

(Engine Degrees and R.P.M)	Model IAT-4203-A	Model IAT-4202
Start		
Intermediate	0° at 600 R.P.M.	0° at 1000 R.P.M.
Intermediate	2° at 700 R.P.M.	2° at 1340 R.P.M.
Intermediate	9° at 1000 R.P.M.	8° at 2300 R.P.M.
Full Advance	24° at 2650 R.P.M.	16° at 3650 R.P.M.
	27° at 3000 R.P.M.	18° at 4000 R.P.M.

Vacuum Advance

(Engine Degrees and Inches of Mercury)	Model IAT-4203-A	Model IAT-4202
Start	0° at 5-1/4"	0° at 9-1/2"
Intermediate	2° at 5-3/4"	2° at 10"
Intermediate	8° at 7-1/2"	4° at 10-3/8"
Intermediate	12° at 8-3/4"	6° at 10-7/8"
Full Advance	15° at 9-1/2"	7.5° at 11-1/4"

The distributor cap should be thoroughly cleaned and a visual inspection made for cracks, carbon runners or corroded high tension terminals. If any of these conditions are found, the cap should be replaced.

After a distributor cap has had normal use, the vertical face of the insert will become slightly burned and can be cleaned with refined carbon tetrachloride. DO NOT FILE. If the burning is excessive, the cap should be replaced.

Also note if the insert shows signs of burning on its horizontal face. If burning is noticeable at this point, it indicates that the rotor is too short and should be replaced.

The rotor should be visually inspected for cracks, (replace if cracked) and evidence of burning on the top of the metal strip. After normal use the end of the metal strip will become slightly burned and can be cleaned with refined carbon tetrachloride. If evidence of burning is found on top of the metal strip, it indicates that the strip is too short and the rotor should be replaced.

Use of Distributor Test Fixture

The distributor test fixture accurately checks cam angle, spark advance and synchronization on distributors removed from the car. It will also show excessive distributor shaft eccentricity as indicated by variation in synchronization.

After a distributor has been repaired, the calibration of the centrifugal automatic mechanism should be checked. Proper engine performance

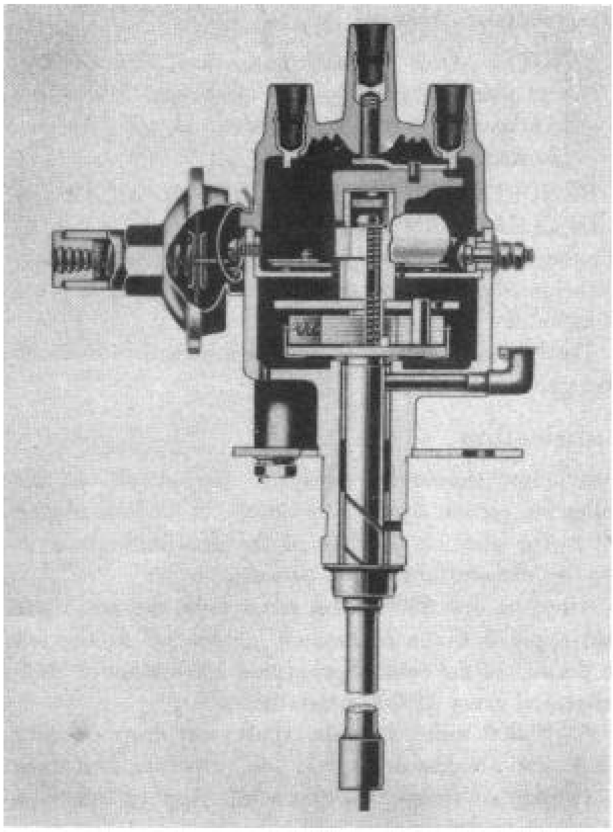


FIGURE 28—*"Hornet" 6 and "Wasp" Series Auto-Lite Distributor Assembly Side Sectional View*

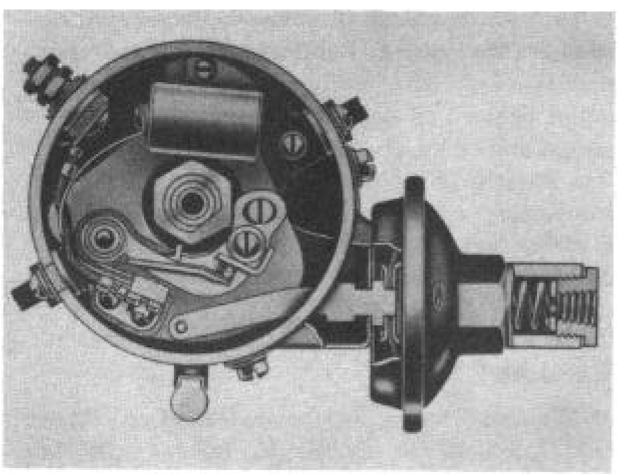


FIGURE 29—*"Hornet" 6 and "Wasp" Series Auto-Lite Distributor Top View*

checked. Proper engine performance cannot be obtained unless the centrifugal curve is within the limits specified for the particular engine.

The Condenser

The function of a condenser is to prevent excessive arcing at the contacts. Correct condenser capacity is necessary to insure good performance and to protect the life of the breaker contacts.

When checking the distributor, the condenser should always be checked for both leakage and capacity with an approved condenser tester.

Four factors affect condenser performance and each factor must be considered in making any condenser tests. BREAKDOWN is a failure of the insulating material, a direct short between the metallic elements of the condenser. This prevents any condenser action. LOW INSULATION RESISTANCE or leakage prevents the condenser from holding a charge. A condenser with low insulation resistance is said to be "weak." All condensers are subject to leakage which, up to a certain limit, is not objectionable. When it is considered that the ignition condenser performs its function in approximately 1/12,000 of a second, it can be seen that leakage can be large without detrimental effects. It must be considered, however, in any condenser test. HIGH SERIES resistance is excessive resistance in the condenser circuit due to broken strands in the condenser lead or to defective connections. This will cause burned points and ignition failure upon initial start and at high speeds. CAPACITY is built into the condenser and is determined by the area of the metallic elements and the insulating and impregnating materials. For a complete check of the condenser, it is desirable to use a tester which will check for the above four conditions.

Breaker Contacts

Contacts that show a grayish color, are only slightly pitted and are within .002" of the correct maximum gap, need not to be replaced or adjusted.

A dial indicator is recommended to check the point opening of used points.

When necessary to check and adjust point opening with a feeler gauge, use a wire feeler gauge.

After adjusting the gap, tighten the lock screw and recheck the gap.

It is desirable that the contacts be replaced if they are pitted as refaced contacts do not have the shape and finish for satisfactory performance.

When replacing contacts, be sure they are aligned and that they make contact near the center. Bend the stationary contact bracket to secure proper alignment. DO NOT BEND THE BREAKER ARM.

Breaker arm spring tension should be checked when the contacts are inspected. Use a spring scale hooked on the arm at the contact and held at right angles to the contact surfaces. Take a reading as the contacts separate. This spring tension should be 17 to 20 ounces. Adjust by loosening the screw holding the end of the contact spring and install spacing washers or slide the end of the spring in or out as necessary. Retighten the screw and recheck the pressure.

If the tension is too weak, the contacts will chatter at high speed giving poor performance while, if the tension is too strong, excessive wear of the cam and breaker arm rubbing block will result.

Governor Adjustment

Mount the distributor on a test fixture that will show the distributor R.P.M. and degrees of advance. Operate the distributor in the correct rotation and increase the speed until the spark begins to advance. Reduce the speed slightly and set the indicator to zero. Increase the speed to the value specified to give 1° advance. If the advance is not 1°, stop the distributor and bend the outer spring lug on the weak weight spring to change its tension.

Check this point again; then operate the distributor at the specified speed to give an advance 1° below the maximum. If this advance is not as specified, stop the distributor and bend the outer spring lug on which the heavy spring is mounted. Recheck the zero point and the above two points and make whatever readjustments are necessary; then check the advance at all of the points specified. When making this check, operate the distributor both up and down the speed range. If there is a variation between the readings for increasing and decreasing speeds, it indicates that the governor action is sluggish and requires overhaul.

Vacuum Advance Adjustment

Vacuum advance should be checked on a distributor test fixture that has a controlled source of vacuum and a vacuum gauge. Mount the distributor on the fixture and connect the vacuum line. Tighten the vacuum connections thoroughly, being careful not to apply a torque to the vacuum housing as this could cause leakage where diaphragm is clamped in the housing. Turn on the vacuum pump to give a reading of 10" to 20" vacuum; then shut off the pump. If the gauge reading falls, it indicates leakage in the vacuum chamber, pump, gauge, or connections which should be located and corrected before tests and adjustments are made.

Remove all vacuum from the distributor and operate it at a speed above the maximum governor advance speed to eliminate all spark variations due to the governor. Set the indicator to zero and apply vacuum to give one of the advance figures specified. If the advance is incorrect, change the spacing washers between the vacuum chamber spring and nut. Be sure to tighten the nut thoroughly and have gasket in place. When one point of the curve is adjusted, the others should be checked. If they are not within limits, it indicates either incorrect spring characteristics or leakage in the vacuum chamber and lines.

The maximum advance is controlled by a stop on the vacuum chamber arm. If the maximum advance is not correct, make sure the parts are correctly assembled and have not had an incorrect part installed.

Distributor Assembly

NOTE: After the distributor has been reassembled, all of the points mentioned in the following lubrication section should be checked.

BE SURE THAT THE DISTRIBUTOR CONTACTS ARE CLEAN AND DRY. If any grease or oil is on the contacts, they should be cleaned with refined carbon tetrachloride. Remove any residue by pulling a piece of clean dry tape between the contacts.

The breaker contacts should be adjusted to the correct gap.

Lubrication

Distributor should be lubricated periodically at the following points: Apply 3 to 5 drops of medium engine oil to the oiler on the side of the distributor base at regular chassis lubrication periods.

After the first 2500 miles, remove the cap and rotor and apply 5 drops of medium engine oil to the felt in the top of the cam. Repeat this lubrication at 5000 miles and every 10,000 miles thereafter.

At 10,000 mile intervals, apply one drop of light oil to the breaker arm pivot pin. Operate arm once or twice; then remove the excess oil. Apply a light film of grease to the breaker cam.

At overhaul, soak drive shaft bearings in medium engine oil and drain before reassembling the distributor. Wipe all oil from upper part of base. At assembly apply a film of grease to the upper drive shaft washer and put a small amount of grease in the bearing bore just above the bearing. Lubricate the governor mechanism sparingly with medium engine oil. Place one drop of light oil on each of the breaker plate support hearings and on the pivot bearing.

On Models IAT-4203-A and IAT-4202, press on pivot retainer spring to expose a slight gap between the spring and the washer. Apply one drop of light oil under the washer.

DISTRIBUTOR (DELCO-REMY)

"Rambler" Series

The "Rambler" Series distributor, Delco-Remy Model 1112382, is a six volt, six cylinder, full automatic unit with centrifugal advance of 24 engine degrees. The shaft revolves in a special porous bushing which spans an oil reservoir in the distributor housing (Fig. 30).

Spark Control

Advancing and retarding of the spark for varying conditions of speed and load is accomplished by a centrifugal advance mechanism (governor weights) on the distributor shaft which advances the contact breaker cam and a vacuum control mechanism which, actuated by the manifold vacuum, rotates the distributor in its mounting.

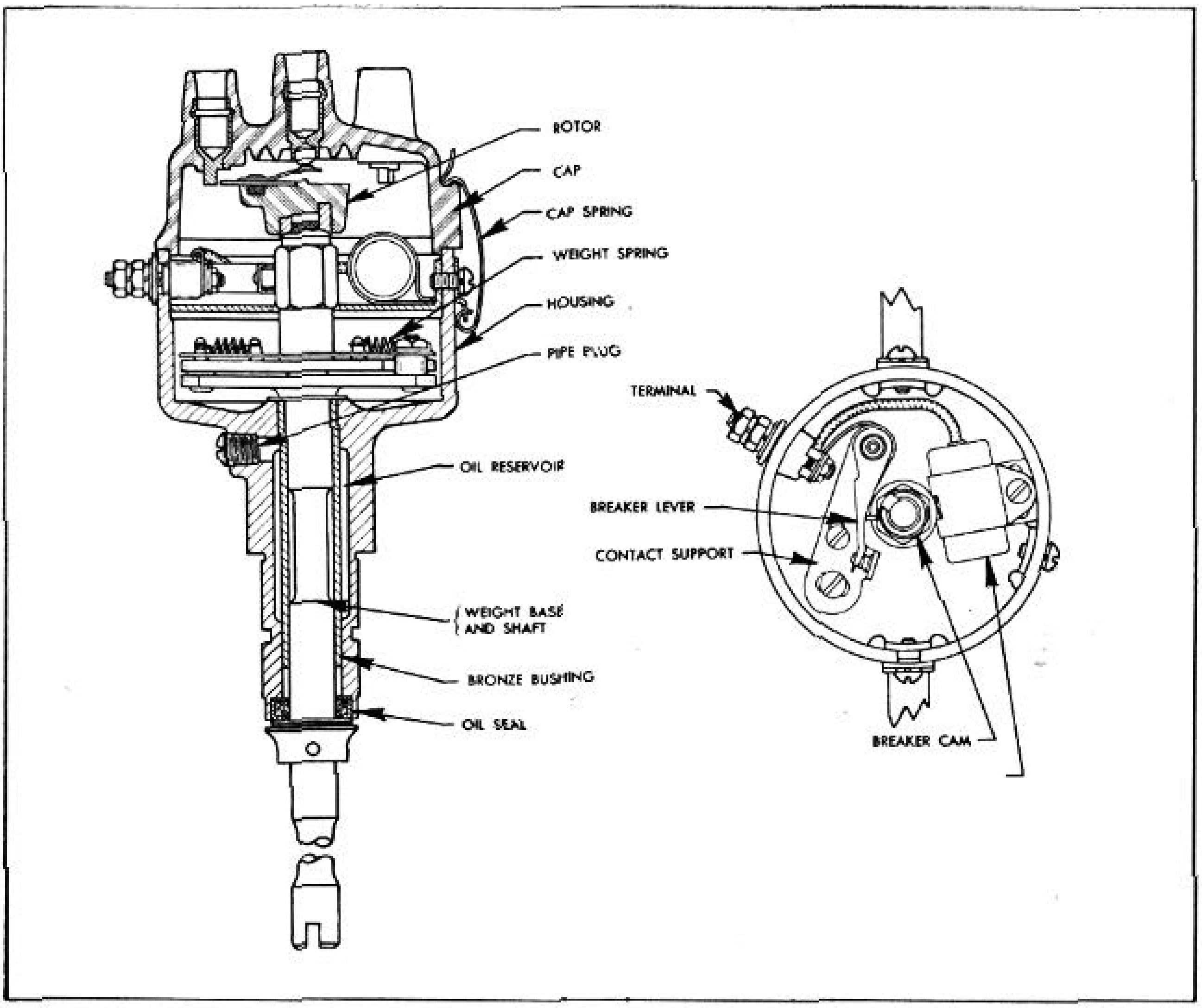


FIGURE 30 - *"Rambler" Series Distributor*

Distributor Specifications (Delco-Remy)
"Rambler" Series

Make	Delco-Remy
Model	1112382
Rotation	Clockwise at Drive End
Cam Angle	31 to 37 Degrees
Contact Point Pressure	17 to 21 Ounces
Contact Point Opening	.022"
Condenser Capacity	.18 to .23 Mfd.
Automatic Advance	Start at 2.0 Engine Degrees at 600 Engine R.P.M. Intermediate-11 Engine Degrees at 800 Engine R.P.M. Maximum 24.0 Engine Degrees at 2800 Engine R.P.M. NOTE: Low Limit---4 Degrees Less
Vacuum Advance	
Make	Delco-Remy
Model	1116045
Advance	3 to 5 Inches Vacuum to Start Travel 13 to 17 Inches Vacuum. for 17 Degrees Engine Advance (23/64" Travel)

Centrifugal Control

With speed variations, it is desirable to advance the spark in direct relation to the engine speed in order to develop maximum power (Fig. 31) .

As engine speed increases, the weights gradually throw out and advance the cam assembly to give the desired spark advance for the speed at which the engine is running. The correct centrifugal spark advance is determined by various specified throttle tests until the maximum is obtained. Weight, cam contour, and spring calibration, which permits this advance, may then be corrected by adjustment or replacement.

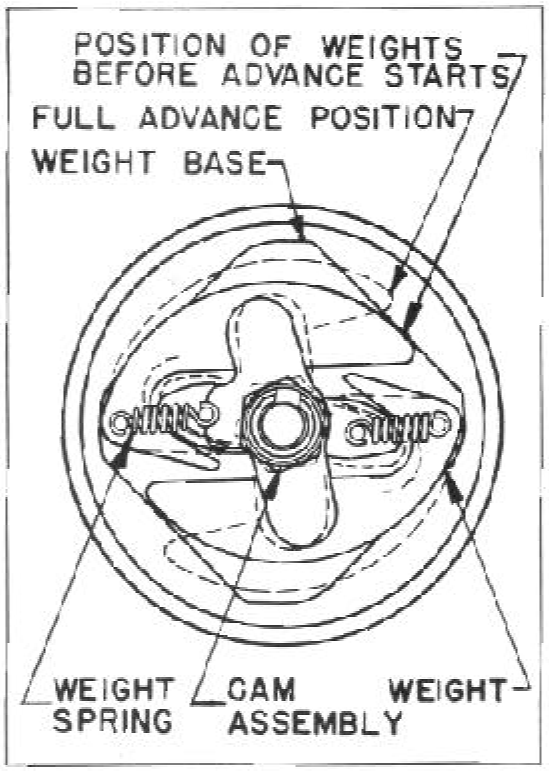


FIGURE 31—*Centrifugal Advance Mechanism*

Vacuum Control

Under part throttle operation, additional spark advance is desirable for improved performance and fuel economy. The vacuum control (Fig. 32) consists essentially of a diaphragm and linkage acting against a return spring. The linkage is riveted to the diaphragm at one end and clamped about the distributor stem at the other end. The vacuum tube from the vacuum control connects to a passage, in the carburetor, leading to a port just above the throttle valve. As soon as the throttle is opened, the manifold vacuum is admitted to the carburetor and the vacuum control diaphragm is caused to collapse in proportion to the vacuum. The linkage between the diaphragm and the distributor stem is drawn into the vacuum units, causing the distributor to rotate in its mounting to secure vacuum advance.

The total spark advance for any condition of engine speed is determined by the two advance mechanisms acting together and depending on the throttle opening and load. When the throttle is closed, there is no vacuum advance, all advance being secured by the centrifugal advance mechanism. The total advance is the sum of the centrifugal plus the vacuum advance. With a wide open throttle, the vacuum drops off and all advance is obtained by the centrifugal advance mechanism.

The "Rambler" Series is equipped with an external vacuum spark control unit which rotates the entire distributor in its mounting pad to the correct advance for the existing vacuum.

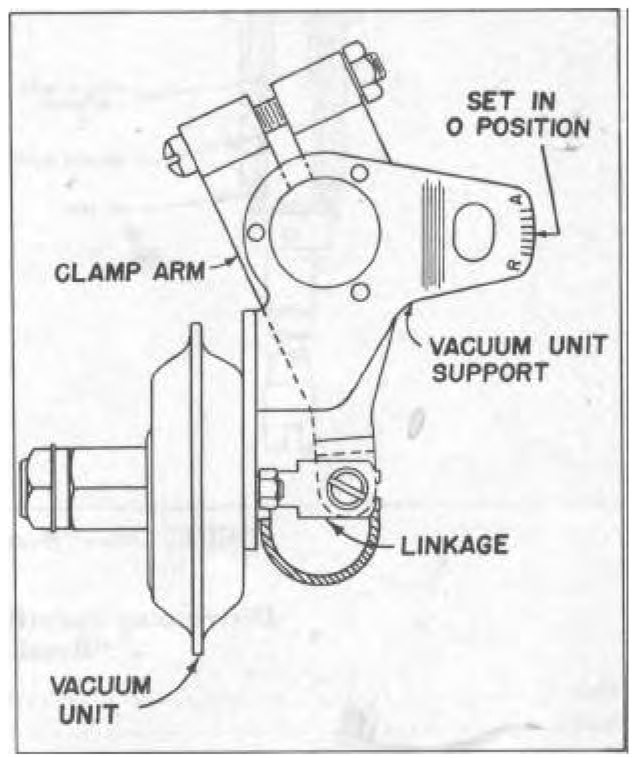


FIGURE 32—*Distributor Vacuum Control "Rambler" Series*

Distributor Maintenance (Delco-Remy) Lubrication

The distributors incorporate a built-in oil reservoir from which shaft lubrication is obtained through a porous bushing. This reservoir back of the shaft bushing is filled with light engine oil and sealed before the unit is shipped. The supply of oil is sufficient to last for 10,000 miles of operation (approximately 200 hours) under normal operating conditions. The oil reservoir should be refilled every 10,000 miles of operation or more frequently when unusual heat or other operating conditions are experienced

To refill the reservoir, remove the oil plug and add Grade 20W oil. When replacing plug, seal with a compound that will hold against oil. In addition, a trace of high melting point ball bearing grease should be placed on the breaker cam every 5,000 miles. Also at 5,000 miles, place one drop of light engine oil on the breaker lever pivot and a few drops on the felt wick under the rotor.

Inspection

The cap should be removed at regular intervals and the contact points, rotor and cap examined. Check the high tension wiring for frayed or damaged insulation and poor connections at the cap or plugs. Replace if necessary. Replace the cap or rotor if they are cracked or show carbonized paths indicating the secondary current is leaking to ground over the surface of the material.

Contact Points

Contact points that are burned or pitted should be replaced or dressed with a clean, fine-cut contact file. The file should not be used on other metals and should not be allowed to become greasy or dirty. NEVER USE EMERY CLOTH TO CLEAN CONTACT POINTS. Contact surfaces, after considerable use, may not appear bright and smooth, but this is not necessarily an indication that they are not functioning satisfactorily.

Oxidized Contact Points

Oxidized contact points may be caused by high resistance or loose connections in the condenser circuit, oil or foreign materials on the contact. surfaces, or most commonly, high breaking current. Check for these conditions where burned contacts are experienced.

The Contact Point Opening

Contact point opening must be set to specification. Points set too closely may tend to burn and pit rapidly. Points with excessive separation tend to cause a weak spark at high speed. The point opening of new points may be checked with a feeler gauge. Use of a flat feeler gauge on used points is not recommended, since the roughness of used points make it impossible to set the point opening accurately by this method. A dial indicator is recommended to check the point opening of used points. When necessary to check and adjust point opening with a feeler gauge, proceed as follows:

Rotate breaker cam until breaker lever rubbing block is on the high point of the cam lobe, thus giving the maximum point opening. Loosen the clamp screw holding the contact support and adjust point opening by turning the eccentric screw in the contact support. Tighten clamp screw; check with gauge again after tightening clamp screw. THE CONTACT POINTS SHOULD BE CLEANED BEFORE ADJUSTING IF THEY HAVE BEEN IN SERVICE. The cam or contact angle is the angle in degrees of cam rotation through which the points remain closed.

Contact Point Pressure

Contact point pressure must fall within the limits given. Weak tension will cause point chatter and ignition miss at high speed, while excessive tension will cause undue wear of the contact points, cam and rubbing block.

The Condenser

Four factors affect condenser performance and each factor must be considered in making any condenser tests. BREAKDOWN is a failure of the insulating material, a direct short between the metallic elements of the condenser. This prevents any condenser action. LOW INSULATION RESISTANCE or leakage prevents the condenser from holding a charge. A condenser with low insulation resistance is said to be "weak." All condensers are subject to leakage, which up to a certain limit, is not objectionable. When it is considered that the ignition condenser performs its function in approximately 1/12,000 of a second, it can be seen that leakage can be large without detrimental effects. It must be considered, however, in any condenser test. HIGH SERIES resistance is excessive resistance in the condenser circuit due to broken strands in the condenser lead or to defective connections. This will cause burned points and ignition failure upon initial start and at high speeds. CAPACITY is built into the condenser and is determined by the area of the metallic elements and the insulating and impregnating materials. For a complete check of the condenser, it is desirable to use a tester which will check for the above four conditions.

IGNITION TIMING

Timing of the distributor to the engine should be made after the distributor has been calibrated in accordance with specifications. (See Distributor Specifications.)

"Hornet" V-8 Series

The ignition timing is controlled by the distributor location in its mounting. The breaker contact set that controls the interruption of the primary circuit (circuit opening contact) must just open when the 5° B.T.D.C. No. 1 cylinder position of the crankshaft is obtained (Fig. 33) .

Timing marks are located on vibration damper pulley and timing chain cover.

A basic timing location position for the distributor is given to prevent undue bending of the vacuum tube and rewiring of the distributor cap for timing and firing order. This timing should be done whenever the distributor is removed and the engine inadvertently cranked. Locate No. 1 cylinder in firing position. Install distributor with the

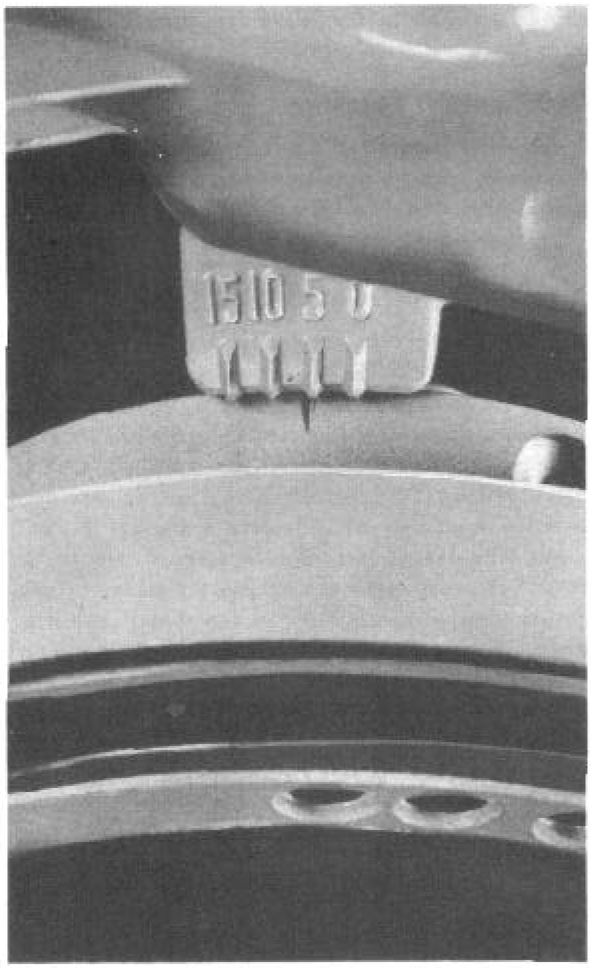


FIGURE 33—*Ignition Timing Position V-8 Series*

vacuum advance connection in approximately 2:00 o'clock position as viewed from the front of engine and the rotor pointing to the cap terminal, No. 1 cylinder position, just to the left of the rear distributor cap clip. Position the distributor so the circuit opening contacts are just ready to open. Tighten the distributor retaining clamp screw enough to hold distributor and start engine. With a timing light, accurately time distributor to engine.

The distributor is driven at Y2 crankshaft speed from a gear cast and cut on the rear of the camshaft. An extension on the distributor (Fig. 26) drives the oil pump. This makes it possible to engage the oil pump shaft in advance of engagement with the cam shaft drive gear. Because of this drive arrangement, the oil pump can be removed at any time with no effect on distributor timing location. While installing the distributor, the extension also permits engagement with the oil pump drive shaft in one of two locations 180° apart merely by turning the rotor. Further downward movement of the distributor assembly will engage the distributor drive gear with the camshaft drive gear

"Hornet" 6, "Wasp", and "Rambler" Series

All distributors on these models have off-set drives so they can only be installed in one position, provided the oil pumps have not been removed and replaced. Proper location of the oil pump is necessary to obtain basic distributor timing location. (Refer Oil Pump Removal and Replacement, Engine Section.) -

Position engine in No. 1 firing position and install distributor. Rotate distributor until points just begin to separate. Tighten clamp screw to prevent distributor from turning. Check firing order arrangement in distributor cap. Start engine and retime accurately with timing light at T.D.C. for the "Hornet" 6 and "Wasp" Series, and 4° A.T.D.C. for the "Rambler" Series.

Timing marks are located on the flywheel on the "Hornet" 6 Series. Correct timing is obtained by firing No. 1 cylinder as the U.D.C. No. 1 mark aligns with the lower edge of opening in the rear engine end plate near the starting motor. The four lines are 3° apart.

The "Wasp" Series has four marks plus the No. 1 U.D.C. timing mark located on the vibration damper. The marks are 3° apart.

The "Rambler" Series has two marks on the vibration damper pulley, one for U.D.C. and one for ignition timing 4° after top center.

IGNITION COILS

Ignition coils do not require special service other than the keeping of terminals and connections clean and tight. It is necessary to replace the complete coil in case of failure in the windings.

TYPE		TORQUE	GAP	THREAD REACH
Champion H-10 (Prior to P-6001) *Auto-Lite AL-7	"Hornet" V-8	30 Ft. Lbs.	.035"	7/16"
Auto-Lite AG-5 (At P-6001) *Champion N-8	"Hornet" V-8	30 Ft. Lbs.	.035"	3/4"
Champion H-10	"Wasp"			
	(C.I. Heads)	30 Ft. Lbs.	.032"	7/16"
*Auto-Lite AL-7	(Aluminum Heads)	25 Ft. Lbs.	.032"	7/16"
Champion H-11 *Auto-Lite AL-9	"Hornet" 6	25 Ft. Lbs.	.030"	7/16"
Auto-Lite A-7 *AC-44 *Champion J-7	"Rambler"	30 Ft. Lbs.	.030"	3/8"

*Optional

Inspection

The spark plugs should be removed periodically from the engine and examined for burned electrodes and dirty, fouled, cracked, or broken porcelains (Fig. 34).

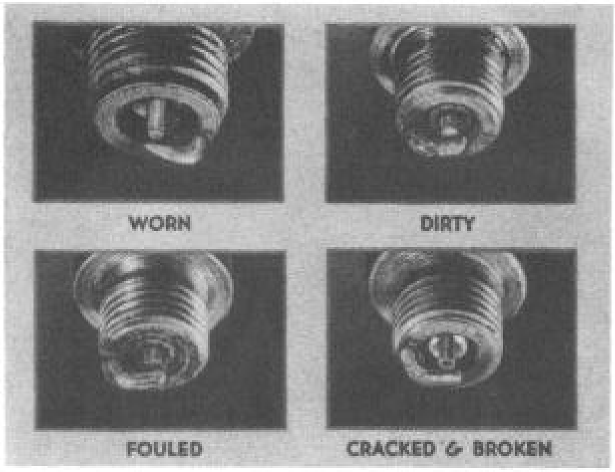


FIGURE 34—*Spark Plugs Often Indicate Other Sources of Trouble*

The gaps should be checked, set, and rechecked with an adjusting tool and gauge (Fig. 35).
CAUTION: *When installing plugs, always use new gaskets. They aid in dissipating heat and also insure compression and power expansion pressure seal.*

FIGURE 35—*Set Gap with Gauge*

Always use a torque wrench when installing spark plugs. Distortion from over-tightening will change the gap clearance of the plug. Torque to 30 Foot Pounds in cast iron cylinder heads, 25 Foot Pounds in aluminum heads.

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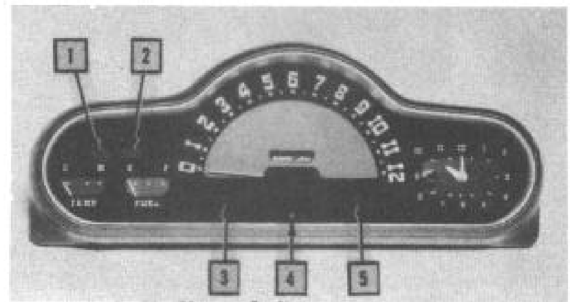
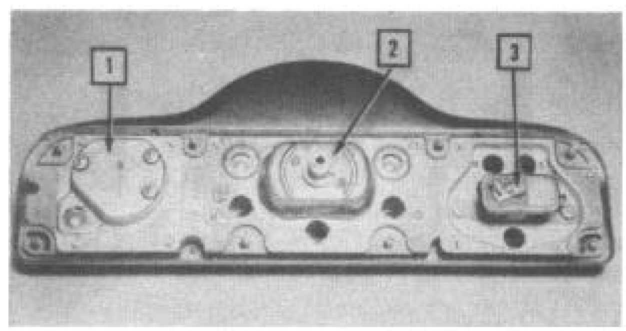
INSTRUMENT CLUSTER
"Hornet" and "Wasp" Series

The instrument cluster housing is mounted in the left side of the dash panel. In addition to the speedometer, it contains the panel lights, high beam indicator light, no-charge indicator light, low oil pressure light, electric gauge receiver units for water temperature and fuel level, clock, and directional signal pilot lights.



1. No-Charge Indicator
2. Low Oil Pressure Warning Light
3. Left Turn Indicator Pilot Light
4. Hi-Beam Indicator Light
5. Right Turn Indicator Pilot Light

FIGURE 36—*Instrument Cluster Assembly "Hornet" and "Wasp" Series*



1. Clock
2. Speedometer
3. Instrument Voltage Regulator

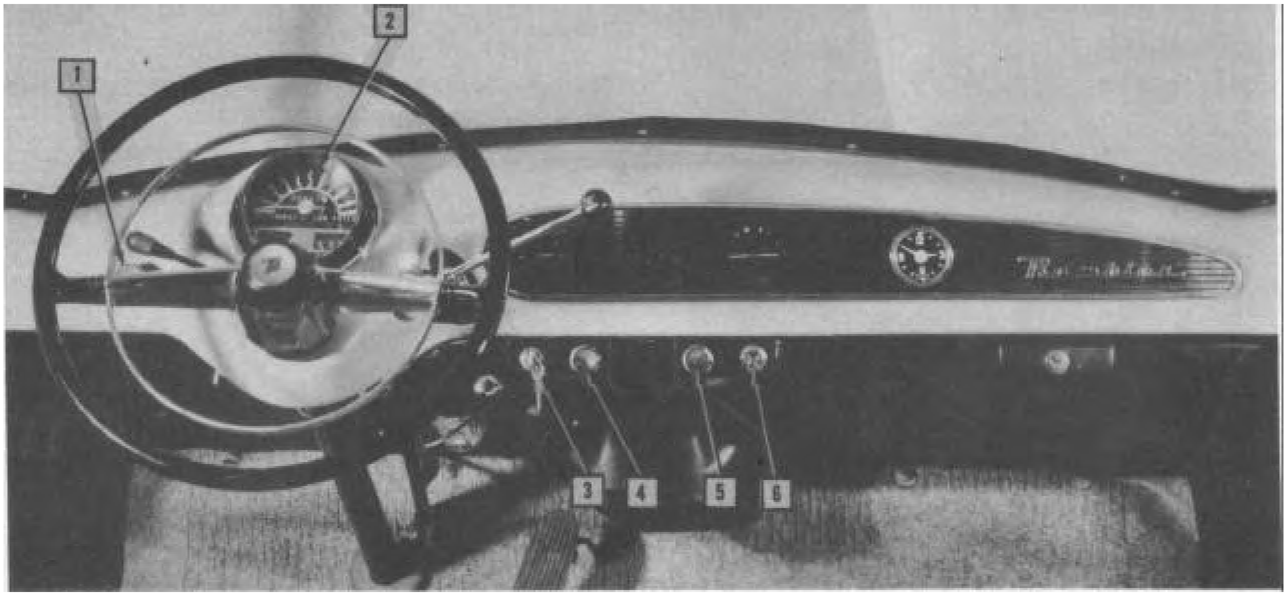
FIGURE 37—*Instrument Cluster Assembly Rear View "Hornet" and "Wasp" Series*

"Rambler" Series

The instrument cluster assembly contains the speedometer, low oil pressure light, high beam indicator light, no-charge indicator light, electric gauge receivers for water temperature, and fuel level indicators.

INSTRUMENT LIGHTS

The instrument lights illuminate the faces of the instrument cluster gauges for night driving.
The main light switch must be in "Park" or "Drive" position before the instrument lights will operate. They are controlled by an independent rheostat switch on the left and lower edge of the dash panel on the “Hornet”



1. Windshield Wiper Control
2. Instrument Cluster
3. Ignition Switch
4. Light Switch
5. Weather Eye Control Valve
6. Cigar Lighter

FIGURE 38—*Instrument Cluster Assembly and Dash Panel "Rambler" Series*

and "Wasp" Series, and by a toggle switch in dash panel edge on left side of steering column on the "Rambler" Series.

HIGH BEAM INDICATOR LIGHT

This light is connected to the high beam circuit in the headlight foot or dimmer switch. When the high beam is Operating in the head lamps, a red light dot is seen below the center of the speedometer scale on the "Hornet" and "Wasp" Series, and in the lower radius of the instrument cluster on the "Rambler" Series.

NO CHARGE INDICATOR LIGHT

A light is used to indicate general generator operation. When the output of the generator is below battery potential, a red light dot is seen on the left hand side of the instrument cluster above temperature gauge. When the generator output is above battery potential, other factors (wiring, voltage regulator, etc.) being normal, the light is out. On the "Rambler" Series, the no charge light is in the left side of the instrument cluster.

The charge indicator bulb is in an insulated socket and is connected to the charging circuit obtaining its ground through the voltage regulator. When the generator output rises above battery potential, the current flow from the generator reverses the direction of flow in the charging circuit and the light goes out. At this time, the charge indicator light no longer obtains a ground through the voltage regulator.

LOW OIL PRESSURE WARNING LIGHT

The low pressure warning light is wired in series with the oil
pressure sending unit on the engine block. This sending unit contains a diaphragm, spring, linkage, and electrical contacts. When the ignition switch is in the "on" position, the warning light circuit is energized and the circuit is completed through the closed contacts in the sending unit. Upon start of the engine, build up of oil pressure will compress the diaphragm opening the contact points, thereby breaking the circuit.

Oil Pressure Unit Test Procedure

Connect indicator light bulb in series with sending unit. Apply air or oil pressure to sending unit controlling pressure with a control valve and positive indicating gauge (Fig. 39).

With less than 13 P.S.I. ± 2 on the "Hornet" and "Wasp" Series and 61/2 P.S.I. 11/2 "Rambler" Series, the light will be on. Over this pressure, the light will be off.

ELECTRIC GAUGES

The fuel level and temperature gauges (indicators) are of the bi-metal type King Seeley Models.

"Hornet" and "Wasp" Series

Variable resistor type sending units are used for fuel and temperature gauges. Because of this, a voltage regulator is required.

The function of the instrument voltage regulator is to recieve the variable voltage supply from

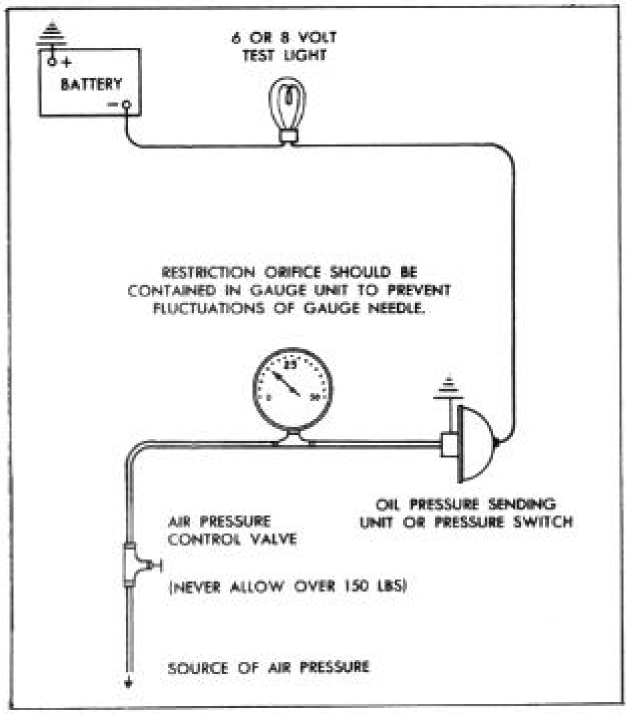


FIGURE 39—*Oil Pressure Warning Light Test Procedure*

the storage battery or charging circuit and regulate it to a constant value for the single wire gauge circuit shown schematically in Figure 40.

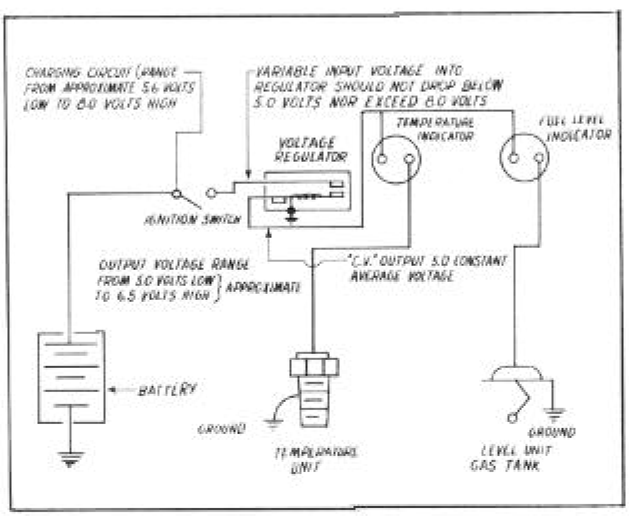


FIGURE 40—*Fuel and Temperature Gauge Circuit "Hornet" and "Wasp" Series*

To produce the constant voltage 5.0 volts output, the regulator is constructed simply as a heater bi-metal in conjunction with a pair of contacts. It is temperature compensated to produce correct constant voltage for the gauge systems at all expected temperatures. It is mounted near the dash panel indicators at approximately their same temperatures. The voltage regulator does not produce a steady D.C. voltage output, but rather a pulsating voltage at an effective constant average value of 5.0 volts.

The input voltage source can, therefore, be D.C. intermittent or interrupted D.C. or A.C. just as long as the average input voltage does not drop below 5.0 volts. Input voltage lower than 5.0 volts will result in proportionately low gauge indication. With the constant voltage regulator operating properly (with input voltage normally varying from 5.6 to 8.0 volts) input voltages in excess of 8.0 volts will not affect gauge indication accuracy but will overload the regulator contacts and may result in premature wear.

Fuel Level Gauge Operation "Hornet" and "Wasp" Series

With the tank empty, the float holds the slide rheostat (variable resistance) at maximum resistance causing the gauge to read "empty" (Fig. 41).

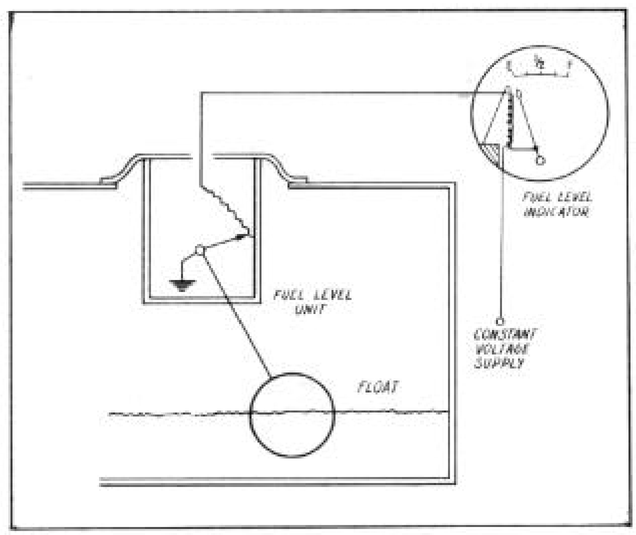


FIGURE 41—Tank "Empty" Position

With the tank full, the slide rheostat is moved to the minimum resistance point causing the gauge to read "full" with the ignition switch on (Fig. 42).

Temperature Gauge Operation "Hornet" and "Wasp" Series

The temperature gauge sending unit is a thermistor which varies in electrical conductivity with change in temperature, being very high in resistance when cold and low in resistance when hot.
The schematic drawings (Figs. 43 and 44) show the operation of the temperature gauge system.

Testing the Gauge Units "Hornet" and "Wasp" Series

If both gauges read excessively high such as fuel gauge reading high level when actually low level exists or temperature gauge reading

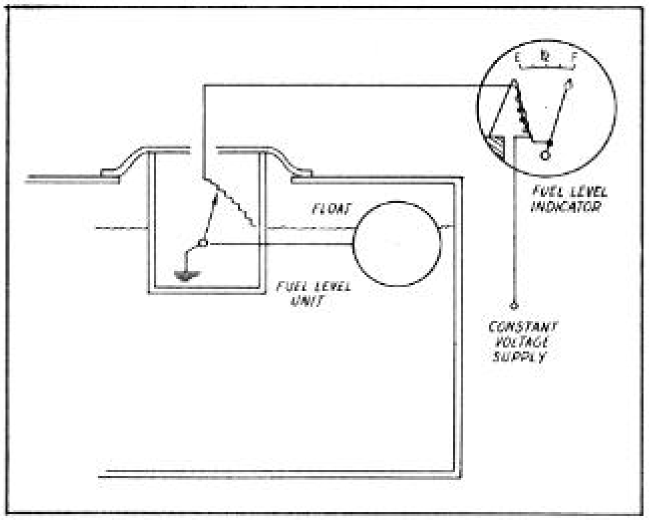


FIGURE 42—*Tank "Full" Position*

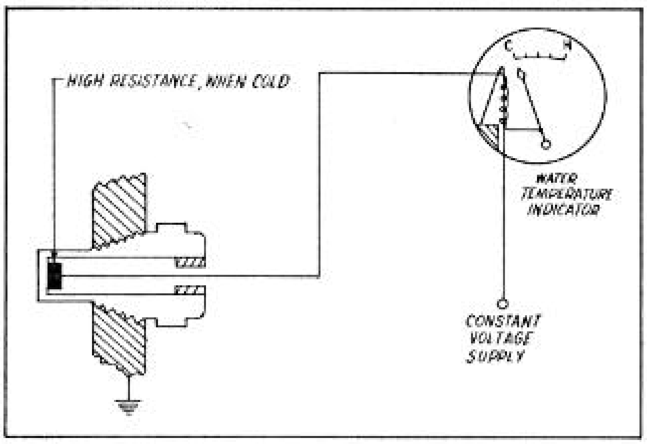


FIGURE 43—*Cold Coolant Conditions of Temperature Indicator*

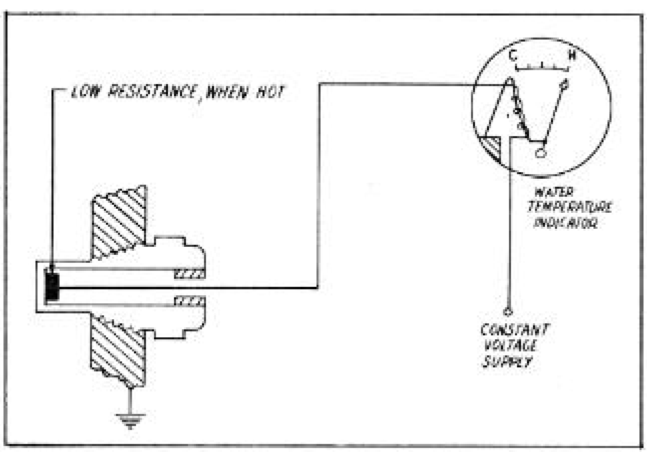


FIGURE 44—*Hot Coolant Conditions of Temperature Indicator*

higher temperatures with a cold engine, the constant voltage regulator is at fault and should be replaced.

If both gauges read too low, either the input voltage to the voltage regulator is too low (below 5.0) or the voltage regulator is not functioning properly and should be replaced

To check instrument cluster complete:

Connect accurate resistor of 73 ohms between temperature indicator terminal and case.

Connect accurate resistor of 59 ohms between fuel indicator terminal and case.

Apply 6-8 volts between "IGN" terminal on instrument voltage regulator and case. Indicator pointers should be on "E" and "C" marks. Duplicate same test except use 9 ohm resistor in temperature gauge circuit to ground and 10.9 ohm resistor in fuel gauge circuit to ground. Indicator pointers should be on "F" and "H" marks.

To check temperature indicator gauge in cluster:

With a current flow of .06 amperes plus or minus .007 amperes through temperature gauge, pointer should align with "C" mark. With current of .208 amperes plus or minus .006, pointer should be on "H" mark.

To check fuel indicator gauge in cluster:

With a current of .072 amperes plus or minus .009 passed through indicator, pointer should align with "E" mark. With current of .195 amperes plus or minus .006, pointer should align with "F" mark.

Electric Gauges
"Rambler" Series

The "Rambler" Series indicator units in the instrument cluster are very much like those of the "Hornet" and "Wasp" Series. However, bi-metal type sending units are used. Figures 45, 46, 47, and 48 illustrate the schematic circuit conditions in the bi-metal type circuit.

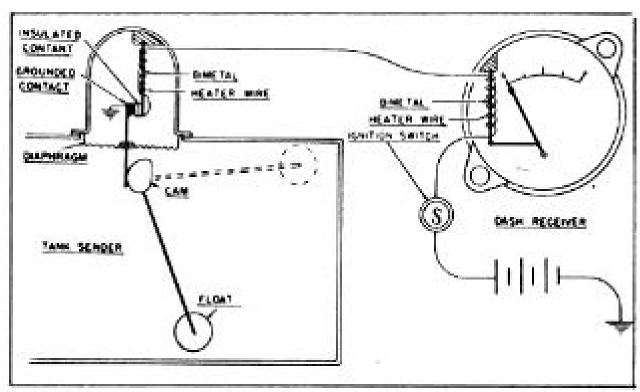


FIGURE 45—*Fuel Tank "Empty" Condition "Rambler" Series*

All Series

Gauge units may be tested but cannot be repaired in the field. When one fails to function properly, it is necessary to replace it. Gauges can be removed from the rear of the cluster. They are held in the cluster plate by mounting screws.

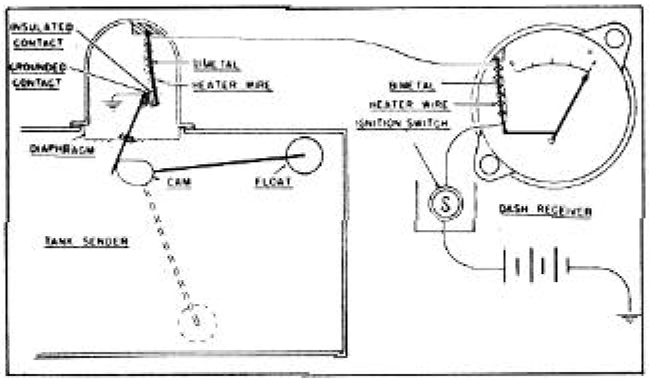


FIGURE 46—*Fuel Tank "Full" Condition "Rambler" Series*

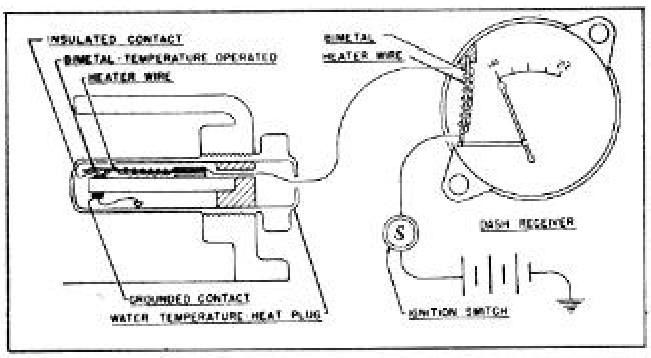


FIGURE 47—*Cold Coolant Condition of Temperature Indicator*

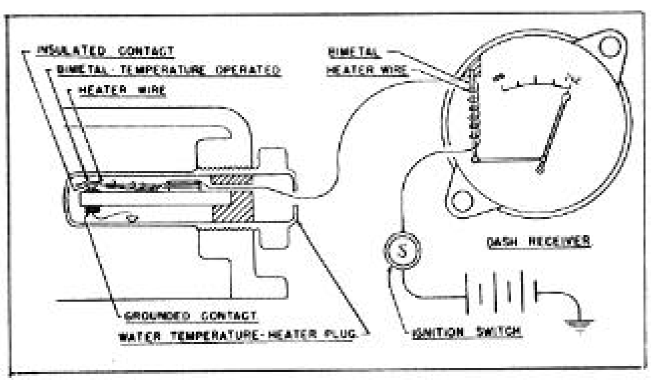


FIGURE 48—*Hot Coolant Condition of Temperature Indicator*

CAUTION: *Whenever any work is to be performed on the instrument cluster, speedometer, ignition switch or horn blower, disconnect one battery lead at the battery terminal.*

When removing more than one wire in the gauge cluster, label each wire as it is removed. This will insure proper relocation.

Testing Fuel Level and Temperature Indicators (General)

No unit should be removed from the car until a check has been completed which shows that such units are damaged or defective.

Obtain a known-to-be-good tank unit from parts stock. The "Hornet" and "Wasp" Series requires a King-Seeley variable resistor type. The "Rambler" Series requires a King-Seeley bi-metal type. Do not attempt checking one system with the tank unit from the other.

To determine that the test unit is satisfactory, connect it in series with a known-to-be-good receiver of the same type as the sending unit and a six volt source of current (and voltage regulator "Hornet" and "Wasp" Series). Operate the tank unit by hand. The receiver must read "empty" with tank unit float in bottom position and "full" with tank float in top position.

Two ten foot lengths of insulated wire equipped with clip terminals at each end will facilitate checking procedure.

Disconnect the sending unit being checked and connect a tank test unit. Turn on ignition switch and operate tank unit by hand.

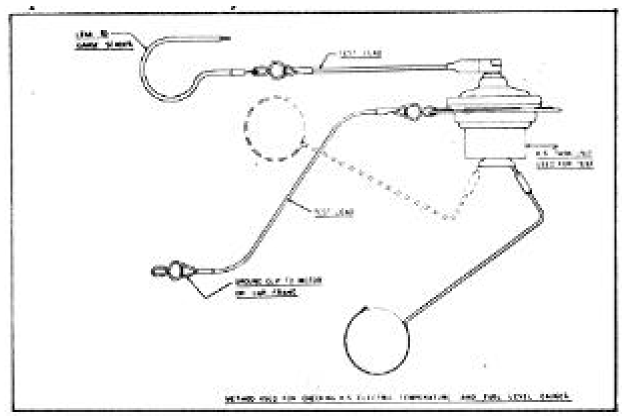


FIGURE 49—*Test Circuit (All Series). Be Sure Correct Type Tank Unit is Used*

Fuel Level Indicator

With float of tank unit at bottom position, receiver being checked should register at bottom mark on dial. Move float up to top position; receiver being checked should move to top mark on dial. Allow one minute for receiver pointer to come to rest.

Water Temperature Indicator "Hornet" and "Wasp" Series

Refer to Gauge Testing "Hornet" and "Wasp" Series.

"Rambler" Series

With float of tank unit at bottom position, receiver being checked should register at HOT end of scale. Move float up to top position; receiver being checked should move to COLD end of scale. Allow one minute for receiver pointer to come to rest.

All Series (Testing Continued)

If the dash unit needle reads high scale at all times, check for grounded wiring to the sending unit. shorted or burned out sending unit, or reversed wiring on the dash unit. If the dash unit needle reads low scale at all times, check for open circuit to the sending unit, open circuit in the sending unit, or failure of the ignition switch circuit to energize the gauge units.

If receiver operates correctly, check sender on car to see if it is properly grounded. If car is radio equipped, check condenser on sender. If condenser is shorted, it will cause receiver to over-indicate. When replacing condenser, it is preferable to use one of .10 microfarad capacity, but up to .50 can be used if necessary to cut out radio interference.

If ground and condenser are all right, replace sender and check to see if this has corrected the difficulty.

If receiver does not operate or fails to operate correctly, check wire lead to receiver and replace wire if faulty. If wiring is good, then replace receiver and check with sender on car. If receiver fails to operate, then replace sender.

NOTE: *If necessary to replace the receiver because it has been burned out, check wiring, sender, and radio condenser (if any) for a "short" and correct this condition. Otherwise, new receiver will also burn out. A short in the gauge circuit is easily recognizable because it will cause receiver to over-indicate in most cases beyond full scale.*

WARNING: Do not apply six volts direct to receiver (dash unit) as this will burn it out.

IGNITION LOCK CYLINDER REMOVAL
"Hornet" and "Wasp" Series

Remove the left ash tray assembly. Then remove the large switch retaining nut and "map" reading light assembly. Enough slack exists in the wiring to the ignition switch to permit lowering the switch assembly so that the ignition lock cylinder can he removed.

The cylinder is held in the housing by a spring loaded horseshoe lock which snaps into a groove cut in the switch housing to retain the cylinder.

Insert a stiff piece of wire, or paper clip, into the small hole as illustrated in Figure 50. Turn the key to the right (ignition "on" position). With the wire, depress the horseshoe lock in the lock cylinder and pull lock cylinder from the housing.

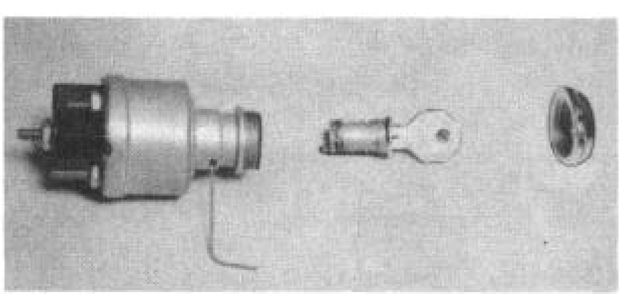
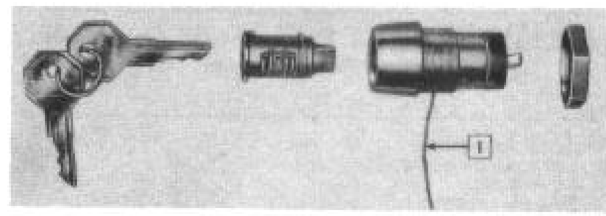


FIGURE 50—*Ignition Switch Assembly "Hornet" and "Wasp" Series*

Briggs and Stratton type lock cylinders are used on the "Hornet" and "Wasp" Series.

"Rambler" Series

Disconnect the ignition switch wires and remove the switch retainer nut located behind the instrument panel. The switch assembly may then be withdrawn from the panel. Insert a stiff wire, or paper clip, through the small hole in the switch housing to depress the small horseshoe lock retaining the lock cylinder (Fig. 51).



1. Use Stiff Wire to Depress Horseshoe Lock

FIGURE 51—*Ignition Switch Assembly "Rambler" Series*

Briggs and Stratton lock cylinders are used on all "Rambler" Series.

IGNITION SWITCH REMOVAL

Follow the procedure outlined under "Ignition Lock Cylinder Removal."

CAUTION: Before any work is performed under the dash, the battery should be disconnected from the electrical system.

CIRCUIT BREAKERS
"Hornet" and "Wasp" Series

Circuit breakers are provided to protect the main electrical wiring from overload. These consist of 20 ampere circuit breaker (ignition switch, heater motors, and stop light) and one 30 ampere circuit breaker (main lighting circuit). The 20 ampere circuit breaker is located behind the dash panel on the left side of the ceiling of the cowl. The 30 ampere circuit breaker is attached to the headlight switch.

ELECTRICAL FUSE
"Rambler" Series

A 30 ampere fuse is provided in the light switch assembly to protect the main lighting circuit from overload. The stop light and directional signal lights are protected by a 30 ampere fuse located on the left front wheelhouse panel.

HEAD LAMPS

The head lamps are of the familiar sealed beam type. Adjustment of beam direction may be made to agree with existing state regulations by the method outlined below. For access to the adjustment screws on each sealed beam, it is only necessary to remove the head lamp door.

To obtain maximum results in road illumination and the safety that has been built into the headlighting equipment, the headlamp beams must be properly aimed.

Locate the car on a level floor (with no passengers in the car). Place a light colored vertical screen 25 feet ahead. (A vertical wall may be used.) Draw a horizontal line on the wall two inches (three inches if required by local State law) below the headlamp center level, and draw a vertical line directly ahead of each lamp. The vertical line, midway between the headlamps, may be located by sighting through the center of the rear window and over the center of the hood.

Cover one lamp and adjust the other lamp by centering the high intensity beam (Fig. 52).

Repeat the operation for the second lamp. No further adjustment is needed for the lower beam.

> CAUTION: *If your state requires a loading allowance, draw the horizontal line below the level line by the amount required in your particular state.*

LIGHT SWITCH
"Hornet" and "Wasp" Series

The main lighting switch is located at the left side of the dash panel between the radio speaker grille and windshield wiper control. To remove the light switch assembly, remove the Knob with an Allen wrench.
Then remove the retaining (French) nut.
The light switch assembly can now be removed from the dash panel and lowered to provide access to the wiring (Fig. 54).

"Rambler" Series

Disconnect the instrument switch panel from the dash panel. Place the switch in the full "on" position and insert a stiff wire, or paper clip, in the hole provided to release the switch shaft and knob assembly (Fig. 55). Then remove retaining (French) nut.

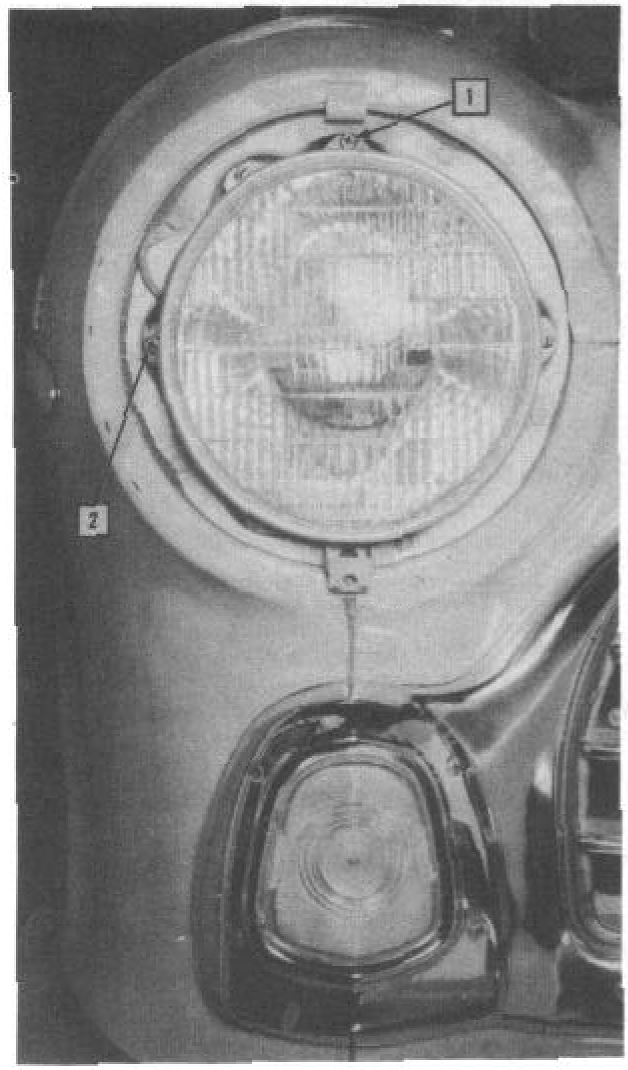
HEADLAMP DIMMER SWITCH

The "Hornet" and "Wasp" Series dimmer switch is located below the left front fender on the toe board. It is protected with a shield which must be removed from below the car before the switch can be removed (Fig. 56).

PARKING, TAIL, STOP, AND DIRECTIONAL LIGHTING

"Hornet" and "Wasp" Series

Parking and directional signal lights are mounted in a single assembly located in the front fender. Double contact bulbs are used in parking and directional signal light sockets. One element for parking light the



1. Vertical Adjustment
2. Horizontal Adjustment

FIGURE 52—Head Lamp Adjustment

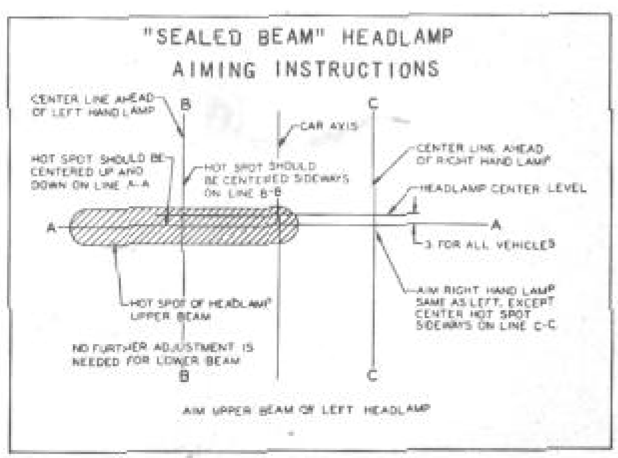
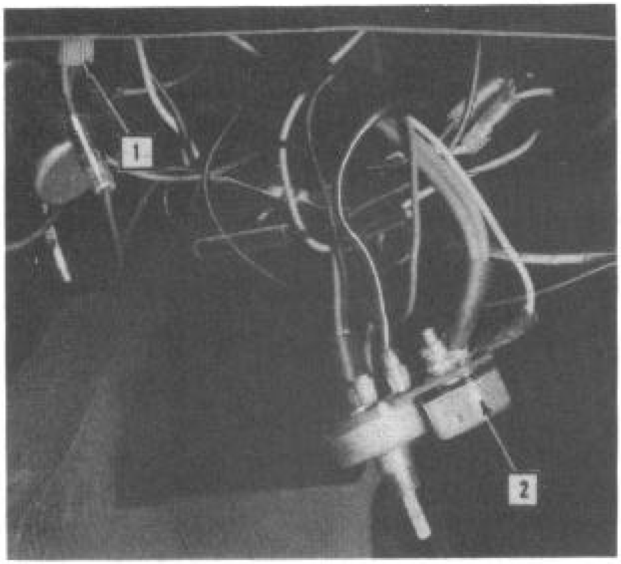
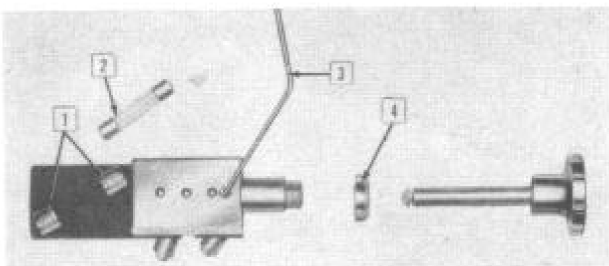


FIGURE 53—*Head Lamp Adjusting Chart*



1. Resistor for Dash Instrument Lighting
2. 30 Ampere Circuit Breaker

FIGURE 54—*Light Switch Removed from Dash*



1. Fuse Holder
2. 30 Ampere Fuse
3. Stiff Wire to Release Knob and Shaft
4. French Nut

FIGURE 55—*Light Switch Assembly "Rambler" Series*

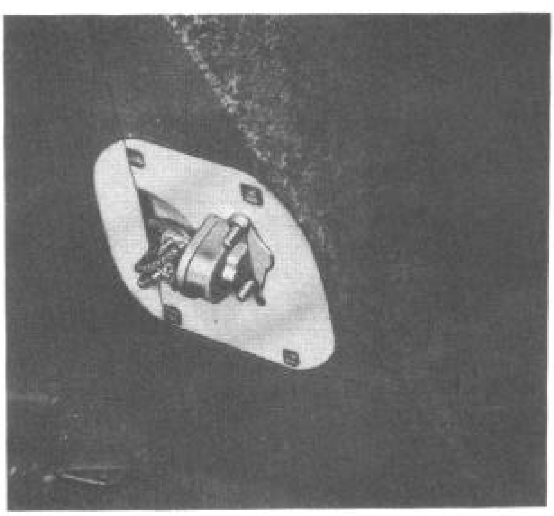


FIGURE 56—*Headlight Dimmer Switch "Hornet" and "Wasp" Series*

the other for directional signal light.

Bulb #1154 (Trade Number)
Directional Light Element 21 cp 6-8 volts
Parking Light Element 3 cp 6-8 volts

Tail, stop, and directional signal lights are all contained in the rear fender light assemblies.

Double contact bulbs are used in the tail lamp assembly. One element is in the tail light circuit while the other element is alternately in the brake light or directional light circuit depending on how the directional control switch is positioned. The lens are retained with three screws.

Bulb Size #1154 (Trade Number)
Tail Light Element 3 cp 6-8 volts
Stop and Directional Element 21 cp 6-8 volts

The right hand light assembly upper compartment houses the fuel tank filler cap.

The license lights are located in the rear vertical bars.

Bulb Size #63 (Trade Number)
3 Candle Power 6-8 volts

"Rambler" Series

The "Rambler" Series front parking and directional light assemblies are mounted in the front section of the fender.

The parking lamp assembly (less directional signal) contains a single contact bulb for parking light operation.

Bulb #63 (Trade Number) 3 cp 6-8 volts

Where directional light assemblies are installed, they contain double contact bulbs and two wire leads. One bulb element is then directional signal and the other is parking light.

Bulb #1154 (Trade Number)
Directional Light Element 21 cp 6-8 volts
Parking Light Element 3 cp 6-8 volts

To change a parking light bulb, the snap ring holding the lens in place must be removed.

Tail, stop, and directional signal lights are housed in rear fender ends. The lamp assembly contains an upper and lower section. The division is part of the lens.

To change a tail, stop, or directional light bulb, the lens must be removed. It is held with one center retaining screw.

Bulb #1154 (Trade Number)
Stop Light Element 21 cp 6-8 volts
Tail Light Element 3 cp 6-8 volts

License Light Assembly

The license light is mounted in the rear license plate mounting bracket which is mounted with two metal screws from the rear of the license plate cross bar. To change the bulb, the license mounting bracket must be removed from the license plate cross bar and the socket and lens assembly removed from the licensemounting bracket.

Bulb #T-63 (Trade Number) 3 cp 6-8 volts

HORNS AND RELAYS

The horn circuit includes a matched pair of horns, the horn relay, the battery, the horn button, and the car frame. With the relay in the circuit, the button is required to carry only the relay control current. Therefore, the spark formed when the button contacts open is much less than it would be if all current flowed through the button.

The "Hornet" and "Wasp" Series horns are mounted on the right and left wheelhouse panel extensions behind the radiator grille.

The "Rambler" Series straight twin horns and relay assembly are mounted on the right front wheelhouse panel underneath the hood.

The horn button contact plates are actuated by the horn ring or button contained in the steering wheel. The horn button wire has a bayonet connection at the lower end of the steering post under the hood.

Each horn consists of a diaphragm vibrated rapidly by an electromagnet. When the electromagnet is energized, it pulls on an armature attached to the diaphragm. The slight movement of the armature flexes the diaphragm and also opens a set of contacts. With the contacts open, the electromagnet is no longer energized and the diaphragm returns to its original shape. This closes the contacts and the cycle is repeated.

The constant flexing and straightening of the diaphragm produces vibration and sound.

A resistance unit is connected across the contact points to reduce arcing and prolong contact life.

The horn relay consists of an electromagnet and a set of contacts arranged so that when the magnet is energized an armature is attracted and the contacts close. A spring keeps the contacts open when the unit is at rest.

Horn Wiring

Inspect the wiring between the horn, button, relay, and battery for loose connections, chafed insulation, corroded terminals, and for partial breaks—especially where the leads enter a conduit or are clamped by a terminal. This inspection should include the battery ground strap and the grounding of the horn through its mounting bracket.

If the horns do not operate when the horn ring is depressed, check for breaks in the horn button circuit by grounding the relay "S" terminal. If the horns operate, the horns and relay are not defective. Then the horn button and lead should be thoroughly inspected.

The usual cause of continuous operation of the horns is a ground in the horn button wiring. To check, disconnect the horn button lead from the relay "S" termimal. If this stops the horn operation, inspect the button lead for grounds especially where it enters the steering column. If the horns do not stop when the "S" terminal lead is removed, disconnect the other leads from the relay and inspect the relay.

Horn Maintenance

The horns should be cleaned and inspected periodically. If horns are rusted or corroded, they should be removed for overhaul or replacement. If the horn mounting is cracked or loose, repairs should be made.

To test whether the horns are inoperative, connect a jumper lead from the battery to the horn terminal. The horns should operate with this lead in place. If they do not, ground the horn frame to the chassis to check the horn ground connection. If the horns now operate, the ground connection is at fault and the horn should be removed and the mounting surfaces cleaned.

Hornet" and "Wasp" Series

If the horns are inoperative, or do not have a steady clear tone, they should be removed, cleaned, and disassembled. To remove the horn dome, place a screw driver between the dome head and the projection and loosen.

Inspect the diaphragm for cracks and distortion and inspect the windings and connections for breaks, faulty insulation, and grounds.

Horn Relay Maintenance

To check the relay operation, ground the relay horn button terminal. If the relay does not close with the terminal grounded, check the wiring and horns as described previously and remove the relay for a complete test.

"Hornet" and "Wasp" Series

The relay coil resistance is 4.5 ohms taken through the coil from the "S" and "B" terminals.

The normal amperage draw for the low pitch horn is 13-17 amperes @ 5-7 volts. The normal amperage draw for the high pitch horn is 12-16 amperes @ 5-7 volts.

"Rambler" Series

Clean relay points with contact file. Bend brass strip on top of armature to readjust points to .03125" plus or minus .010".

SPEEDOMETERS

King-Seeley type speedometers are used. They are the magnetic type.

For servicing of the speedometer head within warranty, it is recommended that the head be replaced with a unit from stock. For maintenance service after the warranty period, the speedometer head should be removed and taken to an authorized service station.

Lubrication of the needle shaft bearing is provided by a wick located at the rear of the speedometer head.

The end play of the speedometer needle shaft bearing should be inspected. This should not exceed a maximum of .005" on the "Hornet" and "Wasp" Series. Maximum end play not to exceed .008" to .014" on the "Rambler" Series.

Speedometer Cable Inspection

Always inspect the speedometer cable housing, whenever working on the speedometer, for kinks or sharp bends in the housing. Make sure that the cable is of the correct length for the series required.

To insure the use of speedometer cable cores which will give quiet and satisfactory service, locate the cable core on a flat surface in the form of an inverted "U" and then cross the open ends. Hold one end in the left hand, the other in the right hand.

Twist one end, applying light finger pressure to the other end. If the core is satisfactory, the turning action will be smooth.

On a damaged core, although not noticeable by visual inspection, the turning action will be jerky and, in a severe case, the core will leap or jump.

The speedometer cable requires no lubrication but as a sound deadener, it is beneficial to coat the cable with a light coating of high melting point grease.

BATTERY SPECIFICATIONS

Series	"Hornet"	"Wasp" and "Rambler"
Make	Auto-Lite	Auto-Lite
Model	CT-1-15	1M-100
Ampere Hours: 20 Hour Rating	105	100
Amperes: 20 Minute Rating	133	
No. of Plates	15	15

GENERATOR SPECIFICATIONS

Series	"Hornet" V-8	"Hornet" 6 and "Wasp"	"Rambler"
Make	Auto-Lite	Auto-Lite	Auto-Lite
Model With Air Conditioning Without Air Conditioning	 GGW-4801-F GGW-4801-F	 GGW-4802-B GGW-4802-B	 1102815 1100021
Type	Shunt	Shunt	Shunt
Rotation	R.H. Drive End	R.H. Drive End	R.H. Drive End
Brush Spring Tension	35-53 Ozs.	35-53 Ozs.	28 Ozs.
Field Current@ 6 Volts 80°F.			1.87 to 2.00 Amperes (Model 1102815) 1.85 to 2.03 Amperes (Model 11000211
@ 5 Volts	1.6 to 1.7 Amperes	1.6 to 1.7 Amperes	
Max. Controlled Charging Rate (Controlled by Current Setting)	45 Amperes	45 Amperes	45 Amperes (Model 1102815) 38 Amperes (Model 1100021)

ELECTRICAL VOLTAGE AND CURRENT REGULATOR SPECIFICATIONS

	"Hornet" and "Wasp"	"Rambler"	
Make	Auto-Lite	Delco-Remy	Delco-Remy
Model	VBE-6101-A	1118841 (Without A.C.)	1118828 (With A.C.)
Cut-Out Relay Voltage at Closing	6.3-6.8	5.9-6.7 Adjust to 6.4	5.9-6.7 Adjust to 6.4
Air Gap	.031"-.034"	.020"	.020"
Voltage Regulator Volts	7.35	6.9-7.4 Adjust to 7.2	6.9-7.4 Adjust to 7.2
Air Gap	.048"-.052"	.075"	.075"
Current Regulator Amperes	43-47	34-39 Adjust to 38	42-47 Adjust to 45
Air Gap	.048"-.052"	.075"	.075"

STARTING MOTOR SPECIFICATIONS

	"Hornet"		"Rambler"	
	V-8	6 Cylinder		
Make	Auto-Lite	Auto-Lite	Auto-Lite	Delco-Remy
Model	MCL-6132	MCH-6109 (Std. and O.D.) MCH-6306 (Hydra-Matic)	MCH-4167 (Std. and O.D.) MZ-4172 (Hydra-Matic)	1107119 (Std. and O.D.) 1107136 (Hydra-Matic)
Brush Spring Tension	42-53 Ozs.	42-53 Ozs.	42-53 Ozs.	24-28 Ozs.
Lock Test Amperage Draw	410	335	280	550
Volts	2.0	2.0	2.0	3.25
Torque in Foot Pounds	8.0	6.0	4.4	11
No Load Test Amperage Draw	65	65	70	70
Volts	5.0	5.5	5.5	5.65
R.P.M.	4900	4900	4300	5500

DISTRIBUTOR SPECIFICATIONS

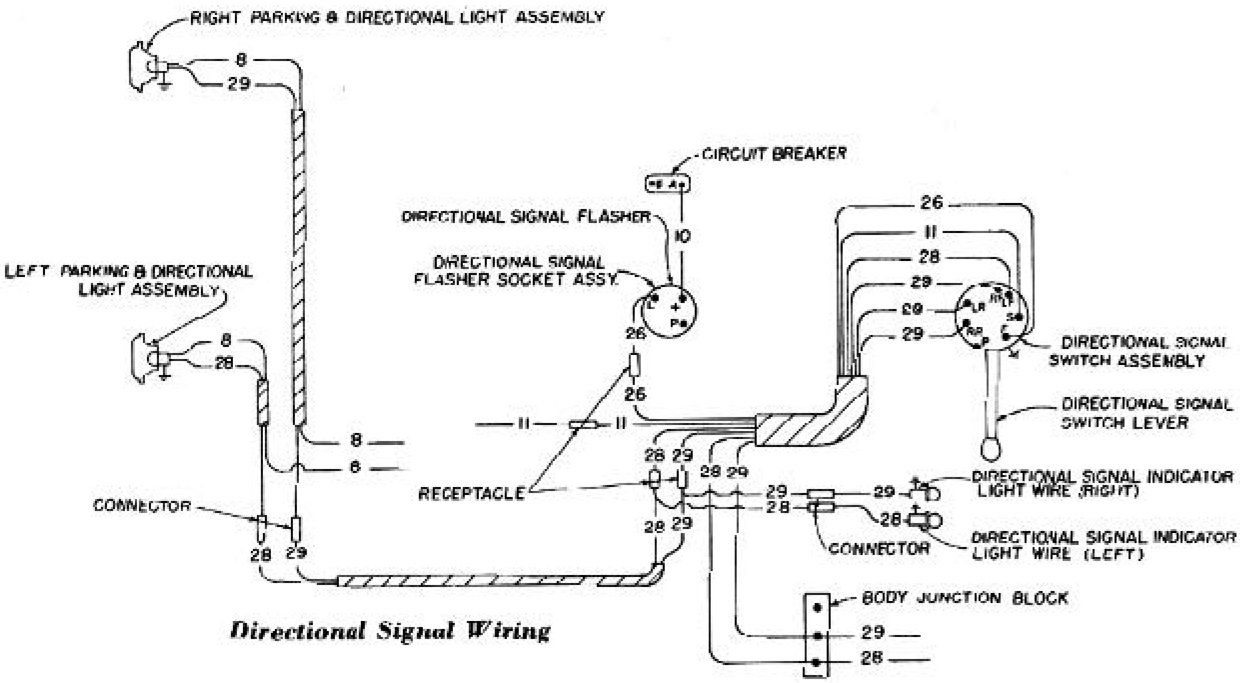
Series	"Hornet" V-8		"Hornet" 6	"Wasp"	"Rambler"
Make	Auto-Lite	Auto-Lite	Auto-Lite	Auto-Lite	Delco-Remy
Model	IBK-4001	IBK-4001-B	IAT-4203-A	IAT-4202	1112382
*Max. Automatic Advance (Engine Degrees and R.P.M.)	40 @ 2400	32 @ 3500	27 @ 3000	18 @ 4000	24 @ 2800
*Max. Vacuum Advance (Engine Degrees)	11°	24°	15°	7.5°	17°
Vacuum in Inches	10″	13″	9½″	11¼″	13-17″
Dwell Angle	33°-39°	33°-39°	31°-37°	31°-37°	31°-37°
Rotation	R.H. @ Drive End	R.H. @ Drive End	L.H. @ Drive End	L.H. @ Drive End	R.H. @ Drive End
Breaker Gap	.017″	.017″	.020″	.020″	.022″
Breaker Arm Tension	17-20 Ozs.	17-20 Ozc.	17-20 Ozs.	17-20 Ozs.	17-21 Ozs.
Condenser Capacity	.25-.28 Mfd.	.25-.28 Mfd.	.21-.25 Mfd.	.21-.25 Mfd.	.18-.23 Mfd.

*NOTE: Low Limit—Delco-Remy 4 Degrees Less. Auto-Lite 1 Degree Less.

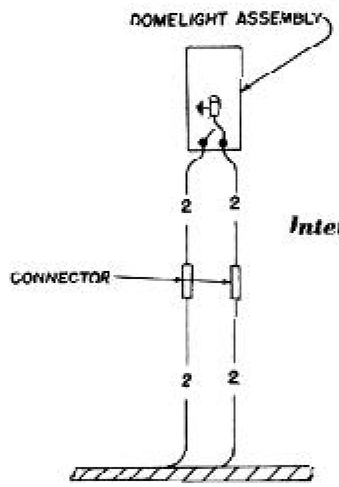
MISCELLANEOUS SPECIFICATIONS

Series	"Hornet" V-8	"Hornet" 6	"Wasp"	"Rambler"
Timing Breaker Points Open	5° B.T.D.C.	T.D.C.	T.D.C.	4° A.T.D.C.
Timing Mark Location	Vibration Damper	Flywheel	Vibration Damper	Vibration Damper
Firing Order	1,8,4,3,6,5,7,2	1,5,3,6,2,4	1,5,3,6,2,4	1,5,3,6,2,4
Spark Plug	Champion H-10 (Prior to Engine #P-6001)	Champion H-11	Champion H-10	Auto-Lite-A-7
(Optional)	Auto-Lite AL-7	Auto-Lite AL-9	Auto-Lite AL-7	AC-44 Champion J-7
(Optional)	Auto-Lite AG-5 (At Engine #P-6001) Champion N-8			
Thread	14MM	14MM	14MM	14MM
Spark Plug Gap	.035″	.030″	.032″	.030″

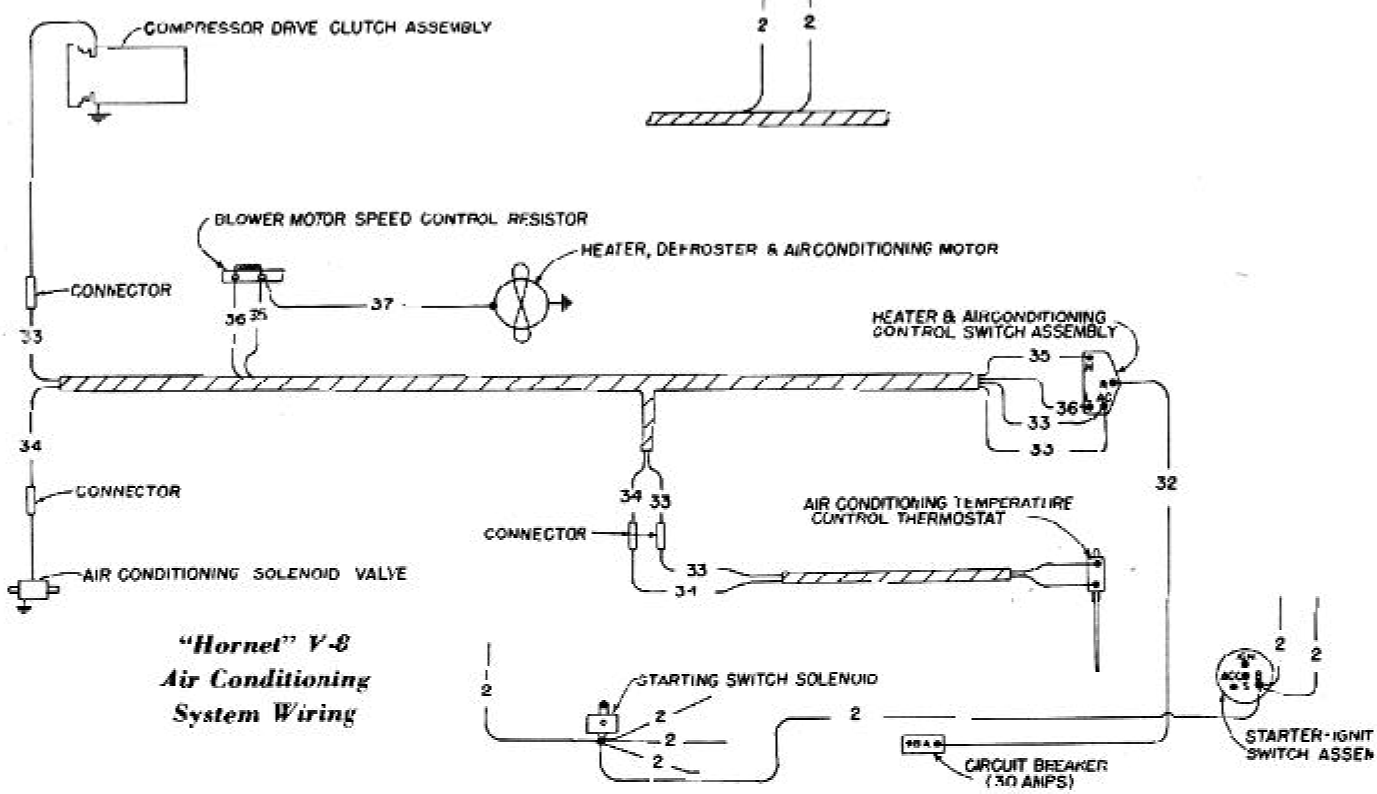
ELECTRICAL WIRING DIAGRAMS



Directional Signal Wiring



Interior Wiring Hollywood Hardtop



"Hornet" V-8
Air Conditioning
System Wiring

o.

l Lights. Also, Instrument Lights and ie Transmission Selector Dial Light and rnament

Primary Circuit—Ignition Switch to Coil and Distributor .

Switch Controlled Circuits—Ignition to Radio, 20 Ampere Circuit Breaker, ight Switch, Instruments, Heater Blower and Directional Flasher

ight Circuit—Stop Light Switch to Body n Block and Stop Light Directional Conments of Stop Lights

ontrol Circuit—Horn Ring to Horn Relay

ircuit—Horns to Horn Relay

anel Courtesy Light Circuit Wire—Instruanel Switch to Courtesy Light

auge Circuit—Fuel Tank to Fuel Gauge Unit

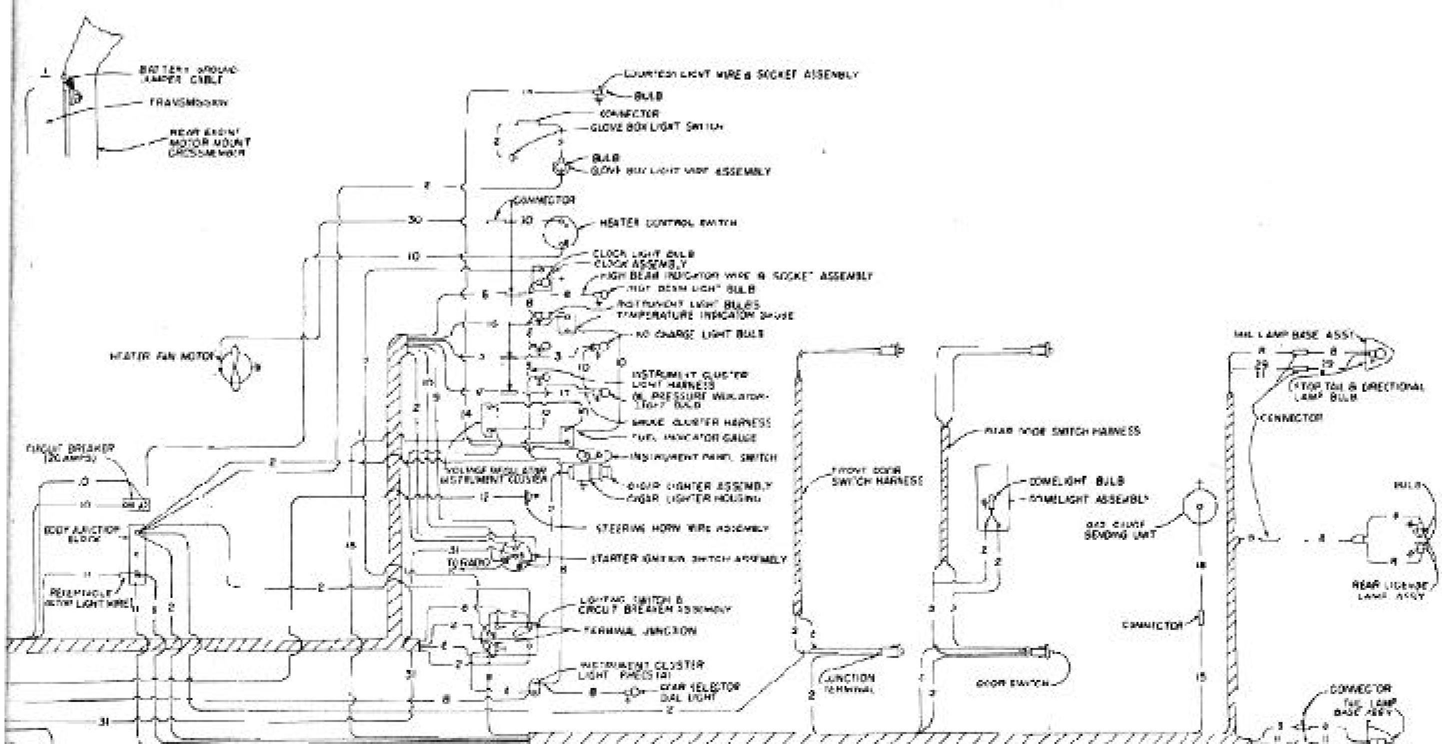
rature Gauge Circuit—Temperature Sendit on Block to Panel Gauge Unit

CIRCUIT No.

17. Oil Pressure Gauge Circuit—Oil Pressure Sending Unit on Block to Oil Pressure Warning Light
18. Spark Plug Wire—Distributor to #1 Spark Plug
19. Spark Plug Wire—Distributor to #2 Spark Plug
20. Spark Plug Wire—Distributor to #3 Spark Plug
21. Spark Plug Wire—Distributor to #4 Spark Plug
22. Spark Plug Wire—Distributor to #5 Spark Plug
23. Spark Plug Wire—Distributor to #6 Spark Plug
24. Spark Plug Wire Distributor to #7 Spark Plug
25. Spark Plug Wire—Distributor to #8 Spark Plug
26. Directional Signal Switch Circuit Wire—Signal Flasher "L" Terminal to "F" Terminal on Signal Switch
27. Starter Safety Switch to Starting Motor Solenoid Wire
28. Left Turn Signal Circuit—Signal Switch to Front and Rear Left Signal Lights and Pilot Light

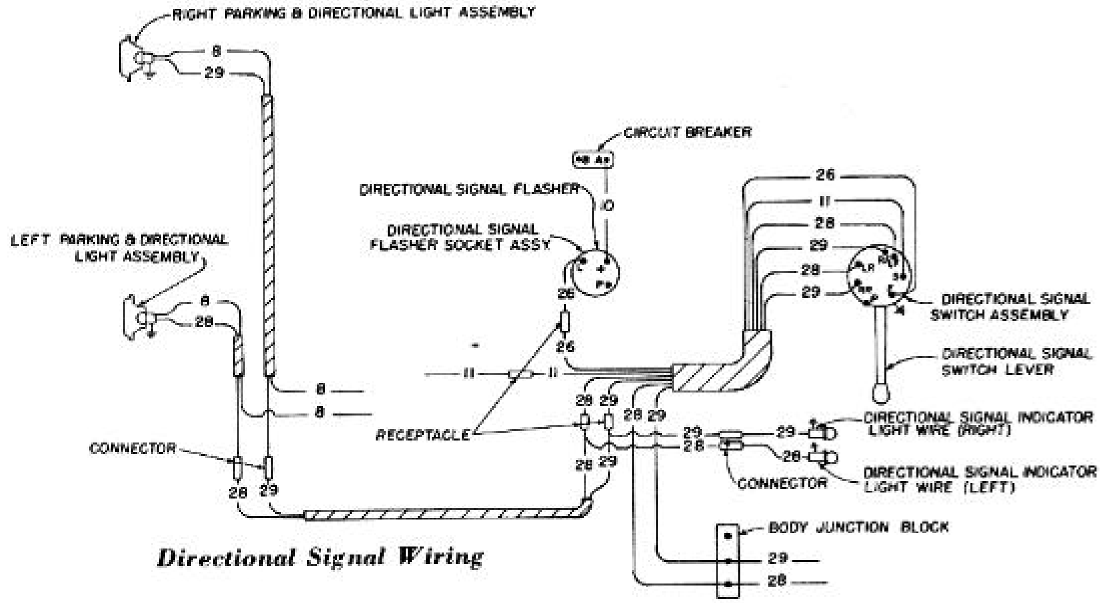
CIRCUIT No.

29. Right Turn Signal Circuit—Signal Switch to Front and Rear Right Signal Lights and Pilot Light
30. Heater Motor Circuit—Heater Switch to Heater Motor
31. Ignition Switch to Starting Safety Switch
32. Air Conditioning Circuit Wire—Air Conditioning Control Switch "B" Terminal to 30 Ampere Circuit Breaker "A" Terminal
33. Air Conditioning Compressor Clutch and Control Thermostat Circuit Wire—Air Conditioning Control Switch to Thermostat and Compressor Clutch
34. Air Conditioning Thermostat Control Wire—Control Thermostat to By-Pass Solenoid
35. Air Conditioning High Speed Blower Control Circuit—Control Switch "H" Terminal to Resistor Out" Terminal on Blower Speed Control Resistor
36. Air Conditioning Low Speed Blower Control Circuit—Control Switch "L" Terminal to Resistor "In" Terminal on Blower Speed Control Resistor
37. Blower Motor Wire—Blower Speed Control Resistor Terminal to Blower Motor

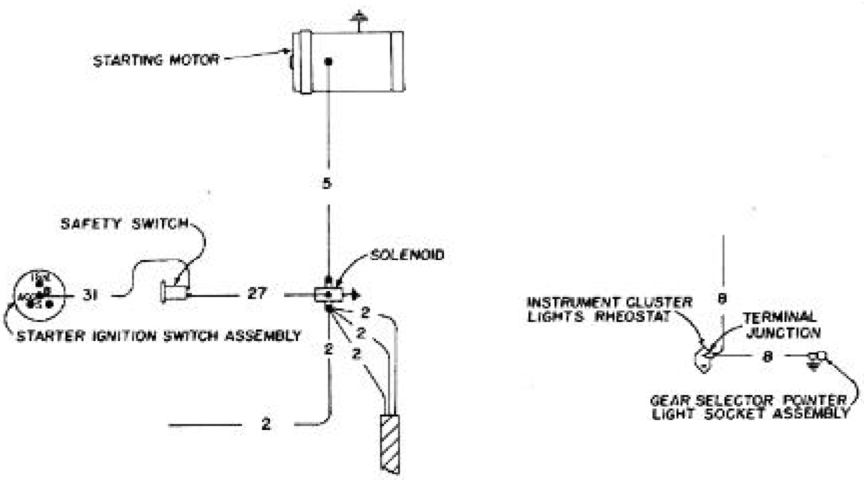


"Hornet" V-8 Series

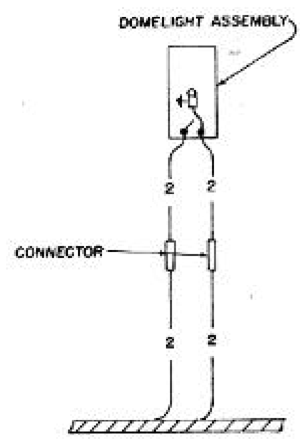
ELECTRICAL WIRING DIAGRAMS



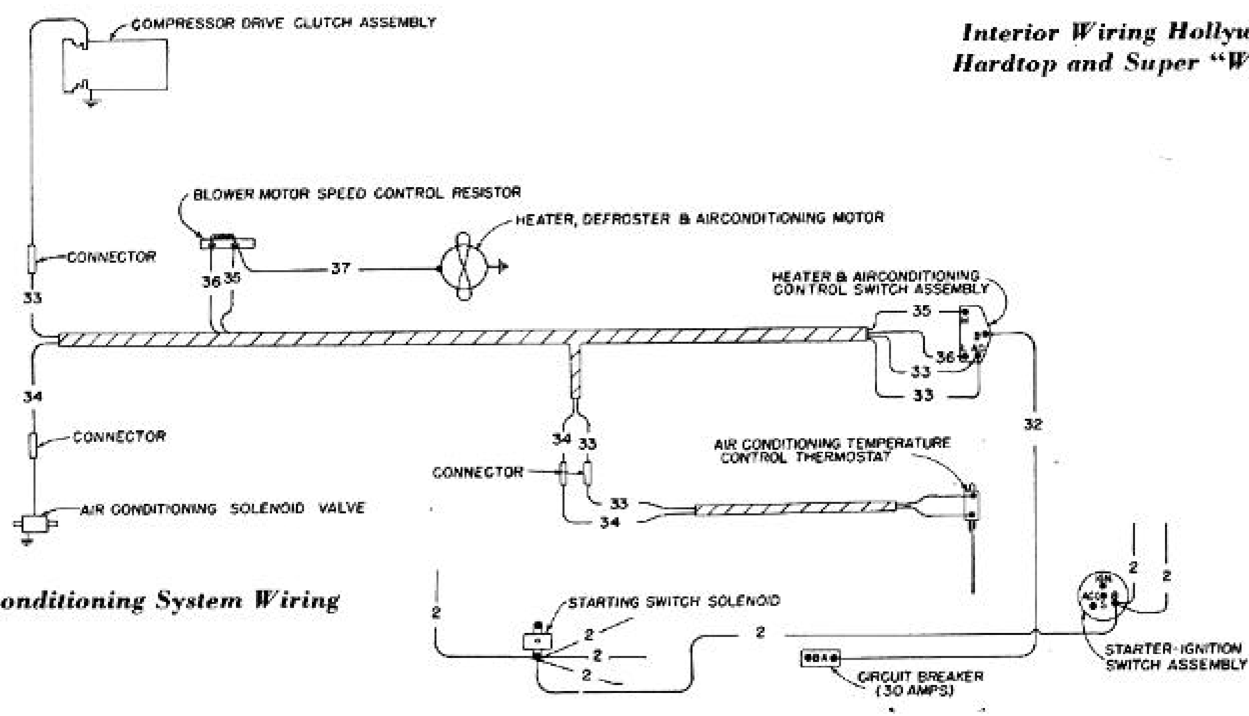
Directional Signal Wiring



Hydra-Matic Transmission Starting and Selector Lever Wiring



Interior Wiring Hollywood Hardtop and Super "Wasp"



Air Conditioning System Wiring

1955 ELECTRICAL WIRING DIAGRAM

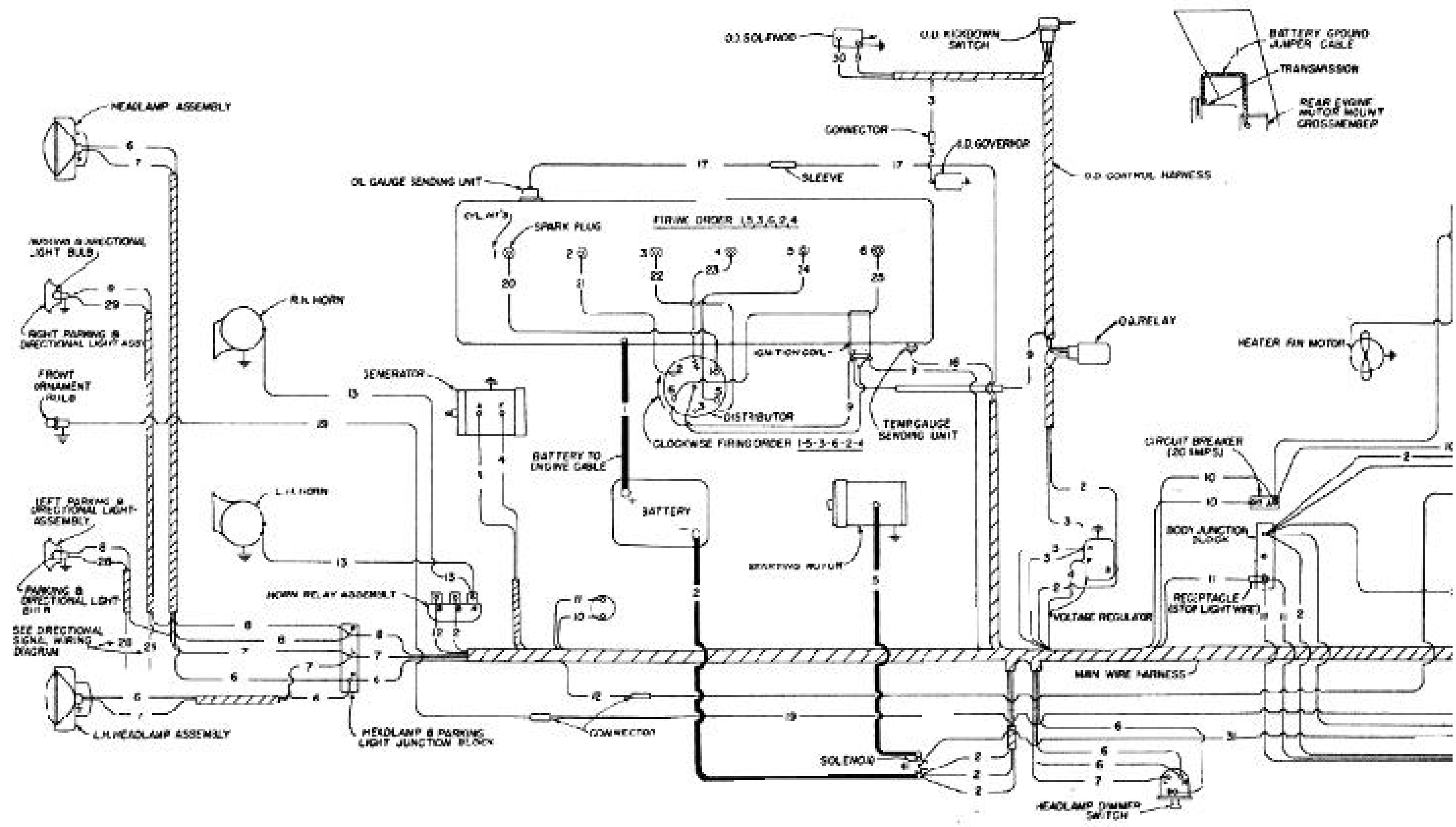
CIRCUIT No.

1. Battery Ground and Engine to Body Ground Cables—Battery Positive Terminal to Engine and from Engine Rear Crossmember to Transmission
2. Battery Negative Circuit—Battery Negative Terminal to Starter Switch, Horn Relay, Voltage Regulator, Light Switch, Ignition Switch, Cigarette Lighter, Body Junction Block, Glove Box Light Switch, Clock and Instrument Panel Switch, and Overdrive Relay and Dome Light Switch
3. Generator Armature Wire—Generator Armature Terminal to Voltage Regulator "A" Terminal. Then to No-Charge Indicator Light and Overdrive Relay and Overdrive Governor
4. Generator Field Wire—Generator Field Terminal to Voltage Regulator "F" Terminal
5. Starting Motor Cable—Starting Motor to Starting Motor Solenoid
6. Headlight Upper Beam Wires—Light Switch to Dimmer Switch and Upper Beam Bulb Elements and Indicator Light on Panel
7. Headlight Lower Beam Wires—Dimmer Switch to Lower Beam Light Bulb Elements
8. Parking Light and Tail Light Wires—Light

CIRCUIT No.

Switch to Front Parking Lights and Rear and Tail Lights. Also, Instrument Ligh Automatic Transmission Selecter Dial Li

9. Ignition Primary Circuit—Ignition Switch nition Coil, Distributor, Overdrive Ki Switch, and Solenoid and Instruments
10. Ignition Switch Controlled Circuits— Switch to Radio, 20 Ampere Circuit Stop Light Switch, Instruments, Heater Switch, and Directional Flasher
11. Stop Light Circuit—Stop Light Switch t Junction Block and Stop Light Direction trol Elements of Stop Lights
12. Horn Control Circuit—Horn Ring to Hor
13. Horn Circuit—Horns to Horn Relay
14. Dash Panel Courtesy Light Circuit Wire- ment Panel Switch to Courtesy Light
15. Fuel Gauge Circuit—Fuel Tank to Fuel Tank Unit
16. Temperature Gauge Circuit—Temperatur ing Unit on Block to Panel Gauge Unit



"Hornet" 6 and "Wasp'

Front Parking Lights and Rear License Lights. Also, Instrument Lights and c Transmission Selector Dial Light

Primary Circuit—Ignition Switch to Ig- Coil, Distributor, Overdrive Kickdown nd Solenoid and Instruments

Switch Controlled Circuits—Ignition o Radio, 20 Ampere Circuit Breaker, ht Switch, Instruments, Heater Blower nd Directional Flasher

ht Circuit—Stop Light Switch to Body Block and Stop Light Directional Con- nects of Stop Lights

trol Circuit—Horn Ring to Horn Relay

rcuit—Horns to Horn Relay

el Courtesy Light Circuit Wire—Instru- el Switch to Courtesy Light

ge Circuit—Fuel Tank to Fuel Gauge it

ture Gauge Circuit—Temperature Send- on Block to Panel Gauge Unit

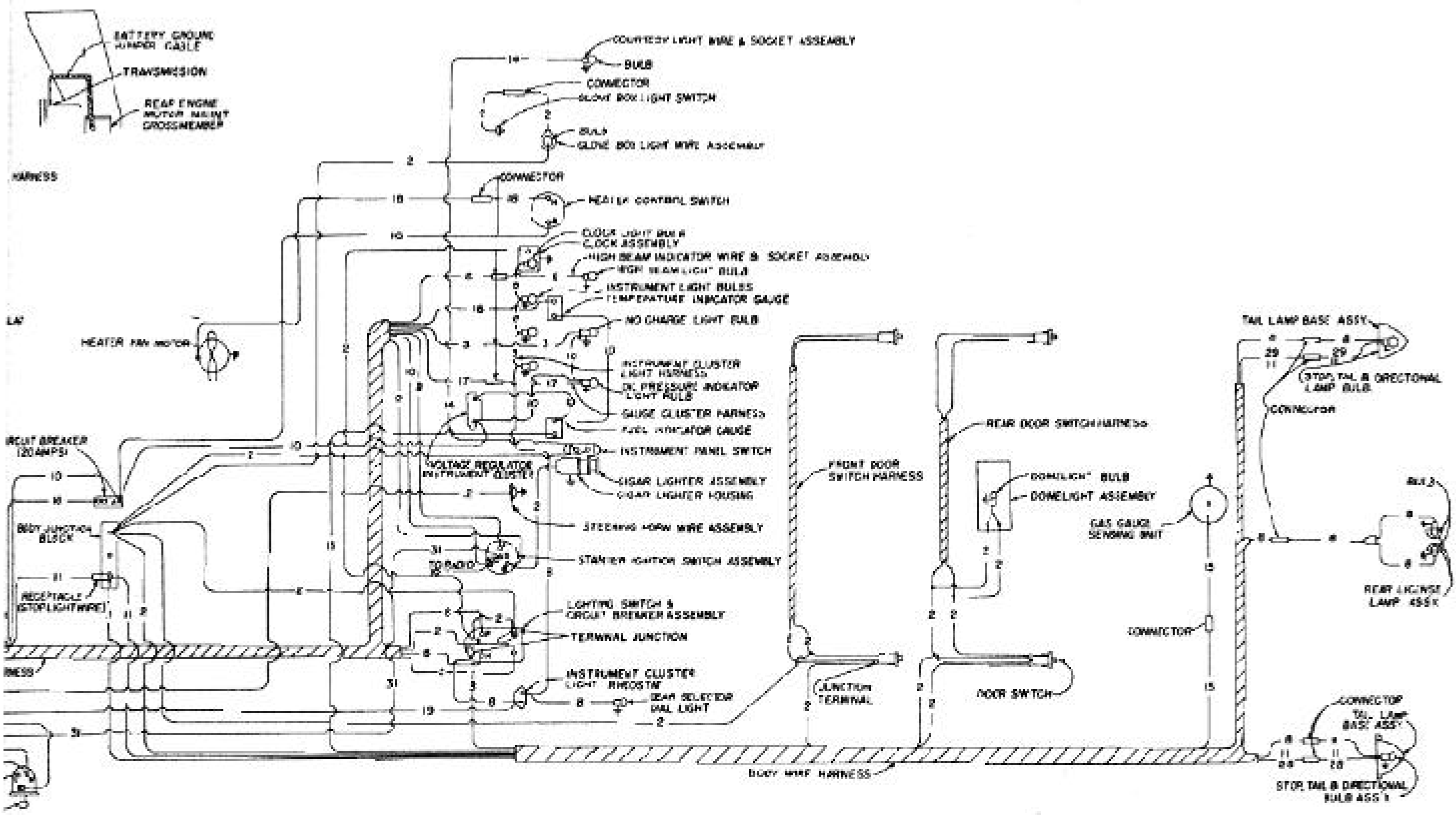
CIRCUIT No.

17. Oil Pressure Gauge Circuit—Oil Pressure Sending Unit on Block to Oil Pressure Warning Light
18. Heater Motor Circuit—Heater Switch to Heater Motor
19. Instrument Cluster Light Rheostat to Front Ornament Light Wire
20. Spark Plug Wire—Distributor to #1 Spark Plug
21. Spark Plug Wire—Distributor to #2 Spark Plug
22. Spark Plug Wire—Distributor to #3 Spark Plug
23. Spark Plug Wire—Distributor to #4 Spark Plug
24. Spark Plug Wire—Distributor to #5 Spark Plug
25. Spark Plug Wire—Distributor to #6 Spark Plug
26. Directional Signal Switch Circuit Wire—Signal Flasher "L" Terminal to "F" Terminal on Signal Switch
27. Starter Safety Switch to Starting Motor Solenoid Wire
28. Left Turn Signal Circuit—Signal Switch to Front and Rear Left Signal Lights and Pilot Light
29. Right Turn Signal Circuit—Signal Switch to

CIRCUIT No.

Front and Rear Right Signal Lights and Pilot Light

30. Overdrive Solenoid Wire—Overdrive Relay to Overdrive Solenoid
31. Ignition Switch to Starting Motor Solenoid Wire
32. Air Conditioning Circuit Wire—Air Conditioning Control Switch "B" Terminal to 30 Ampere Circuit Breaker "A" Terminal
33. Air Conditioning Compressor Clutch and Control Thermostat Circuit Wire—Air Conditioning Control Switch to Thermostat and Compressor Clutch
34. Air Conditioning Thermostat Control Wire—Control Thermostat to By-Pass Solenoid
35. Air Conditioning High Speed Blower Control Circuit—Control Switch "H" Terminal to Resistor "Out" Terminal on Blower Speed Control Resistor
36. Air Conditioning Low Speed Blower Control Circuit—Control Switch "L" Terminal to Resistor "In" Terminal on Blower Speed Control Resistor
37. Blower Motor Wire—Blower Speed Control Resistor Terminal to Blower Motor



t" 6 and "Wasp" Series

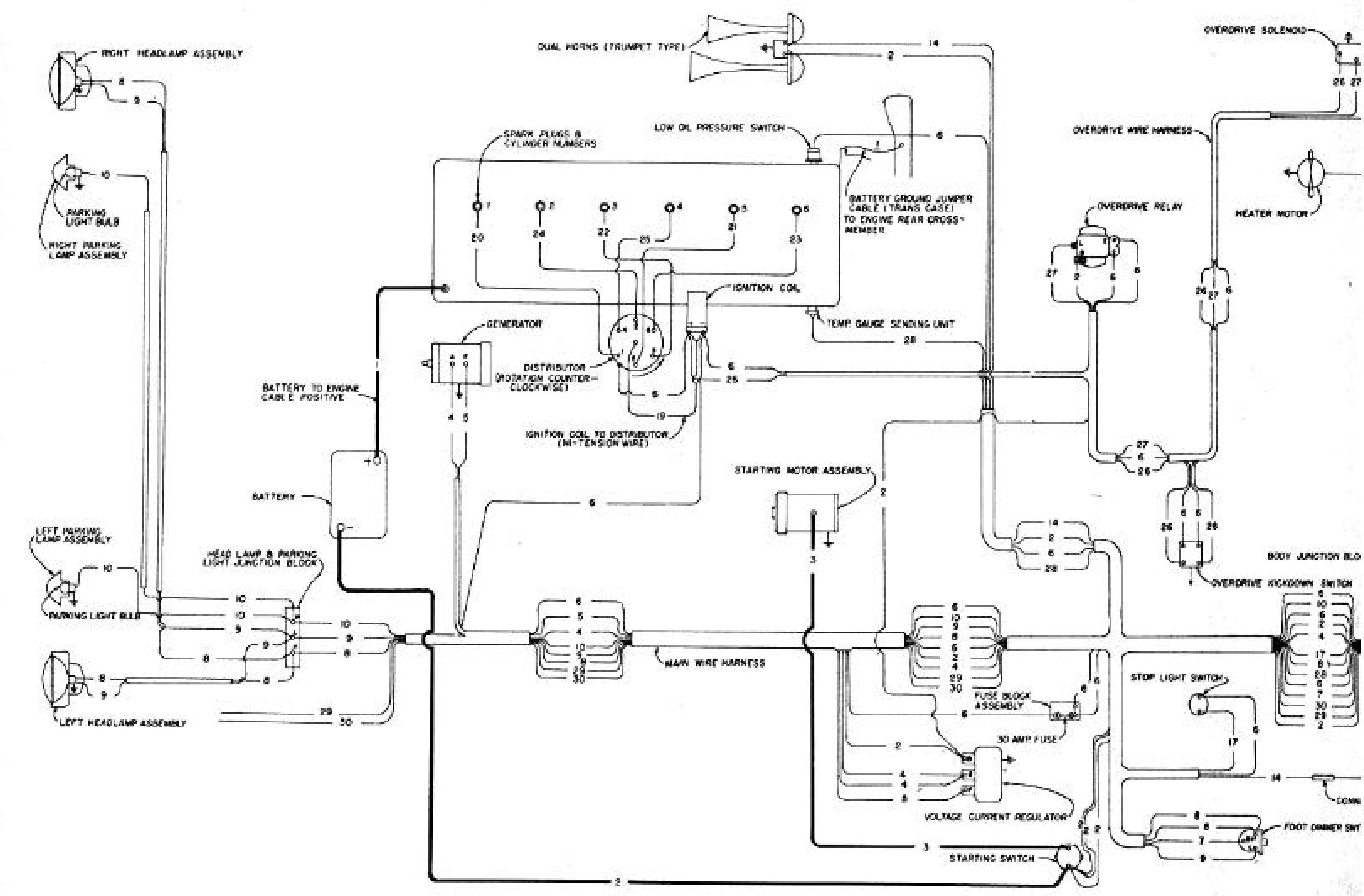
1955 ELECTRICAL WIRING DIAGRAM

CIRCUIT No.

1. Battery Ground and Engine to Body Ground Cables—Battery Positive Terminal to Engine and from Engine Rear Crossmember to Transmission
2. Battery Negative Cable—Battery Negative Terminal to Starting Motor Switch. Then to Horn Relay, Light Switch, Ignition Switch, Cigarette Lighter, Radio, and "bat" Terminal of Voltage Regulator, and Overdrive Relay
3. Starting Motor Cable—Starting Switch or Solenoid to Starting Motor
4. Generator Armature Wire—Generator Armature Terminal to Voltage Regulator. Then to No-Charge Indicator Light
5. Generator Field Wire—Generator Field Terminal to Voltage Regulator "F" Terminal
6. Ignition Switch Controlled Circuits—Ignition Switch to Body Junction Terminal. Then to Ignition Coil, Distributor, Overdrive Relay, Kickdown Switch, Overdrive Governor. Also, Oil Pressure Warning Light, Oil Pressure Gauge Unit, Fuel Gauge, Temperature Gauge, and No-Charge Light. Also, 30 Ampere Fuse on Wheelhouse Panel, Stop Light Switch, Directional Signal Switch Flasher. Also to Heater Motor Switch
7. Headlamp Circuit—Light Switch "H" Terminal to Foot Dimmer Switch "B" Terminal

CIRCUIT No.

8. Headlamp Upper Beam Circuit—Foot Dimmer "H" Terminal to Headlamp Upper Beam Elements and to Hi-Beam Indicator Light in Instrument Cluster
9. Headlamp Low Beam Circuit—Foot Dimmer Switch "L" Terminal to Low Beam Elements in Headlamps
10. Parking Light Circuit—Light Switch "P" Terminal to Front Parking Lights
11. Tail and Instrument Panel Light Circuit—"T" Terminal on Light Switch to Instrument Light Switch and Clock. Also, Tail and License Lamp
12. Speedometer Cluster Light Circuit—Instrument Light Switch to Speedometer Cluster Light, Clock, and Gear Selector Pointer
13. Courtesy Light Circuit—Light Switch to Door Switches and/or Domelight
14. Horn Control Circuit—Horn Button to Horn Relay
15. Fuel Gauge Circuit—Fuel Gauge to Tank Fuel Gauge Unit
16. Courtesy Light Circuit—Light Switch to Rear Door Switches and/or Domelight Switch
17. Stop Light Circuit—Stop Light Switch to Stop Light



"Rambler" Series

ıer Beam Circuit—Foot Dimmer to Headlamp Upper Beam Ele- Hi-Beam Indicator Light in Instru-

w Beam Circuit—Foot Dimmer rminal to Low Beam Elements in

Circuit—Light Switch "P" Ter- Parking Lights

ument Panel Light Circuit—"T" ight Switch to Instrument Light ck. Also, Tail and License Lamp

Cluster Light Circuit—Instrument Speedometer Cluster Light, Clock, tor Pointer

Circuit—Light Switch to Door or Domelight

ircuit—Horn Button to Horn Relay

ircuit—Fuel Gauge to Tank Fuel

Circuit—Light Switch to Rear and/or Domelight Switch

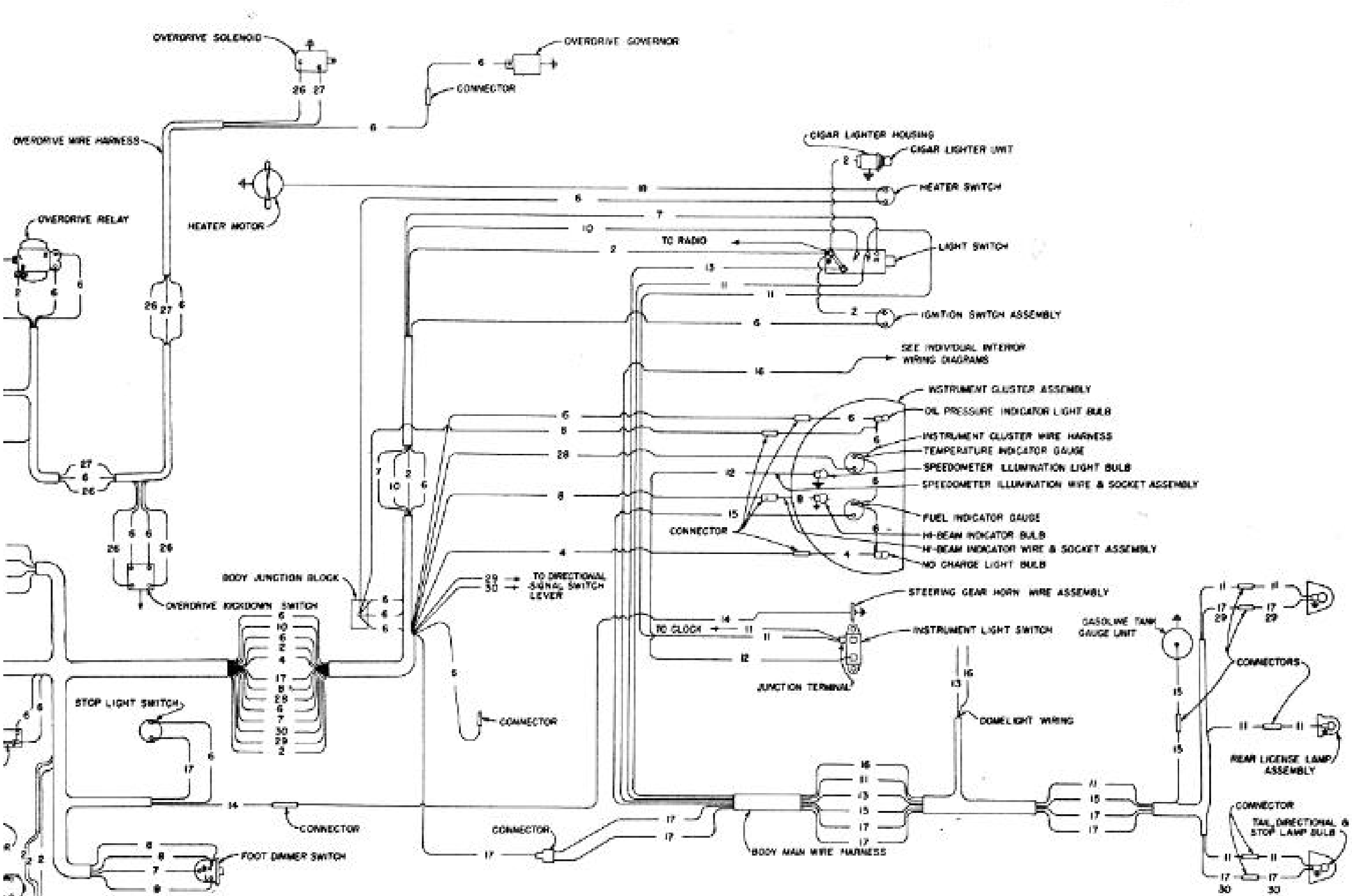
rcuit—Stop Light Switch to Stop

CIRCUIT No.

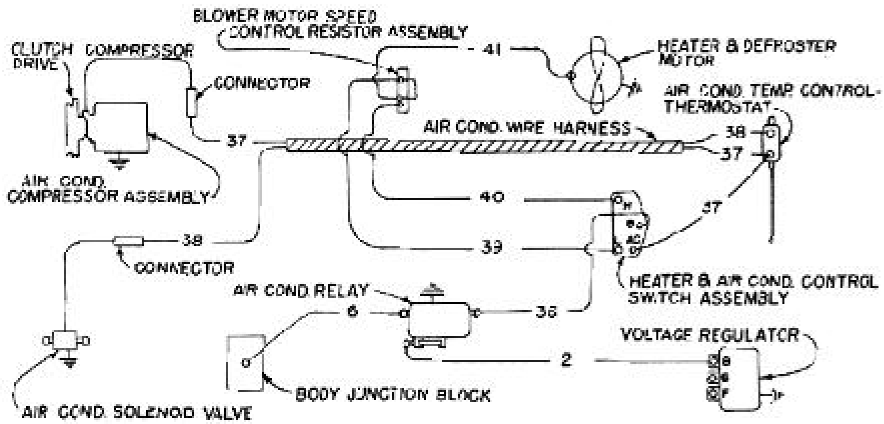
18. Heater Motor Circuit—Heater Switch to Heater Motor
19. Coil Hi-Tension Wire—Coil Tower to Center Terminal of Distributor Cap
20. Spark Plug Wire—Distributor to #1 Spark Plug
21. Spark Plug Wire—Distributor to #5 Spark Plug
22. Spark Plug Wire—Distributor to #3 Spark Plug
23. Spark Plug Wire—Distributor to #6 Spark Plug
24. Spark Plug Wire—Distributor to #2 Spark Plug
25. Spark Plug Wire—Distributor to #4 Spark Plug
26. Overdrive, Ignition Interrupter Circuit—Ignition Coil (Dist. Side (+) Terminal) to Kickdown Switch. Then to Ignition Interrupter Point on Overdrive Solenoid
27. Overdrive Solenoid Circuit—Overdrive Relay to Overdrive Solenoid
28. Temperature Gauge Circuit—Temperature Sending Unit on Block to Panel Gauge Unit
29. Right Turn Signal Circuit—Signal Switch to Front and Rear Right Signal Lights and Pilot Light
30. Left Turn Signal Circuit—Signal Switch to Front and Rear Left Signal Lights and Pilot Light
31. Directional Signal Switch Circuit Wire—Signal Flasher to Signal Switch

CIRCUIT No.

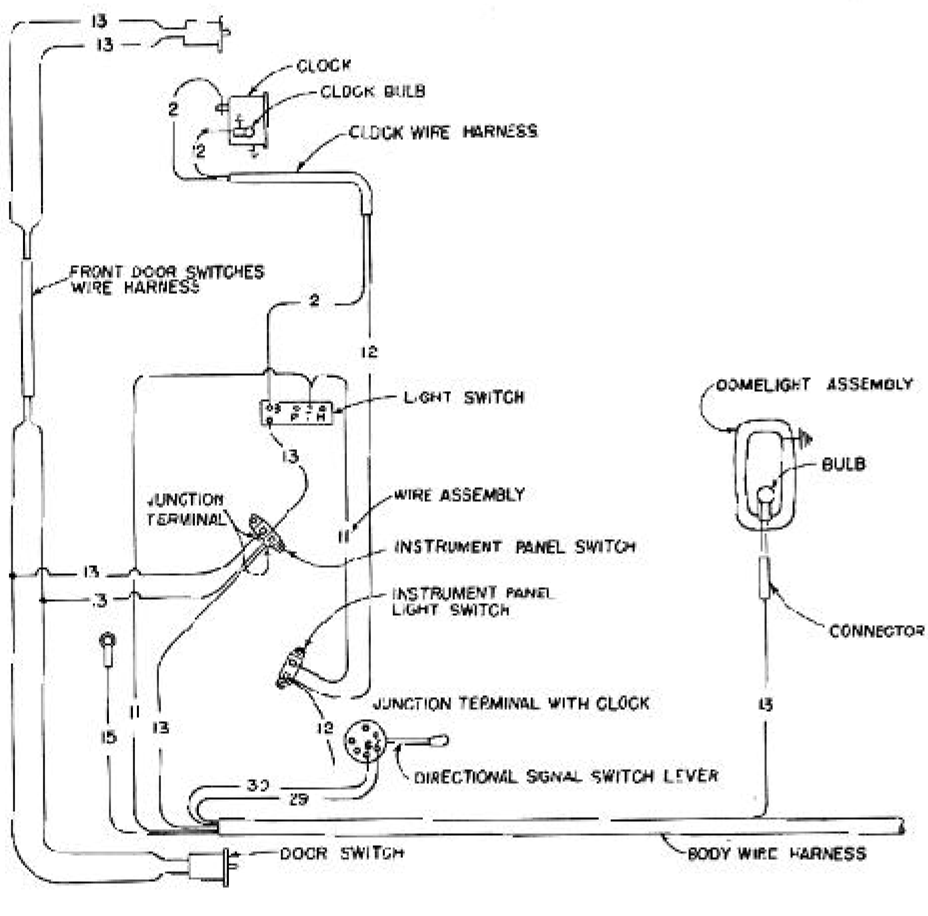
32. Directional Signal Pilot Light Wire—Signal Flasher to Pilot Light
33. Starter Safety Switch to Starting Motor Solenoid Wire
34. Instrument Panel Light Switch to Domelight Switch Wire. Instrument Panel Light to Domelight Switch
35. Instrument Panel Light Wire—Instrument Panel Switch to Instrument Panel Light
36. Air Conditioning Relay to Air Conditioning Control Switch Feed Wire—Air Conditioning Control Relay to Air Conditioning Control Switch
37. Air Conditioning Control Thermostat Circuit Wire—Air Conditioning Control Switch to Thermostat and Compressor Clutch Solenoid
38. Air Conditioning Thermostat Control Wire—Control Thermostat to By-Pass Solenoid
39. Air Conditioning Low Speed Blower Control Circuit—Control Switch "L" Terminal to Resistor "In" Terminal on Blower Speed Control Resistor
40. Air Conditioning High Speed Blower Control Circuit—Control Switch "H" Terminal to Resistor "Out" Terminal on Blower Speed Control Resistor
41. Blower Motor Wire—Blower Speed Control Resistor Terminal to Blower Motor



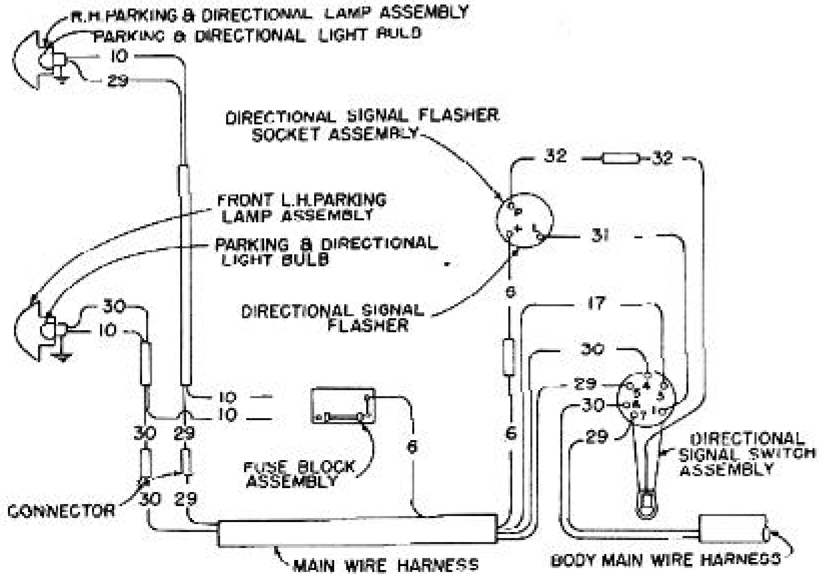
"Rambler" Series



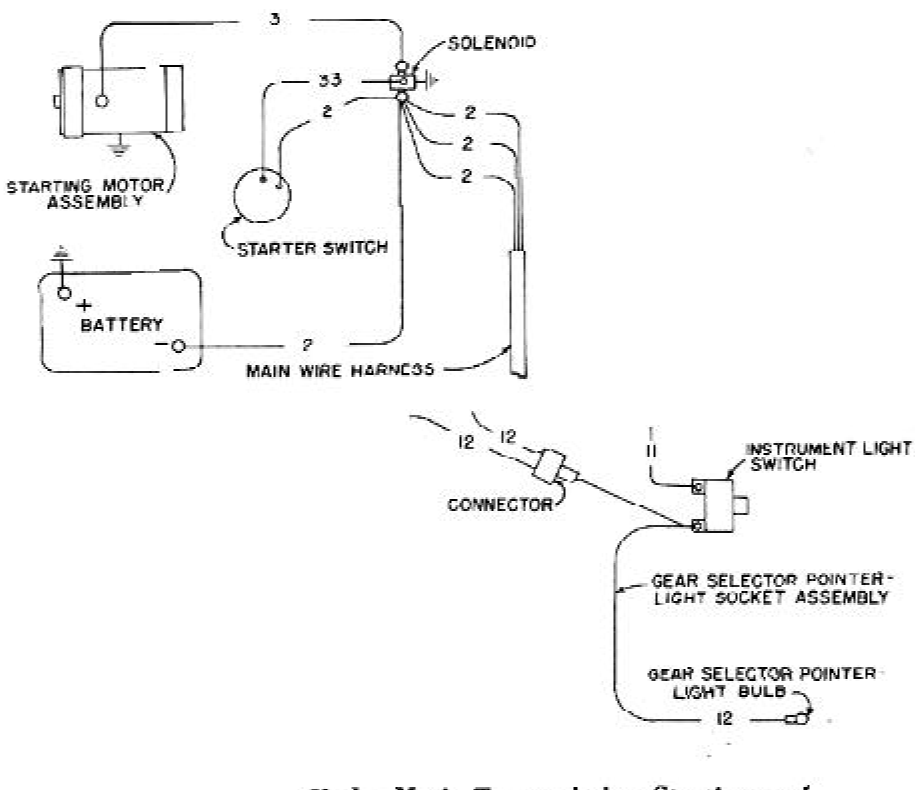
Air Conditioning System Wiring— "Rambler" Series



Super Two-Door Sedan— 100" Wheelbase "Rambler" Series

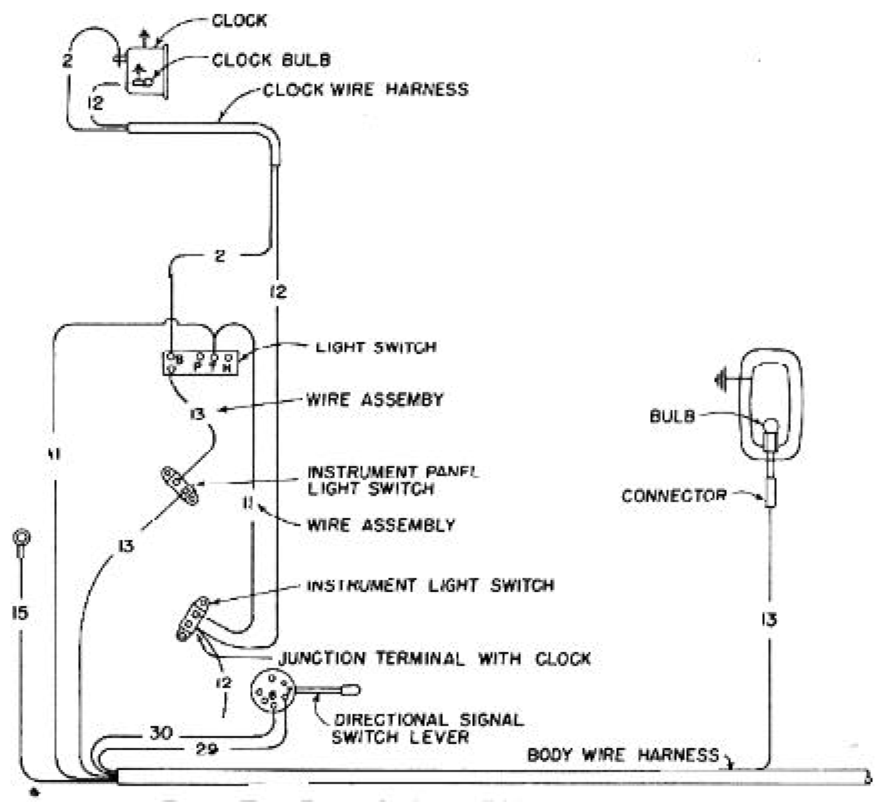


Directional Signal Wiring—
"Rambler" Series

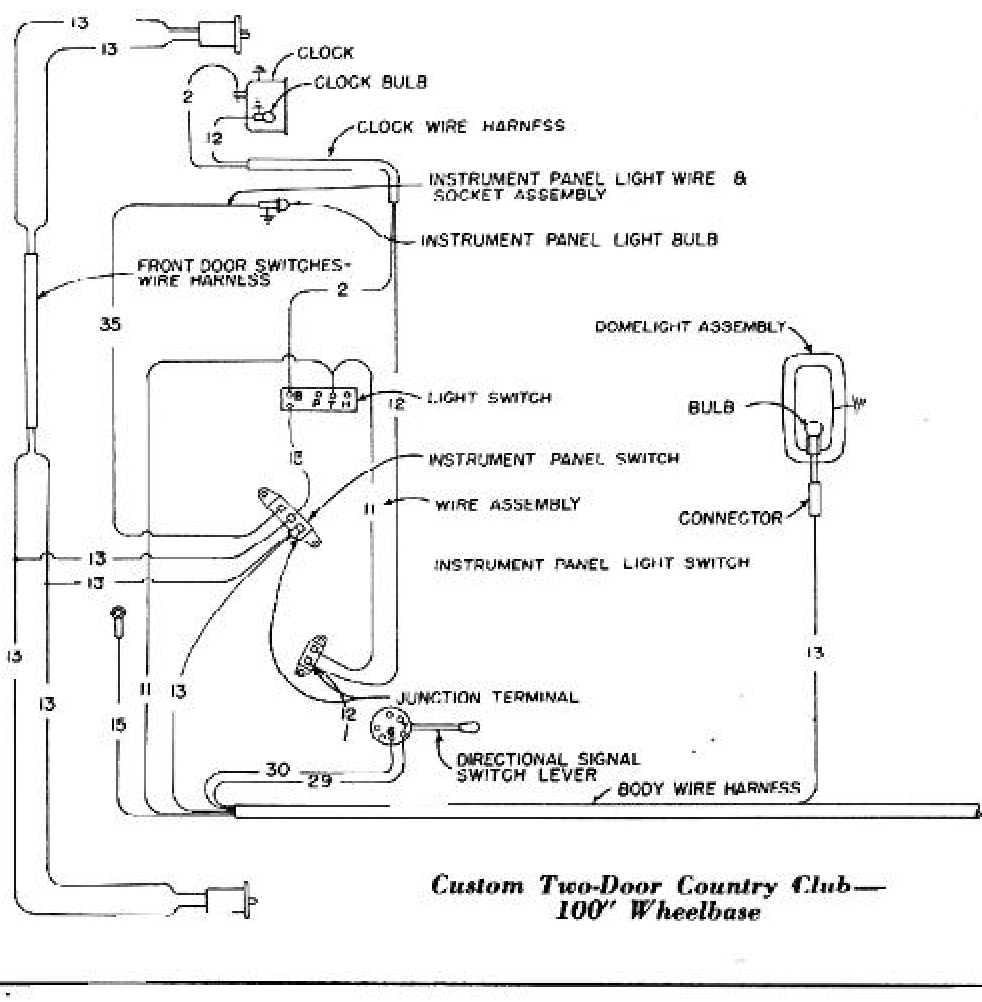


Hydra-Matic Transmission Starting and
Selector Lever Wiring—
"Rambler" Series

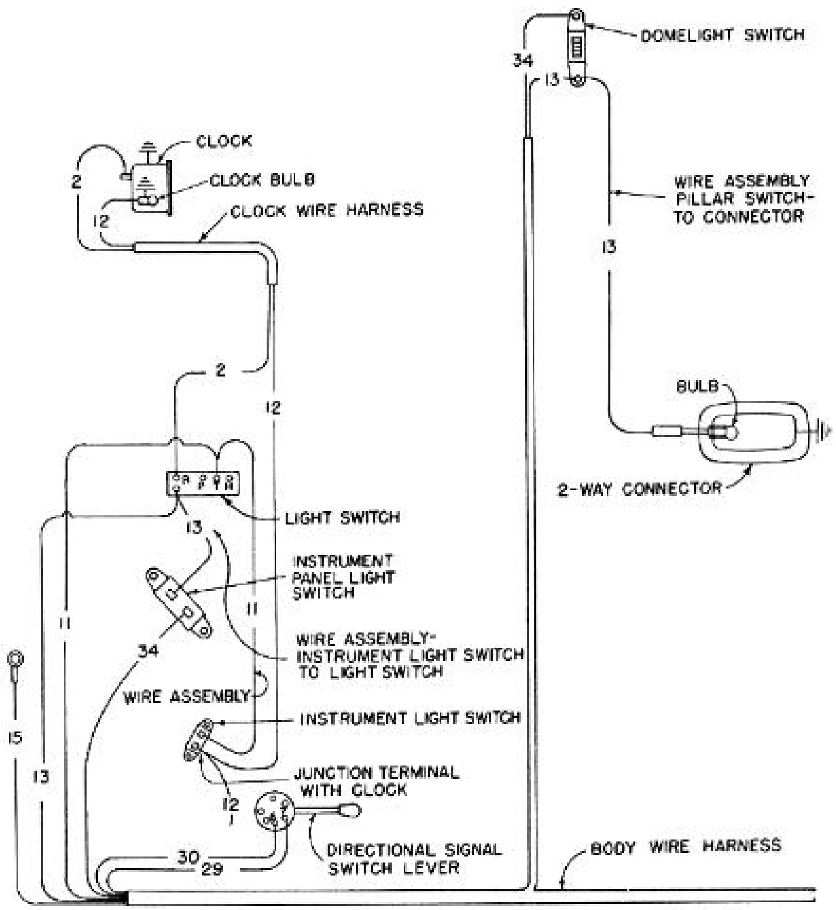
WIRING DIAGRAMS



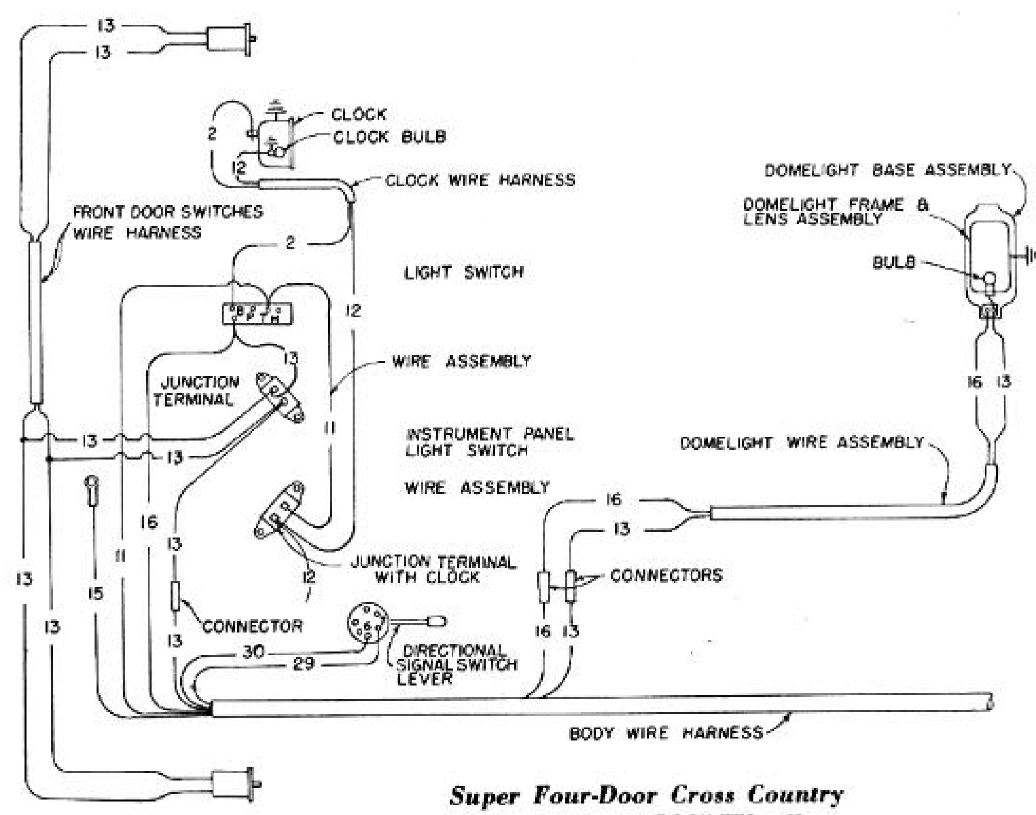
Basic Two-Door Sedan—100" Wheelbase



Custom Two-Door Country Club—
100' Wheelbase

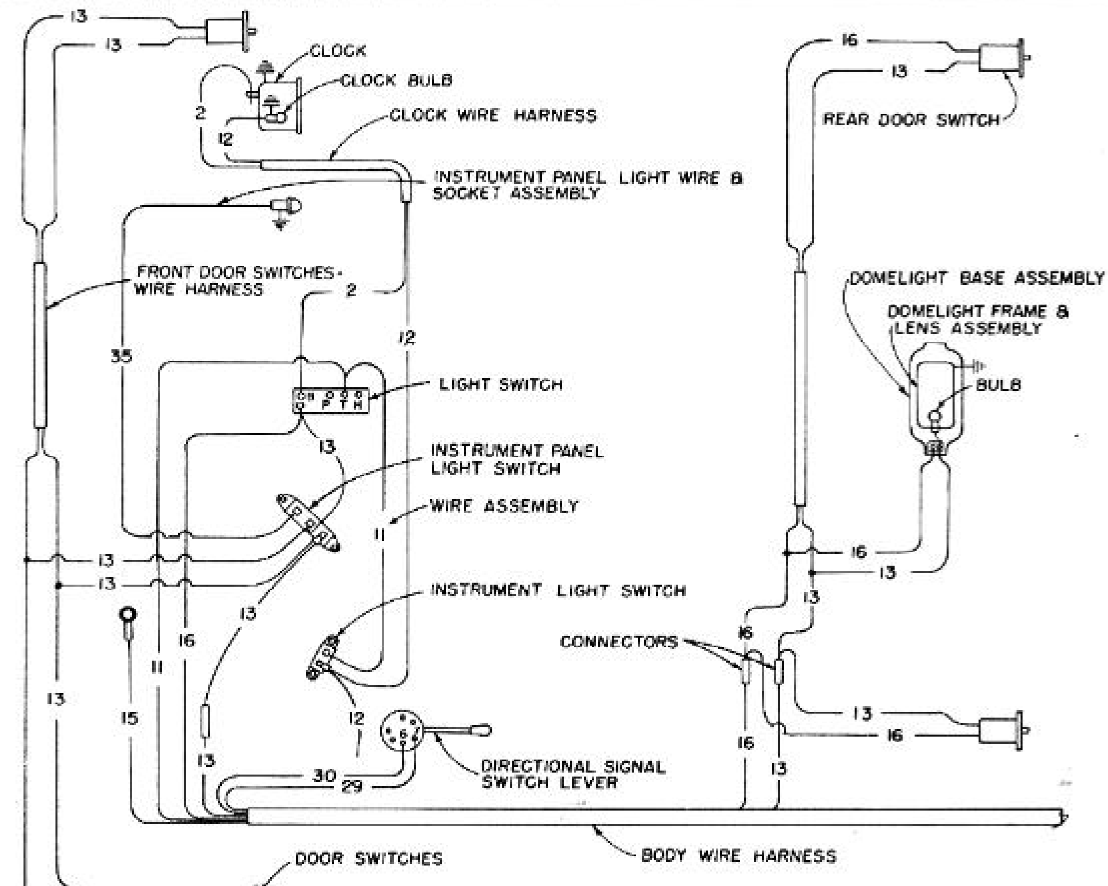


Super Two-Door Station Wagon—100″ Wheelbase

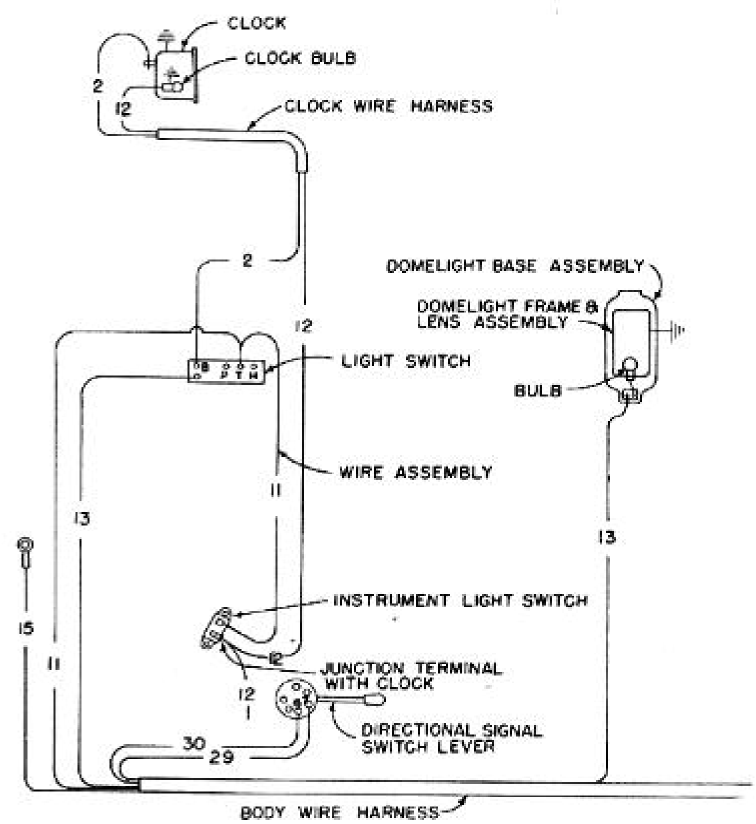


Super Four-Door Cross Country Station Wagon—108″ Wheelbase

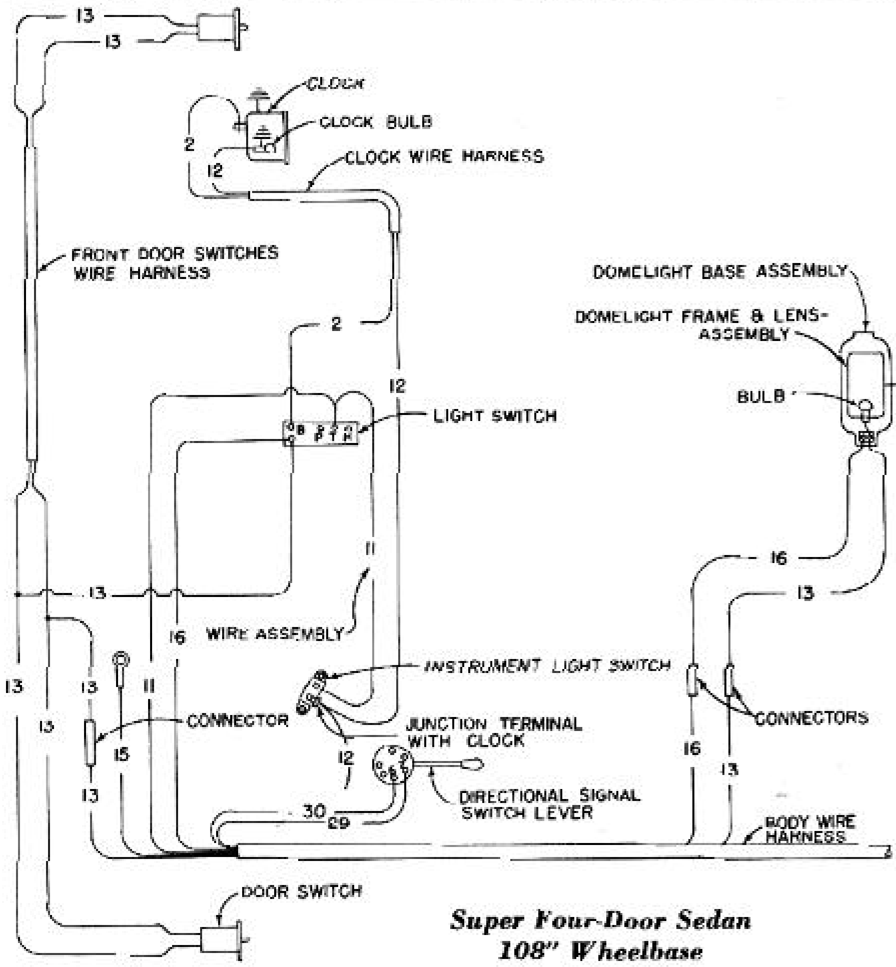
WIRING DIAGRAMS



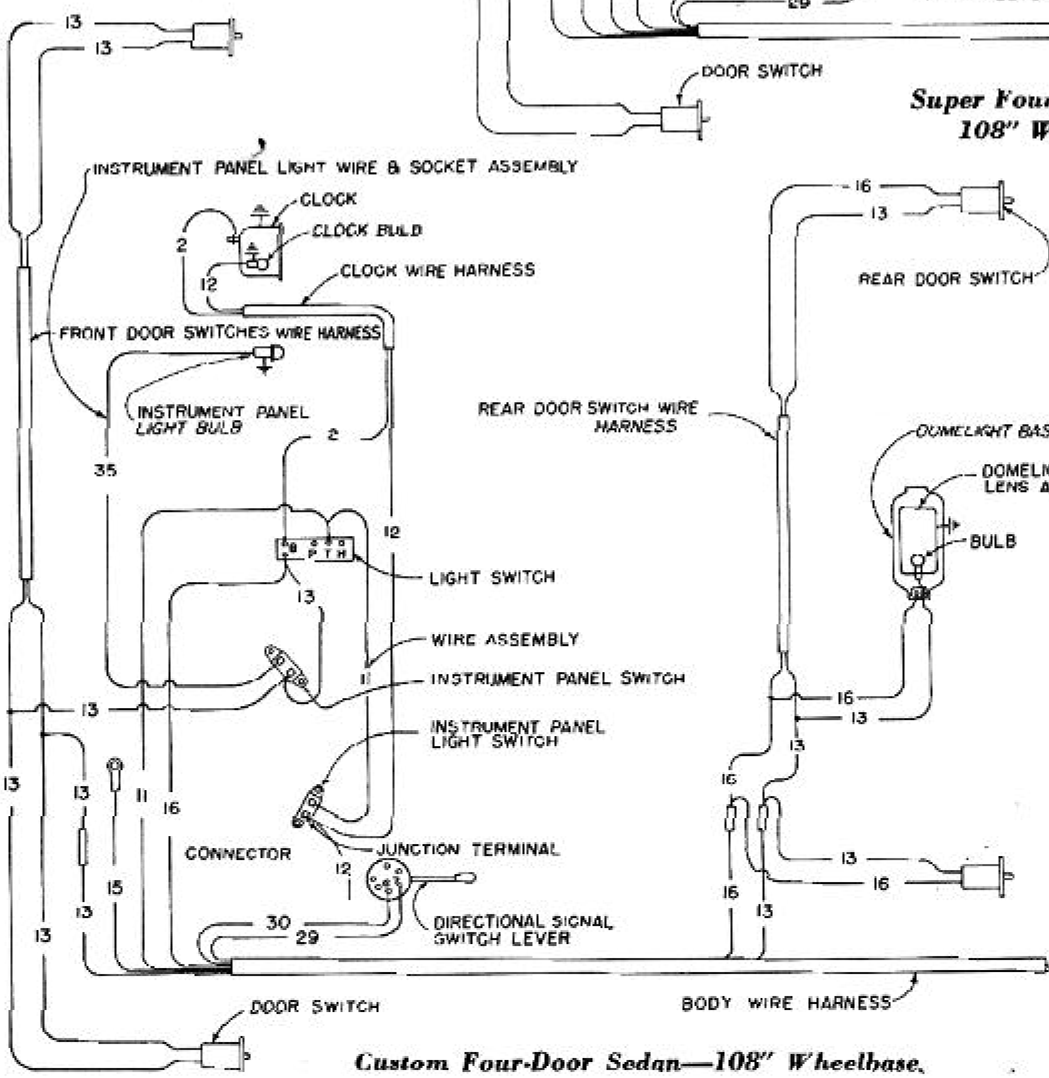
Custom Four-Door Cross Country Station Wagon—108″ Wheelbase



Basic Four-Door Sedan—100″ Wheelbase



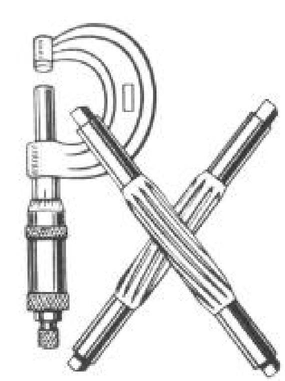
Super Four-Door Sedan
108" Wheelbase



Custom Four-Door Sedan—108" Wheelbase.

HUDSON

TECHNICAL SERVICE MANUAL



FUEL—CARBURETION—EXHAUST SYSTEM

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FUEL TANKS 2

FUEL PUMP 2

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EXHAUST MANIFOLDS.................... 10

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FUEL-CARBURETION-EXHAUST SYSTEM

FUEL- CARBURETION EXHAUST SYSTEM

FUEL SYSTEM
CARBURETOR AIR CLEANER

The air cleaners are required to protect the fuel system as well as the working parts of the engine from abrasive clogging action of dust, dirt, and sediment normally present in the combustion air supply.

The portion of the assembly between the filter and the carburetor is designed as a resonance silencer to eliminate the noise of vibration periods emitted through the carburetor.

"Hornet" 6 and "Wasp" Series

The carburetor air cleaners are of the dry replaceable cartridge type.

Remove the cartridge and shake out the accumulated dirt every 1,000 miles. DO NOT WASH. In extremely dusty conditions, it is advisable to service daily or more often. Install a new cartridge every 6 months or 10,000 miles whichever occurs first.

"Hornet" V-8 and "Rambler" Series

An oil bath type air cleaner is used on the "Hornet" V-8 Series. Air cleaners of either the oil bath type or dry (wire mesh) type are used on the "Rambler" Series.

The air cleaners should be serviced in accordance with the instruction decalcomania attached; however, where no instruction decalcomania is present, it should be serviced at every engine crankcase oil change.

More frequent service will be required where dusty conditions exist.

Disassemble the air cleaner and clean all parts in kerosene or solvent; blow excess fluid off with compressed air.

Dip the gauze (wire mesh) as used in the dry type in crankcase grade engine oil; allow excess to drain.

Fill the oil bath type to the level indicated using SAE 50 for moderate weather and SAE 20 for below freezing.

FUEL TANKS

Twenty gallon fuel tanks suspended at the rear of the under body by a steel strap are used on all Series.

FUEL PUMP

The fuel pump rocker arm is actuated by a cam on the engine camshaft and provides a steady supply of fuel at a fairly constant pressure to the carburetor. When the carburetor float needle valve closes, accumulation of fuel in the pump extends the diaphragm compressing the diaphragm spring. This action causes the rocker arm linkage to become inoperative until the pressure on the diaphragm and spring is reduced. The fuel pump discharge pressure is thus controlled by the diaphragm spring.

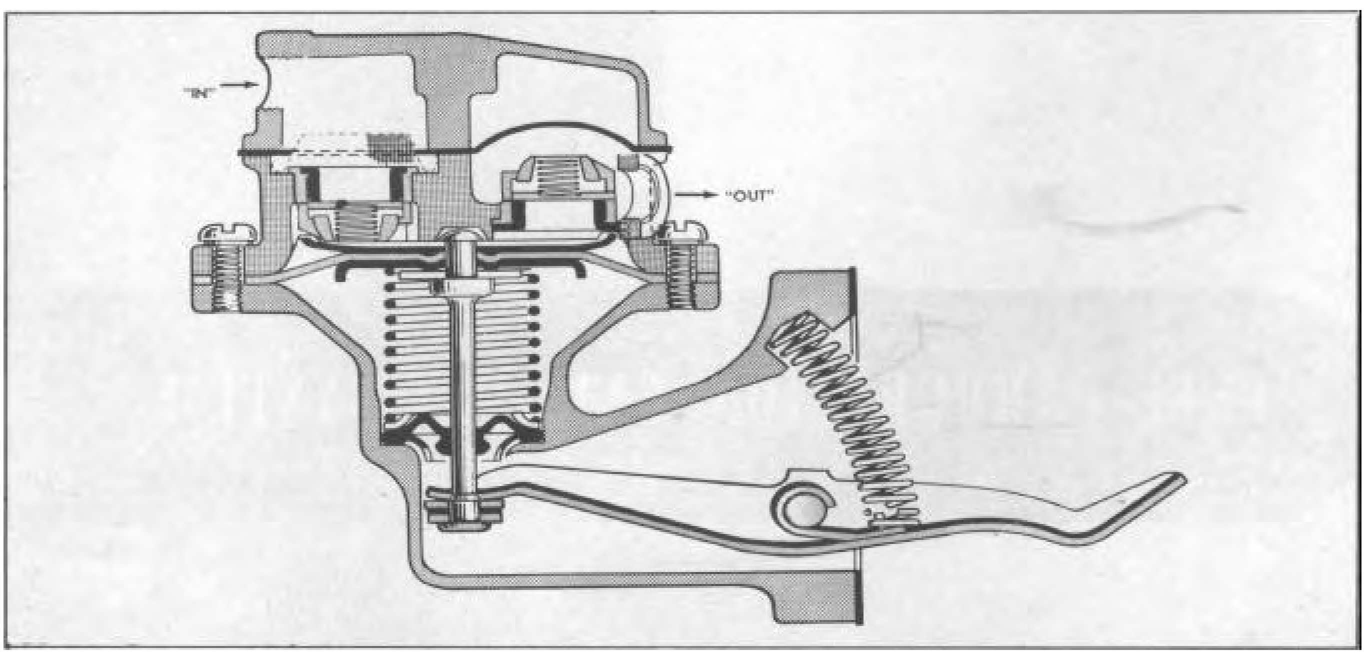


FIGURE 1 - ***Sectional View Single Action Fuel Pump (Carter)***

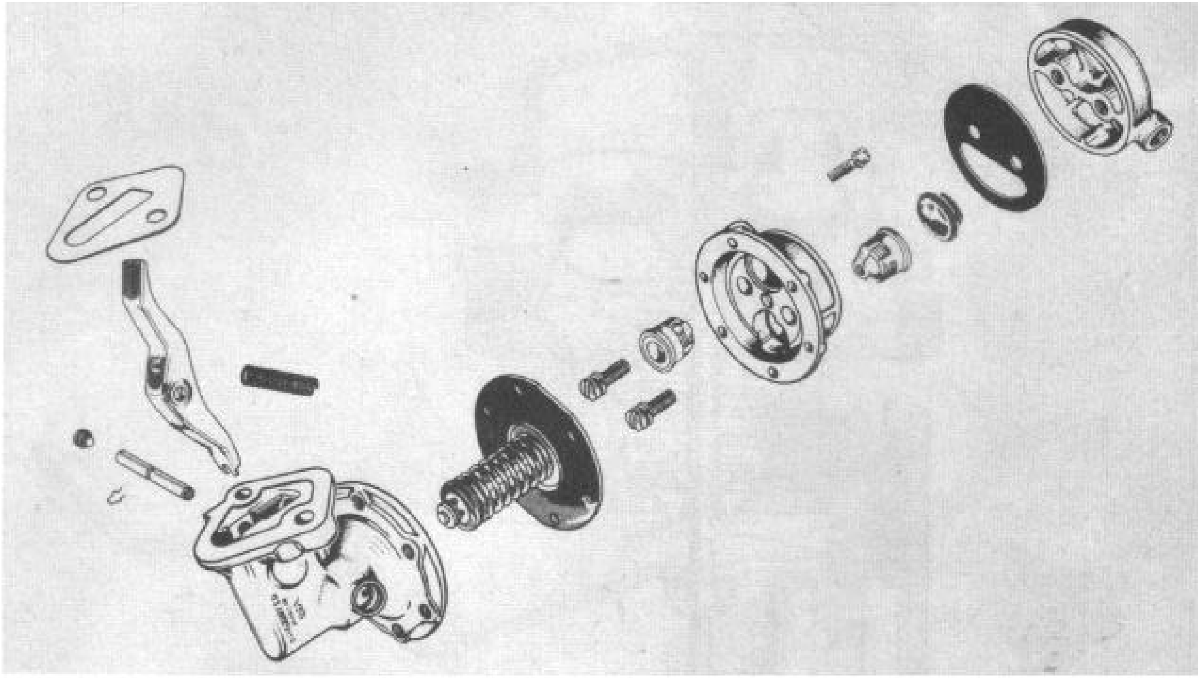


FIGURE 2—Assembly Sequence Single Action Fuel Pump (Carter)

Single acting type pumps are used only on cars equipped with standard transmission. Cars equipped with overdrive or automatic transmissions use the double action (combination) fuel and vacuum pump. This pump in addition to supplying fuel pressure incorporates a vacuum booster pump which helps boost intake manifold vacuum for more stable windshield wiper operation.

Both type pumps have an air dome on the discharge side to dampen pulsations in the fuel flow. This reduces flow variations and increases the pump output.

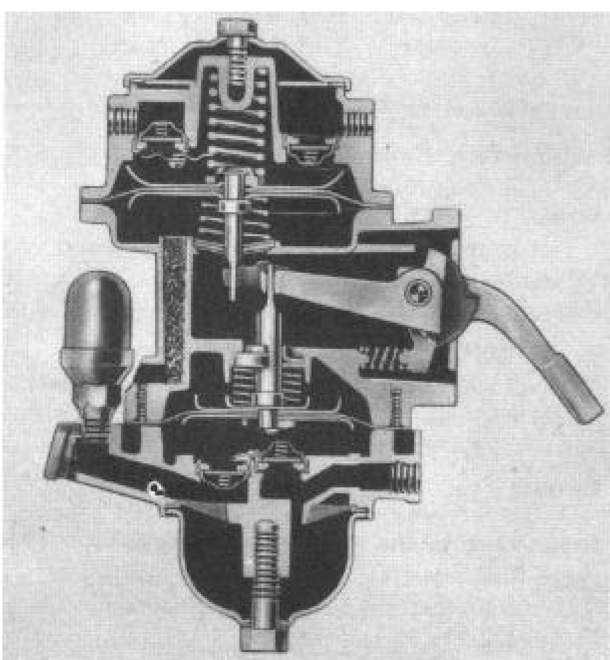


FIGURE 3—Sectional View Double Action Fuel Pump (A.C.)

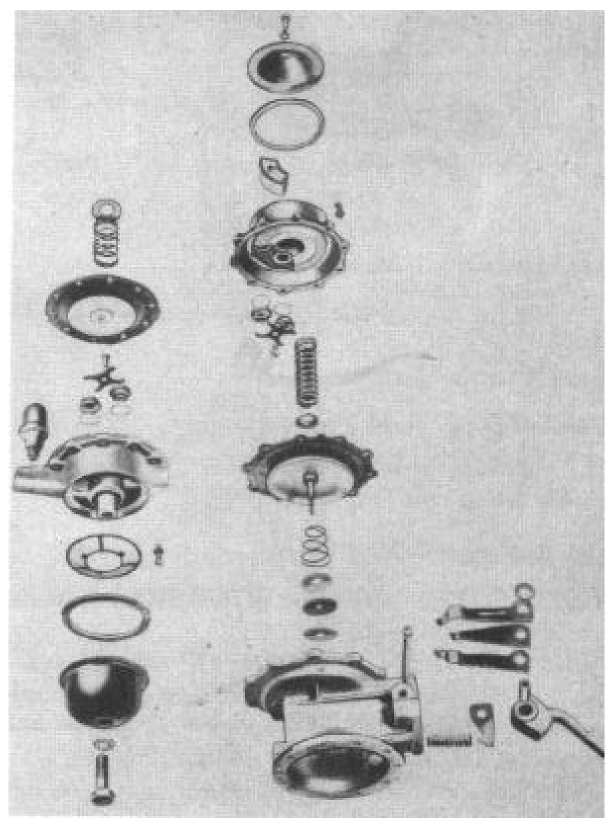


FIGURE 4—*Assembly Sequence Double Action Fuel Pump (A.C.)*

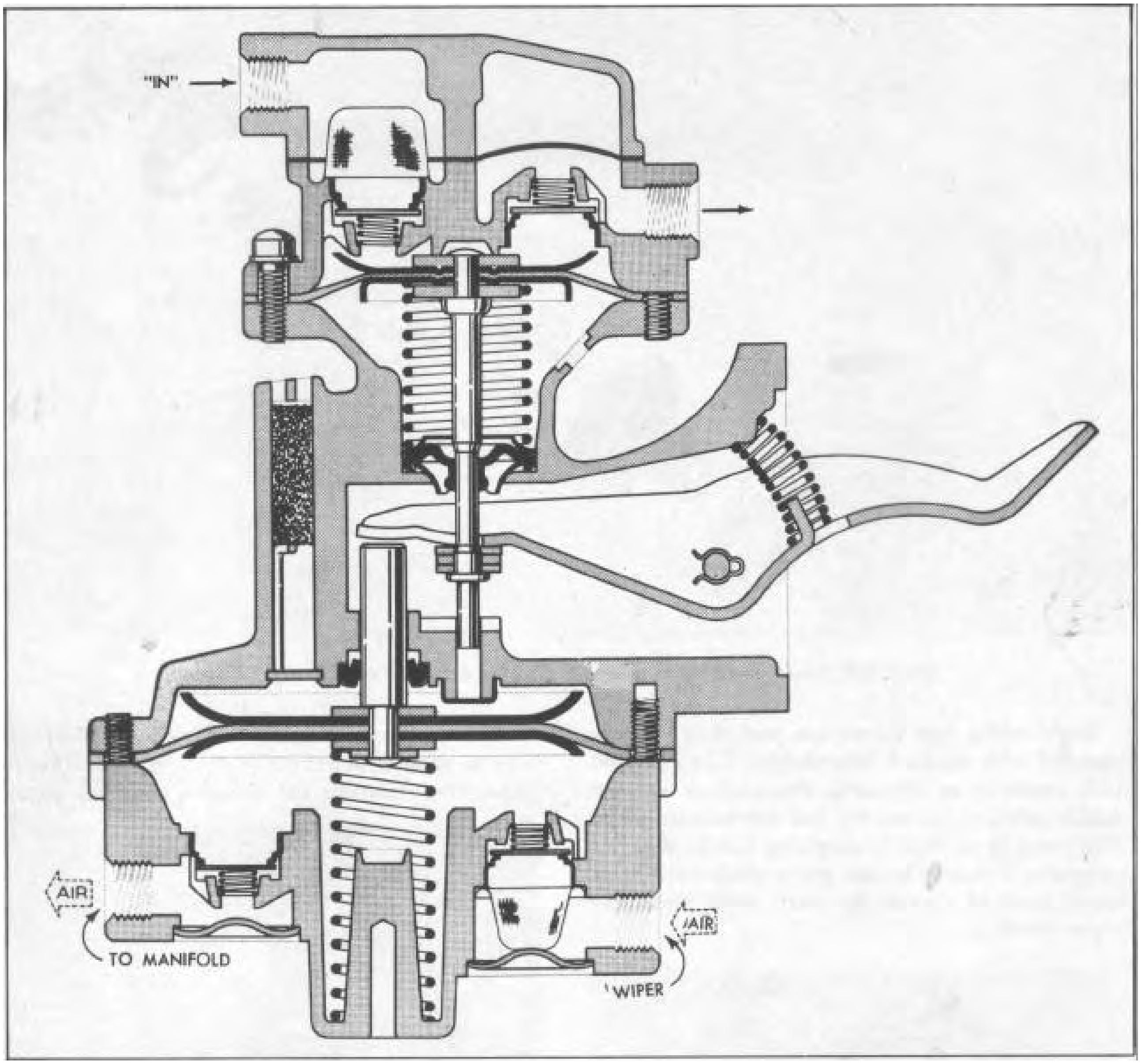


FIGURE 5—Sectional View Double Action Fuel Pump (Carter)

Fuel Pump Tests

Carter Type Fuel Pumps

The following tests apply to both the single and double action type Carter fuel pumps.

On Engine

VOLUME TEST—one quart of fuel in one minute maximum at 500 Engine R.P.M.

VACUUM TEST—minimum of 10" mercury (vacuum) at 500 Engine R.P.M. Fuel line from the pump to carburetor must be disconnected so pump will operate at full capacity.

PRESSURE TEST-3-1/2 to 5 P.S.I. at 500 Engine R.P.M. on the "Hornet" 6 and V-8 Series combination fuel and vacuum pumps; 3-1/2 to 4-1/2 P.S.I. at 500 Engine R.P.M. on the single action fuel pumps, all Series. Test is made with a pressure gauge connected to a "T" fitting at the carburetor. The pressure gauge connecting hose must not exceed six inches in length.

IMPORTANT: *Inaccurate pressure readings will result if a "T" fitting is not used or if a hose in excess of 6" is used.*

Bench Test

Clamp pump in vise with soft face jaws to protect the pump from vise.

Connect a mercury manometer or suitable vacuum gauge to intake side of pump.

Actuate pump lever full stroke at approximately 60 strokes per minute. The pump should pull at least 10" vacuum.

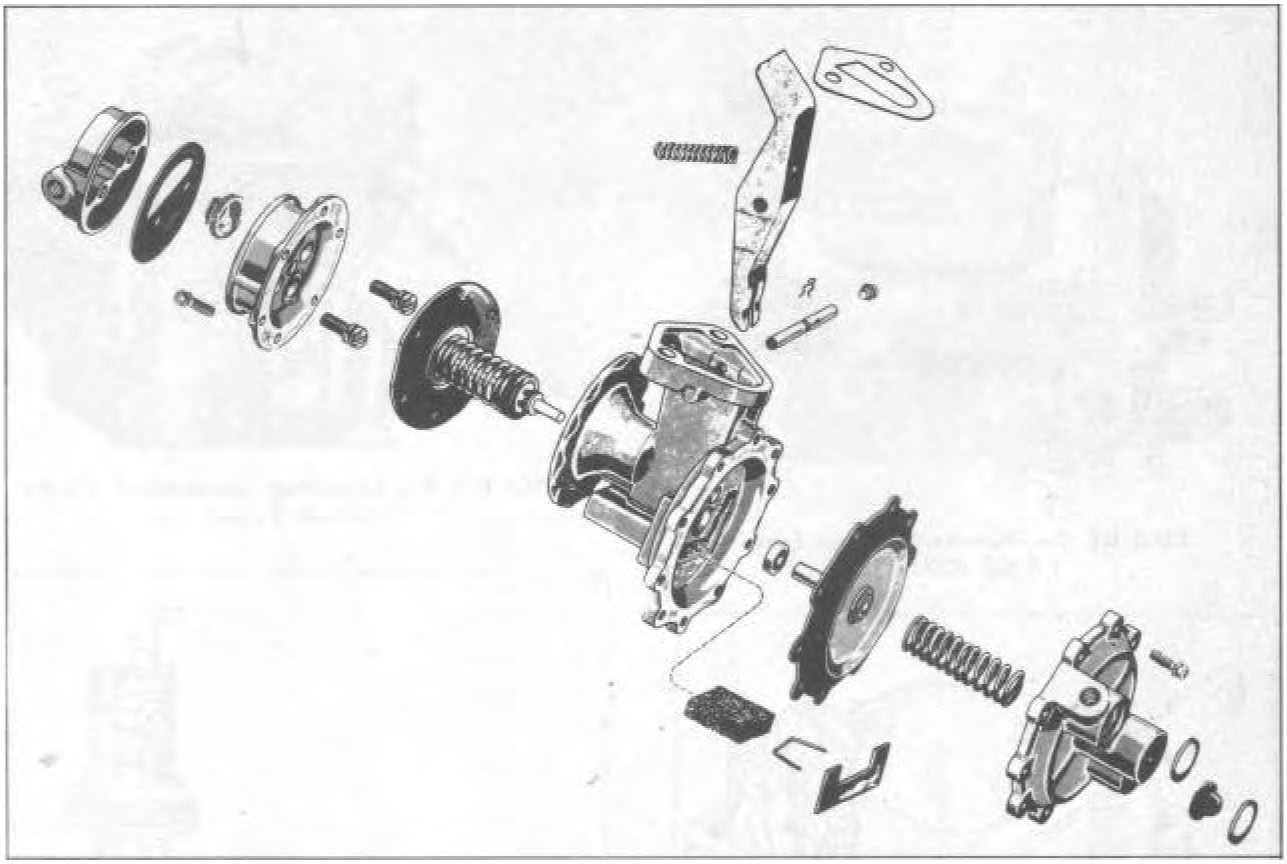


FIGURE 6—Assembly Sequence Double Action Fuel Pump (Carter)

Vacuum Pump Test (Double Action Fuel Pump)

With engine idling, turn on the vacuum windshield wiper to make certain the wiper motor is in operating condition.

Disconnect the vacuum pump line at the manifold and plug the manifold fitting. With the engine running, windshield wipers should operate; if they slow down a trifle, but do not stop, the pump is satisfactory.

A.C. Type Fuel Pumps

The following tests apply to the A.C. double action fuel pump.

On Engine

PRESSURE TEST—disconnect the fuel line to the carburetor and install a tee fitting; connect a fuel pump gauge to one port and plug the remaining opening. Operate the engine at 1800 R.P.M. on the existing fuel in the carburetor. The pressure should be 4 to 5 P.S.I. Stop the engine and observe the pressure. If it falls off perceptibly, leaking valves are indicated.

VOLUME TEST—disconnect the pressure gauge and connect the fuel line to the tee fitting and a rubber hose to the remaining opening of the tee fitting.

Operate the engine at normal idle speed. The fuel pump should fill a one pint measure held at carburetor float bowl height in one minute maximum.

Assembly on the Engine

Carter and A.C. Fuel Pump

The fuel pump cam lever is installed under the cam of the engine camshaft.

CARBURETORS

Specifications for Carter Climatic Control carburetors are listed on Page 13. Adjustment procedures follow.

Float Adjustment

The bowl cover gasket must be removed. Invert the bowl cover assembly so that the float is resting on the seated needle by its own weight. The height of the float is measured between the bowl cover and the top of the float when held horizontal at eye height (Figs. 7 and 8).

Models WGD-2231-S and WGD-2252-S

Adjust the float level by bending the float arm. Avoid straining the float. Do not grasp the float shell while bending the arm.

Models WA1-2013-S, WA1-2009-SA, WA1-2113-S, and YF-2014-S

The float level is adjusted by bending the lip of the float, not the float arm.

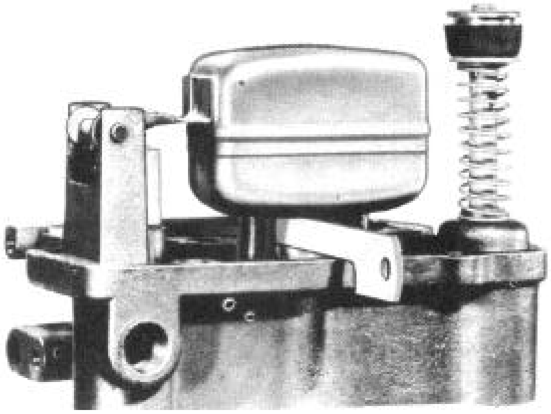


FIGURE 7—Measuring Float Level (WGD-2231-S)

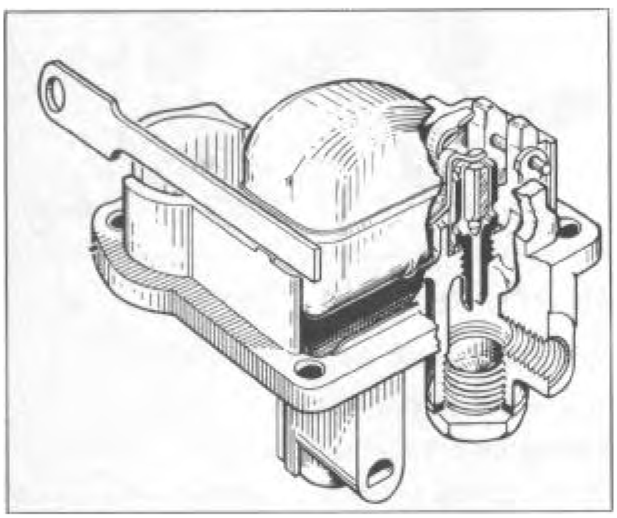


FIGURE 8—Measuring Float Level (WA1-2013-S)

Accelerator Pump Adjustment

Models WGD-2231-S and WGD-2252-S

Open the choke valve and back out throttle lever set screw until the throttle valves are seated in the bores of the carburetor. Hold a straight edge across top of dust cover gasket surface at pump arm. The flat boss on top of pump arm should be parallel to straight edge. Adjust by bending throttle connector at the upper angle. Use Bending Tool T-109-213 (Fig. 9).

Models WA1-2013-S, WA1-2009-SA, and WA1-2113-S

The throttle valve must be seated and the connector link in the lower hole (medium stroke) ; the pump plunger should travel 16/64" from the closed to wide open throttle position. Measure the travel using universal pump travel gauge T-109-117-S (Fig. 10).

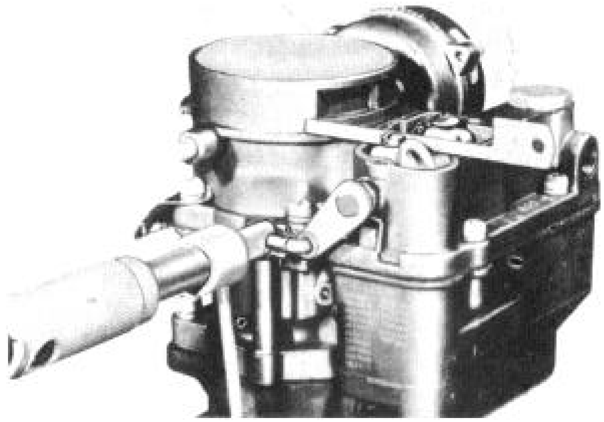


FIGURE 9—Adjusting Accelerator Pump (WGD Type)

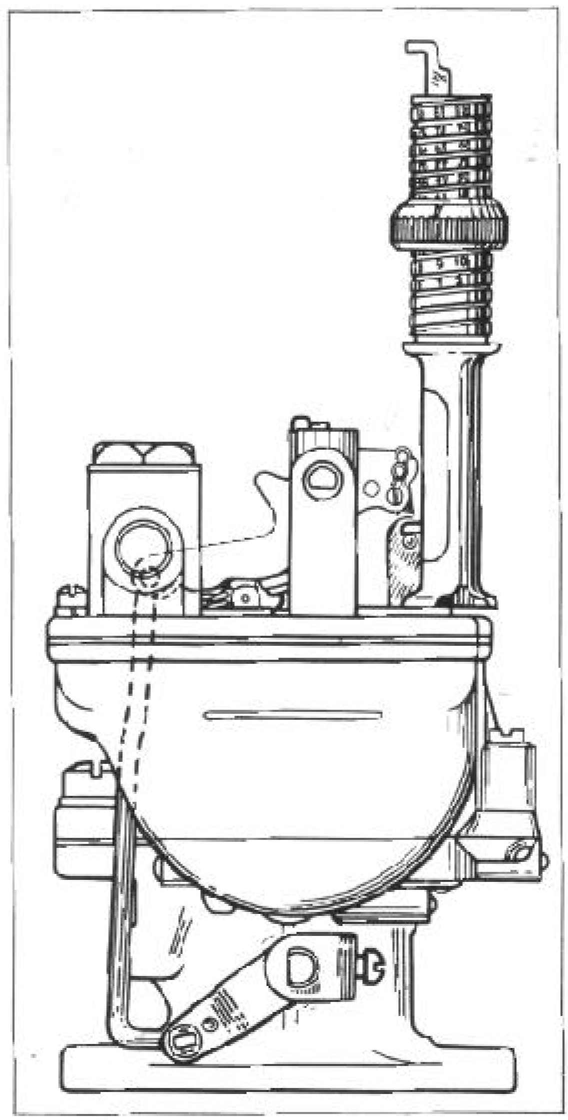


FIGURE 10—*Pump Stroke Adjustment (WA1 Type)*

Place the base of the gauge on the ridged portion of the bowl cover so that the indicator rests on the top of the connector link at the pump shaft. Hold the gauge vertical. The difference between the numbers shown by index mark on gauge at wide "open" and "closed" throttle position should be "16" (16/64"). Adjust by bending throttle connector link at lower angle.

Metering Rod Adjustment

IMPORTANT: ***The metering rods must be adjusted after the pump adjustment or each time the carburetor is reassembled.***

Models WGD-2231-S and WGD-2252-S

The metering rods must be adjusted after the pump adjustment. Metering rod gauges are not necessary for this adjustment. Throttle valves must be seated in the bores of the carburetor. Loosen metering rod arm set screw and press down on the vacumeter link until the metering rods bottom in the metering rod jet wells. Holding the metering rods in this position, revolve the metering rod arm until the lip contacts the vacumeter link and retighten the metering rod arm set screw in this position (Fig. 11).

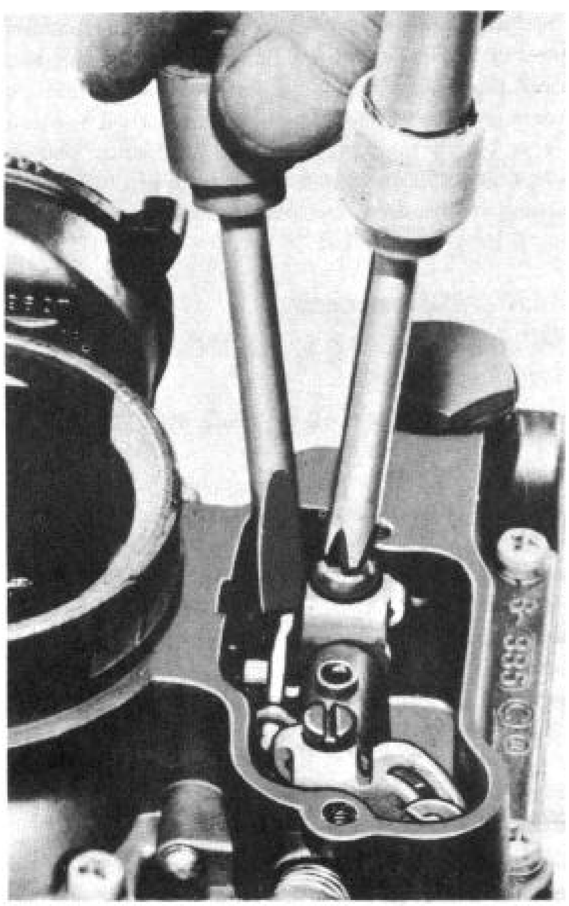


FIGURE 11—Adjusting Metering Rods (WGD-2231-S)

Models WA1-2013-S, WA1-2009-SA, and WA1-2113-S

Remove the metering rod and insert gauge (Tool T-109-102 for WA1-2013-S and WA1-2113-S, and T109-241 for WA1-2009-SA) in place of the metering rod, seating the tapered end of gauge in the metering rod jet. Hold gauge vertical to insure seating. With throttle valve tightly closed, press down on piston link directly over piston until it contacts the pump arm. There should be less than .005" clearance between metering rod pin and the shoulder in notch of gauge. Gauge must not drag on pin. Adjust by bending lip on piston link; use T-109-105 bending tool.

Reinstall metering rod, disc, pin, and spring (Fig. 12).

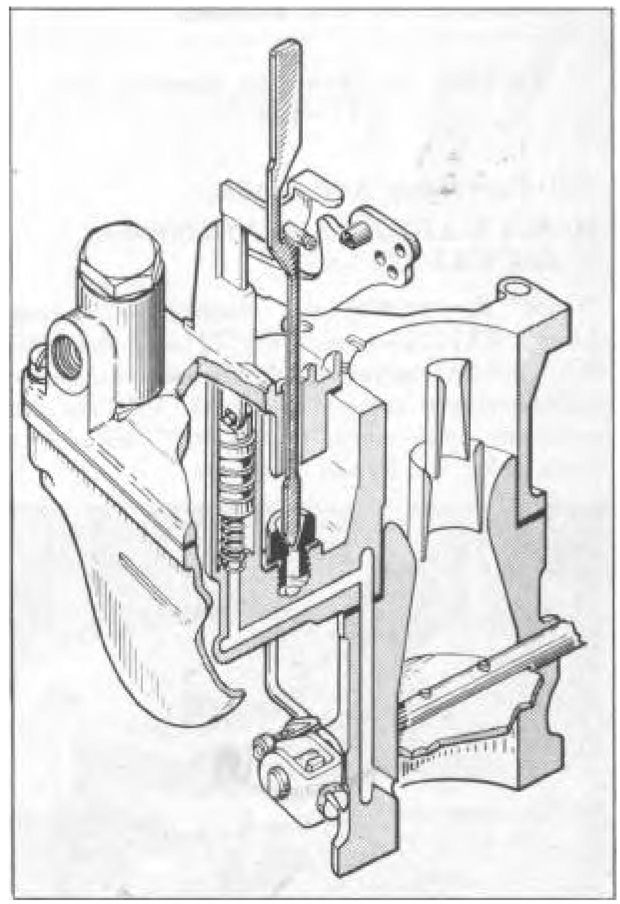


FIGURE 12—*Metering Rod Adjustment (WA1 Type)*

Model YF-2014-S

Close throttle until valve is seated in the bore. Press down on upper end of diaphragm shaft until diaphragm bottoms in vacuum chamber. Metering rod should contact bottom of metering rod well and metering rod arm should contact lifter link between springs and at supporting lug. Adjust by bending lip up or down (Fig. 13).

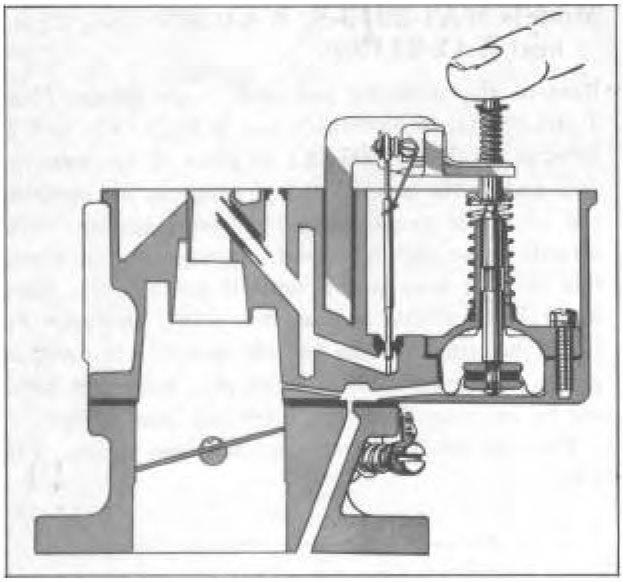


FIGURE 13—Adjusting Metering Rod (YF-2014-S)

Anti-Percolator Adjustment

Models WA1-2013-S, WA1-2009-SA, and WA1-2113-S

"Crack" the throttle valve placing a wire gauge (.016" WA1-2013-S and WA1-2113-S, and .030" WA1-2009-SA) between the throttle valve and bore of carburetor (side opposite idle port). Bend the anti- percolator rocker arm to provide .010" clearance between rocker arm lip and pump arm.

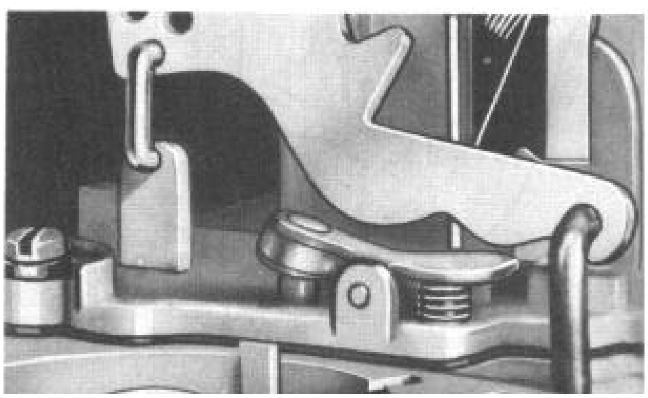


FIGURE 14—Anti-Percolator Valve (WA1 Type)

Fast Idle Adjustment
Models WGD-2231-S, WGD-2252-S, and YF-2014-S

Remove the thermostatic coil housing gasket and baffle plate. "Crack" the throttle valve and hold the choke valve closed to rotate the first idle cam to the fast idle position. Close the throttle. Measure the clearance between the throttle valve and bore of the carburetor (side opposite idle port). Adjust by bending connector link at the lower angle. Use Bending Tool T-109-213 (Fig. 15).

FIGURE 15—Adjusting Fast Idle (WGD-2231-S)

Models WA1-2013-S, WA1-2009-SA, and WA1-2113-S

With the fast idle cam held in a normal idle position, tighten throttle lever adjusting screw until it just seats against the cam. Hold throttle lever closed and pull the cam back until first (low) step is against (not on) set screw. There should be 5/8" clearance between inside wall of air horn and lower edge of choke valve.

Adjust by bending fast idle link at off set portion, using T-109-41 (Fig. 16).

Unloader Adjustment
Models WGD-2231-S, WGD-2252-S, and YF-2014-S

Unloader adjustment must be made after the fast idle adjustment.

Hold the throttle valve wide open and close the choke valve as far as possible without forcing. Measure the clearance between the lower edge of the choke valve and the inner wall of the carburetor air horn. On Model WGD-2231-S, measure between the upper edge of the choke valve and the inner wall of the air horn.

Adjust by bending the choke shaft unloader arm (Fig. 17).

Models WA1-2013-S, WA1-2009-SA, and WA1-2113-S

There should be 3/16" clearance (Gauge T-109-84) between the lower edge of the choke valve and inner wall of the air horn with the throttle valve wide open. Adjust by bending cam on throttle lever.

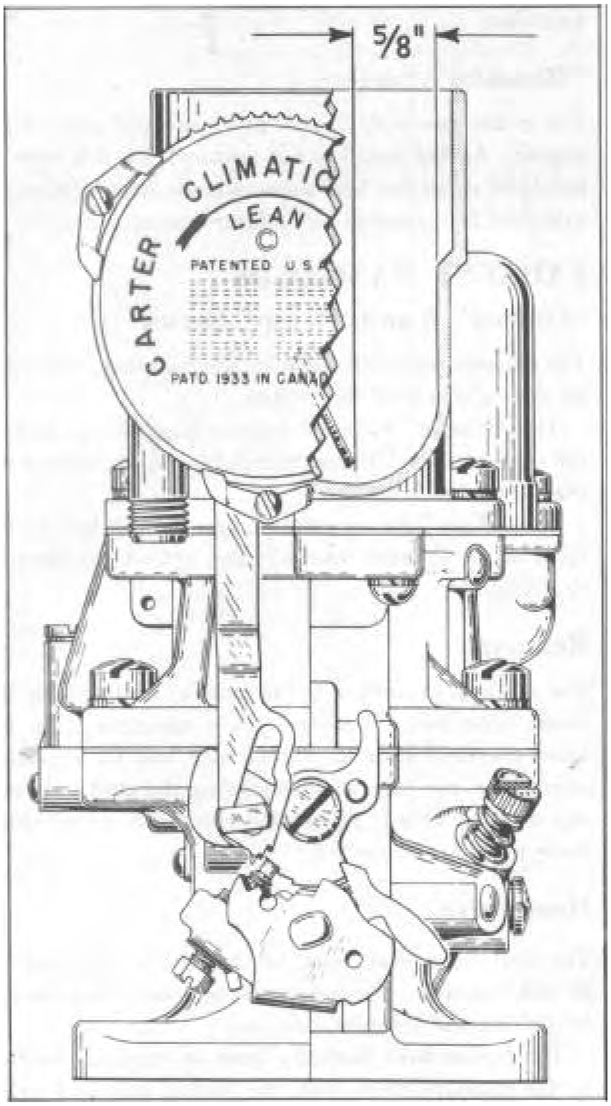


FIGURE 16—Fast Idle Adjustment (WA1 Carburetor Shown)

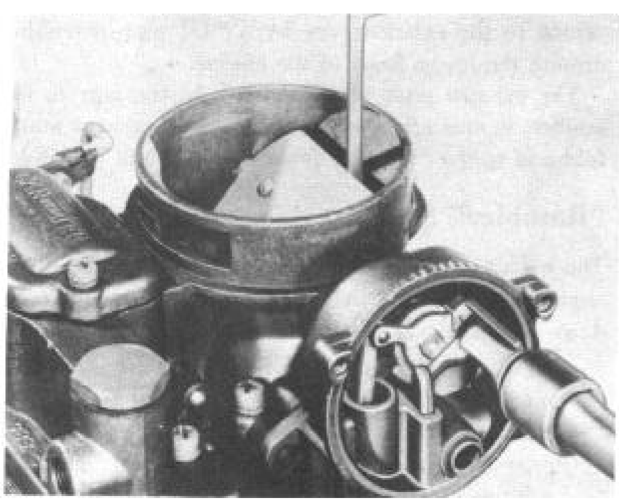
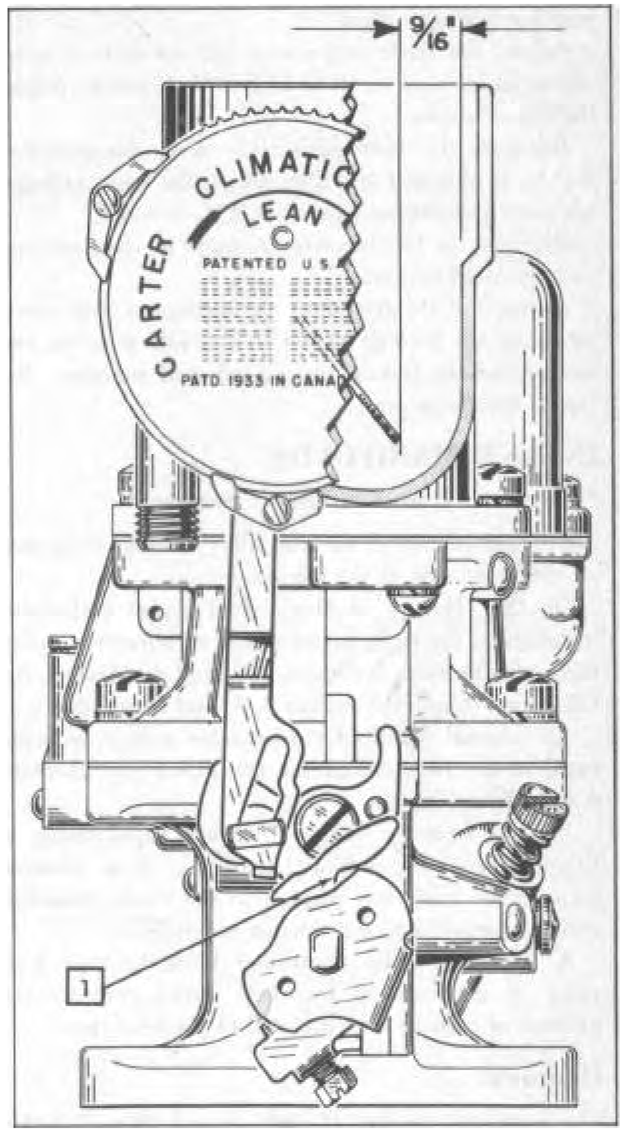


FIGURE 17—Unloader Adjustment (WGD-2231-S)



1. Bend Cam

FIGURE 18—Unloader Adjustment (WA1 Type)

SYNCHRONIZATION ADJUSTMENT

"Hornet" 6 and "Wasp" Series

Remove the clevis pins from the throttle shaft to carburetor rod devises.

Connect a vacuum gauge and tachometer.

Hold the fast idle cam in the normal idle position and adjust the idle speed screws until the throttle valves are just seated in closed position.

"Crack" the rear carburetor throttle valve and adjust the idle mixture screws (1-1/4 to 2-1/4 turns out "Hornet" 6 and 1/2 to 1-1/2 turns out "Wasp" Series).

Start the engine and allow to warm up to normal operating temperature.

Hold the front carburetor throttle valve closed and adjust the rear carburetor idle speed 25 to 40 R.P.M. less than specified. Adjust the rear carburetor mixture for best operation.

Adjust the front carburetor idle speed to a point where an increase of 10 to 15 R.P.M. is noted. Adjust the idle mixtures.

Readjust the rear carburetor until the specified R.P.M. is obtained and then adjust the front carburetor until a slight increase in R.P.M. is noted.

Readjust the idle mixture to obtain the- best mixture and manifold vacuum.

Adjust the throttle shaft to carburetor rod clevis retaining the throttle valves in the idle position and the accelerator linkage in the released position. Reinstall the clevis pins.

INTAKE MANIFOLDS

"Hornet" 6 and "Wasp" Series

The intake manifold, an iron alloy casting, is located on the right side of the engine.

On the "Hornet" 6 single dual throat carburetor installation, the right barrel of the carburetor supplies fuel-air mixture to Numbers 1, 2, and 3 cylinder; the left barrel supplies Numbers 4, 5, and 6 cylinder.

An internal manifold compensator port is incorporated in the twin carburetor manifolds for "Hornet" 6 and "Wasp" Series.

Exhaust heat for fuel-air mixture vaporization is supplied from the exhaust manifold. It is directed through the heat riser passage in the intake manifold and discharged into the exhaust manifold.

A thermostatically controlled butterfly type heat valve at the exhaust manifold outlet controls the amount of exhaust heat directed to the heat riser.

Removal

The manifolds on the "Hornet" 6, and "Wasp" Series with twin carburetors may be removed by removing the 5/8" nut from the top of the front motor supports and loosening the rear motor supports. Move the engine upward and to the left with the use of a Porto- Power or suitable jack. This will provide sufficient clearance to remove the manifolds from the studs.

"Hornet" V-8 Series

The intake manifold, an iron alloy casting, is located between the two banks of cylinders. The left barrel of the carburetor supplies fuel-air mixture through uniform passages to Numbers 1, 7, 4, and 6 cylinder intake ports. The right barrel supplies 3, 5, 2, and 8.

Exhaust heat for fuel-air mixture vaporization is supplied from the left bank exhaust manifold. It is directed through a heat cross-over passage in the intake manifold, through the heat riser passages surrounding the carburetor risers in the manifold, and then discharged into the right bank exhaust manifold.

A thermostatically controlled butterfly type heat valve at the outlet of the left bank exhaust manifold controls the amount of exhaust heat directed to the heat riser.

"Rambler" Series

The intake manifold, is cast as an integral part of the engine. A "hot spot" is not required for this type of manifold as engine heat automatically heats the intake manifold for complete fuel mixture vaporization.

EXHAUST MANIFOLDS
"Hornet" 6 and "Wasp" Series

The exhaust manifold, an iron alloy casting, is located on the right side of the engine.

The "Hornet" 6 Series exhaust pipe is attached to the center of the exhaust manifold and extends to the rear to the muffler.

The "Wasp" Series exhaust pipe is attached to the front of the exhaust manifold and extends to the rear to the muffler.

Removal

The removal procedure is the same as outlined for the intake manifold. However, when separating the exhaust manifold from the intake manifold for servicing operations, use care when removing the stud nuts and cap screws. This is due to the extreme heat to which these parts are subjected.

Heat Valve

The heat valve shaft must be cut with a hack saw to permit removal. The counter weight may be removed by driving out the retaining pin. The replacement butterfly must be centrally located in the open position with the spring removed prior to welding to the shaft.

"Hornet" V-8 Series

A cast iron alloy exhaust manifold is attached on the outboard side of each bank. The left bank is connected to the exhaust pipe by a "U" pipe extending around the lower front of the engine.

The exhaust pipe, which extends to the rear to the muffler, is connected to the right bank exhaust manifold and to the "U" pipe from the left bank manifold.

"Rambler" Series

The exhaust pipe is clamped to the right side of the engine covering the exhaust ports and then extends down toward the rear to the muffler.

NOTE: Prior to removing the exhaust pipe mark the pipe adjacent to the exhaust pipe clamps with a scribe. This will assure correct port alignment at the time of reassembly. Do not over tighten exhaust clamp stud nuts because of heat expansion of the pipe during operation.

MUFFLERS . The "Hornet" V-8, 6, and "Wasp" Series are equipped with straight-through type mufflers and tail pipe	resonators The "Rambler" Series use a reverse flow oval type muffler

1955 CARBURETOR TOOLS

Kent-Moore Number	Carter Number	Description
J-818-3	T-109-28	3/16" Float and Unloader Gauge
J-1388	T-109-29	.030" - .020" Wire Gauge
J-818-6	T-109-31	1/4" Float and Unloader Gauge
J-1137	T-109-41	Bending Tool
KMO-657	T-109-44	.015" - .018" Wire Gauge
J-816-5	T-109-51	Screw Driver Handle
KMO-728	T-109-51	Grip Handle for Sockets
KMO-729	T-109-53	Cross Bar for T-109-51
J.816-2	T-109-58	1/4" Screw Driver Bit
J-816-1	T-109-59	3/16" Screw Driver Bit
J-816-4	T-109-61	7/16" Screw Driver Bit
	T-109-76	1/4" x 5/16" . Wrench
J-818-15	T-109-81	7/16" Float and Unloader Gauge
J-818-1	T-109-83	1/2" Float and Unloader Gauge
J-5651	T-109-84	9/16" Float and Unloader Gauge
J-818-10	T-109-85	5/8" Float and Unloader Gauge
J-1265	T-109-102	Metering Rod Gauge
J-1389	T-109-105	Bending ,Tool
J-4465	T-109-106	7/32" Float and Unloader Gauge
J-1475	T-109-1175	Universal Pump Travel Gauge
J-5510	T-109-126	8/32" Float and Unloader Gauge
J-5660	T-109-193	.040" .054" Wire Gauge
J-5496	T-109-213	Bending Tool
J-5652	T-109-241	Metering Rod Gauge

TECHNICAL SERVICE LETTER REFERENCE

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TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes of informatin on Page. No.

CARBURETOR SPECIFICATIONS

Model Numbers	WGD-2252-S	WGD-2231-S	WA1-2113-S
Car Models	"Hornet" Championship 6	"Hornet" V-8	"Hornet" 6 Twin-H-Power
Dimensions			
Flange Size	1-1/4" (Dual 4 Bolt)	1-1/4" (Dual 4 Bolt)	1-1/2" S.A.E.
Primary Venturi	1-1/32" I.D.	11/32" I.D.	11/32" I.D.
Secondary Venturi	21/32" I.D.	21/32" I.D.	11/16 I.D.
Main Venturi	1-3/16" I.D.	1-3/6" I.D.	1-3/8" I.D.
Float Level	1/4"	1/4"	1/2"
Float Adjustment	See Adjustments	See Adjustments	See Adjustments
Vents	Inside Balanced Vent to Carburetor Air Horn, Outside None	Inside Balanced Vent to Carburetor Air Horn	Outside—No. 10 Inside None
Gasoline Intake	Solid Needle Size No. 42 Drill in Needle Seat	Solid Needle Size No. 42 Drill in Needle Seat	Square Vertical Push Pull Needle Size No. 46 Drill in Needle Seat
Low Speed Jet Tube			
Jet Size	No. 67 Drill	No. 69 Drill	No. 66 Drill
By-Pass	In Cover No. 53 Drill	In Cover No. 56 Drill	No. 52 Drill
Air Bleed	In Cover No. 53 Drill	In Cover No. 53 Drill	No. 52 Drill
Economizer	In Cover .0453"	In Cover No. 55 Drill	.0545"—.0555"
Idle Port			
Upper Port)	Slot	Slot	Slot
Length	.167"	.160"	.190"
Width	.030"	.030"	.040"
Idle Port Opening (Top of Port Above Edge of Tightly Closed Valve)	.112"–.118"	.109"–.115"	.178"—.182"
Lower Port (For Idle Adjusting Screw)	No. 46 Drill	.065"–.069"	No. 46 Drill
Set Idle Adjustment Screw (Screw Out for Richer Mixture)	1-3/4-2-3/4 Turns Open	1/2-1-1/2 Turns Open	1-1/4-2-1/4 Turns Open
Idle Speed Minimum R.P.M.—(When Equipped with Air Conditioning, Adjust with Air Conditioning Unit Turned On)			
Ultramatic	----	425	----
Hydra-Matic (In "N")	490-510	----	490-510
Standard	540-560	----	540-560
Overdrive	575	----	575

CARBURETOR SPECIFICATIONS (Cont'd)

Model Numbers	WA1-2009-SA "Wasp"	WA1-2013-S "Wasp"	YF-2014-S
Car Models	Hi-Torque 6	Twin-H-Power	"Rambler"
Dimensions			
Flange Size			
Primary Venturi	1-1/4" S.A.E.	1-1/4" S.A.E.	1-1/4" S.A.E.
Secondary Venturi	11/32" I.D.	1-1/32" I.D.	1-1/32" I.D.
Main Venturi	11/16" I.D.	11/16" I.D.	1-1/16" I.D.
	1-3/8" I.D.	1-5/16" I.D.	1-1/4" I.D.
Float Level	7/6"	1/4"	1/2"
Float Adjustment	See Adjustments	See Adjustments	See Adjustments
Vents	Outside—No. 10 Inside None	Outside—No. 10 Inside None	Inside Balanced Vent to Carburetor Air Horn, Outside None
Gasoline Intake	Size No. 46 Drill in Needle Seat	Spring Loaded Needle Size No. 42 Drill in Needle Seat	Square Spring Loaded Needle Size No. 46 Drill in Needle Seat
Low Speed Jet Tube			
Jet Size	No. 65 Drill	No. 68 Drill	No. 70 Drill
By-Pass	No. 53 Drill	No. 53 Drill	In Air Horn No. 55 Drill
Air Bleed	No. 53 Drill	No. 53 Drill	In Body No. 52 Drill
Economizer	.0545"—.0555"	.0545"—.0555"	In Body No. 53 Drill
Idle Port			
Upper Port)	Slot	Slot	Slot
Length	.165"	.150"	.200"
Width	.030"	.030"	.030"
Idle Port Opening (Top of Port Above Edge of Tightly Closed Valve)	.120"—.124"	.103"—.107"	.142"—.146"
Lower Port (For Idle Adjusting Screw)	No. 46 Drill	No. 46 Drill	.0615"—.0655"
Set Idle Adjustment Screw (Screw Out for Richer Mixture)	1/2_11/2 Turns Open	3/4-1-3/4 Turns Open	1/2-1-1/2 Turns Open
Idle Speed Minimum R.P.M.—(When Equipped with Air Conditioning, Adjust with Air Conditioning Unit Turned On)			
Ultramatic	----	----	----
Hydra-Matic (In "N")	490-510	490-510	475
Standard	540-560	540-560	500-550
Overdrive	575	575	500-550

CARBURETOR SPECIFICATIONS (Cont'd)

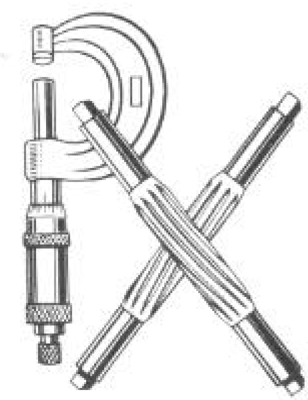
Model Numbers	WGD-2252-S	WGD-2231-S	WA1-2113-S
Main Nozzle	Installed Permanently— Do Not Remove	Installed Permanently— Do Not Remove	Slip Nozzle Flush Type Discharge Jet Size .110" Inner Nozzle (Seats in Slip Nozzle) I.D. No. 31 Drill
Anti-Percolator	Well Jet No. 71 Drill	Well Jet No. 70 Drill	Saxaphone Key Type
Metering Rod	Vacumeter Type	Vacumeter Type	Vacumeter Type
Economy Step	.063"	.0665"	.075"
Middle Step Tapers to—	.060"		.068"
Power Step	.052"	.043"	.059"
Metering Rod Jet	.086"	.089"	.1015"
Metering Rod Settings	See Adjustments	See Adjustments	See Adjustments
Accelerating Pump	Plunger Type Mechanically Operated. Dis-charge Jet (Twin) Size No. 70 Drill. Pump Jet Air Bleed Passage to Outside 1/8" Drill. Intake Ball Check in Plunger Shaft. Discharge (Needle Seat) Size No. 50 Drill.	Plunger Type Mechanically Operated. Dis-charge Jet (Twin) Size No. 72 Drill. Pump Jet Air Bleed Passage to Outside 1/8" Drill. Intake Ball Check in Plunger Shaft. Discharge (Needle Seat) Size No. 50 Drill	Plunger Type Adjustable Stroke. Discharge Jet Size No. 74 Drill. In-take Ball Check Seat Size No. 60 Drill. Discharge Ball Check Seat Size No. 32 Drill. Relief Passage (to Outside) Size No. 42 Drill.
Accelerator Pump Adjustment	See Adjustments	See Adjustments	See Adjustments
Choke	Carter Climatic Control	Carter Climatic Control	Carter Climatic Control
Coil Setting	Index	1 Point Rich	1 Point Lean
Heat Suction Hole	In Piston Housing No. 42 Drill	In Piston Housing No. 42 Drill	In Body No. 40 Drill
Fast Idle Adjustment (See Adjustments)	.030"	.030"	5/8"
Unloader Adjustment	7/32"	3/16"	9/16"
Vacuum Spark Port	Horizontal Slot	Horizontal Slot	Round Type
Size	.045"x.110"	.040"x.130"	.054"–.057"
Location of Port Above Top Edge of Valve in Closed Position	Top of Port .028"	Bottom of Port .038"–.044"	Top of Port .049"

CARBURETOR SPECIFICATIONS (Cont'd)

Model Numbers	WA1-2009-SA	WA1-2013-S	YF-2014-S
Main Nozzle	Slip Nozzle Flush Type Discharge Jet Size .110" Inner Nozzle (Seats in Slip Nozzle) I.D. No. 31 Drill	Slip Nozzle Flush Type Discharge Jet Size .110" Inner Nozzle (Seats in Slip Nozzle) I.D. No. 31 Drill	Installed Permanently— Do Not Remove
Anti-Percolator	Saxaphone Key Type	Saxaphone Key Type	Air Bleed No. 70 Drill
	Vacumeter Type	Vacumeter Type	Diaphragm Type
Metering Rod	.074"	.073"	.078"
Economy Step	.063"	.067"	.07325"
Middle Step Tapers to—	.040"	.053"	.047"
Power Step	.1015"	.096"	.10236"
Metering Rod Jet	See Adjustments	See Adjustments	See Adjustments
Metering Rod Settings			
Accelerating Pump	Plunger Type Adjustable Stroke. Discharge Jet Size No. 68 Drill. Intake Ball Check Seat Size No. 40 Drill. Discharge Ball Check Seat Size No. 32 Drill. Relief (to Outside) No. 42 Drill.	Plunger Type Adjustable Stroke. Discharge Jet Size No. 68 Drill. Intake Ball Check Seat Size No. 40 Drill. Discharge Ball Check Seat Size No. 32 Drill. Relief (to Outside) No. 42 Drill	Diaphragm Type Vacuum and Mechanically Operated. Discharge Through Nozzle. Discharge Restriction (in Housing) Size No. 65 Drill. Intake Ball Check Seat (in Diaphragm Housing) Size No. 40 Drill. Discharge Ball Check Seat (in Diaphragm Housing) Size No. 32 Drill. Vacuum Restriction (in Flange) Size No. 55 Drill. Vacuum Passage (Diaphragm Bleed) Size No. 65 Drill.
Accelerator Pump Adjustment	See Adjustments	See Adjustments	See Adjustments
Choke	Carter Climatic Control	Carter Climatic Control	Carter Climatic Control
Coil Setting	Index	1 Point Lean	l Point Lean
Heat Suction Hole	In Body No. 40 Drill	In Body No. 40 Drill	In Body No. 46 Drill
Fast Idle Adjustment See Adjustments)	5/8"	1/2"	.054"
Unloader Adjustment	9/16"	9/16"	9/32"
Vacuum Spark Port	Round Type	Round Type	Round Type
Size	.051"–.054"	.039"–.041"	.040"
Location of Port Above Top Edge of Valve in Closed Position	Bottom of Port .005"-.015"	Top of Port .010"-.020"	Bottom of Port .021"-.029"

HUDSON

TECHNICAL SERVICE MANUAL



CLUTCH SECTION

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CLUTCH

CLUTCH SECTION

The is a single plate, dry disc type. A steel covet bolted to the flywheel contains the drive plate, the pressure plate, levers, and springs (Fig. 1).

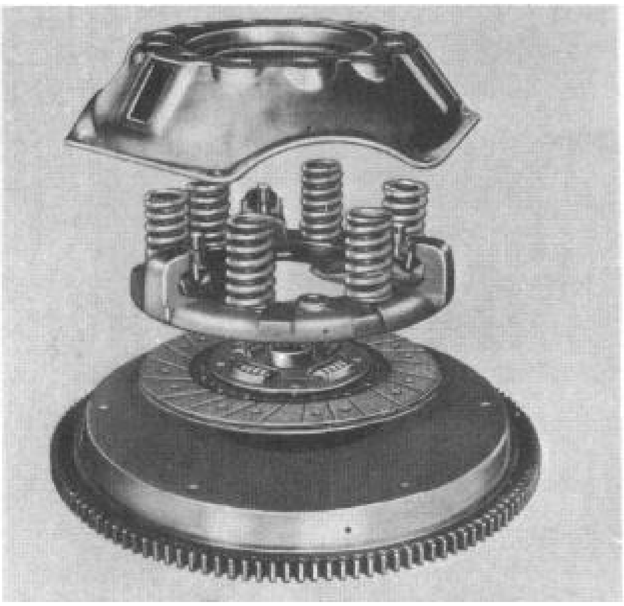


FIGURE 1—Component Parts of Clutch

The clutch drive plate is spring cushioned with a facing riveted to both sides. The coil springs around the hub absorb the power shocks and cushion the driving mechanism.

The clutch throw-out bearing is of the ball type, packed at time of manufacture, and requires no further lubrication.

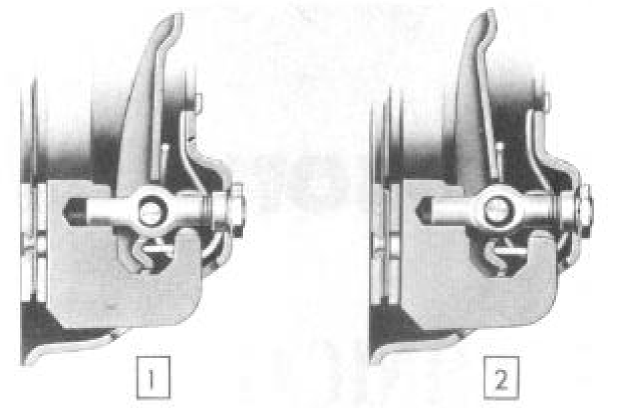
No adjustment for wear is provided in the clutch itself. An individual adjustment is built into the clutch cover to adjust the height of the release levers. This adjusting nut is locked in position and should never be disturbed unless the clutch assembly has been disassembled for the replacement of worn parts.

When the clutch pedal is depressed, the release bearing is moved toward the flywheel and contacts the inner ends of the release levers. Each lever is pivoted on a floating pin which remains stationary in the lever and rolls across a short flat portion of the enlarged hole in the eyebolt. The outer ends of the eyebolts extend through holes in the stamped cover and are fitted with adjusting nuts to secure the levers in the correct position. The outer ends of the release levers engage the pressure plate lugs by means of fulcrums, which provide knife-edge contact between the outer ends of the levers and the lugs (Fig. 2).

REMOVING THE CLUTCH ASSEMBLY

Always mark the cover, pressure plate and flywheel on original production assemblies before removing, so that when they are reassembled they will be in their same relative positions (Fig. 1).

CAUTION: *When removing the clutch cover from the flywheel, loosen each cap screw a few turns until the spring tension on the cover has been released. The clutch cover is a steel stamping which could be sprung by incorrect removal, resulting in clutch chatter when reused.*



1. Engaged Position
2. Released Position

FIGURE 2—Clutch Lever

CRANKSHAFT PILOT BUSHING

When a assembly is removed from the flywheel, always inspect the crankshaft pilot bushing for scoring or loose condition. The bushing may be removed by using a tap. After the tap has bottomed in the bore, the bushing will be forced out. To provide initial lubrication for this bushing, coat lightly with a short fiber, medium wheel bearing grease.

CLUTCH DISASSEMBLY

The clutch cover and pressure plate are under spring tension at all times. Therefore, care must be exercised when a cover assembly is disassembled. Place the cover assembly in an arbor press with a hard wood block under the pressure plate. Have the block of such a length that the cover can move down and not interfere with the blocks. Place a wood block across the top of the cover so that it rests on the spring bosses and does not interfere with the eyebolt adjust. ing nuts (Fig. 3).

Compress the clutch cover in the press until the clutch release levers are free. Remove the adjusting nuts (Fig. 3). Release the press slowly to prevent the springs from flying out.

CAUTION: *When relieving the spring pressure, be sure the cover does not stick on the pressure plate bosses.*

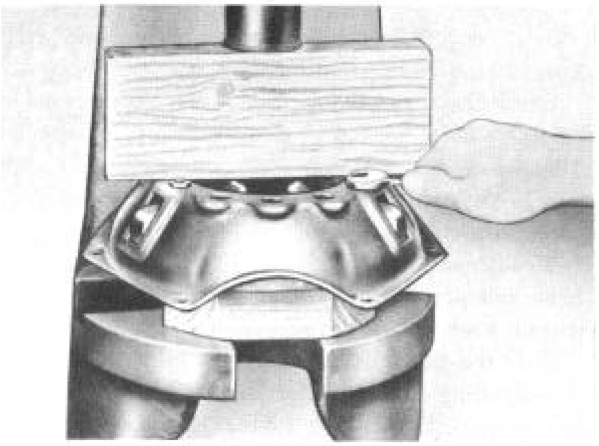


FIGURE 3—Compress Springs to Remove Nuts

Clutch Pressure Springs

A thorough inspection of the clutch springs should always be made. They should be tested for spring tension when the spring is compressed to a given length. (See Clutch Pressure Spring Specifications for the correct spring heights.)

Pressure Spring Specifications

Series	*No. of Springs*	*Compressed Length*
"Hornet Series"	6	230# -± 6 at 1-11/16"
	3	135# ± 5 at 1-11/16"
"Wasp" Series	3	195# ± 6 at 1-1/2"
	3	230# ± 7 at 1-1/2"
"Rambler" Series	3	195# ± 5 at 1-7/1 6"
	3	190# ± 5 at 1-7/16"

Clutch Adjusting Levers

A thorough inspection should be given the levers, the eyebolt pin, and the fulcrum. If they show any wear. replace them.

To remove the release levers, grasp a lever and eyebolt between the thumb and fingers so that the inner end of the lever and the upper end of the eyebolt are as near together as possible. Keep the eyebolt pin seated in its socket in the lever (Fig. 4).

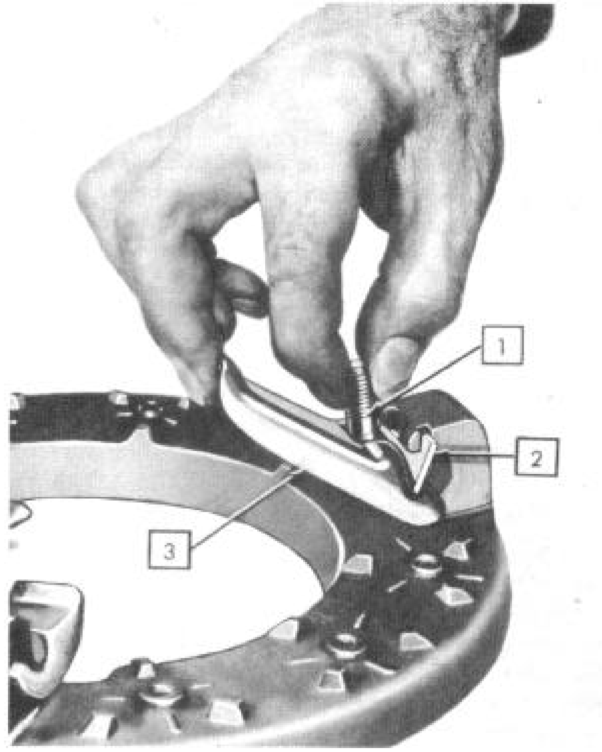
Lift the fulcrum over the ridge on the end of the lever. Lift the lever and eyebolt off the pressure plate (Fig. 5) .

Clutch Pressure Plate

Inspect the pressure plate to make sure that it is not cracked or scored. Check on a surface plate for a warped condition, as a pressure plate out of alignment will result in clutch chatter.

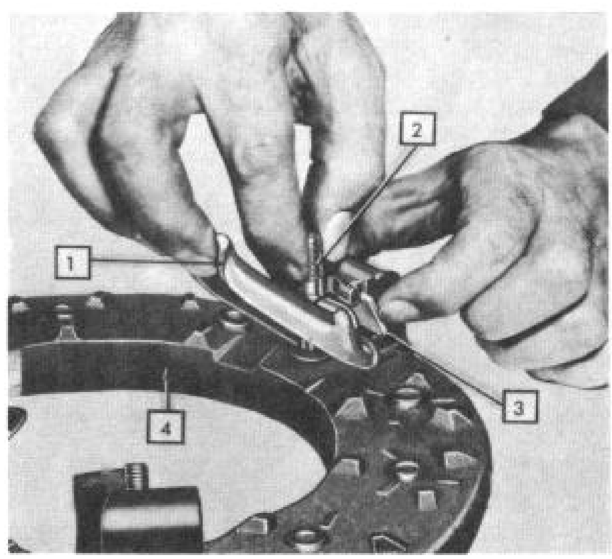
FLYWHEEL

Inspect the condition of the flywheel as well as the pressure plate for any roughness. Check all flywheel stud nuts for tightness. Use a torque wrench and tighten the stud nuts 95 to 100 foot pounds torque on the "Hornet" Series and 50 to 55 foot pounds on the "Wasp" and "Rambler" Series.



1. Eyebolt
2. Fulcrum
3. Lever

FIGURE 4-*Removee Levers*



1. Lever
2. Eyebolt
3. Fulcrum
4. Pressure Plate

FIGURE 5—*Lift Lever and Eyebolt off Pressure Plate*

TRANSMISSION CLUTCH SHAFT

Slide the driven plate onto the transmission shaft to make sure that it is free on the splines. If the splines on the transmission shaft are burred, remove the burrs with a fine file or stone. If the movement of the clutch driven plate is not free on the splines, the result will be clutch drag and hard shifting of transmission gears.

ASSEMBLY OF CLUTCH

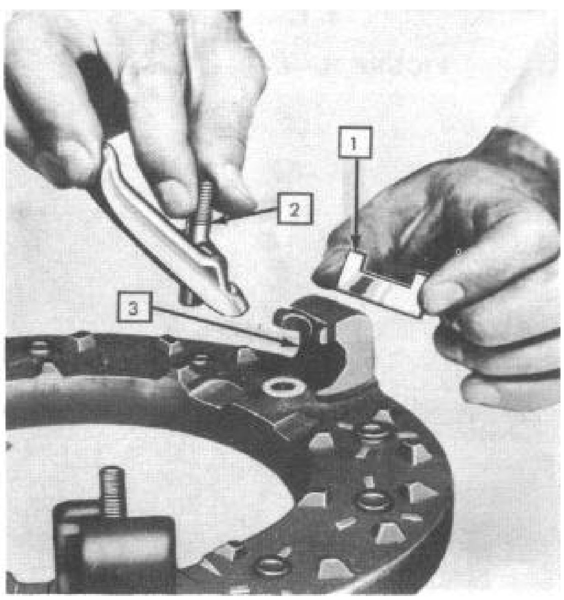
Prior to assembly, apply a small amount of lubriplate to each side of the pressure plate lug.

Lay the pressure plate on the block in the press.

Assemble a lever, eyebolt, and pin holding the lever and eyebolt as close together as possible. With the other hand, grasp the fulcrum as shown in Figure 6.

Insert the fulcrum in the slots of the pressure plate lug. Lower slightly and tilt the lower edge until it touches the vertical milled surface of the lug. Insert the lower end of the eyebolt in the hole in the pressure plate. The short end of the lever will then be under the hook of the lug and near the fulcrum.

Slide the fulcrum upward in the slots of the lug. Lift it over the ridge on the short end of the lever and drop it into the groove in the lever (Fig. 6).



1. Fulcrum
2. Eyebolt
3. Pressure Plate Lug

FIGURE 6—Install Levers

Assembly of Springs and Cover

(See Clutch Pressure Spring Specifications.) After all levers are installed, place the pressure springs in a vertical position on each spring boss. (In the "Wasp" and "Rambler" Series clutch, the center spring boss in each group is not used.)

Check the anti-rattle springs in the clutch cover and place the cover on top of the pressure plate assembly. The top of each pressure spring must enter its spring seat in the cover. (Line up punch marks on cover and pressure plate for balance.) (Fig. 1).

Slowly compress the cover making sure that the eyebolts and pressure plate lugs are guided through the proper holes in the cover.

Hold the clutch under compression and screw down the adjusting nuts until they are flush with the tops of the eyebolts. Release the spindle of the press.

CLUTCH LEVER ADJUSTMENT

IMPORTANT: *Always inspect release lever height adjustment when installing a new or relined clutch drive plate.*

Place the clutch gauge plate (J-5490) on the flywheel in the position normally occupied by the driven plate. Mount the cover assembly, center the plate, and line up the three machined lands on the gauge plate directly under the levers (Fig. 7).

1. Machined Land
2. Gauge Plate

FIGURE 7—Clutch Gauge Plate (J-5490) "Rambler" Series Shown

Tighten the cover screws in rotation, one to two turns at a time, to avoid distortion of the cover.

Each lever should be depressed several times before checking. This will seat the levers in their operating positions (Fig. 8).

"Wasp" Series

The lever height adjustment of the clutch plate is made with the offset side of the gauge up so that the levers are adjusted IA 6" below the hub (Fig. 9).

FIGURE 8—*Each Lever Should be Depressed Several Times to Settle all Parts* in Their Proper Positions

Place the gauge on the hub as shown in Figure 9. To check the lever, turn the lever adjusting nut until the lever is flush with the underside of the gauge. Adjust the other two levers in the same manner.

1. 1/16" Below Hub

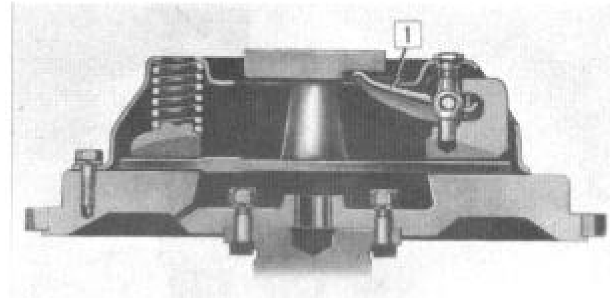
FIGURE 9—*"Wasp" Series Clutch Lever Height*

"Hornet" and "Rambler" Series

The lever adjustment is made in the same manner as on the "Wasp" Series, but the gauge is placed on the hub (Fig. 10) so that the offset of the gauge is 1/32" above the hub as shown.

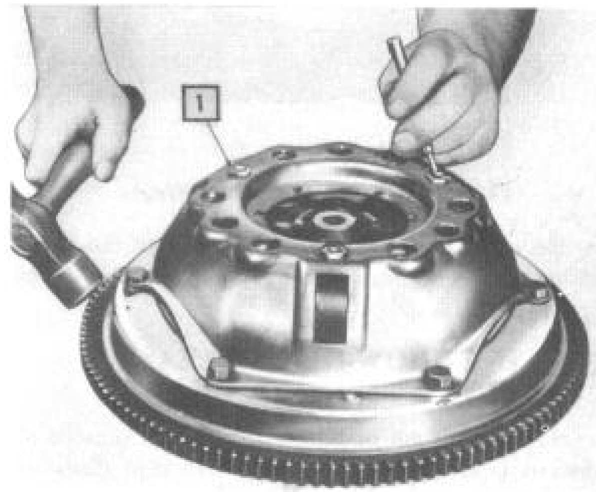
Locking Adjusting Nuts

Before staking the adjusting nuts to lock them in place, work the lever up and down and recheck lever adjustment again. Stake the nut with a dull punch (Fig. 11).



1. 1/32" Above Hub

FIGURE 10—*"Hornet" and "Rambler"* Series Clutch Lever Height



1. Adjusting Nuts

FIGURE 11—*Locking Adjusting Nuts*

CLUTCH DRIVE PLATE

No repair of the clutch drive plate is recommended except replacement of facings.

A new plate should be installed if the plate or cushion springs appear to be defective. The cushion springs must not be bent out of shape or flattened.

In removing old facings, the rivets should be drilled, not punched out (Fig. 12). Use a drill size that will cut out the roll of the rivet.

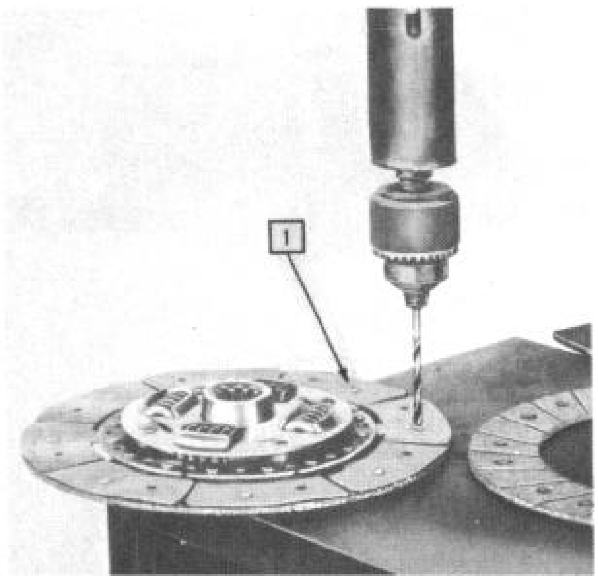
To assemble facings, place one facing on the flywheel side of the drive plate. Line up the countersunk holes with rivet holes in the cushion spring.

Rivet each cushion spring to the facing before installing the other facing. Roll the rivets against the cushion spring. Do not split them.

CLUTCH INSTALLATION

In order to install the clutch drive plate and clutch cover assembly, use aligning tool J-1435 or J-1625.

This tool aligns the clutch drive plate so that the transmission clutch shaft will enter easily. Make sure that the clutch pedal is not



1. Rivets

FIGURE 12—*Drill Out Rivets*

depressed until the transmission has been installed as the plate will drop out of alignment position.

CLUTCH THROW-OUT RELEASE BEARING

The clutch throw-out or release mechanism consists of a forked lever which pivots on a ball stud threaded into the clutch housing. A throw-out lever return spring, as shown in Figure 13, is anchored to a clip under the ball stud and holds the lever in contact with the ball stud. The clutch throw-out bearing, which is a pre-lubricated unit, is attached to the forked end of the throw-out lever.

Never wash the clutch throw-out release bearing in gasoline or any solvent that will dissolve the lubricant. It is neither necessary nor possible to lubricate these hearings at any time.

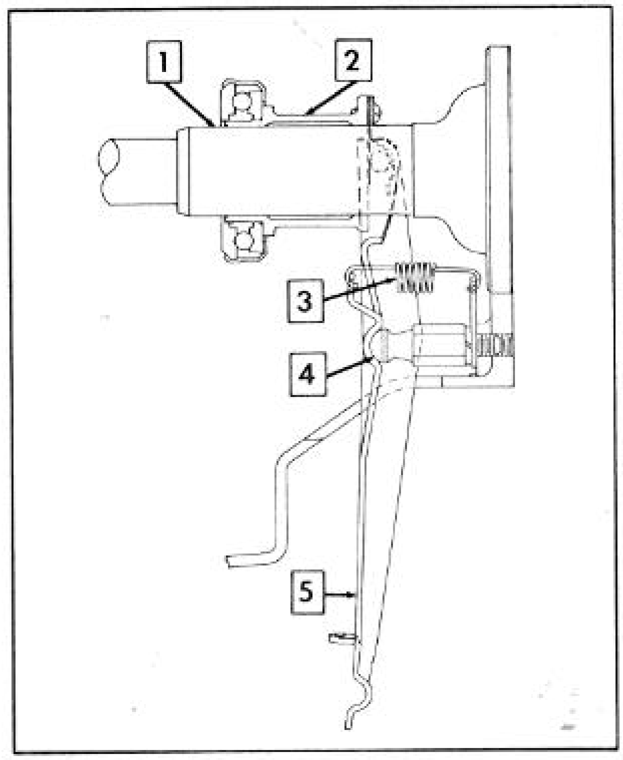
CLUTCH PEDAL LINKAGE

A beam type clutch release linkage is used in all series (Fig. 14).

Adjustment for free pedal play is made by varying the length of the beam to the throw-out lever rod (Item 3, Fig. 15). Lengthening this rod reduces the free pedal play. Shortening the rod increases the pedal play.

In order to provide sufficient free movement of the clutch throw-out bearing when the clutch is engaged and the clutch pedal fully released, free pedal play should be 1/2" to 3/4" at all times.

The clutch pedal to beam rod adjustment (adjusted in production) is made to provide proper leverage. The outer end of the lever projects 5/ 6" on the "Hornet" Series, and 1/2" on the "Rambler" Series from the beam,



1. Transmission Front Bearing Cap
2. Release Bearing Sleeve Assembly
3. Throw-out Lever Return Spring
4. Pivot Ball Stud
5. Throw-out Lever

FIGURE 13—*Clutch Release ("Hornet" Series Shown)*

toward the rear, with the clutch pedal against the floor board (Fig. 14). The inner end of the beam lever projects 34" on the "Wasp" Series from the beam, toward the bracket with the clutch pedal against the floor board. The pedal to beam rod should never be disturbed in service (See Figure 15).

To lubricate the linkage, disconnect the throw-out lever spring and apply lubriplate to the ends of the pedal rod and lever rod. The clutch beam lever pivot pin is pressure lubricated; the lubricating fitting is located at the bottom of the pin. Lubricate the clutch beam at 1,000 miles intervals.

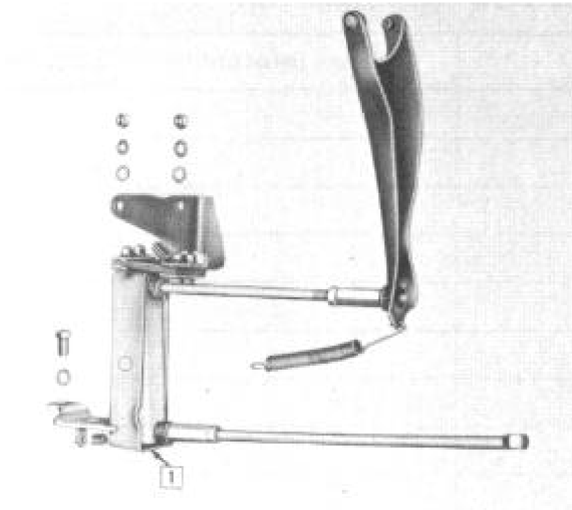
CLUTCH DIAGNOSIS

Clutch Chatter—Chatter may be caused by:

- Grease on the clutch drive plate facings
- Binding of the clutch linkage
- Loose or damaged clutch drive plate facings
- Loose engine mountings
- Incorrect adjustment of clutch pressure levers
- Misalignment of clutch housing
- Loose drive plate hub

Clutch Grabbing—Clutch grabbing may be caused by:

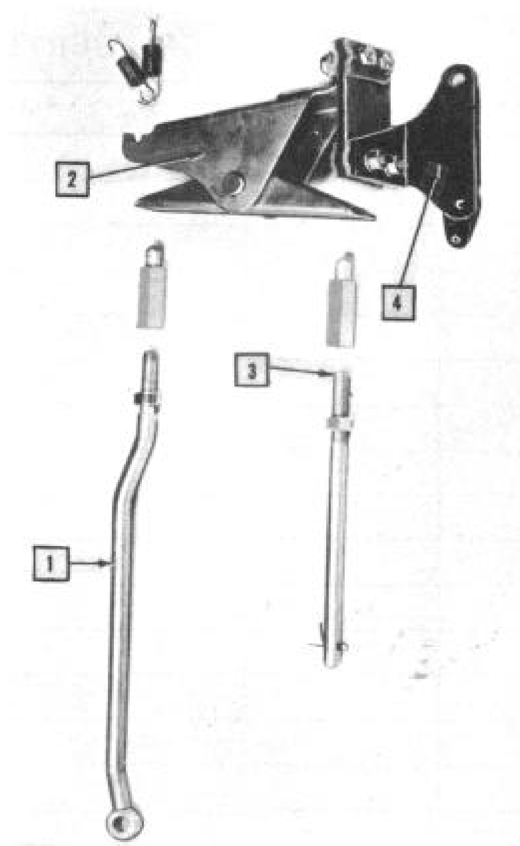
- Oil or grease on clutch drive plate facing
- Broken pressure plate
- Clutch drive plate binding on transmission clutch shaft



1. This point of Clutch Beam Lever to Project From the Clutch Beam 5/16" for "Hornet" Series, and 1/2" for the "Rambler" Series

FIGURE 14—*Assembled View of Clutch Linkage "Rambler" Series Shown*

Clutch Slipping—A slipping clutch may be caused by: Incorrect adjustment of clutch pedal
Lack of lubrication in clutch linkage
Broken clutch pressure springs
Weak pressure springs
Clutch Dragging—A dragging clutch may be caused by:
Incorrect adjustment of clutch pedal
Incorrect pressure lever adjustment
Loose or broken facings



1. Clutch Beam to Pedal Rod
2. Clutch Beam Assembly
3. Clutch Beam to Throw-out Lever Rod
4. Clutch Beam to Engine Bracket

FIGURE 15—Clutch Linkage "Wasp" Series

TECHNICAL SERVICE LETTER REFERENCE

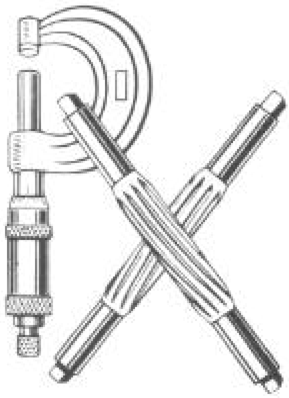
Date	Letter No.	Subject	Changes of informatin on Page. No.

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes of informatin on Page. No.

HUDSON

TECHNICAL SERVICE MANUAL



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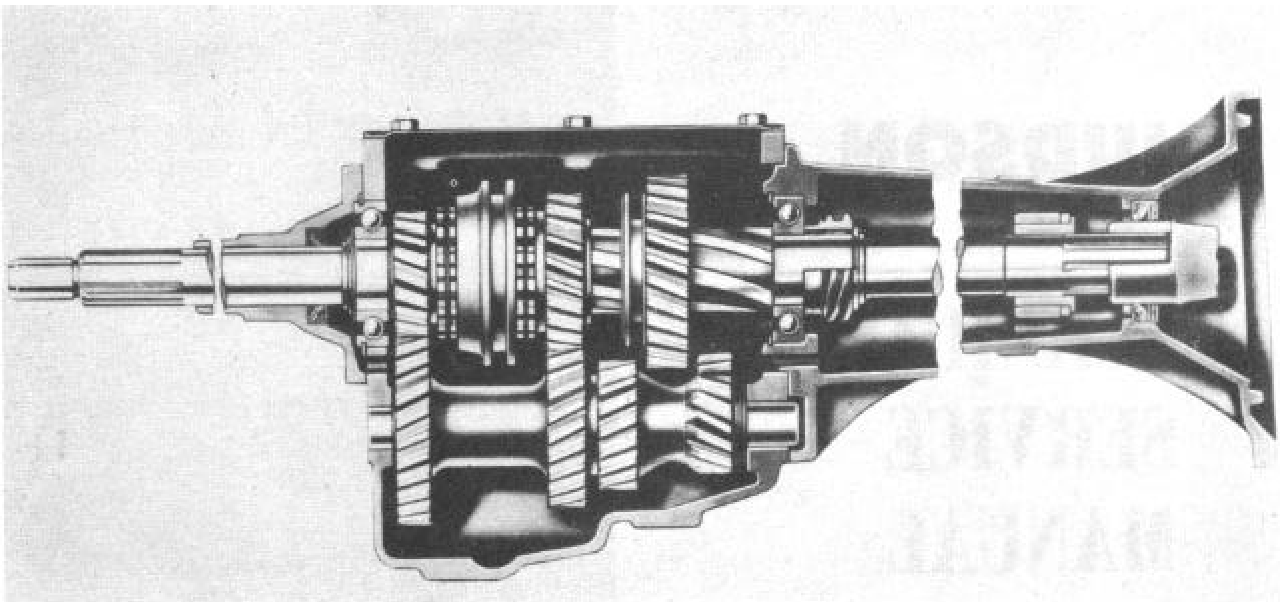
(STANDARD TRANSMISSION)



1955 "Hornet" Standard Transmission and Rear Bearing Cap Extension

"HORNET" SERIES

The transmissions are supplied with or without the overdrive unit (as optional equipment).

The "Hornet" and "Wasp" Series are equipped with torque tube drive. The "Rambler" Series is equipped with Hotchkiss drive.

"HORNET" SERIES TRANSMISSION REMOVAL

To remove the transmission, disconnect the brake tube bracket that is fastened to the underside of the body; then disconnect the torque tube at the rear of the transmission.

Disconnect the hand brake cable at the bell crank and the brake cable housing at the bell crank bracket. Then move the rear axle to the rear to remove the front universal joint from the transmission main shaft. Disconnect the speedometer cable and shifter rods and if overdrive equipped, disconnect the wires at the solenoid and the overdrive cable at the lever.

When removing the transmission from the car, care must be taken not to damage the transmission clutch shaft. Always use two guide-pins (Tool J-1434) in place of the two upper cap screws so the transmission clutch shaft will slide out far enough to clear the clutch pilot bearing and clutch disc.

DISASSEMBLING THE TRANSMISSION

With the transmission assembly completely drained of its lubricant and set up in a transmission stand, remove the case cover noting the stamping marked "FRONT" on both the cover and the gasket.

Removing the Clutch Shaft Assembly

After removing the front bearing cap, remove the clutch shaft snap ring and the bearing lock ring (Fig. 1).

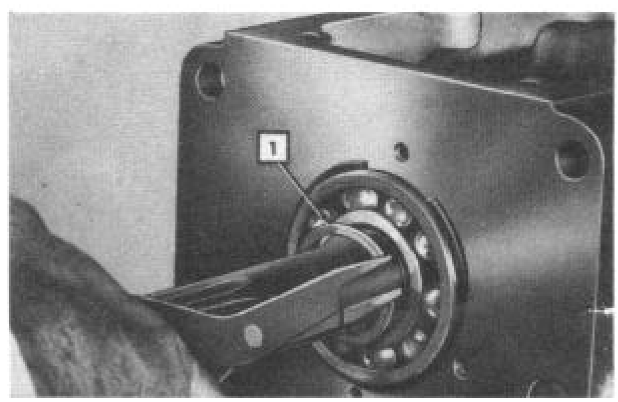
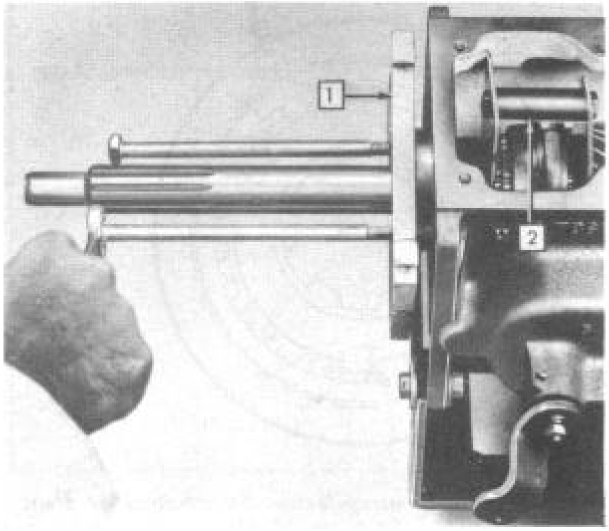


FIGURE 1—*Use Snap Ring Plier*s to Remove the Snap Ring

The front bearing can be removed from the clutch shaft by using bearing puller (J-1298N), together with a thrust yoke (J-3042) to prevent damage to the synchronizer clutch (Fig. 2).

The oil slinger, being a free fit on the clutch shaft, can then be removed.

Loosen the rear bearing cap bolts and move main shaft and bearing cap to the rear about 3/4". Then by lowering the front end of the clutch shaft and raising athe rear end over the



1. Bearing Puller (J-1298N)
2. Thrust Yoke (J-3042)

FIGURE 2—Use Bearing Puller and Thrust Yoke to Pull the Front Bearing and Prevent Damage to the Synchro-Clutch

countershaft gear, the shaft can be removed from the case. Be careful not to nick the gear teeth as it is being removed (Fig. 3).

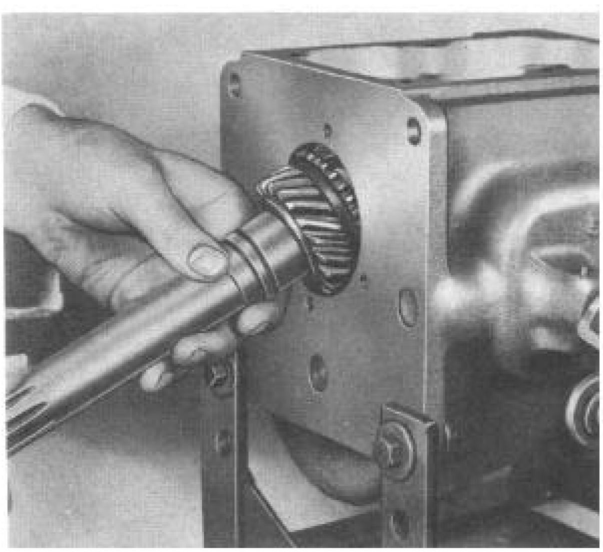
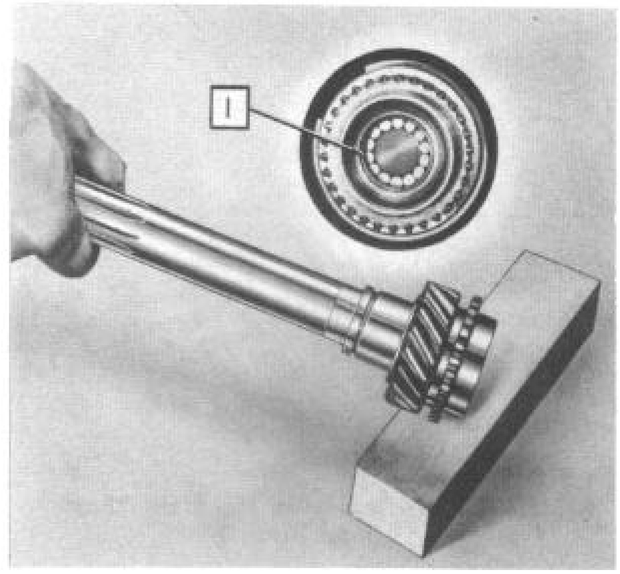


FIGURE 3—Remove the Clutch Shaft

Clutch Shaft Roller Bearings

Inside the rear end of the clutch shaft are fourteen roller bearings. These form the front bearing assembly for the main shaft. Worn or loose rollers will result in a noisy transmission. Inspect for worn, pitted, or scored surfaces (Fig. 4).



1. Roller Bearings

FIGURE 4—Bearing Rollers Inside the Clutch Shaft Hold Themselves in Place by a "Keystone" Effect. Jarring the Shaft Will Show if These Rollers Are Loose

Removing the Main Shaft and Bearing Cap Assembly

Remove the four cap screws that retain the rear bearing cap to the transmission case. Tap the front end of the main shaft with a plastic or lead hammer to force the rear bearing cap out of the rear of the transmission case. Now move the main shaft assembly to the extreme right of the case. The synchro-clutch collar and low and reverse gears will clear the shifter forks; then lift out the complete assembly (Fig. 5).

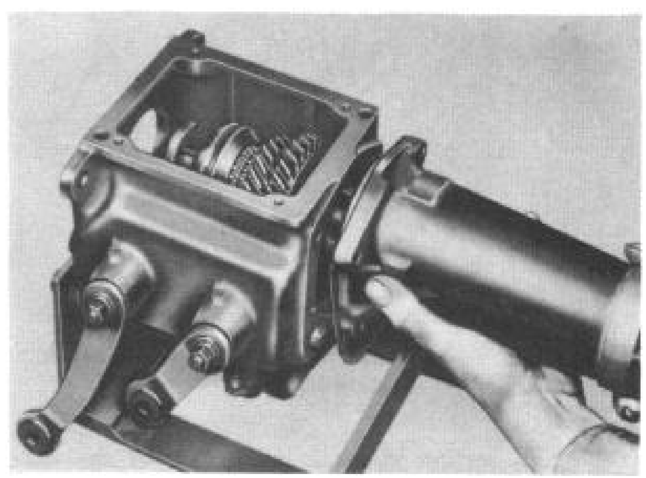


FIGURE 5—Move the Main Shaft and Bearing Cap Assembly to the Rear About .34" and to the Right of the Case. The Shifter Forks will Clear the Synchro-Clutch and the Low and Reverse Gears

Removing the Gears From the Main Spline) Shaft

The gears are held on the main shaft by a snap ring (Fig. 6).

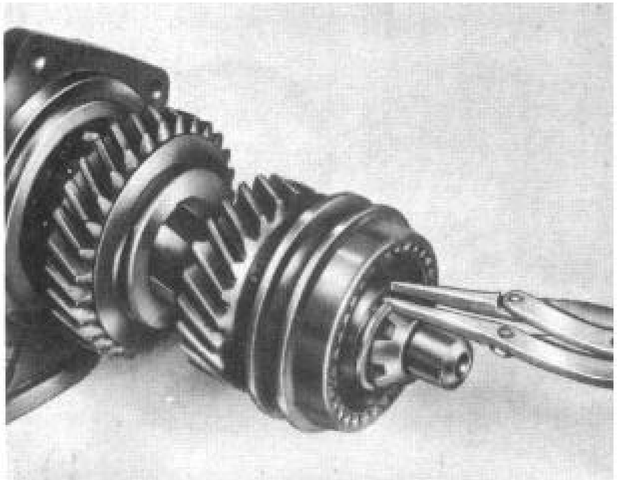


FIGURE 6—Removing the Main Shaft Snap Ring

The Synchro-Clutch Assembly

Remove the synchro-clutch assembly. The bronze friction rings may be removed with the clutch shaft and second speed gear (Fig. 7).

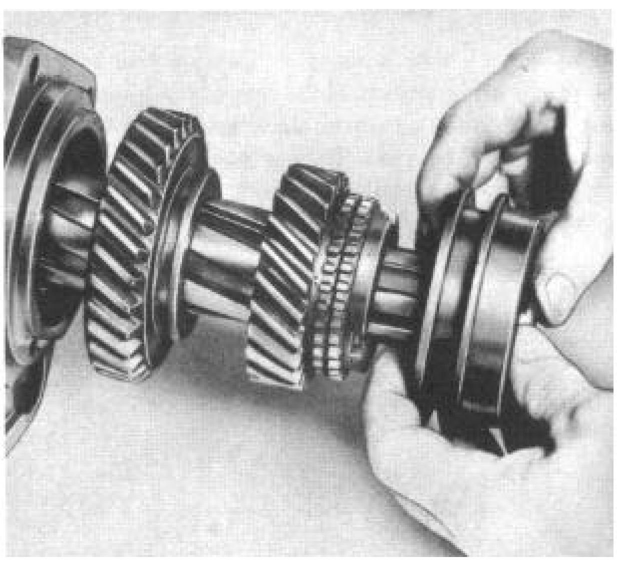


FIGURE 7—Removing the Synchro-Clutch Assembly

The hub section and the outer ring of the synchronizer clutch assembly are matched and lapped when fabricated by the manufacturer and are marked accordingly. The etching marks will correspond when properly assembled (Fig. 8) insuring smooth sliding action during shifting into second and third speed.

The Second Speed, Low, and Reverse Sliding Gears

The second speed, low, and reverse sliding gears can now be removed by sliding them off the front end of the main shaft (Figs. 9 and 10).

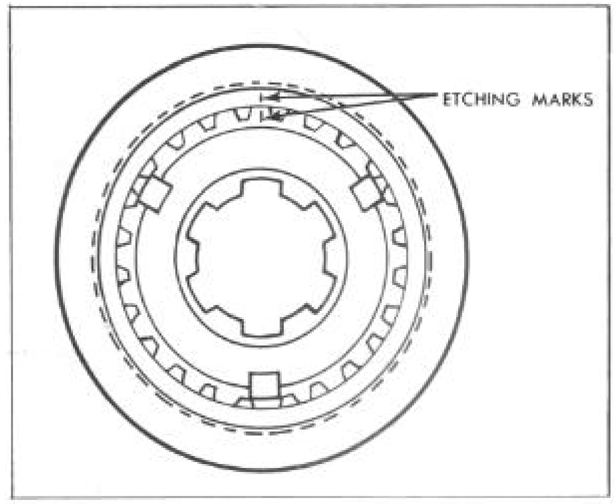


FIGURE 8—*Transmission Synchronizer Unit Etching Marks*

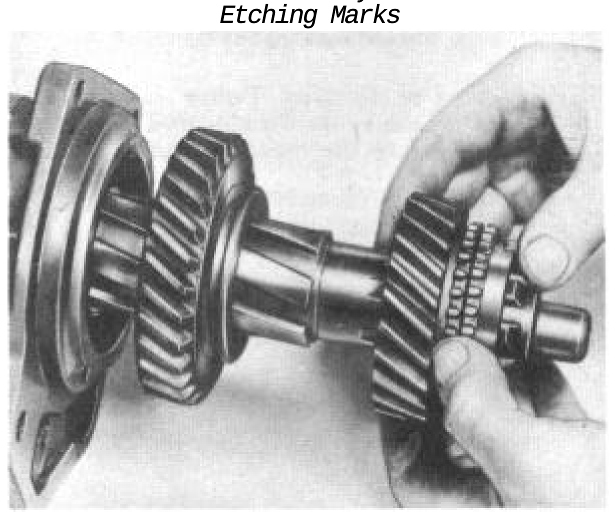


FIGURE 9—*Removing the Second Speed Gear*

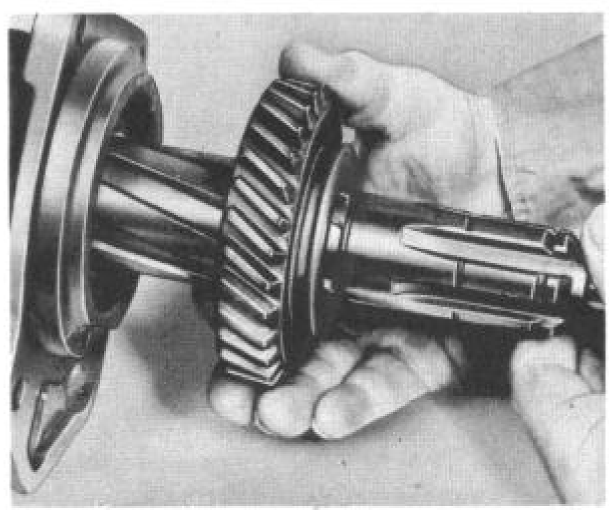


FIGURE 10—*Removing the Low and Reverse Gear*

The Rear Bearing and Bearing Cap

Remove the snap ring from the rear bearing cap (Fig. 11). To remove the main shaft and bearing, tap the rear of the main shaft using a plastic or lead hammer. The rear bearing and speedometer gear will remain on the shaft.

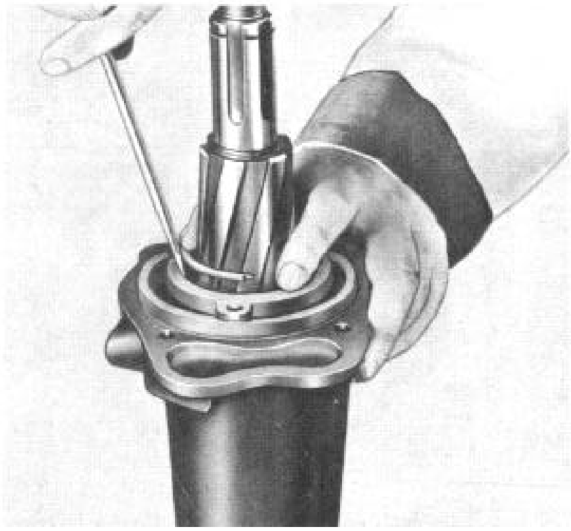


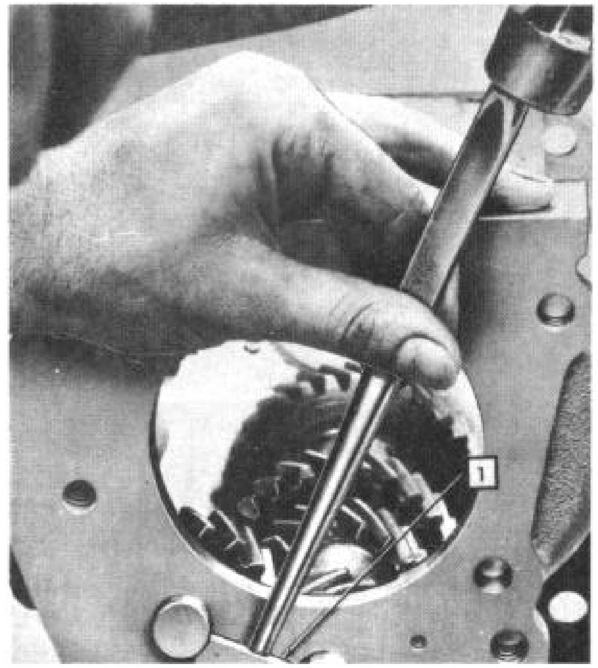
FIGURE 11—*Remove the Snap Ring From the Front of the Rear Bearing Cap*

Remove the main shaft snap ring and the speedometer drive gear. (The speedometer drive gear is held in position with a Woodruff key.) Then press off the rear bearing after the key is removed.

The transmission main shaft bushing (4) and felt ring (3) (which acts as a lubricant wick for the bushing) and the rear bearing cap oil seal (5) can be driven out to the rear of the bearing cap (Fig. 121.

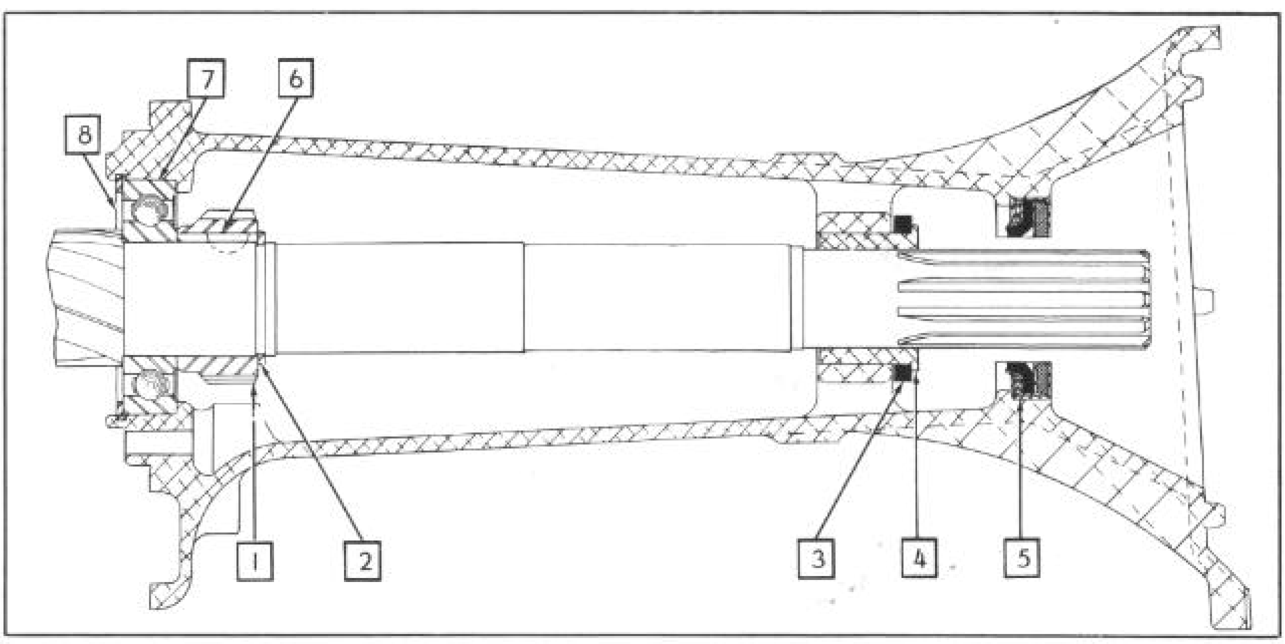
Removing the Countershaft Gear Assembly

Remove the reverse idler and countershaft lock plate I Fig. 13).



1. *Lock Plate*

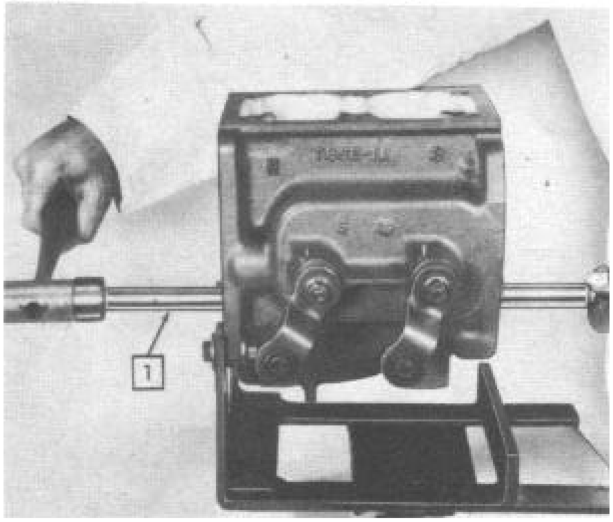
FIGURE 13—Remove the Lock Plate



1. Speedometer Drive Gear
2. Speedometer Drive Gear Snap Ring
3. Oilite Bushing Felt
4. Oilite Bushing
5. Rear Main Bearing Cap Oil Seal
6. Speedometer Drive Gear Key
7. Ball Bearing
8. Ball Bearing Lock Ring

FIGURE 12—Sectional View of Rear Bearing Cap

To maintain the position of the needle bearings in the countershaft gear, drive the countershaft out of the rear of the case using a dummy shaft machined to .750" x 71/16" (Fig. 14).



1. Dummy Shaft .750" x 7-1/16"

FIGURE 14—Use a Dummy Shaft Machined to .750" x 7-1/16" to Remove the Countershaft

With the dummy shaft in place, lower the countershaft gear to the bottom of the case.
Remove the reverse idler gear shaft by using a brass drift (Fig. 15), and lift the reverse idler gear out of the case.

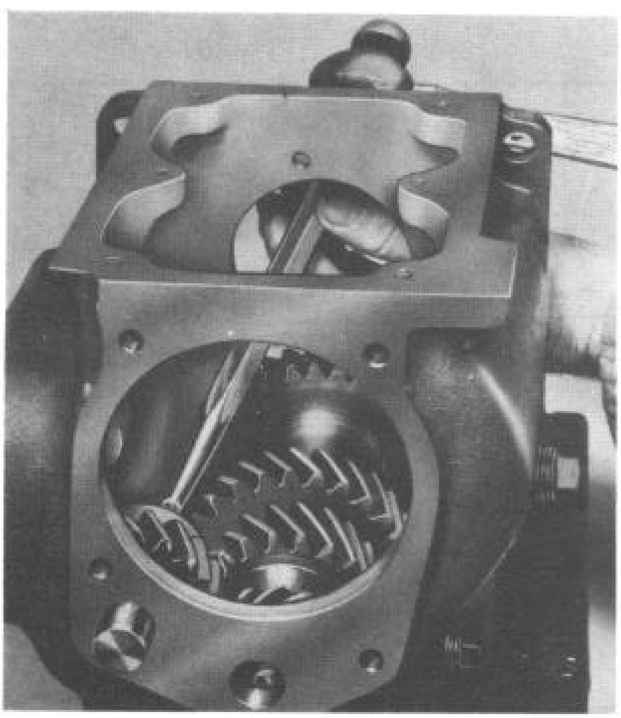


FIGURE 15—*Removing the Reverse Idler Gear Shaft*

Lift the countershaft gear assembly out of the transmission case (Fig. 16).

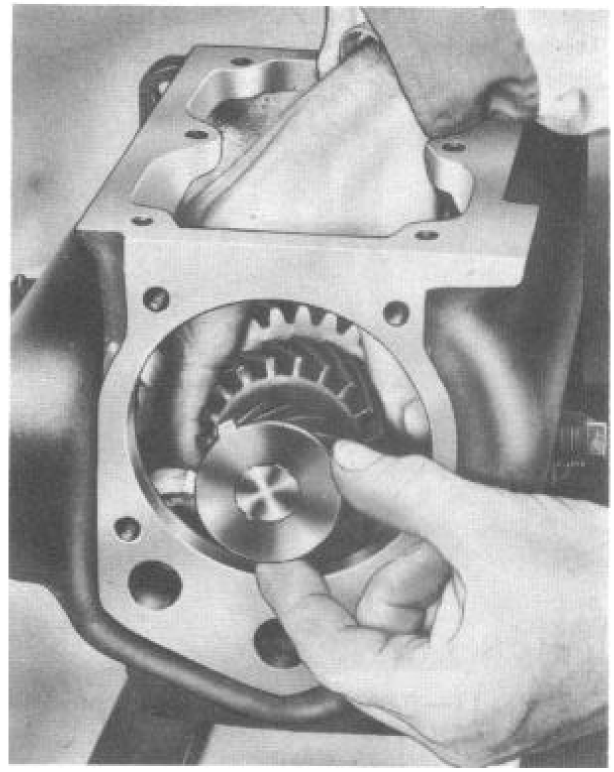
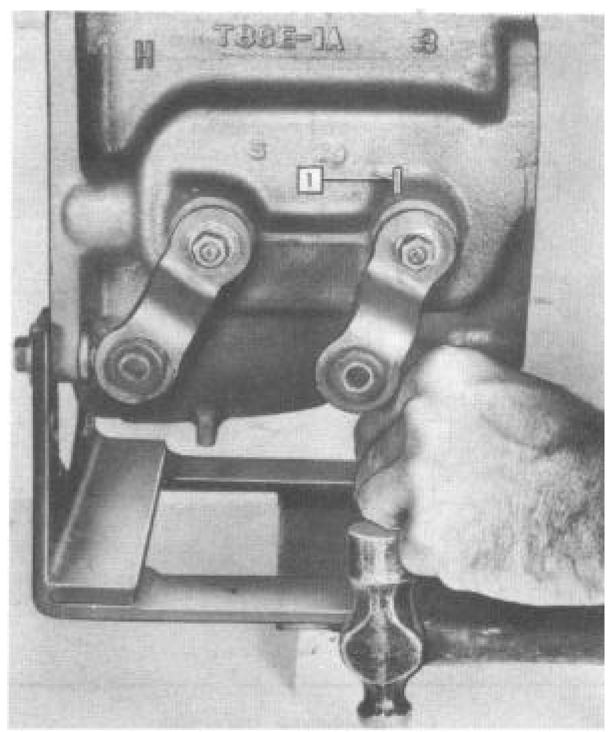


FIGURE 16—*Removing the Countershaft Gear Assembly*

Removing the Interlock Assembly

Remove the outer shift levers and shifter shaft lock pins (Fig. 17).



1. Shifter Shaft Lock Pin

FIGURE 17—*Drive Out the Shifter Shaft Lock Pins From the Bottom of the Bosses*

Remove the shifter shafts from the inside of the case slowly to catch the two interlock ball bearings as the shafts are being removed. The interlock sleeve and spring can then be removed.

Now remove the shifter shaft oil seals from the case. This completes the disassembly of the transmission.

CLEANING AND INSPECTING PARTS

With the transmission completely disassembled, all parts should be carefully cleaned so that they can be thoroughly examined.

Gears

Wash all gears in a cleaning solution. Inspect for worn, cracked, or chipped teeth. Slide each gear onto a new shaft. If it appears to be loose, it must be replaced.

NOTE: Whenever any transmission gear requires replacement, the gear with which it meshes should also be replaced.

Bearings

Bearings must be handled with great care. Wrap them in a clean cloth or paper until they can be washed.

To wash a bearing, submerge it in a cleaning solution that is absolutely free of dirt, and rotate it to flush away all oil and dirt. Dry the bearing with care.

Carefully examine each bearing for cracked races, worn, or scored balls.

Main Shaft

Install the gears onto the main shaft to be sure they slide on and off easily. They should fit smoothly without excessive play between the splines. If the fit is tight, look for burred edges on the splines.

Synchro-Clutch and Friction Rings

Carefully inspect the synchro-clutch and friction rings. Slide the rings on the cones of the second speed gear and the clutch shaft. Replace rings if there is excessive wear on the taper.

Transmission Case

Examine the surfaces of the bearing recesses in the transmission case for wear or scoring, which indicates that the bearing has been revolving in its housing. Examine the case for cracks or other defects.

Be certain that all parts of the case are thoroughly clean before and during assembly.

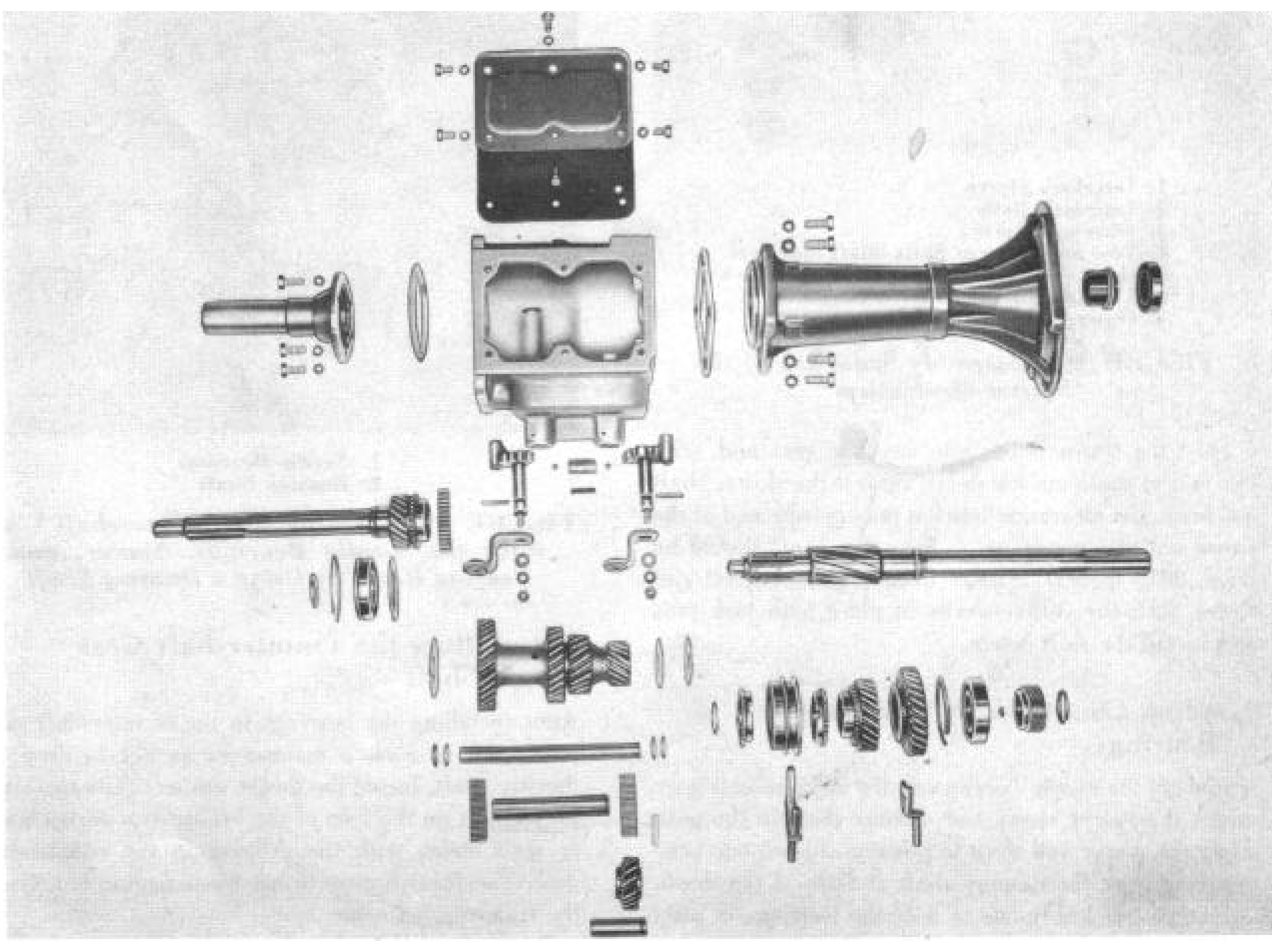


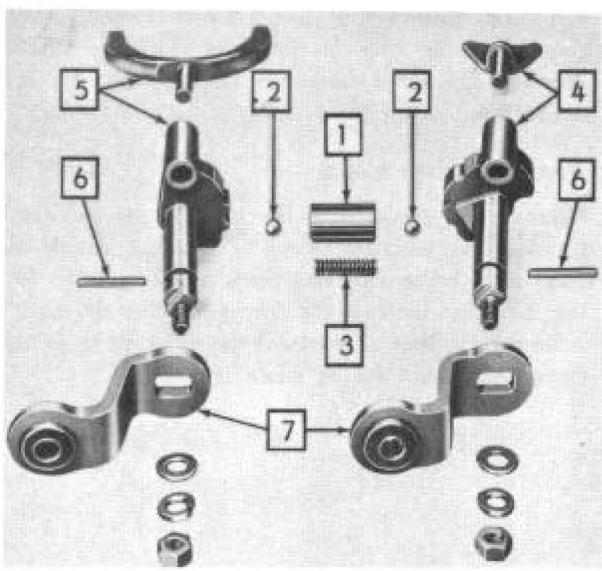
FIGURE 18—*"Hornet" Series Transmission*

REASSEMBLY

When reassembling the transmission, always use new gaskets and oil seals.

Shifter Shafts and Levers

Install new shifter shaft oil seals. Then reinstall the low and reverse shifter shaft. the interlock sleeve. ball bearing, and spring. With the second and high shifter shaft installed against the case, place the second ball bearing in position. While compressing the interlock spring with finger pressure, locate the ball in the detent of the quadrant.



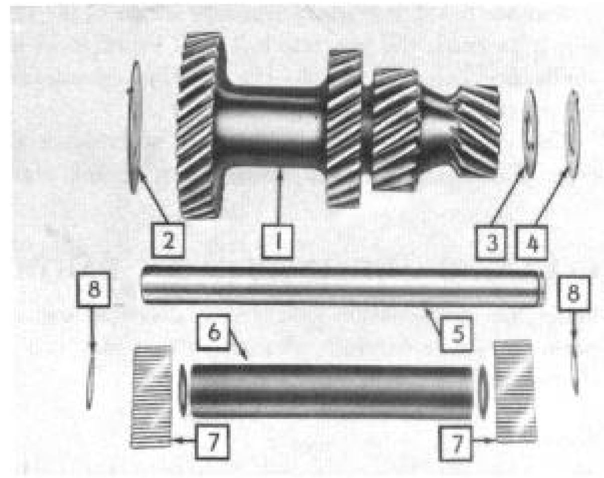
1. Interlock Sleeve
2. Interlock Balls
3. Interlock Spring
4. Low and Reverse Shift Shaft and Fork
5. High and Second Shift Shaft and Fork
6. Locking Pins
7. Outer Shift Shaft Levers

FIGURE 19—Assembly Sequence of the Shifter Mechanism

Shift the transmission into any one gear and, with one end of the interlock sleeve against the shifter shaft quadrant, the clearance between the opposite end of the sleeve and the quadrant on the other shaft should be from .001" to .007". After installing the correct size sleeve, lock the shifter shafts in place with lock pins and install the shift levers.

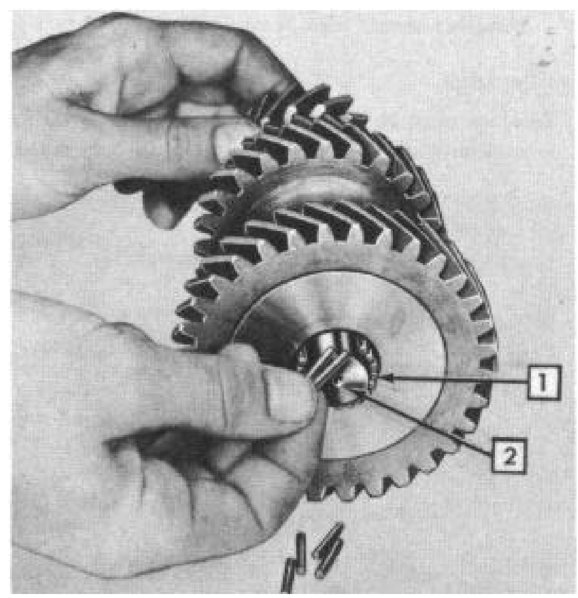
Loading Countershaft Gear Needle Bearings

To install the needle bearings in the counter-shaft gear, insert the spacer sleeve and dummy shaft in the gear. Hold the spacer and shaft in position. Install one bearing ring over the dummy shaft and insert the needle bearings. Use Lubriplate to hold the bearings in place and install the outer bearing ring. Repeat same operation on opposite end I Fig. 21).



1. Countershaft Gear
2. Front Thrust Washer
3. Bronze Rear Thrust Washer
4. Rear Thrust Washer
5. Countershaft
6. Spacer
7. Needle Bearings
8. Bearing Rings

FIGURE 20—*Countershaft Assembly Sequence*



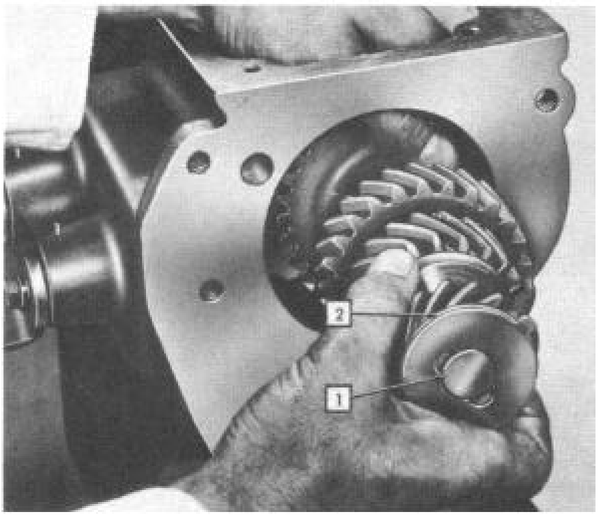
1. Needle Bearings
2. Dummy Shaft

FIGURE 21—Loading the Countershaft Gear With the Needle Bearings, Spacer, and Bearing Rings by Using a Dummy Shaft

Reinstalling the Countershaft Gear and Shaft

After installing the bearings in the counter-shaft gear, holding it in such a manner so as not to drop the dummy shaft, install the thrust washers. The two small projections on the face of the bronze rear thrust washer must index with the grooves in the countershaft gear. The front bronze thrust washer must index with the transmission case.

Position the large rear thrust washer and insert the assembly in the bottom of the case (Fig. 22).

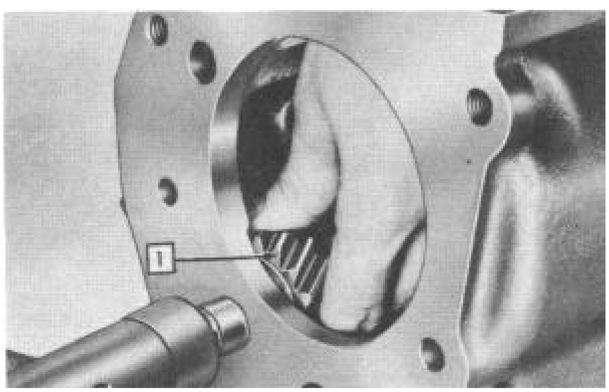


1. Dummy Shaft
2. Rear Thrust Washer

FIGURE 22—*Install the Countershaft Gear Assembly in the Transmission Case*

Reinstalling the Reverse Idler Gear

Install the reverse idler gear with the chamfered side of the teeth (or the hub section) to the front of the case. Then drive the reverse idler shaft in from the rear of the case with the notched end of the shaft to the rear. The notch should face to the countershaft (Fig. 23).



1. Reverse Idler Gear

FIGURE 23—Installing Reverse Idler Gear

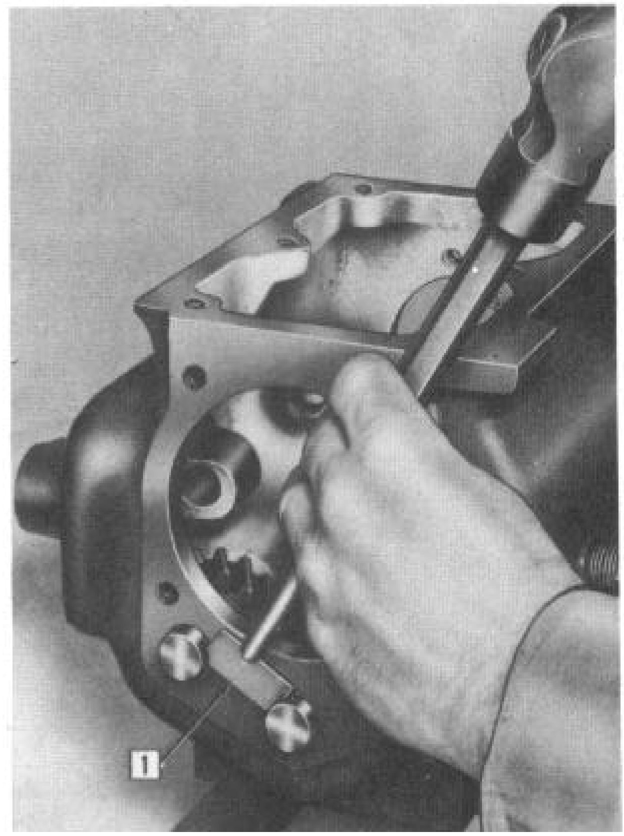
Position the countershaft gear assembly and drive the countershaft in place, thereby removing the dummy shaft.

Install the lock plate in the grooves in the countershaft and reverse idler shaft (Fig. 24).

Now install the low and reverse, and second and high shifter forks.

Assembling the Main (Spline) Shaft and Rear Bearing Cap

Press the rear transmission bearing onto the main shaft until it is tight against the shoulder of the shaft.



l. Lock Plate

FIGURE 24—Installing the Lock Plate

Then place the Woodruff key in the main shaft keyway, install the speedometer drive gear on the shaft tight against the rear bearing, and install the snap ring (Item 5, Fig. 25). USE THE THICKEST SIZE SNAP RING POSSIBLE TO PREVENT END PLAY.

To install the main shaft Oilite bushing, assemble the felt oil ring on it and press the bushing into the rear bearing cap. The shoulder on the main shaft bushing must remain 1/4" from the shoulder in the bearing cap to prevent compressing the felt oil ring (Item 7, Fig. 25).

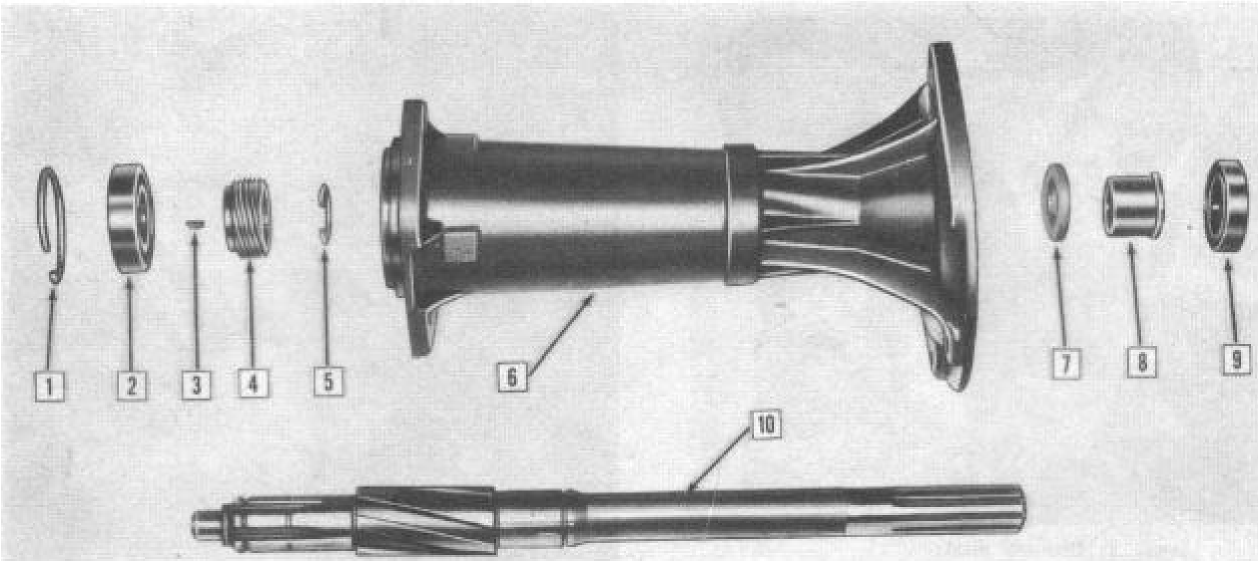
Install the main shaft assembly into the rear bearing cap, and install the rear bearing lock ring (Item 1, Fig. 25). This lock ring must be large enough to fill the groove in the main shaft to prevent possible end play.

Use Tool J-1354 to install the rear bearing cap oil seal (Item 9. Fig. 25).

Assembling the Gears on the Main (Spline) Shaft

The low and reverse sliding gear goes on first. Slide it onto the shaft with the shifting collar to the front. The gear should be free to slide on the splines for easy shifting (Fig. 26).

Install the second speed gear with the tapered cone to the front.



1. Rear Ball Bearing Lock Ring
2. Rear Ball Bearing
3. Woodruff Key
4. Speedometer Drive Gear
5. (Main Shaft) Snap Ring
6. Rear Bearing Cap
7. Oilite Bushing Felt
8. Oilite Bushing
9. Rear Bearing Cap Oil Seal
10. Transmission Main (Spline) Shaft.

FIGURE 25—Rear Bearing Cap and Main Shaft

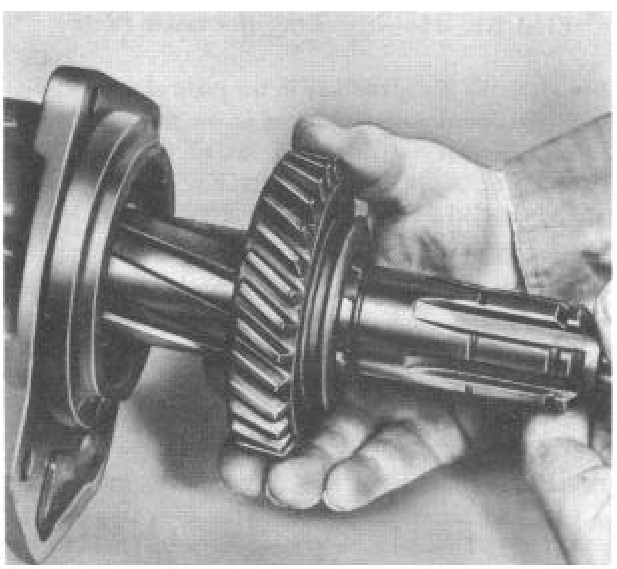


Figure 26-*Install the Low and Reverse Sliding Gear*

The Synchronizer Clutch Assembly

Install the synchro-clutch assembly, being sure that the hub section and the outer ring are correctly assembled as shown in Figure 8.

(The front friction ring is installed together with the clutch shaft to prevent its dropping out of place during installation of the main shaft assembly.)

Completing the Main Shaft Assembly

Install the main shaft front snap ring using snap ring pliers (Fig. 27).

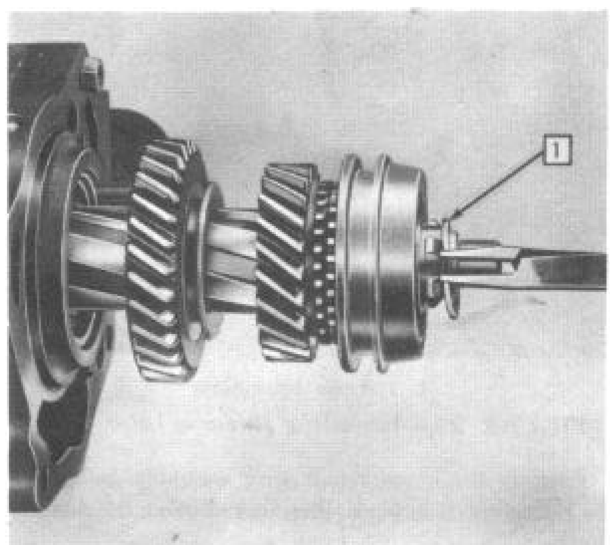


FIGURE 27—Complete the Main Shaft Assembly by Installing the Front Snap Ring

When the synchro-clutch hub is pressed tight against the snap ring, there should be .003" to .010" clearance between the second speed gear and the shoulder on the main shaft.

Install the main shaft assembly through the rear of the case. As this is done, move it to the right side of the case so as to engage the shifter forks.

Installing the Clutch Shaft Assembly

Insert the fourteen clutch shaft bearing rollers in the clutch shaft. A coat of lubriplate will hold them in position. Then install the front friction ring and the clutch shaft on the main shaft (Fig. 28).

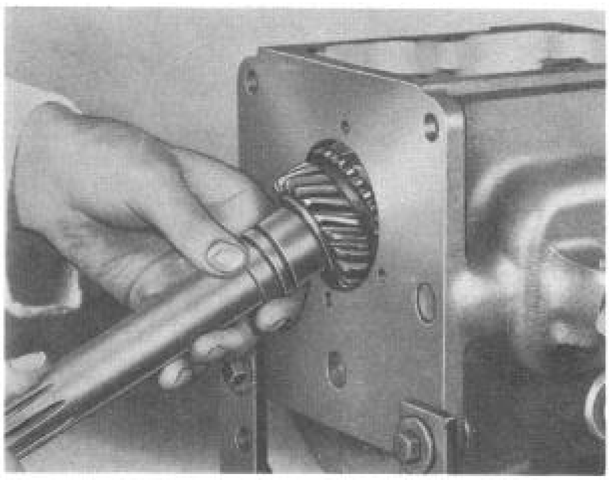
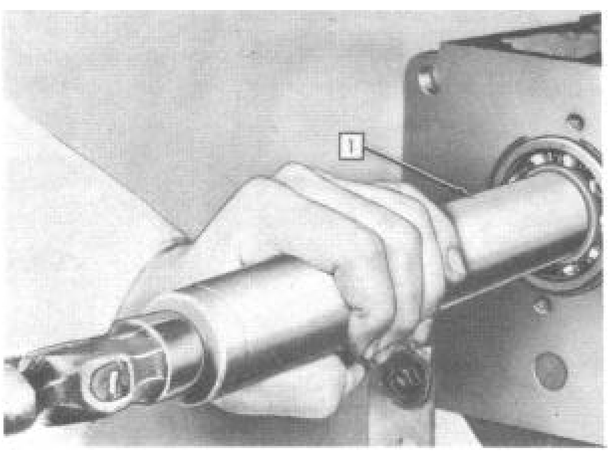


FIGURE 28—*Installing the Clutch Shaft*

Install the oil slinger on the clutch shaft with the concave side to the rear.

The front bearing can be driven in place using Tool J-2995, together with the thrust yoke J-3042 (Fig. 29).



1. Tool J-2995

FIGURE 29—*Installing the Clutch Shaft Bearing*

The clutch shaft small snap ring can be installed with snap ring pliers or Tool J-2995 Snap Ring Installing Set. Then install the large bearing snap ring.

After installing a rew oil seal in the bearing cap, install the front bearing cap. Always use a new gasket between the bearing cap and the case. The thickness of the gasket used governs clutch shaft end play. The desired end play is .000".

Friction Ring Clearance

Measure the clearance of the friction rings using friction ring clearance gauge (J-1410). These clearances should be between .060" and .080". If less, add steel shims as required between the rear bearing cap or overdrive adapter and transmission case. Gaskets must he used on both sides of the steel shim.

The transmission now requires only a final check by shifting in all gears. Check the operation carefully, then install the case cover and gasket, placing the stamping marked "FRONT" to the front of the case (Fig. 30).

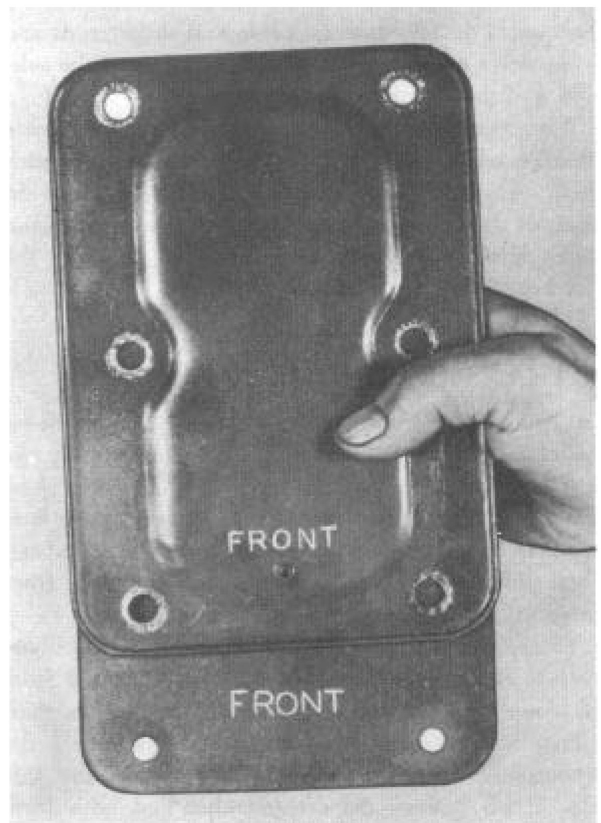


FIGURE 30—*Note the Stamping Marked "FRONT" on Both Cover and Gasket*

LUBRICATION OF THE TRANSMISSION

Check the lubricant level of the transmission every 1,000 miles. The transmission should be filled to the drain plug level on the right side. Drain and clean twice a year, or every 10,000 miles, using only flushing oils. Do not use gasoline, kerosene, steam, etc.

For atmospheric temperatures above 32°F., use mineral gear lubricant SAE No. 90 in the transmission.

Below 32°F., use SAE No. 80.

When difficulty in shifting is experienced in subzero temperatures, dilute the transmission oil as required using light engine oil.

Transmission capacity (U.S.) 2-1/4 pints.

"WASP" AND "RAMBLER" SERIES

"WASP" SERIES TRANSMISSION REMOVAL

To remove the transmission, disconnect the brake tube bracket that is fastened to the underside of the body; then disconnect the torque tube at the rear of the transmission.

Disconnect the hand brake cable at the bell crank and the brake cable housing at the bell crank bracket. Then move the rear axle to the rear to remove the front universal joint from the transmission main shaft. Disconnect the speedometer cable and shifter rods and if overdrive equipped, disconnect the wires at the solenoid and the overdrive cable at the lever.

When removing the transmission from the car, care must be taken not to damage the transmission clutch shaft. Always use two guide-pins (Tool J-1434) in place of the two upper cap screws so the transmission clutch shaft will slide out far enough to clear the clutch pilot bearing and clutch disc.

"RAMBLER" SERIES TRANSMISSION REMOVAL

To remove the transmission on the 100" wheelbase models, disconnect the rear spring front spring eye brackets from the underside of the body floor pan, rear shock absorbers at the axle tube, rear brake hose bracket, and the hand brake cable at the equalizer. Then slide the rear axle to the rear to remove the front universal joint from the transmission main shaft.

To remove the transmission on the 108" wheelbase models, remove the propeller shaft coupling nut from the coupling. Tap the coupling off the pinion shaft splines with a soft faced hammer. Disconnect the crossmember from the support brackets at the side sills. Then remove the crossmember and both front and rear propeller shafts by sliding them from the transmission main shaft.

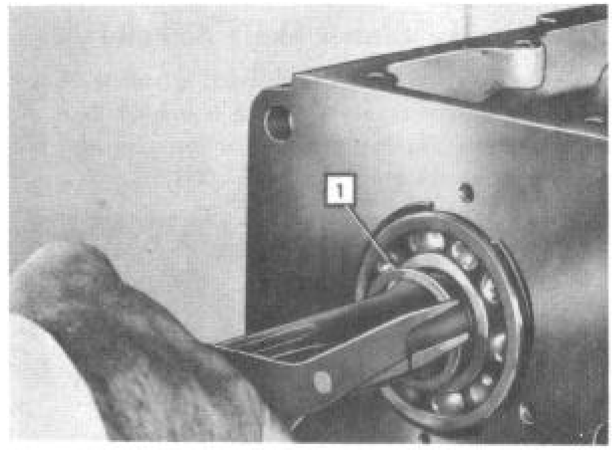
After removing two bolts holding the transmission to the bell housing, install guide-pins (Tool J-1434) to avoid any possibility of damaging the clutch shaft or clutch shaft pilot bearing while removing the transmission.

DISASSEMBLING THE TRANSMISSION

With the transmission assembly completely drained of its lubricant and set up in a transmission stand, remove the case cover noting the stamping marked "FRONT" on both the cover and the gasket.

Removing the Clutch Shaft Assembly

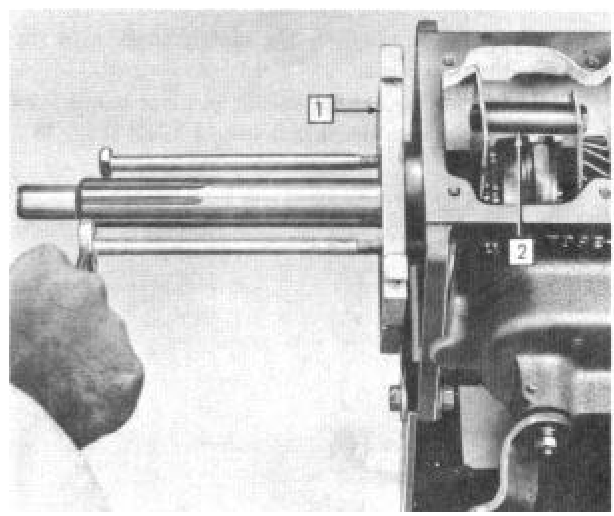
After removing the front bearing cap, remove the clutch shaft snap ring and the bearing lock ring (Fig. 31).



1. Snap Ring

FIGURE 31—*Use Snap Ring Pliers to Remove the Snap Ring*

The front bearing can be removed from the clutch shaft by using bearing puller (J-1298N), together with a thrust yoke (J-2040) to prevent damage to the synchronizer clutch (Fig. 32).



1. Bearing Puller (J-1298N)
2. Thrust Yoke (J-2040)

FIGURE 32—*Use Bearing Puller and Thrust Yoke to Pull the Front Bearing and Prevent Damage to the Synchro Clutch*

The oil slinger, being a free fit on the clutch shaft, can then be removed.

Remove the rear bearing cap and oil seal assembly. Note the copper washer on the long cap screw. This cap screw is below the oil level and the copper washer is used to prevent oil leakage. The transmission rear bearing and speedometer gear are retained on the main shaft by a snap ring (Fig. 33).

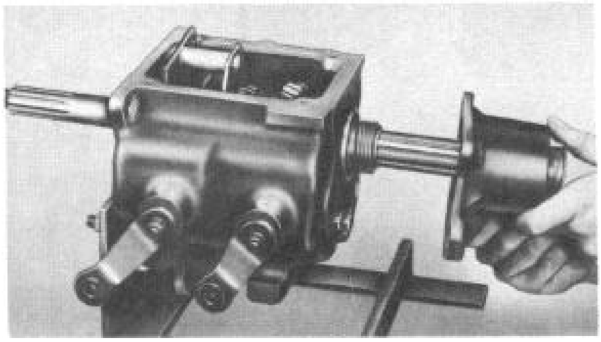


FIGURE 33—*Remove the Rear Bearing Cap and Oil Seal ("Rambler" Series shown)*

After removing the rear bearing cap, drive out the old oil seal. A new oil seal will be used in reassembly.

Now remove the snap ring retaining the speedometer drive gear in position. This snap ring is serviced in four different sizes, and must be used as required on assembly to avoid any possible end play of the speedometer drive gear. The speedometer drive gear is also retained with a Woodruff key (Fig. 34).

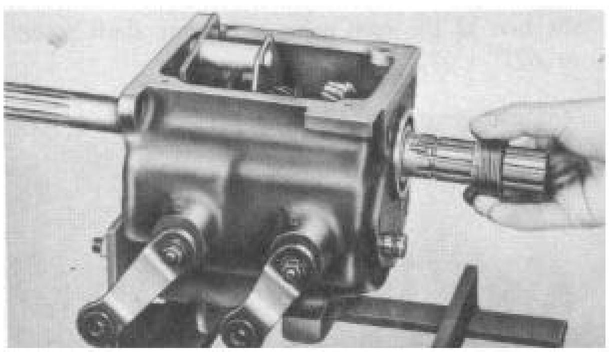


FIGURE 34—*Remove the Speedometer Drive Gear and Woodruff Key*

To remove the transmission clutch shaft, the main shaft assembly must be moved to the rear of the transmission case about 1/2". Then by lowering the front end of the clutch shaft and raising the rear end over the countershaft gear, the shaft can be removed from the case (Fig. 35).

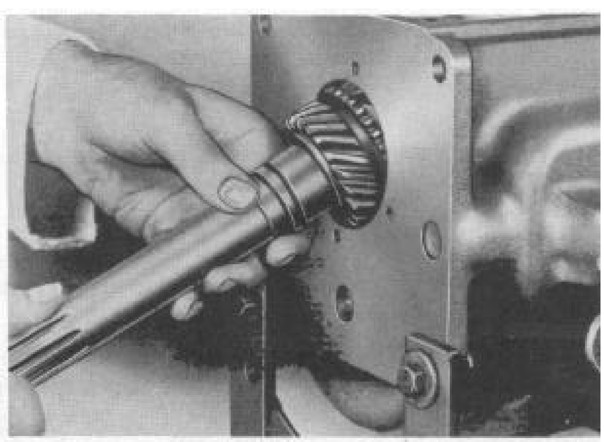
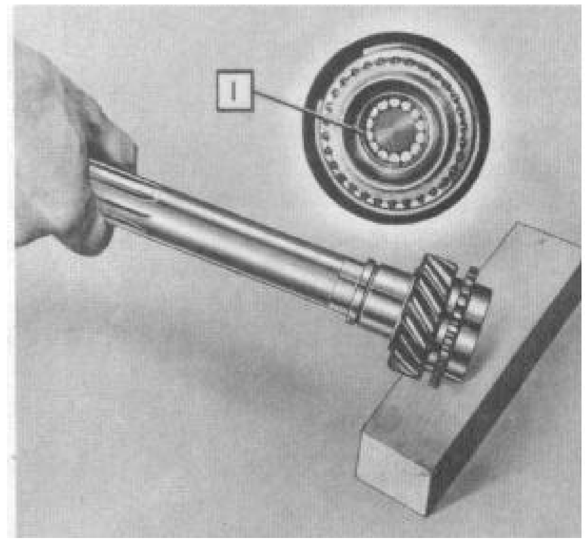


FIGURE 35—*Remove the Clutch Shaft*

Clutch Shaft Roller Bearings

Inside the rear end of the clutch shaft are thirteen roller bearings. These form the front bearing assembly for the main shaft. Worn or loose rollers will result in a noisy transmission. Inspect for worn, pitted, or scored surfaces (Fig. 36).



1. Roller Bearings

FIGURE 36—*Bearing Rollers Inside the Clutch Shaft Hold Themselves in Place by a "Keystone" Effect. Jarring the Shaft Will Show if These Rollers Are Loose*

Disassembling the Main Shaft Assembly

After the clutch shaft is removed, remove the second and high shifter fork. Tilt the main shaft and remove the snap ring, synchro-clutch, second speed gear, and low and reverse gear (Figs. 37, 38, 39 and 40).

Remove the low and reverse shifter fork.

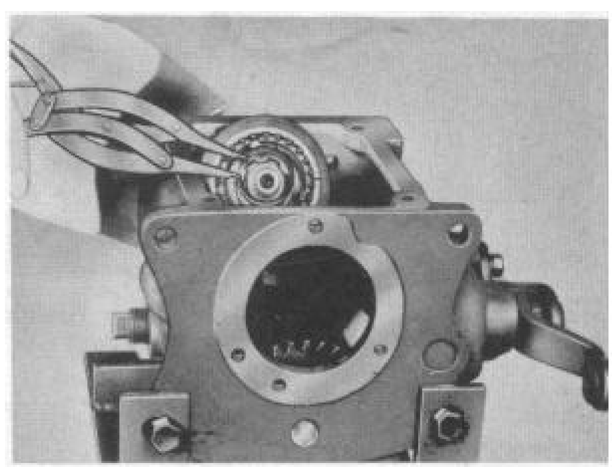


FIGURE 37—*Remove the Snap Ring From the Main Shaft and Remove the Synchro-Clutch*

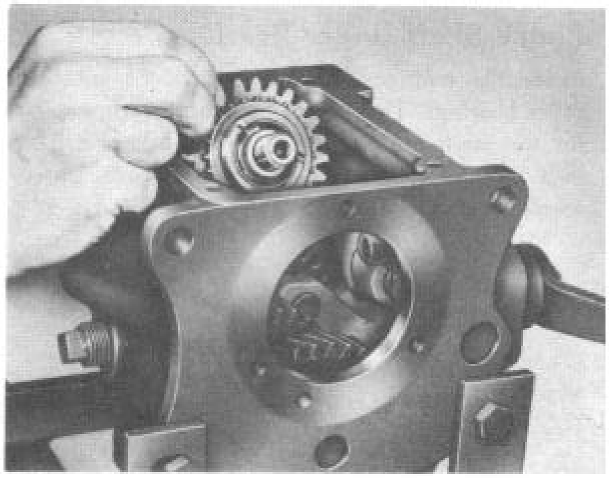


FIGURE 38—*Remove the Second Speed Gear From the Main Shaft*

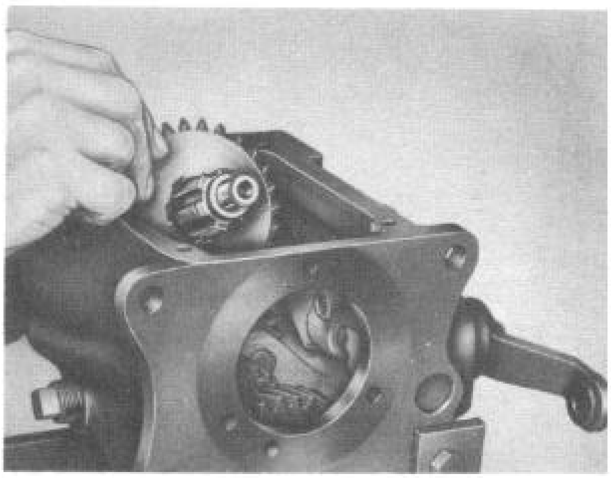


FIGURE 39—*Slide the First and Reverse Gear From the Main Shaft*

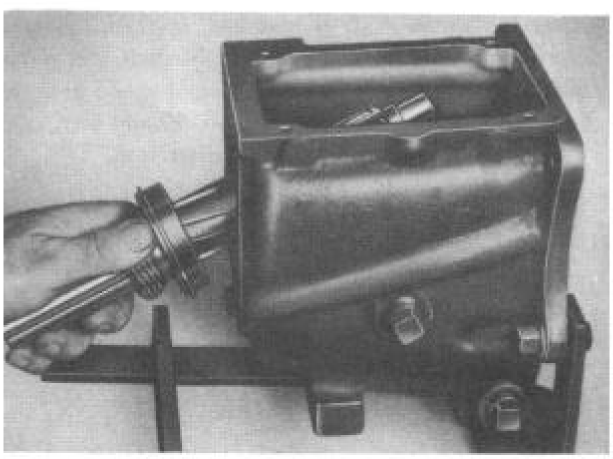


FIGURE 40—*The Main Shaft and Rear Bearing Assembly Can Then be Removed From the Rear of the Transmission*

Removing the Countershaft Gear Assembly

Remove the reverse idler and countershaft lock plate (Fig. 41).

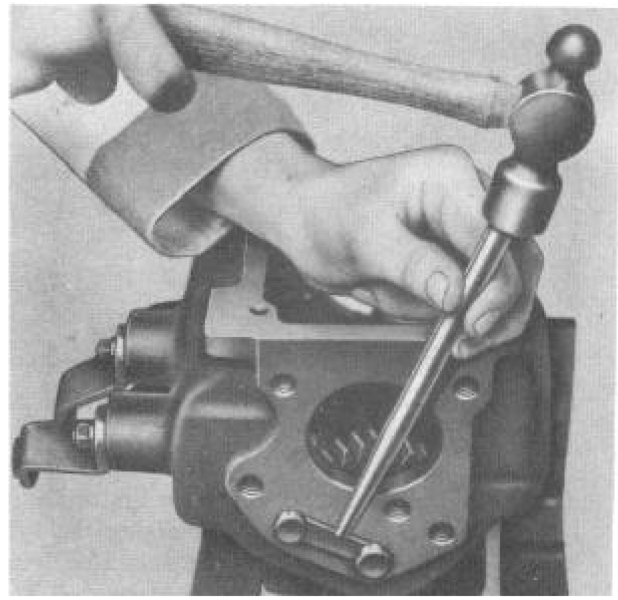


FIGURE 41—*Remove the Lock Plate*

To maintain the position of the needle bearings in the countershaft gear, drive the countershaft out of the rear of the case using a dummy shaft machined to .677" x 578" (Fig. 42).

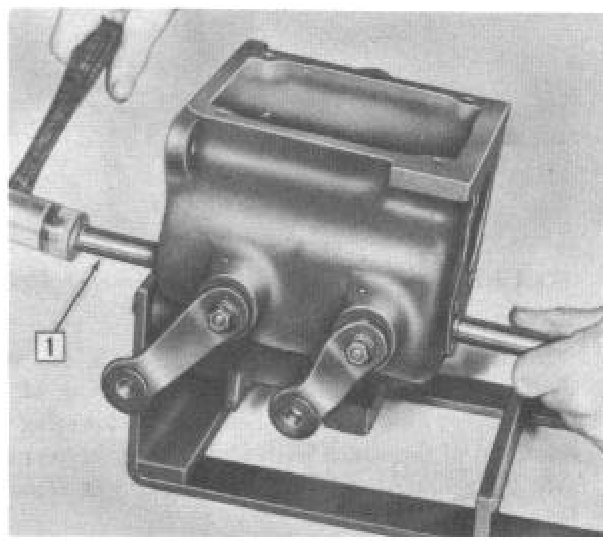


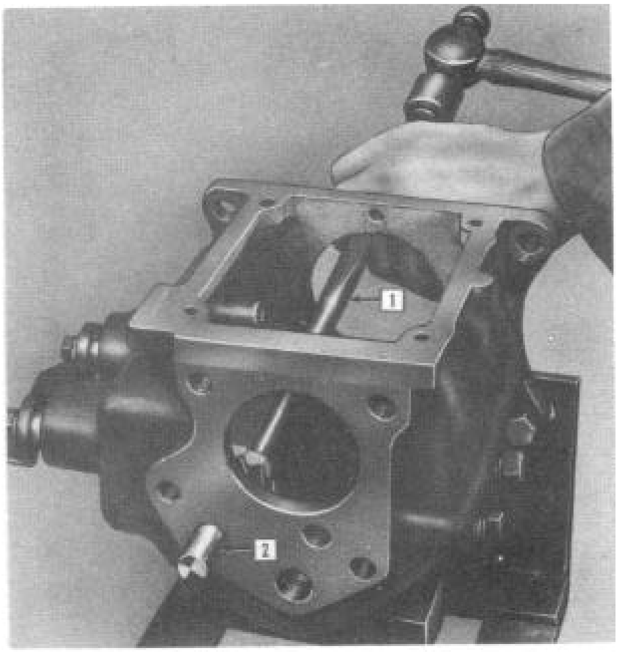
FIGURE 42—*Use a Dummy Shaft Machined to .677" x 5-7/8" to Remove the Countershaft*

With the dummy shaft in place, lower the countershaft gears to the bottom of the case.

Reverse Idler Gear

Remove the reverse idler gear by driving the shaft out the rear of the case with a brass drift (Fig. 43).

Take care not to damage the end of the shaft as you are driving it out. When the shaft is driven out, lift the reverse idler gear from the case. Then remove the countershaft gear assembly (Fig. 44).



1. Brass Drift
2. Idler Gear Shaft

FIGURE 43—*To Remove the Reverse Idler Gear Shaft, Drive it Out the Rear of the Case With a Brass Drift*

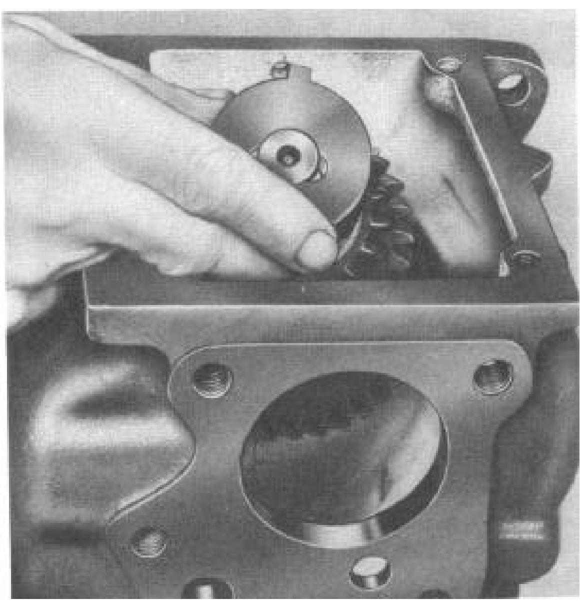


FIGURE 44—*Removing the Countershaft Gear Assembly*

Note carefully the position of the three thrust washers to avoid misplacement during reassembly. Inspect these thrust washers. If they are worn, scored, or damaged in any manner, replace them.

Removing the Interlock Assembly

Remove the outer shift levers and shifter shaft lock pin.

Remove the shifter shafts from the inside of the case slowly to catch the two interlock ball bearings as the shafts are being removed. The interlock sleeve and spring can then be removed. Now remove the shifter shaft oil seals from the case. This completes the disassembly of the transmission.

CLEANING AND INSPECTING PARTS

With the transmission completely disassembled, all parts should be carefully cleaned so that they can be thoroughly examined.

Gears

Wash all gears in a cleaning solution. Inspect for worn or chipped teeth. Slide each gear onto a new shaft. If it appears to be loose, it must be replaced.

> NOTE: *Whenever any transmission gear requires replacement, the gear with which it meshes should be replaced also.*

Bearings

Bearings must be handled with great care. Wrap them in a clean cloth or paper until they can be washed.

To wash a bearing, submerge it in a cleaning solution that is absolutely free of dirt and rotate it to flush away all oil and dirt. Dry the bearing with care.

Carefully examine each bearing for cracked races, worn, or scored balls.

Main Shaft

Install the gears onto the main shaft to be sure they slide on and off easily. They should fit smoothly without excessive play between the splines. If the fit is tight, look for burred edges on the splines.

Synchro-Clutch and Friction Rings

Carefully inspect the synchro-clutch and friction rings. Slide the rings on the cones of the second speed gear and the clutch shaft. Replace rings if there is excessive wear on the taper.

Transmission Case

Examine the surfaces of the bearing recesses in the transmission case for wear or scoring which indicates that the bearing has been revolving in its housing. Examine the case for cracks or other defects.

Be certain that all parts of the case are thoroughly clean before and during assembly.

REASSEMBLY

When reassembling the transmission, always use new gaskets and oil seals.

Shifter Shafts and Levers

Install new shift shaft oil seals.

Then reinstall the low and reverse shift shaft, interlock sleeve, ball bearing and spring. With the second and high shift shaft installed against

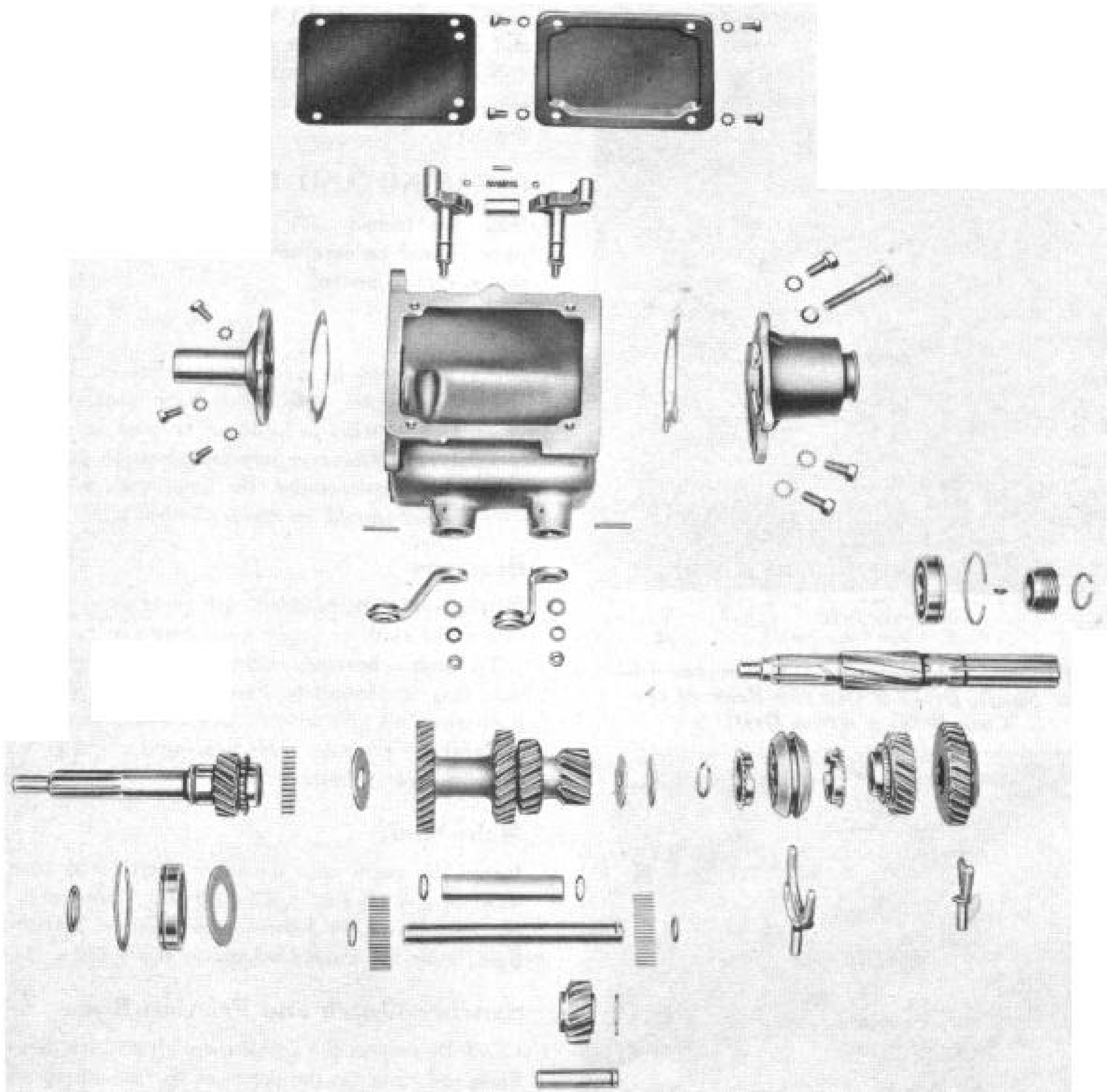


FIGURE 45-*"Rambler" Series Transmisson*

case, place the second ball bearing in position. While compressing the interlock spring with finger pressure, locate the ball in the detent of the quadrant (Fig. 46).

Shift the transmission into any one gear and, with one end of the interlock sleeve against the shifter shaft quadrant, the clearance between the opposite end of the sleeve and the quadrant on the other shaft should be from .001" to .007". After installing the correct size sleeve, lock the shifter shafts in place with lock pins and install the shift levers and forks.

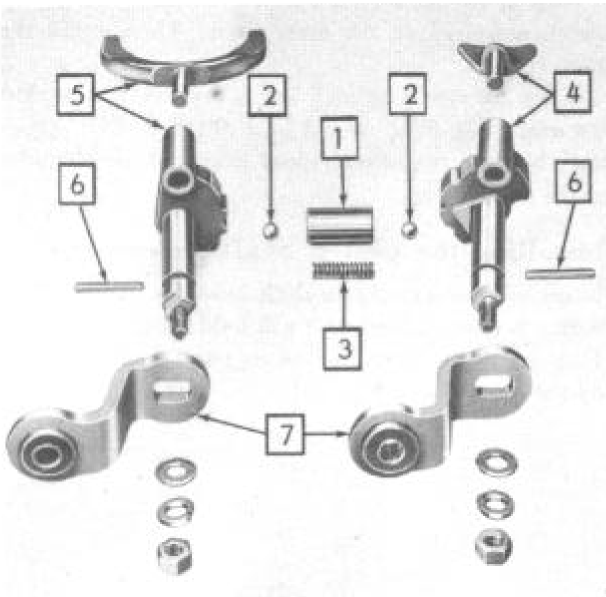
Reinstalling the Countershaft Gear and Shaft

To hold the countershaft needle bearings, spacer, and washers in place while installing the countershaft gear, load the countershaft gear by using a dummy shaft machined to .677" x 5-7/8". (Figs. 47 and 481.

After installing the bearings in the countershaft gear, and holding it in such a manner so as not to drop the dummy shaft, install the thrust washers. The two small projections on the face of the bronze rear thrust washer must index with the grooves in the countershaft gear. The front bronze thrust washer must index with the transmission case. Position the large thrust washer and install the assembly in the bottom of the case (Fig. 491.

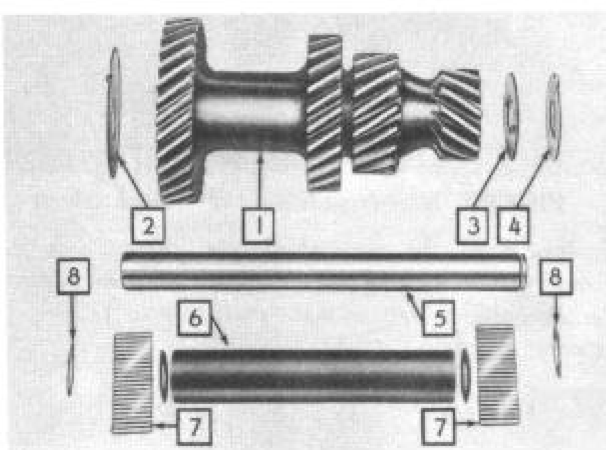
Reinstalling the Reverse Idler Gear

Install the reverse idler gear with the chamfered side of the teeth (or the hub section) to the front of the case. Then drive the reverse idler shaft in from the rear of the case with the notched end of the shaft to the rear. The notch should face the countershaft (Fig. 50).



1. **Interlock Sleeve**
2. **Interlock Balls**
3. **Interlock Spring**
4. **Low and Reverse Shift Shaft and Fork**
5. **High and Second Shift Shaft and Fork**
6. **Locking Pins**
7. **Outer Shift Shaft Levers**

FIGURE 46—***Assembly Sequence of the Shifter Mechanism***



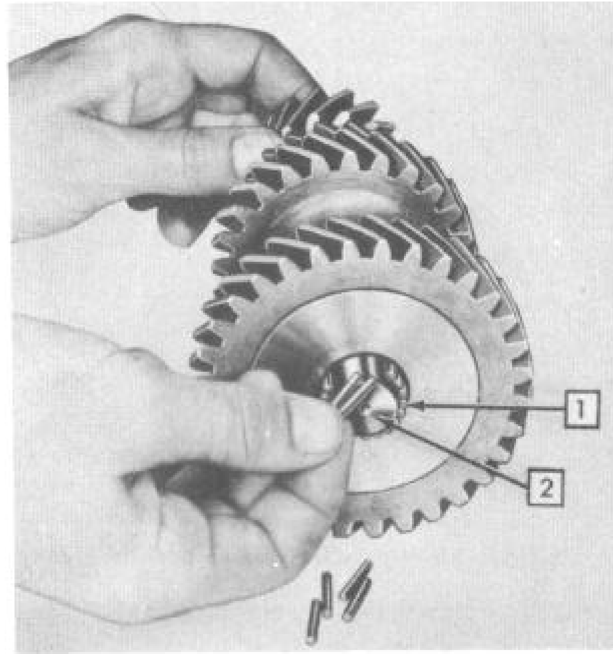
1. **Countershaft Gear**
2. **Front Thrust Washer**
3. **Bronze Rear Thrust Washer**
4. **Rear Thrust Washer**
5. **Countershaft**
6. **Spacer**
7. **Needle Bearings**
8. **Bearing Rings**

FIGURE 47—***Countershaft Assembly Sequence***

After aligning the slots in the countershaft and the reverse idler shaft, position the countershaft gear assembly and drive the countershaft in place. Then insert the lock plate in position (Fig. 51) .

Assembling the Gears on the Main Shaft

Press the transmission rear bearing on the main



1. **Needle Bearings**
2. **Dummy Shaft**

FIGURE 48—***Loading the Countershaft Gear With the Needle Bearings, Spacer, and Bearing Rings by Using a Dummy Shaft***

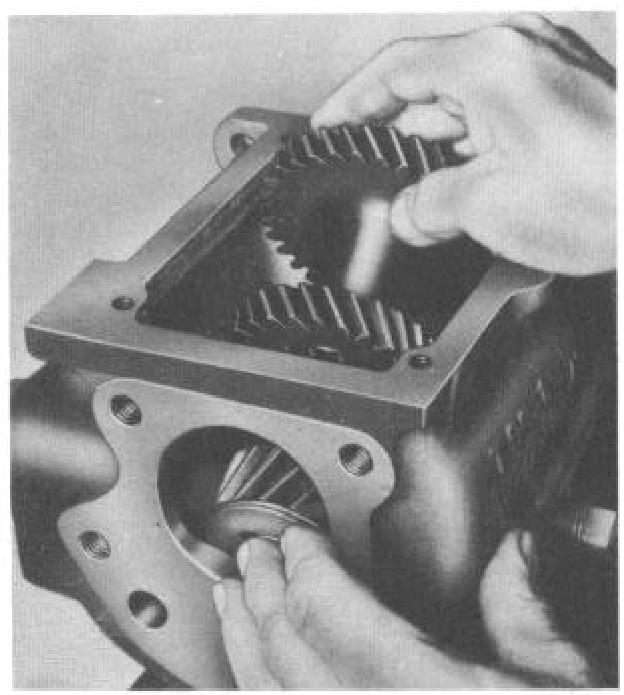


FIGURE 49—***Installing the Counters*****haft Gear Assembly in the Case**

shaft and install snap rings. Then place the main shaft in the case from the rear. Install the first and reverse sliding gear on the main shaft (Fig. 52).

NOTE: **To avoid hardship in assembling, the first and reverse sliding gear should be installed on the main shaft a number of times while out of the case.**

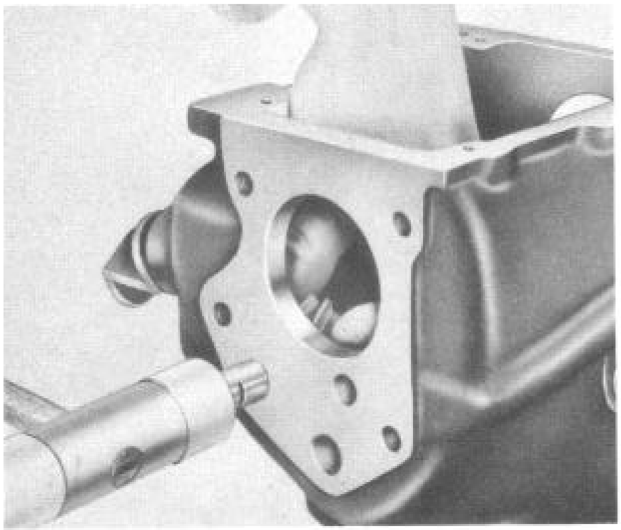


FIGURE 50—***Installing Reverse Idler Gear***

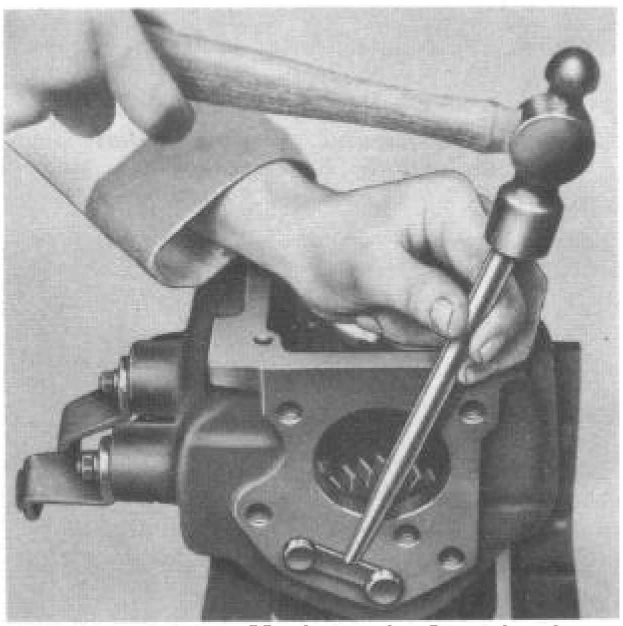


FIGURE 51—***Install the Lock Plate in the Grooves in the Countershaft and Reverse Idler Shaft***

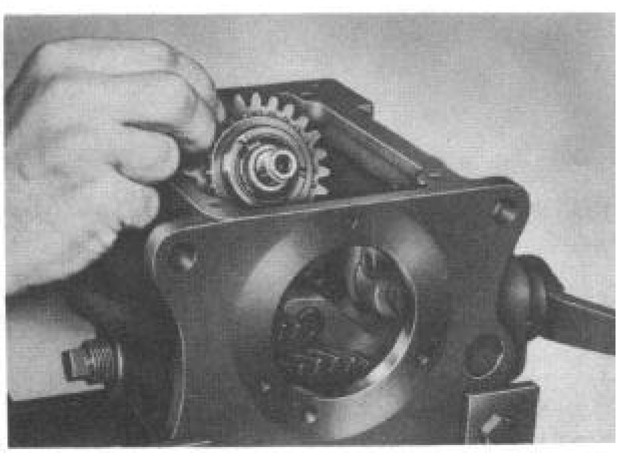


FIGURE 52—***Place the First and Reverse Sliding Gear on the Main Shaft***

Now install the second speed gear and the synchroclutch assembly on the main shaft. Then install the snap ring.

When the synchro-clutch hub is pressed tight against the snap ring, there should be a .003" to .010" clearance between the second speed gear and the shoulder of the main shaft.

Installing the Clutch Shaft Assembly

Insert the thirteen clutch shaft bearings in the clutch shaft. A coat of lubriplate will hold them in position. Then install the front friction ring and the clutch shaft on the main shaft (Fig. 53).

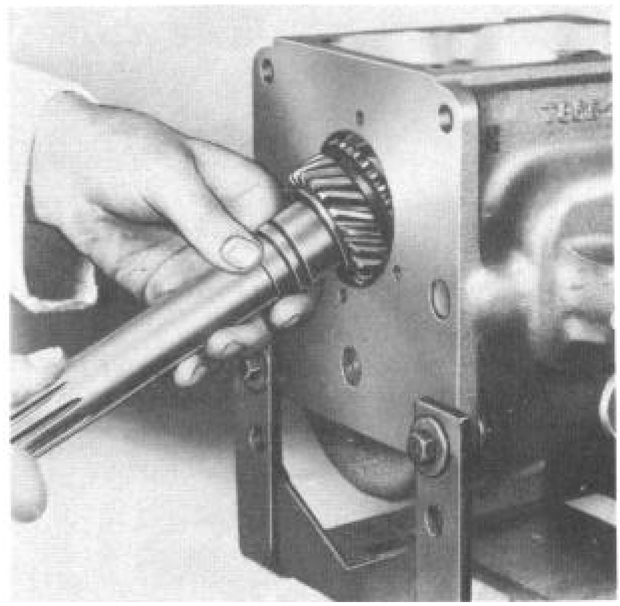


FIGURE 53—***Installing the Clutch Shaft***

Now move the main shaft rear bearing into the transmission case and align the shifter forks and gears guiding the end of the main shaft into its bearing in the clutch shaft (Fig. 54).

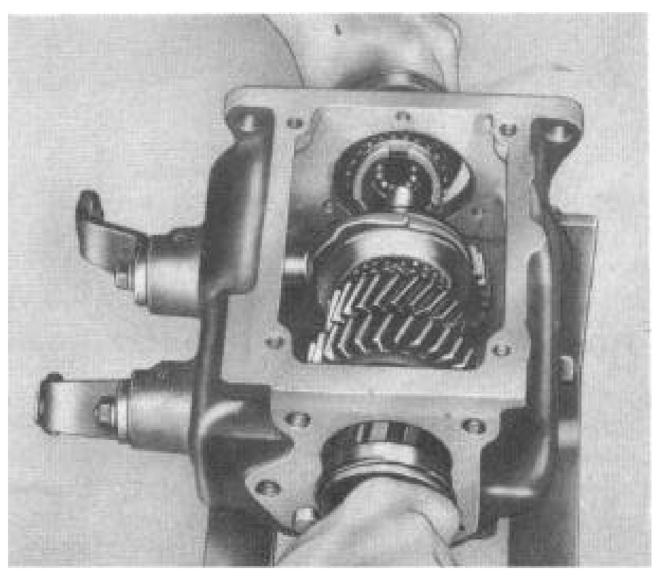


FIGURE 54—***Guide the End of the Main Shaft Into Its Bearing in the Clutch Shaft***

Install the speedometer drive gear. A Woodruff key holds the speedometer gear from rotating on the main shaft. Then install a main shaft snap ring to hold the speedometer gear in position.

To install the main shaft Oilite bushing on the "Wasp" Series, assemble the felt oil ring on it and press the bushing into the rear bearing cap. The shoulder on the main shaft bushing must remain 1/4" from the shoulder in the bearing cap to prevent compressing the felt oil ring (Fig. 25).

When installing the rear bearing cap, note that the depth of the counter bore in the rear bearing cap, the thickness of the rear bearing lock ring, and the rear main shaft snap ring all control main shaft end play. The rear bearing lock ring is available in two thicknesses .076" and .093". The rear main shaft snap ring is available in four thicknesses .087", .090", .093" and .096". Use Tool J-1354 rear oil seal installer, "Hornet" and "Wasp" Series, or J-4485, "Rambler" Series to install a new rear bearing cap oil seal.
Place the oil slinger on the clutch shaft with the concave side toward the rear. The front bearing and lock ring can be installed with Tool J-2995, together with thrust yoke J-2040 (Fig. 55). Then install the clutch shaft snap ring using either snap ring pliers or Tool J-2995 Snap Ring Installing Set.

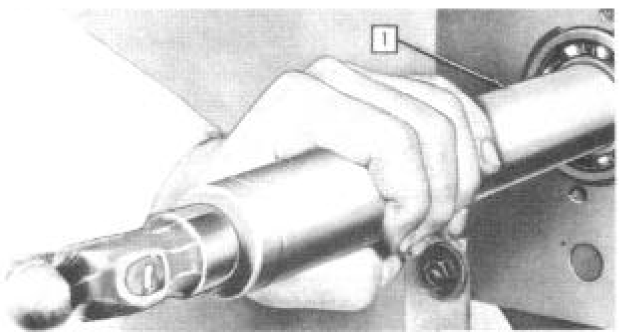


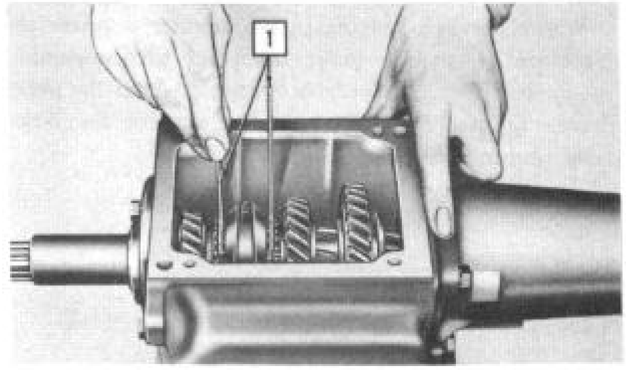
FIGURE 55—*Installing Clutch. Shaft Bearing*

Place a new gasket between the bearing cap and case and install the bearing cap. The thickness of this gasket governs clutch shaft end play. The desired end play is .000".

Friction Ring Clearance

Measure the clearance of the friction rings using friction ring clearance gauge (J-1410). These clearances should be between .060" to .080". If less, add steel shims as required between the rear bearing cap or adapter and transmission case. Gaskets must be used on both sides of the steel shim (Fig. 56).

The transmission only requires a final check by shifting in all gears. Check the operation carefully, then install the case cover and gasket, placing the stamping marked "FRONT" to the front of the case.



1. Tool J-1410

FIGURE 56—*Gauging Front Friction Ring Clearance. It Should be Between .060" and .080"*

LUBRICATION OF THE TRANSMISSION

Check the lubricant level of the transmission every 1,000 miles. The transmission should be filled to the drain plug level on the right side. Drain and clean twice a year, or every 10,000 miles, using only flushing oils. Do not use gasoline, kerosene, steam, etc.

For atmospheric temperatures above 32°F., use mineral gear lubricant SAE No. 90 in the transmission.

Below 32°F., use SAE No. 80.

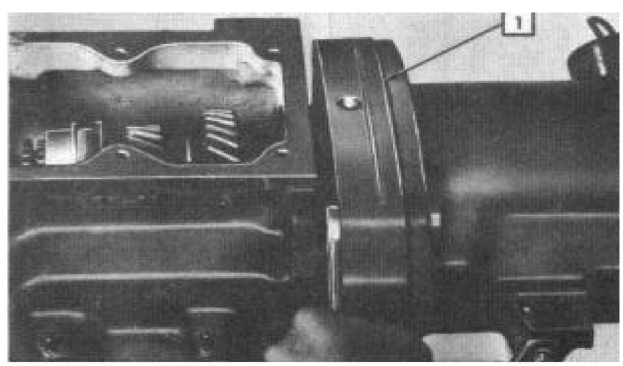
When difficulty in shifting is experienced in subzero temperatures, dilute the transmission oil as required, using light engine oil.

Transmission capacity (U.S.) 11/2 pints "Rambler" Series. 2-1/4 pints "Wasp" Series.

OVERDRIVE TRANSMISSION

On overdrive equipped transmissions, the overhaul procedure is the same as outlined in the standard transmission section with the following exceptions.

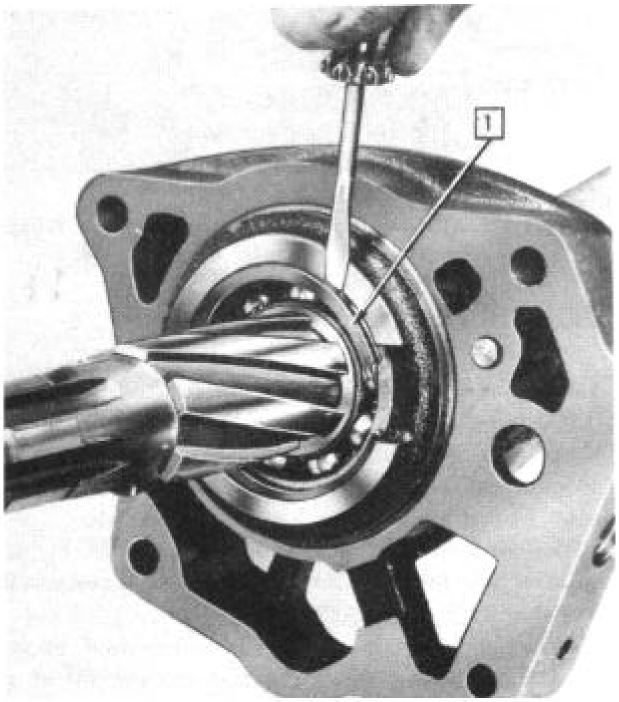
Remove the bolts that hold the overdrive and bearing adapter to the transmission case, and carefully separate the adapter from the transmission. As they are separated, bolt the adapter to the overdrive case to keep the overdrive parts in position (Fig. 57).



1. Adapter

FIGURE 57—*Separate the Adapter From the Transmission Case*

Where the ball bearing in the adapter requires replacement, it then becomes necessary to disassemble the overdrive (See Overdrive Section). After the overdrive unit has been disassembled, remove the large snap ring in the bearing adapter (Fig. 58).



1. Snap Ring

FIGURE 58—***Remove the Large Snap Ring in the Bearing Adapter***

Remove the main shaft ball bearing and oil baffle from the adapter. Then remove the main shaft snap ring and press the bearing from the main shaft.

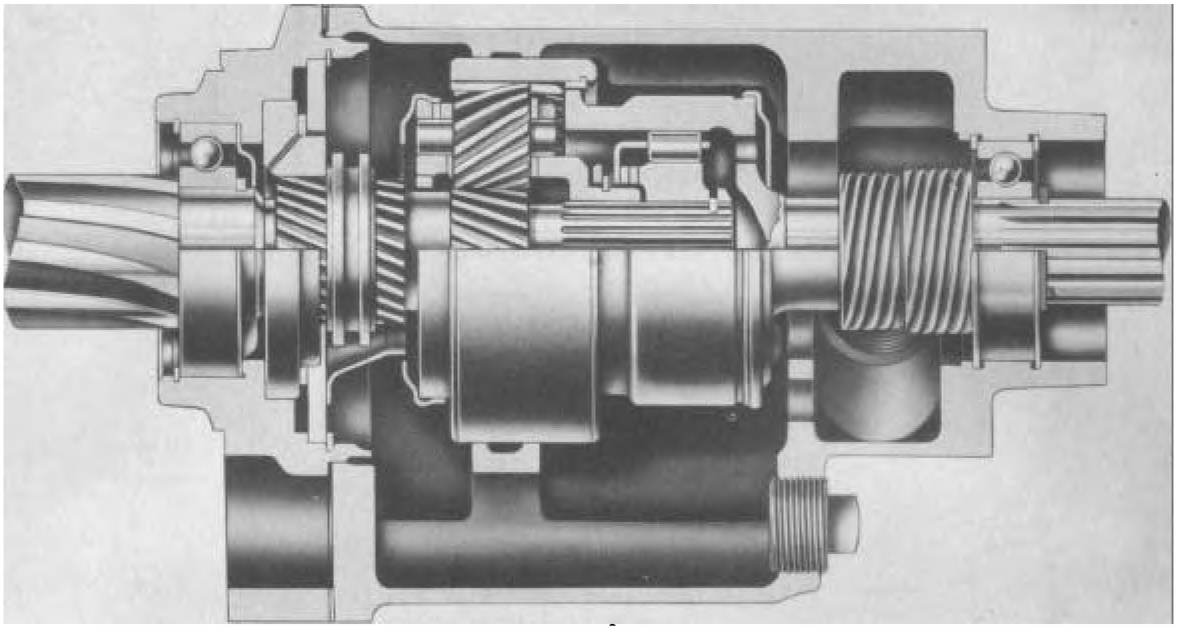
TRANSMISSION END PLAY SPECIFICATIONS

Synchro Clutch Friction Rings—.060" to .080"	Synchro clutch friction rings governed by steel shims "as required," placed between the transmission case and rear bearing cap.
Second Speed Gear End Play—.003" to .010"	Second speed gear end play governed by variable thickness snap rings located on main shaft in front of synchro-clutch gear.
Clutch Shaft End Play—.000" to .005"—.000" preferred	Clutch shaft end play governed by gasket placed between front bearing cap and transmission case.
Counter Shaft Gear End Play—.003" to .006"	Counter shaft gear end play governed by variable thickness bronze thrust washer located at rear between counter shaft gear and steel thrust washer.

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

OVERDRIVE SECTION



Overdrive—"Hornet", "Wasp" and "Rambler" Series

OPERATION

The overdrive unit, when in operation above the governor cut-in speed, automatically reduces the engine to rear axle ratio approximately 30%.
When overdrive operation is desired, the control button is pushed to the forward position. The car speed is then increased to a point higher than the cut- in speed, which is determined by the point setting of the overdrive governor.
As the governor points close, at approximately 30 miles per hour, the solenoid is energized. This allows the locking pawl to engage the sun gear hub and balk ring assembly when the accel- erator is momentarily released. When the accel- erator is again depressed the overdrive is in operation. As this takes place, free wheeling becomes inoperative, since free wheeling is possible only below the cut-in speed determined by the overdrive governor.
To lock out the overdrive the control button must be pulled all the way out. This can be done either when the car is in motion or when it is parked. Locking out the overdrive while the car is in motion can be done while the car is in the free wheeling stage. The accelerator is de- pressed so that the engine is driving the car, and the control button is pulled out without depressing the clutch. While still applying pressure to the control button, the accelerator should be momentarily released to complete the shift.
An alternate method permits pulling the control button back into conventional position during the time the accelerator pedal is fully de- pressed in the overtake position.

THE OVERDRIVE CONTROL UNITS

In order to service this control system, it is very important to understand just how it works. The follow. ing paragraphs explain the entire overdrive control system.

The Electrical Circuits

The electrical system consists of the three following circuits:

Governor Circuit—Light Line
Solenoid Circuit—Heavy Line
Kickdown Circuit—Dotted Line

"Hornet" and "Wasp" Series

The governor, solenoid, and kickdown circuits can be traced as follows:

Governor Circuit

The governor circuit starts from the voltage regulator armature terminal. It continues to terminal No. "2" on the overdrive relay. The current passes through the relay coil to terminal No. "3". Then through the kickdown switch to the "H" terminal on the governor and open contacts "A" (Fig. 1).

Solenoid Circuit

The solenoid circuit starts from the "B" terminal on

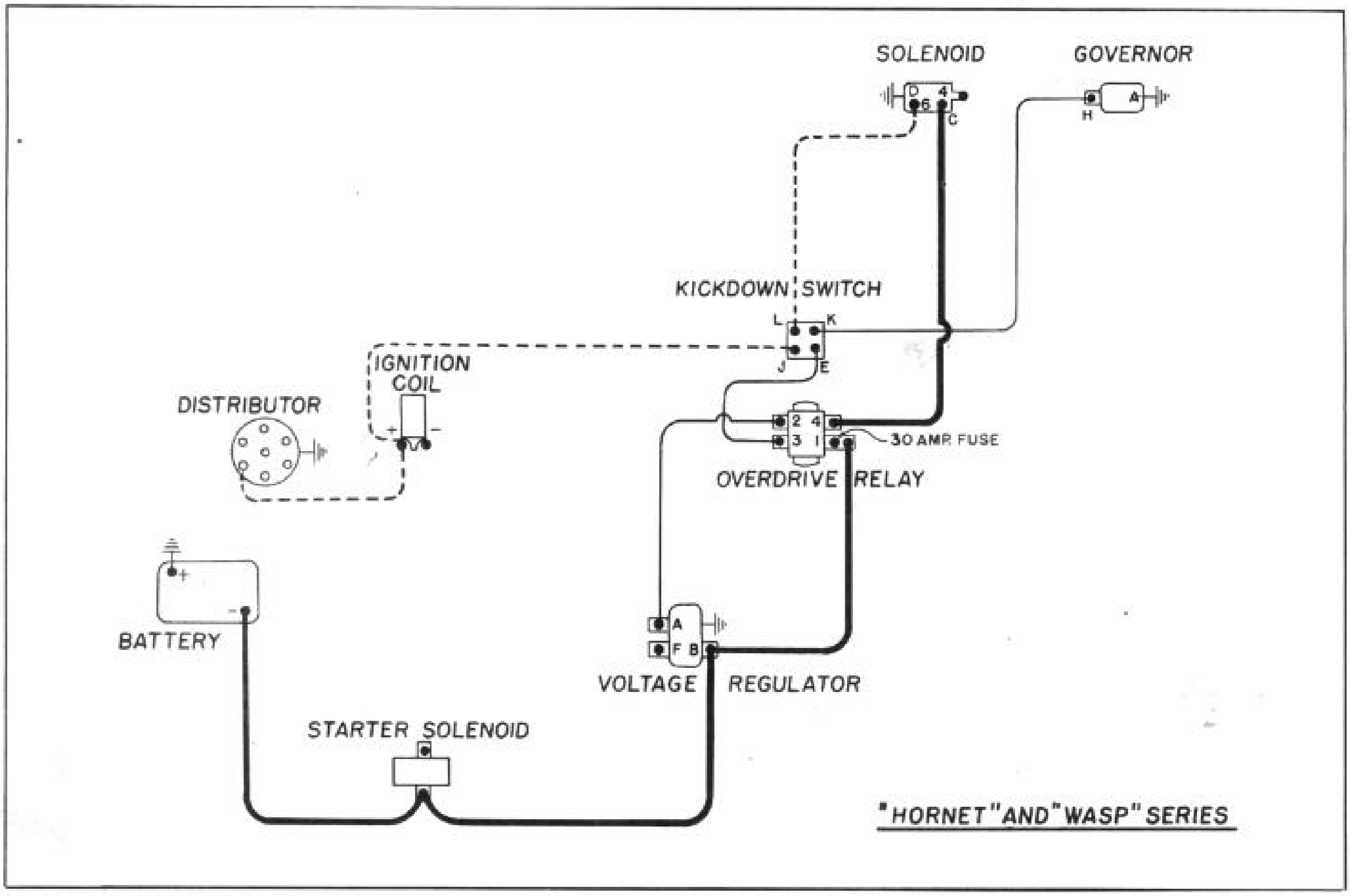


FIGURE 1-The Governor Circuit (Light Line), The Solenoid Circuit (Heavy Line), and The Kickdown Circuit (Dotted Line) All Operate to Energize or De-energize the Solenoid

the voltage regulator to No. 1 terminal on the overdrive relay, through a 30 ampere fuse. The circuit is resumed at terminal No. "4" and continues to the solenoid and closed contacts "C" to ground (Fig. 1).

Kickdown Circuit

The kickdown circuit starts from the (+) or distributor side of the ignition coil terminal. It continues to kickdown switch terminal "J" and resumes from terminal "L" on to terminal "6" of the solenoid (Fig. 1) .

THE CIRCUITS IN ACTION

At Speeds Below 30 Miles Per Hour

Decreasing the car speed to below 30 M.P.H. will result in the opening of the overdrive governor points (Fig. 2). This will de-energize the relay. The current supply to the solenoid holding coil is cut off and the solenoid return spring pulls the solenoid pawl out of the sun gear hub because on deceleration there is no side load on the pawl. The car will now free wheel and when throttle is applied will pull in third gear.

At Speeds Above 30 Miles Per Hour

When the car speed is increased to governor cut-in speed (about 30 M.P.H.), the. governor contacts close completing the governor circuit to ground. This actuates the relay, closing the relay contacts and energizing the solenoid actuating and holding coils (Fig. 3). The solenoid pawl is actuated to contact the step of the overdrive sun gear balk ring. At the same time, the actuating coil contacts are opened and the holding coil, with a low amperage draw, holds the solenoid pawl on the balk ring. A momentary release of the throttle provides the needed reversal of torque in the drive line to slip the solenoid pawl from the step on the balk ring into a window of the sun gear hub to obtain overdrive operation. As the solenoid pawl moves, the ignition interrupter points are closed connecting that part of the interrupter circuit to ground.

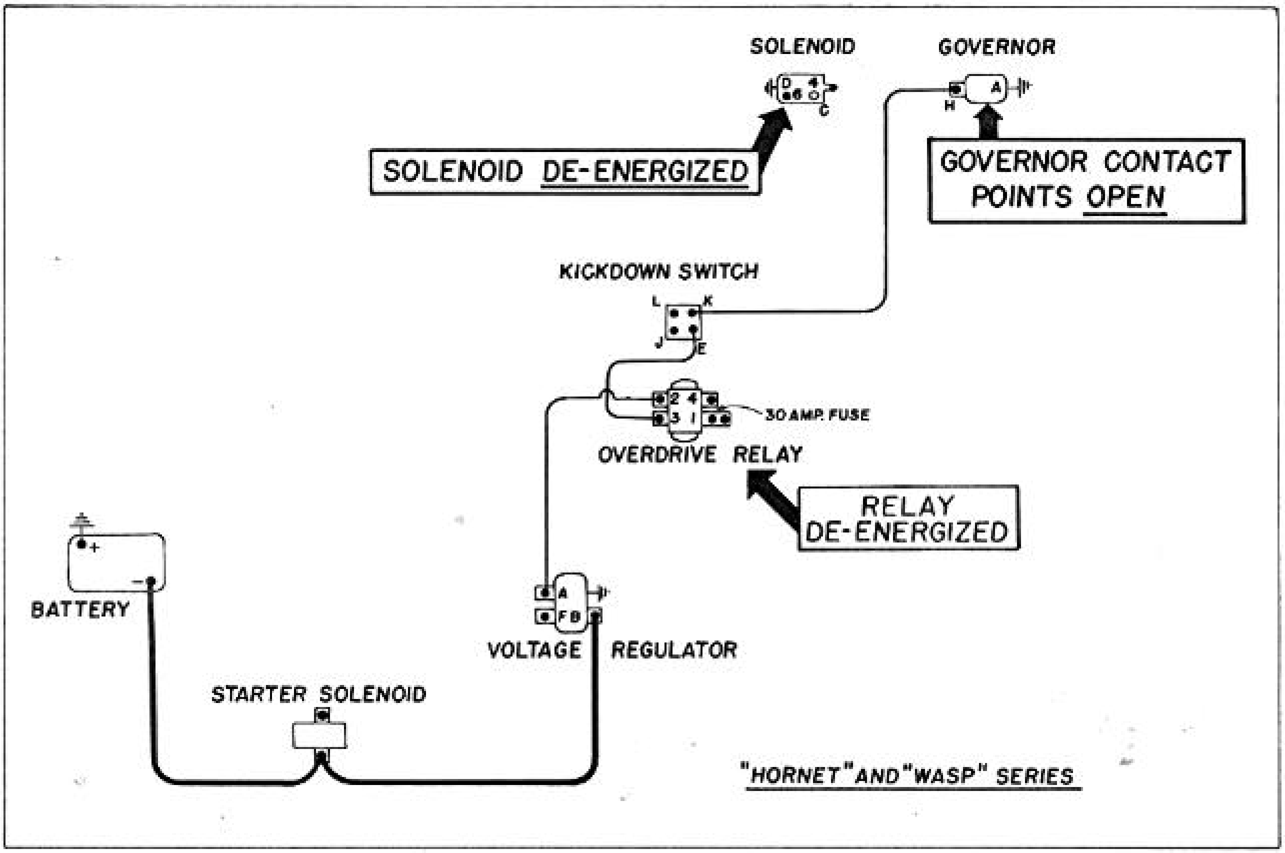


FIGURE 2—*At Less Than 30 Miles Per Hour the Governor Switch Keeps the Circuit Open and the Solenoid Pawl Remains Disengaged*

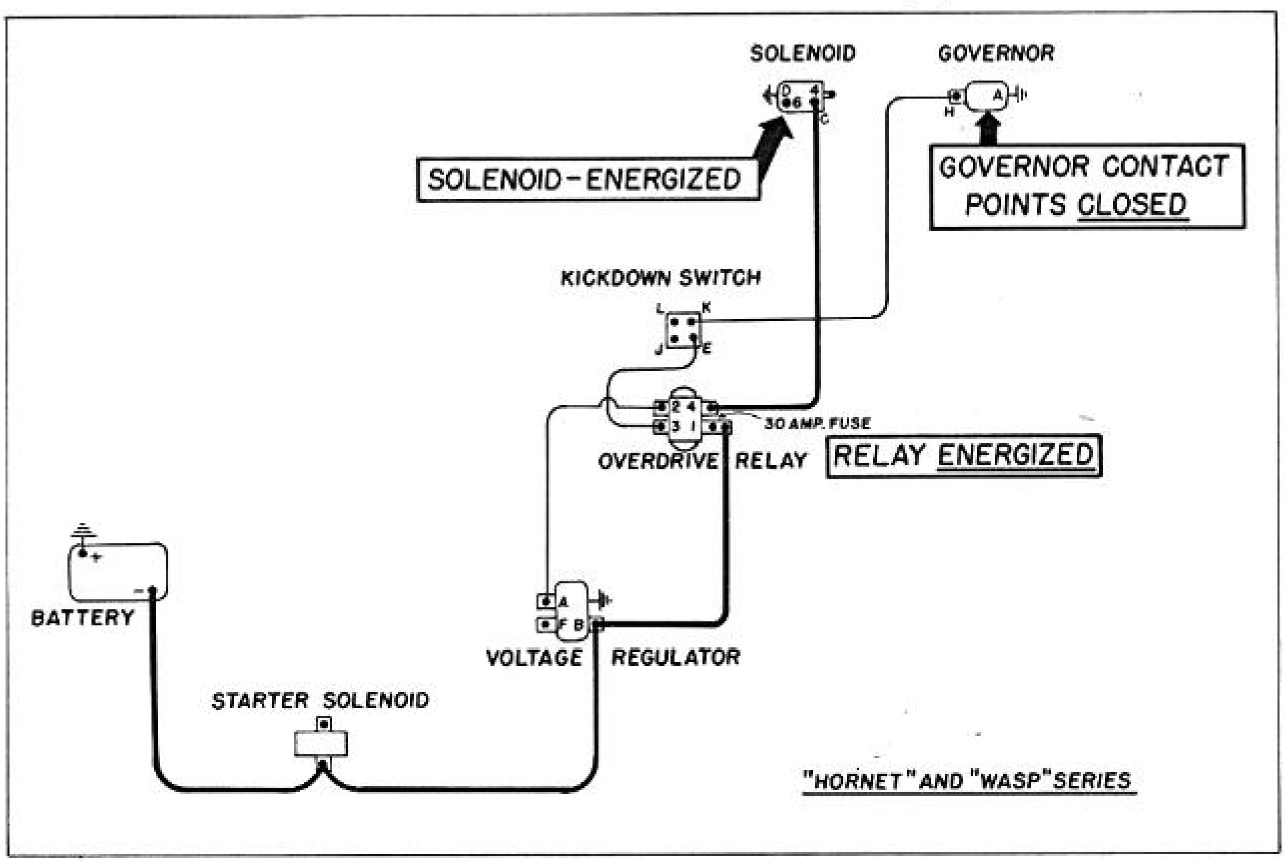


FIGURE 3—*Above 30 Miles Per Hour the Governor Points Automatically Close, Thus Closing the Governor Circuit and the Relay, Which Energizes the Solenoid*

Kickdown Switch

To place the overdrive in overtake position when car is in cruising gear at speeds above 30 M.P.H., depress the foot accelerator all the way to the floor. In doing so, voltage at terminal "K" (Fig. 4), of the overdrive kickdown switch, is eliminated. This immediately de- energizes the overdrive relay coil opening solenoid points "C". The solenoid is de-energized. The solenoid return spring tends to pull the pawl out of the sun gear hub, but it is held in by side thrust. It is necessary to reverse the drive line torque for a moment. This is done by the interruption of the ignition system for approximately two revolutions of the engine.

With kickdown switch points "L" and "J" closed, the ignition primary circuit to the distributor side of the coil is grounded by the circuit completed through the ignition interrupter points of the solenoid. As soon as the solenoid is released, the interrupter points are opened and the engine again fires normally. The drive through overdrive is then direct and conventional third speed operation is obtained.

"Rambler" Series

Governor Circuit

The governor circuit starts from the ignition switch terminal (Negative) on the coil to the terminal "IGN" on the overdrive relay (Fig. 6).

Then, passing through the relay coil which magnetically controls the contact points "B" of the solenoid circuit. it continues from the "TH" terminal of the relay to the kickdown switch relay terminal "E".

Crossing the kickdown switch to terminal "K", it passes to the governor terminal "H" and its open contact points "A".

Solenoid Circuit

The solenoid circuit starts at the "B" terminal of the voltage regulator. It then proceeds to the "B" terminal

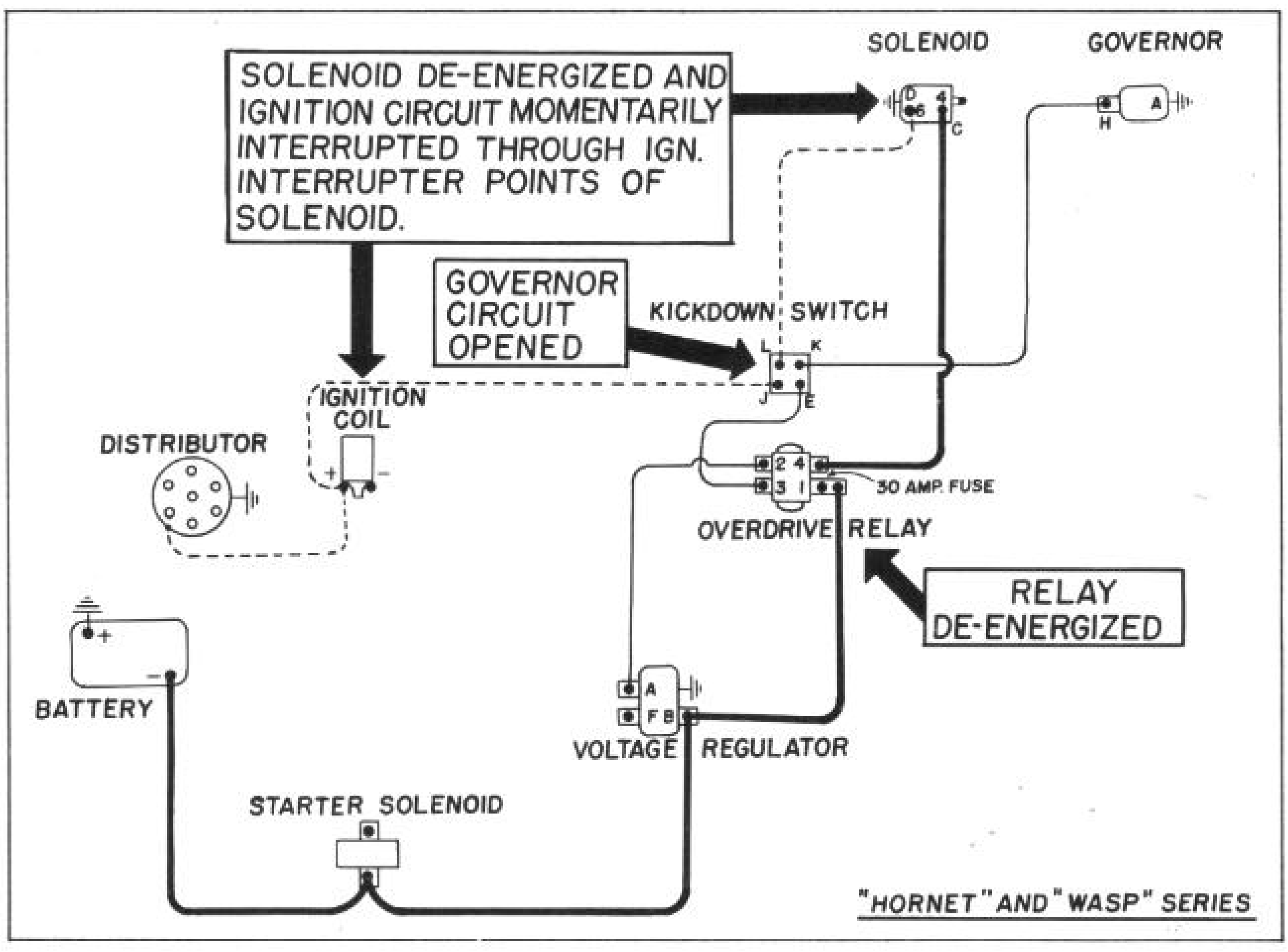


FIGURE 4—*With the Kickdown Switch Open, the Governor Circuit is Broken and the Solenoid De-energized. Also, the Distributor is Shorted Out to Release Engine Torque*

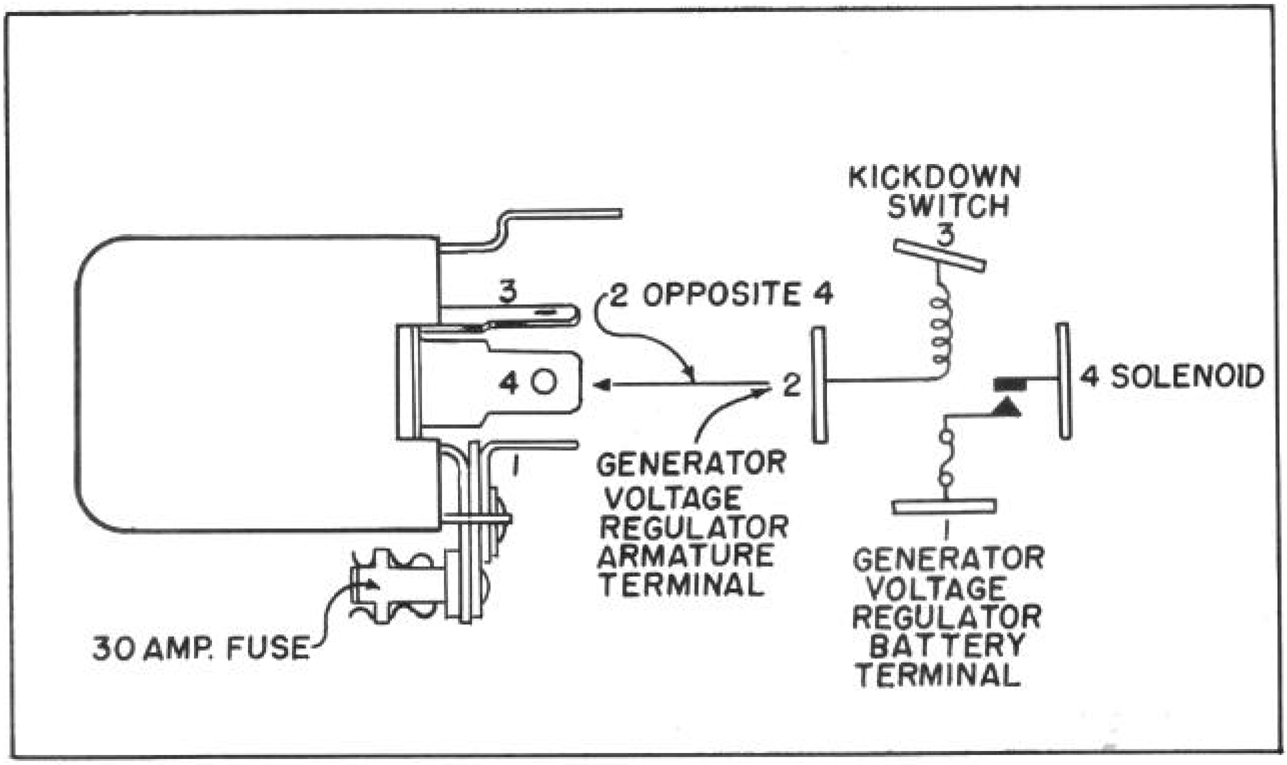


FIGURE 5—*Overdrive Relay Schematic Drawing*

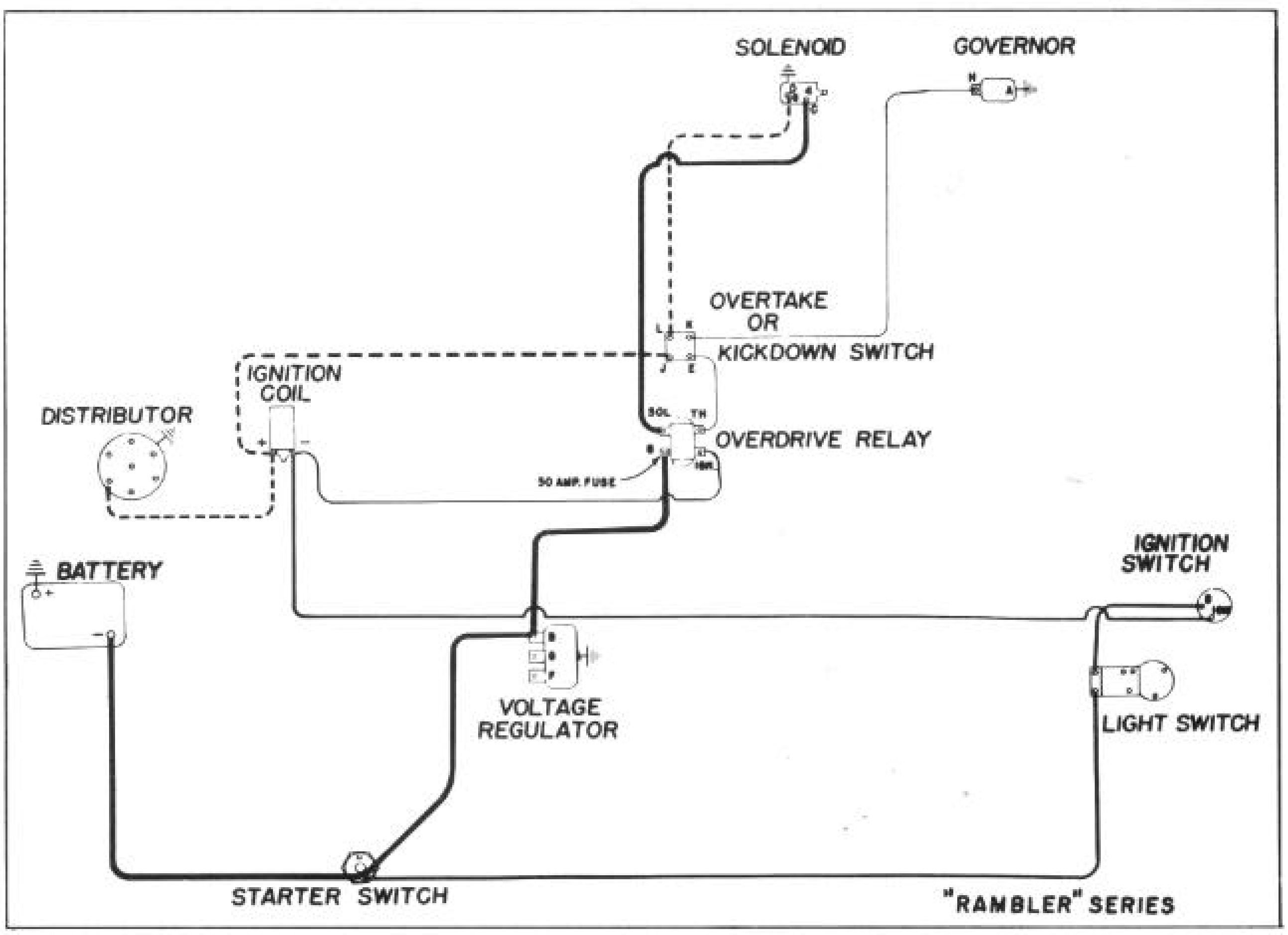


FIGURE 6—*The Governor Circuit (Light Line), the Solenoid Circuit (Heavy Line), and the Kick-down Circuit (Dotted Line) All Operate to Engerize or De-engerize the Solenoid*

of the overdrive relay where it passes through a 30 ampere fuse to open contact points.
The circuit is resumed at the solenoid terminal "SOL" of the relay and proceeds to terminal "4" of the solenoid where it divides into two coils, passing through the holding coil to ground and through the solenoid coil and closed contacts "C" to ground.

Kickdown Circuit

The kickdown circuit starts at the ignition coil positive terminal and proceeds to terminal "J" on the kickdown switch. From the open contacts of the kickdown switch, it continues from terminal "L" to terminal "6" and the solenoid ground (Fig. 61.

The Circuits in Action

When the car attains a speed of approximately 30 miles per hour, the centrifugal action of the weights in the governor closes contacts "A", thus completing the circuit from the ignition switch to the ground.
The relay coil, being energized, closes the relay contacts "B" of the solenoid circuit.
The solenoid circuit, being completed, immediately energizes the actuating coil of the solenoid moving the pawl into the balk ring and lock plate.

As soon as the solenoid plunger has been permitted to enter the lock plate, the contacts "C" in the solenoid actuating circuit are opened, permitting a decreased flow of current through the holding coil to retain the plunger in position during the time when the overdrive is in operation.

The inward movement of the solenoid plunger, in addition to operating the contact "C" in the solenoid actuating circuit, also closes contact "D" in the kickdown circuit through the release of the spring lever on the outer end of the solenoid. The circuits are now in normal condition for continuing the overdrive operation.

In order to understand the overdrive control system, the first thing to remember is that any time there is an open switch in a circuit that entire circuit is open and inactive. When all three switches in the governor circuit are closed, the relay coil is energized, closing the relay points "B". This completes the solenoid circuit and energizes the solenoid, which through the locking pawl, locks the sun gear and places the overdrive in cruising gear. Also, any time any one of the three governor circuit switches is open, the relay coil is de- energized. the points open, and the solenoid circuit is broken.

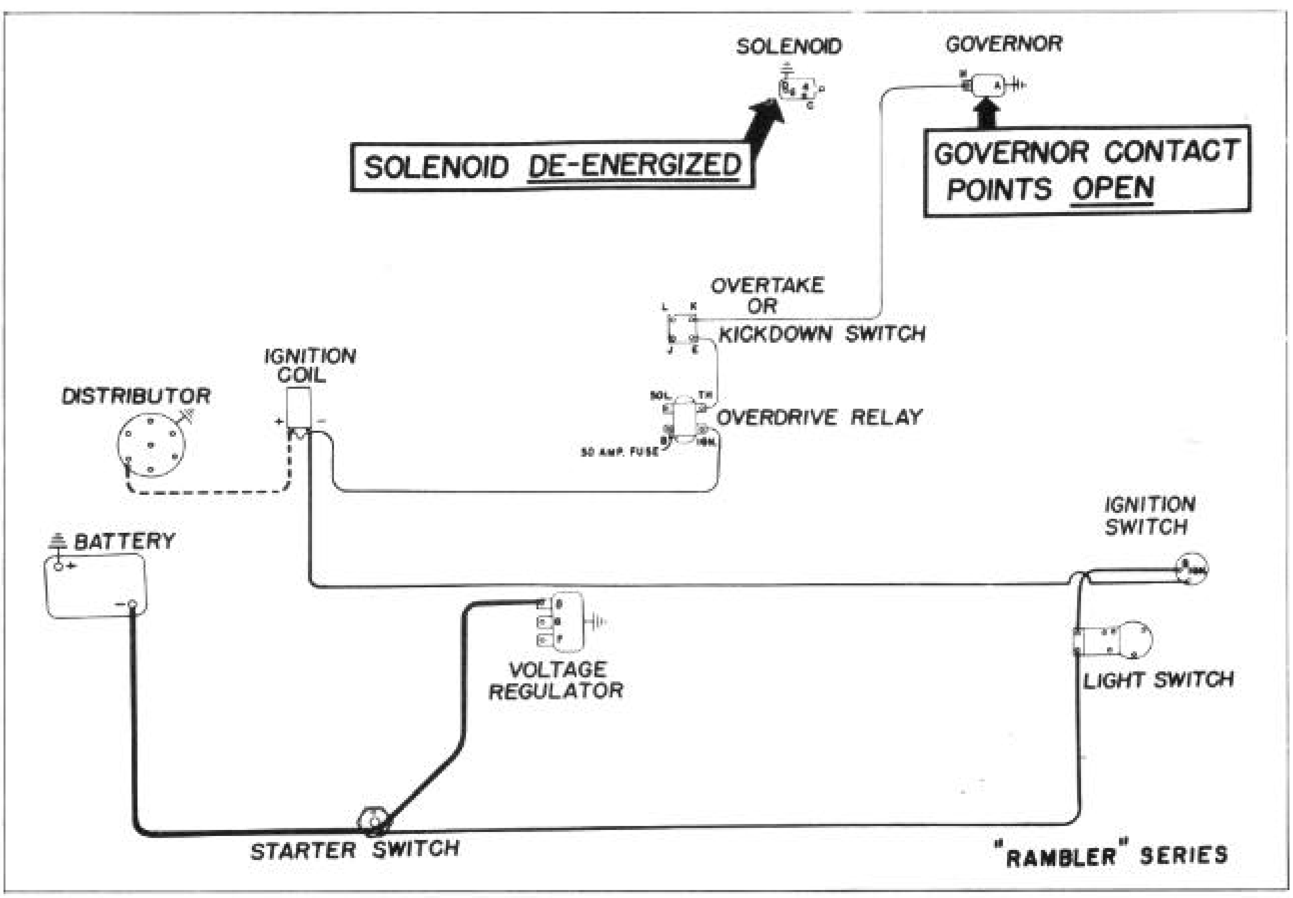


FIGURE 7—*At Less than 30 Miles Per Hour, the Governor Switch Keeps the Circuit Open and the Solenoid Pawl Remains Disengaged*

At Speeds Below 30 Miles Per Hour

With the cruising gear control forward at speeds below 30 miles per hour every switch in the governor circuit is closed except the governor switch. But this one open switch is enough to keep the entire governor circuit and the solenoid circuit open, and the solenoid remains de-energized (Fig. 7).

At Speeds Above 30 Miles Per Hour

As the speed of the car passes 30 miles per hour, the governor points automatically close. This completes the governor circuit, energizes the relay, and closes the relay points "B", thus energizing the solenoid.

Then, with the momentary release of the accelerator pedal, engine torque is released just long enough for the solenoid pawl to move off the step of the balk ring and engage the notch of the lock plate locking the sun gear. This places the car in cruising gear (Fig. 8).

Kickdown Switch

With the car in cruising gear at speeds above 30 miles per hour, depressing the foot accelerator all the way to the floor places the overdrive in overtake position (Fig. 9).

With the accelerator pedal in the wide open position, it contacts the kickdown switch, opening the points "E" and "K" in the kickdown switch and closes points "J" and "L". This at the same time breaks the governor circuit and completes the kickdown circuit. The break in the governor circuit de-energizes the solenoid. The closing of the kickdown circuit momentarily "shorts out" the distributor (for approximately two crankshaft revolutions) releasing engine torque just long enough for the solenoid pawl to disengage. The instant the solenoid disengages, the solenoid points "D" automatically open, restoring the distributor circuit. The car then remains in direct gear as long as the engine is kept under a pulling load.

DIAGNOSING OVERDRIVE TROUBLES

Since overdrive troubles may originate not only in the mechanical operation of the unit but also in the electrical circuit which controls that unit, the service man should always check the control system before disassembling the overdrive.

If the trouble is not found after a thorough inspection of the control system, then the transmission and overdrive should be removed for examination.

Unsatisfactory Overdrive Operation. Look for:
Burnt relay fuse in solenoid circuit.
Loose terminals on any of the connecting wires.

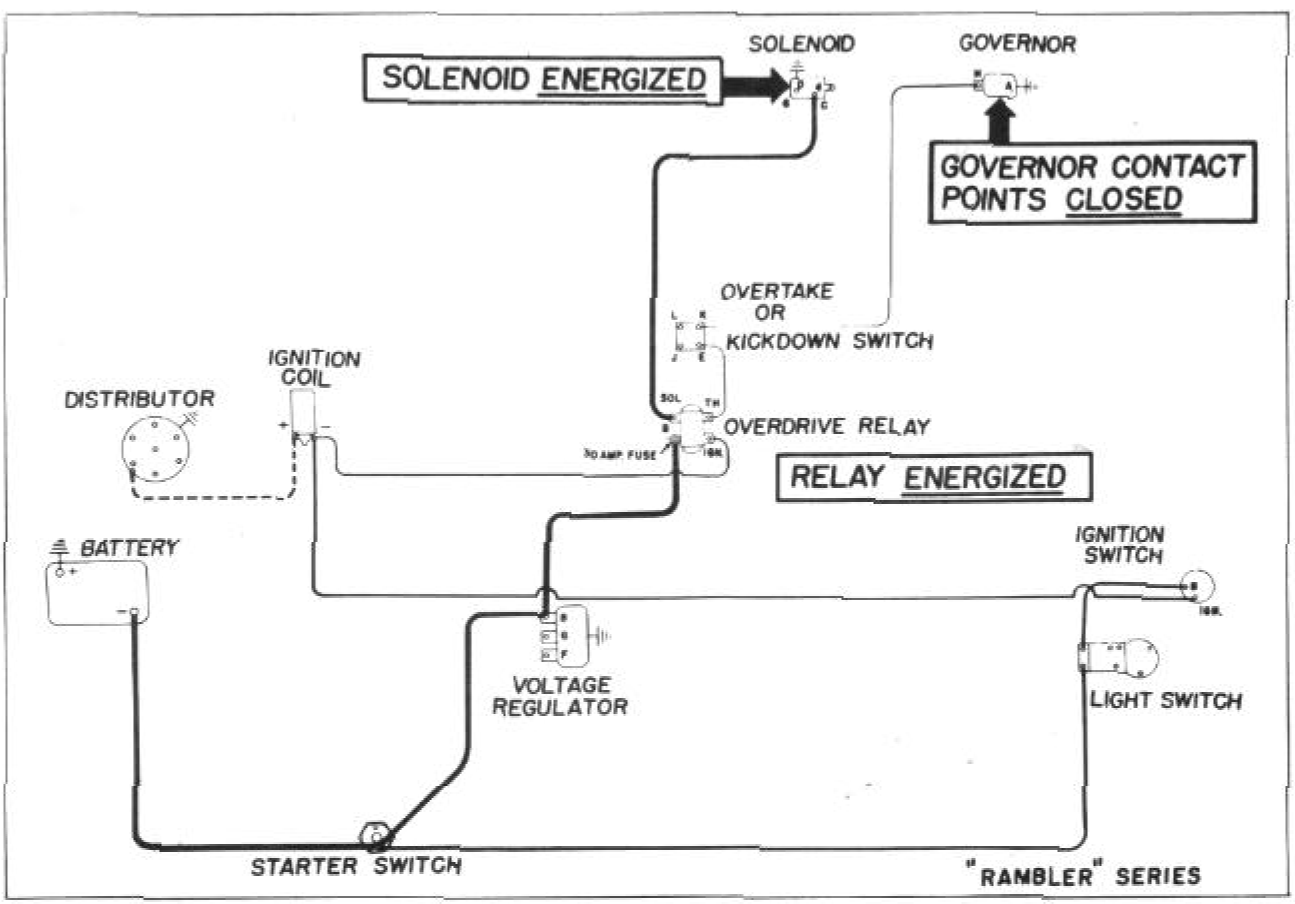


FIGURE 8—***Above 30 Miles Per Hour, the Governor Points Automatically Close, Thus Closing the Governor Circuit and the Relay Which Energizes the Solenoid***

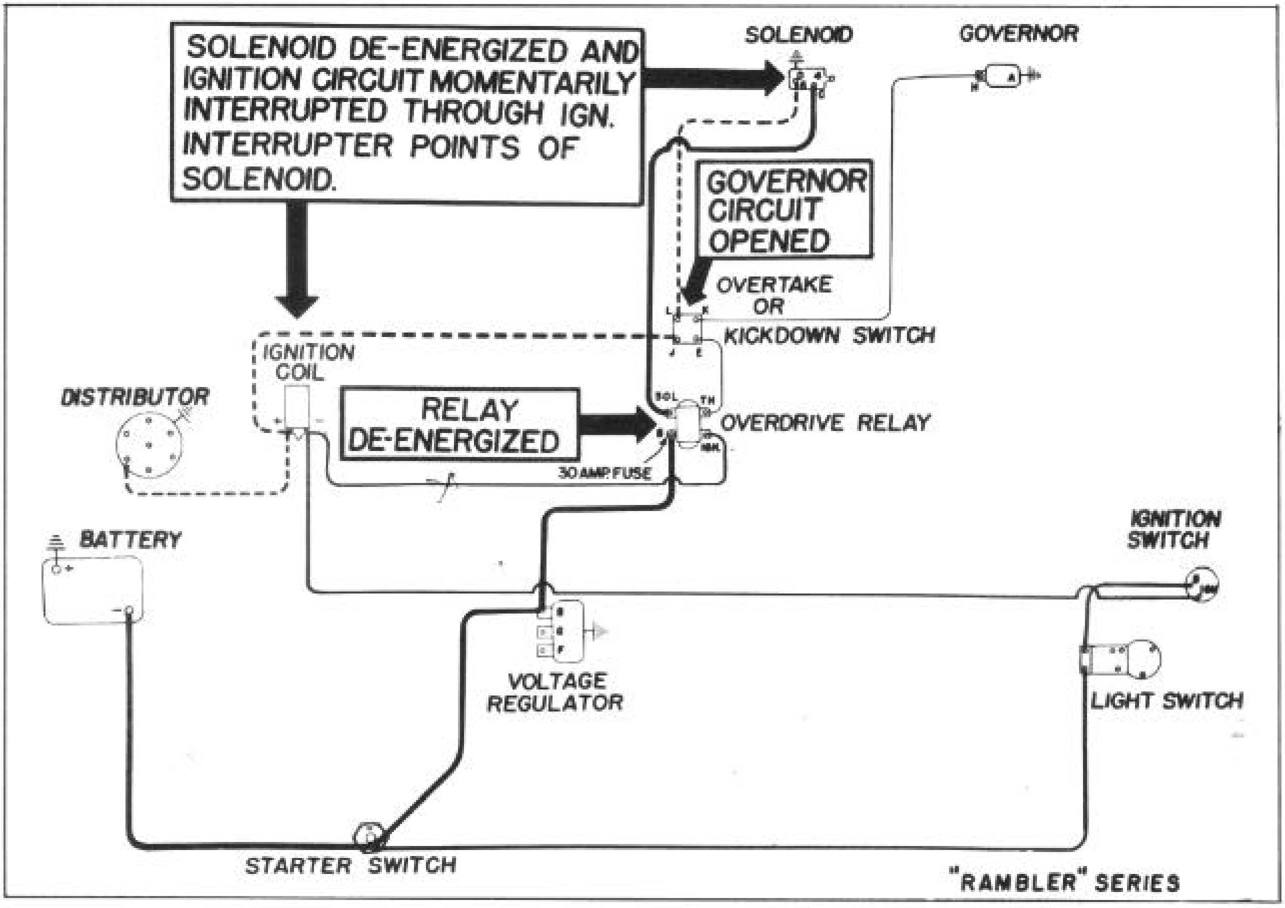


FIGURE 9—*With the Kickdown Switch Open, De-energized. Also, the Distributor is broken and the Solenoid De-energized. Also, the Distributor is Shorted Out to Release Engine Torque*

Incorrect terminal locations of connecting wires.
Circuits grounded by water, dirt, or deformation.
Defective solenoid points.
Dirty or sticking relay contacts.
Insufficient travel or unsatisfactory contacts in the kickdown switch. (Adjust or replace.)
Excessive end play in the governor shaft.
Improper adjustment of governor control springs
Burnt contact points in governor.
Damage to cap and contacts.
Absence of rubber cover to exclude water and dirt.
Insufficient travel of shift rod. (Adjust control cable to operating lever.)

CHECKING INOPERATIVE OVERDRIVE

Mechanical Checks

Determine if the overdrive control button is pushed forward to the limit of travel.
Check to insure that the overdrive cable is adjusted to move the overdrive lever firmly against the stop on the overdrive housing in the engaged position.

Electrical Checks

With the. ignition switch on, and the overdrive button pushed forward, use a test wire or a 6-volt test light as follows:

Check the 30 ampere fuse in the overdrive relay for live circuits and clean contacts.
Connect test lead directly from the hot terminal on the circuit breaker to the terminal "SOL" or No. 4 on the overdrive relay mounted on the front of the cowl. This will supply current to the solenoid which should operate. It is does not, check for a possible defective connecting wire or connection at the solenoid terminal before condemning the solenoid.
Ground the relay terminal "TH" or No. 3. If the relay is functioning properly the points of the relay will close and the solenoid will operate. Ground the terminal "E" on the kickdown switch. If all circuits are correct to this point, the solenoid should operate.
With the kickdown switch terminal "K" grounded, push the plunger in. This breaks the circuit and the solenoid should release.

If the solenoid operates in the above tests, all circuits up to this point are correct and further investigation must be conducted underneath the car.

Ground terminal "H" on the governor. The solenoid should operate.

Governor Operation Inspection: Suspend the axle and operate the engine at low speed in high gem*. Apply a test lamp across the governor contact from the live terminal "H" to the ground strap. The test lamp should light. Now increase engine speed. The governor cut-in speed will be indicated when the light goes out.

Summary

By following the above procedure in the proper sequence, the defective portion of the electrical circuit can be readily located. If all the preceding items are functioning correctly, the trouble may lie in the solenoid itself, such as burned points, or the connecting wires may be grounded to the case.

The kickdown switch should be carefully inspected to see that none of its four terminals are touching each other. If the terminals "E" and "J" make contact, the grounded circuit will supply current to the relay, operating the solenoid without the possibility of disengage. ment. This is usually the case when the car will not free wheel or shift into reverse.

A rubber boot has been provided to exclude water and dirt from the governor. Moisture or an accumulation of foreign matter may ground the line terminal on the governor and cause the solenoid to operate as soon as the ignition is turned on.

If the mechanical and operating checks do not reveal the difficulty, internal trouble should be suspected and the transmission and overdrive removed for examination.

DISASSEMBLING THE OVERDRIVE

NOTE: *Due to the similarity of the "Hornet," "Wasp", and "Rambler" Series Overdrive Units in appearance and operation, most of the illustrations shown refer to the "Hornet" Series.*

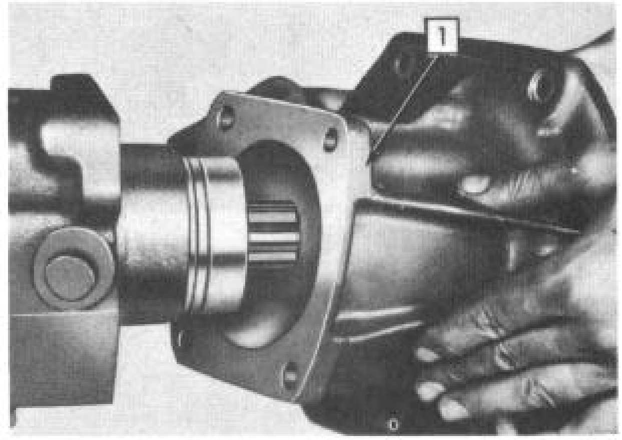
The transmission and overdrive is removed from the car as a unit. However, it is not necessary to disassemble the transmission in order to overhaul the overdrive unless the transmission main shaft, the bearing in the adapter, or other transmission parts require replacement.

With the transmission and overdrive assembly drained of its lubricant and set up in a transmission stand, remove the torque tube adapter ("Hornet" and "Wasp" Series only) (Fig. 10).

Then remove the governor and drive unit assembly from the case (Fig. 11).

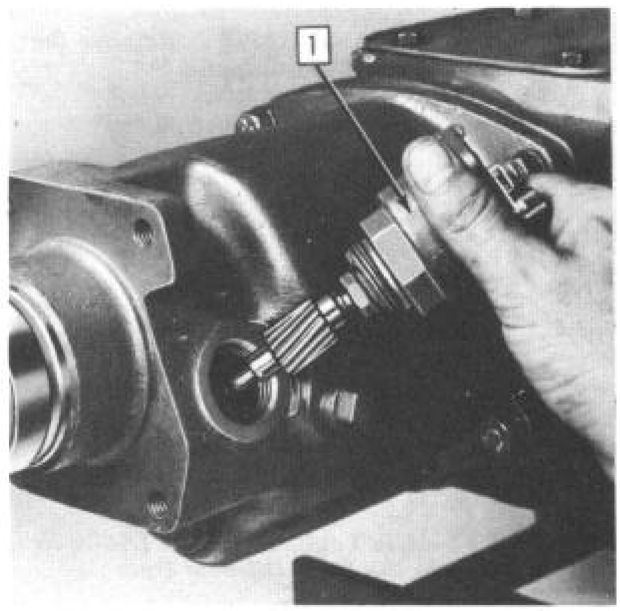
Removing the Overdrive Rear Oil Seal and Adapter

The "Hornet" and "Rambler" Series rear oil seal is pressed into an oil seal adapter. The adapter can be removed from the overdrive case by using Tool J-2497



1. Torque Tube Adapter

FIGURE 10—*Remove the Torque Tube Adapter ("Hornet" and "Wasp" Series Only)*



1. Governor Assembly

FIGURE 11—*Remove Governor Assembly*

(Fig. 12). Tool J-2619 and J-4830 is used to remove the oil seal in those cases where only the replacement of the seal is required (Fig. 13).

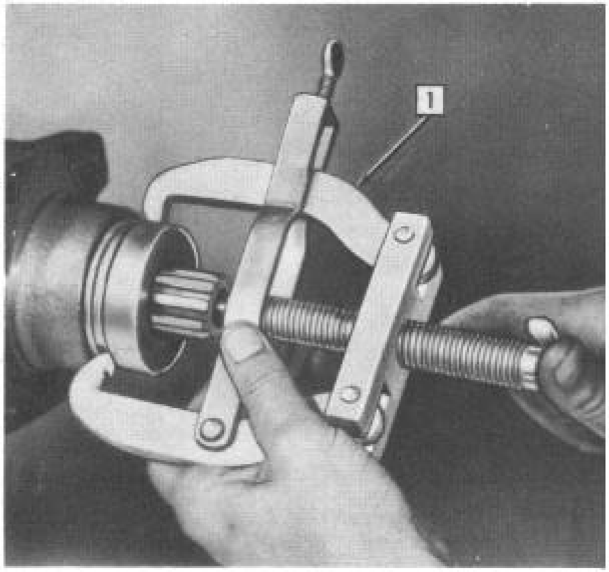
On the "Wasp" Series, the oil seal is pressed into the case and can be removed by using Tool J-2619 and J-4830 (Fig. 13).

After removing the oil seal and/or adapter, remove the main shaft snap ring (Fig. 14).

Disengaging the Shift Shaft

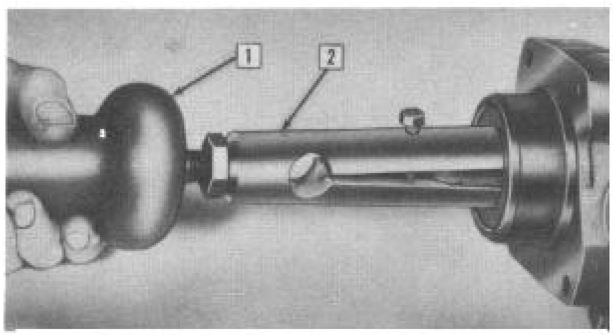
Drive out the lock pin that holds the overdrive shift shaft in the overdrive case (Fig. 15).

After the lock pin has been removed, pull the shaft toward the outside of the case; this disengages the shift shaft from the shift rail.



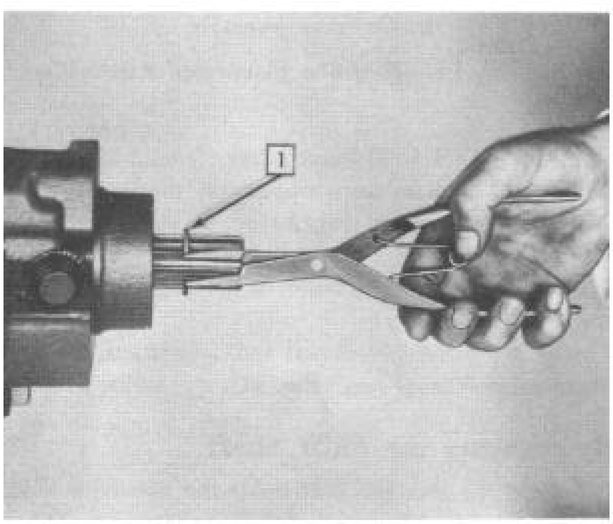
1. Rear Oil Seal Removing Tool

FIGURE 12—*Use Tool J-2497 to Remove the Rear Oil Seal Adapter*



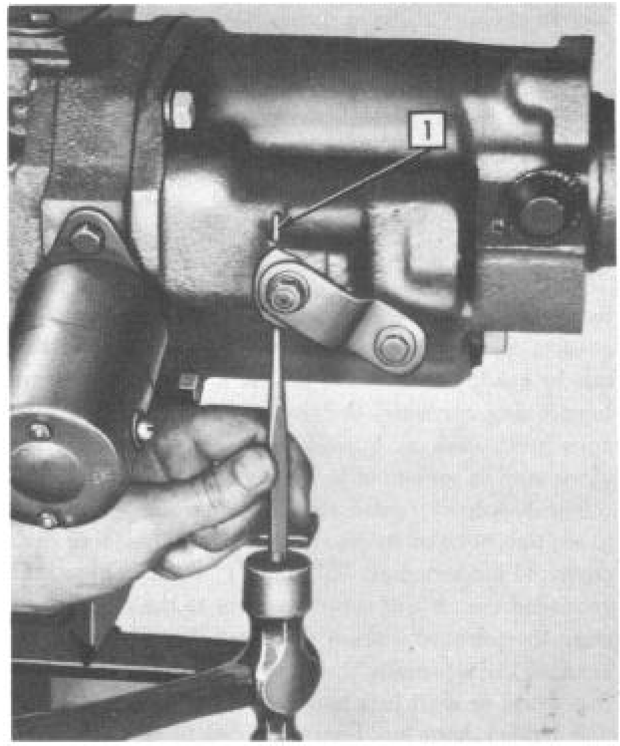
1. Rear Oil Seal Removing Tool J-2619
2. Rear Oil Seal Removing Tool J-4830

FIGURE 13—*Use Tool 1-2619 and J-4830 to Remove the Rear Oil Seal Only*



1. Snap Ring

FIGURE 14—*Remove Main Shaft Snap Ring Using Snap Ring Pliers*



1. Lock Pin

FIGURE 15—*Drive Out Tapered Lock Pin*

Removing the Overdrive Case

Remove the cap screws that hold the overdrive case to the transmission. Then separate the overdrive from the transmission at the rear of the overdrive bearing adapter.

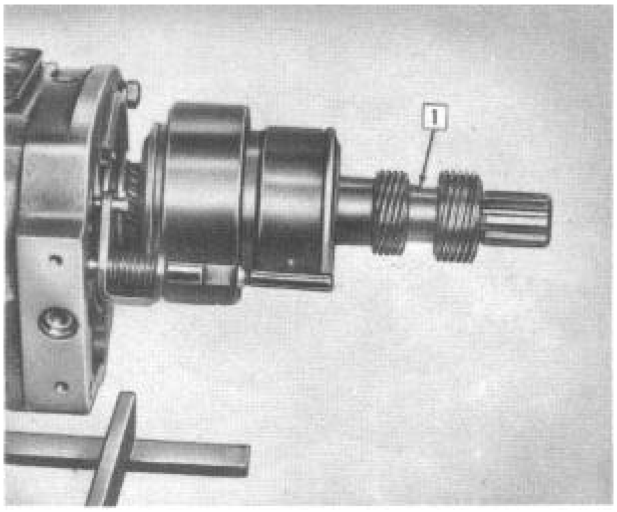
> CAUTION: Do not separate the overdrive hearing adapter from the transmission case. As soon as the overdrive case has been pulled far enough away from the adapter to provide clearance, insert a holding bolt through the adapter and bolt it to the transmission.

As you remove the overdrive case, keep tapping the end of the main shaft with a soft

FIGURE 16—*To Keep the Free Wheeling Rollers From Falling Out, Tap the Main Shaft With a Soft Hammer as You Remove the Overdrive Case*

hammer. This will keep the shaft from coming out, and will prevent the free wheeling rollers from dropping into the case. The speedometer and governor drive gears will remain on the main shaft (Fig. 16).

Both the speedometer and governor drive gears are retained by a Woodruff Key and will easily slide off the main shaft (Fig. 17).

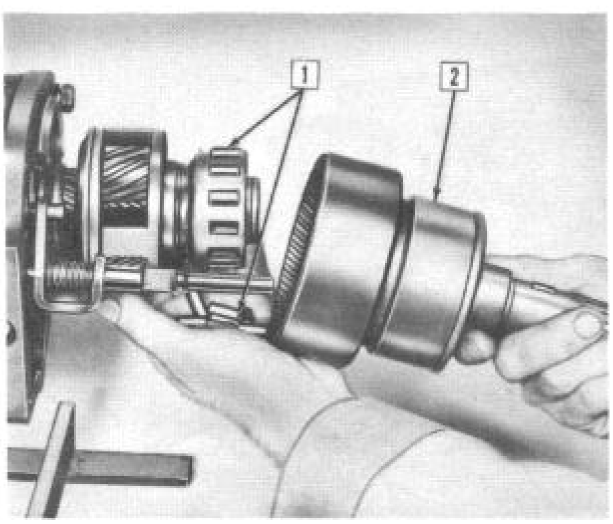


1. Woodruff Key

FIGURE 17—*Both Governor and Speedometer Drive Gears are Retained on the Shaft by a Woodruff Key*

Removing the Main Shaft and Ring Gear

Remove the overdrive main shaft and ring gear. As the main shaft is being removed, the rollers will drop out, so keep one hand underneath to catch them (Fig. 18).



1. Rollers
2. Main Shaft

FIGURE 18—*Remove the Main Shaft and Rollers*

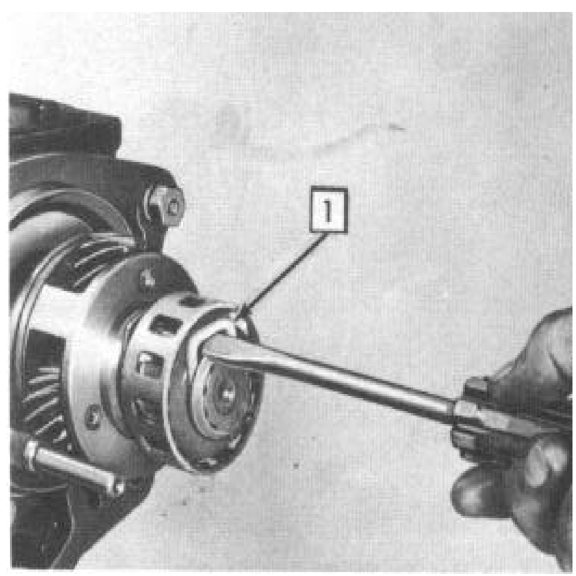
To remove the ring gear from the main shaft, remove the large ring gear snap ring. The gear will then separate from the main shaft (Fig. 191.

FIGURE 19—*Remove the Snap Ring to Separate the Ring Gear From the Main Shaft*

Removing the Cam and Pinion Cage

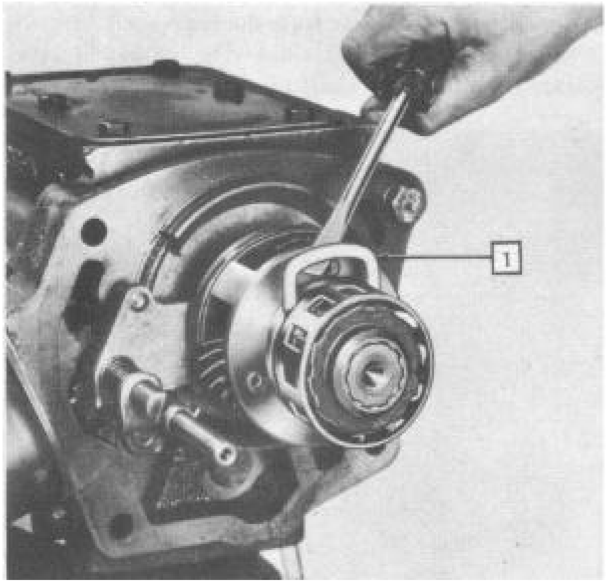
To remove the cam and pinion cage from the transmission main shaft, remove the cam retaining clip with a screw driver (Fig. 20).

The cam can then be separated from the pinion cage by removing the pinion cage retaining clip and separating the two units (Fig. 21).



1. Cam Retaining Clip

FIGURE 20—*Remove Cam Retaining Clip With Screw Driver*

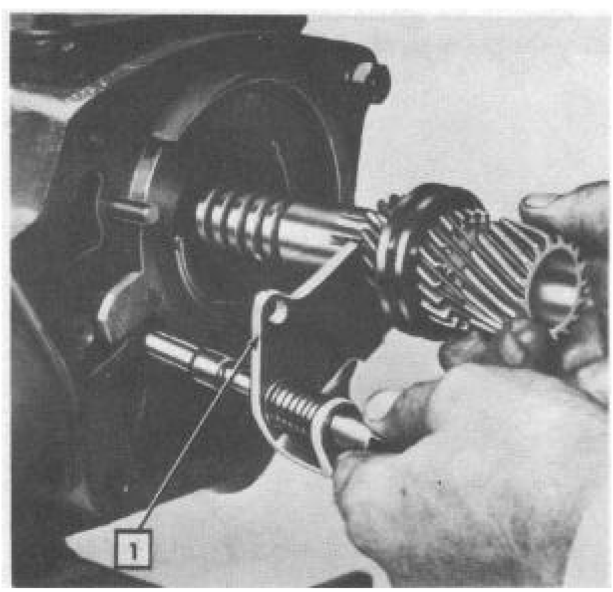


1. Pinion Cage Retaining Clip

FIGURE 21—***The Cam can be Separated From the Pinion Cage by Removing the Pinion Cage Retaining Clip and Sliding the Cage off the Main Shaft***

Removing the Sun Gear and Shifter Rod Assembly

Remove the overdrive shifter rod and sun gear and collar from the main shaft as a unit. When the sun gear is free of the sun gear hub, the shifter rod assembly can be separated from the sun gear shifting collar (Fig. 22).

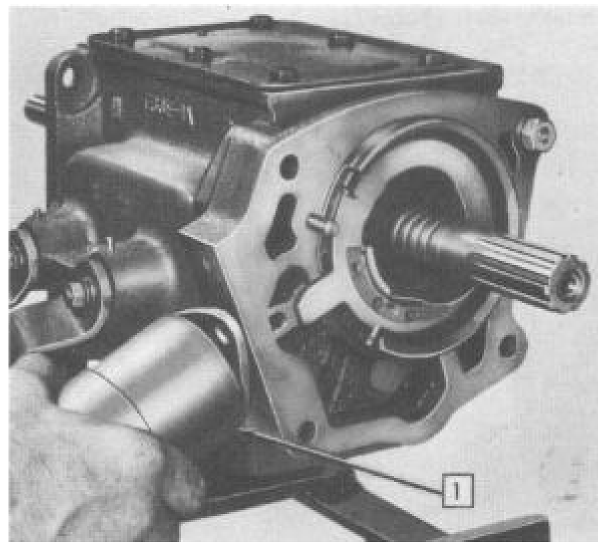


1. Shifter Rod Assembly

FIGURE 22—*The Overdrive Shifter Rod Assembly and the Sun Gear and Collar can be Removed Together*

Removing the Solenoid

Remove the two cap screws that hold the solenoid to the bearing adapter. Turn the unit one-quarter turn clockwise to release the solenoid plunger from the overdrive locking pawl. The solenoid can then be removed (Fig. 23).

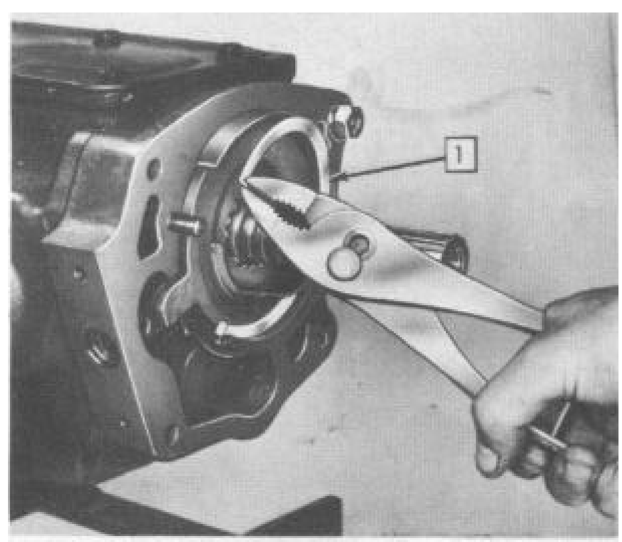


1. Solenoid

FIGURE 23—*Remove the Overdrive Solenoid by Taking out the Cap Screws, Turning the Unit One-Quarter Turn Clockwise, and Pulling it out*

Removing the Cover Plate, Sun Gear Hub and Balk Ring Assembly, and Locking Pawl

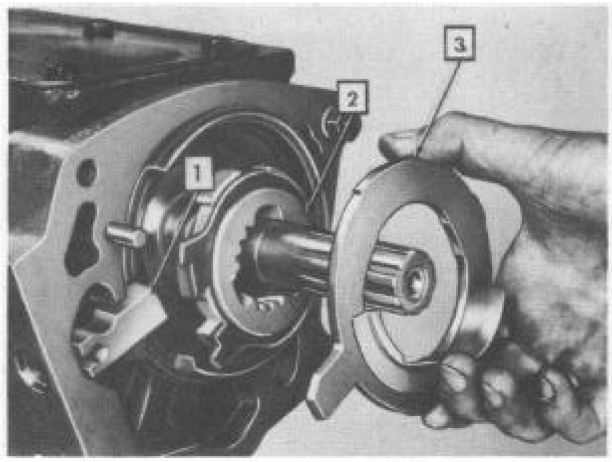
Using a pair of pliers, remove the large snap ring that holds the sun gear cover plate, hub and overdrive balk ring in place (Fig. 24).



1. Snap Ring

FIGURE 24—*Remove Cover Plate Snap Ring*

Remove the cover plate and trough assembly and the sun gear hub assembly. Then the overdrive locking pawl can be lifted out (Fig. 25).



1. **Locking Pawl**
2. **Sun Gear Hub and Balk Ring Assembly**
3. **Cover Plate**

FIGURE 25—*Removing the Cover Plate Allows the Sun Gear Hub Assembly and the Locking Pawl to be Removed*

Removing the Lockout Spring and Shift Shaft

The shifter shaft can easily be removed from the in• side of the overdrive case. Remove the retracting spring, shifter lever, and shaft. Discard the oil seal. A new one will be used on reassembly.

Removing the Main Shaft Bearing

Remove the rear snap ring and tap the bearing out through the rear of the overdrive case. The inner snap ring can then be removed. This completes the disassembly of the overdrive unit. However, if the transmission main (spline) shaft or the bearing adapter must be removed, remove the bearing adapter, the main shaft, and transmission gears as an assembly. Follow the procedure as outlined in' the transmission section.

INSPECTING PARTS

There are no internal adjustments to be made in the overdrive. However, for assurance of good operation, every part should be inspected carefully to be sure it is in good condition. If all parts are up to standard and correctly assembled, the unit will operate properly.

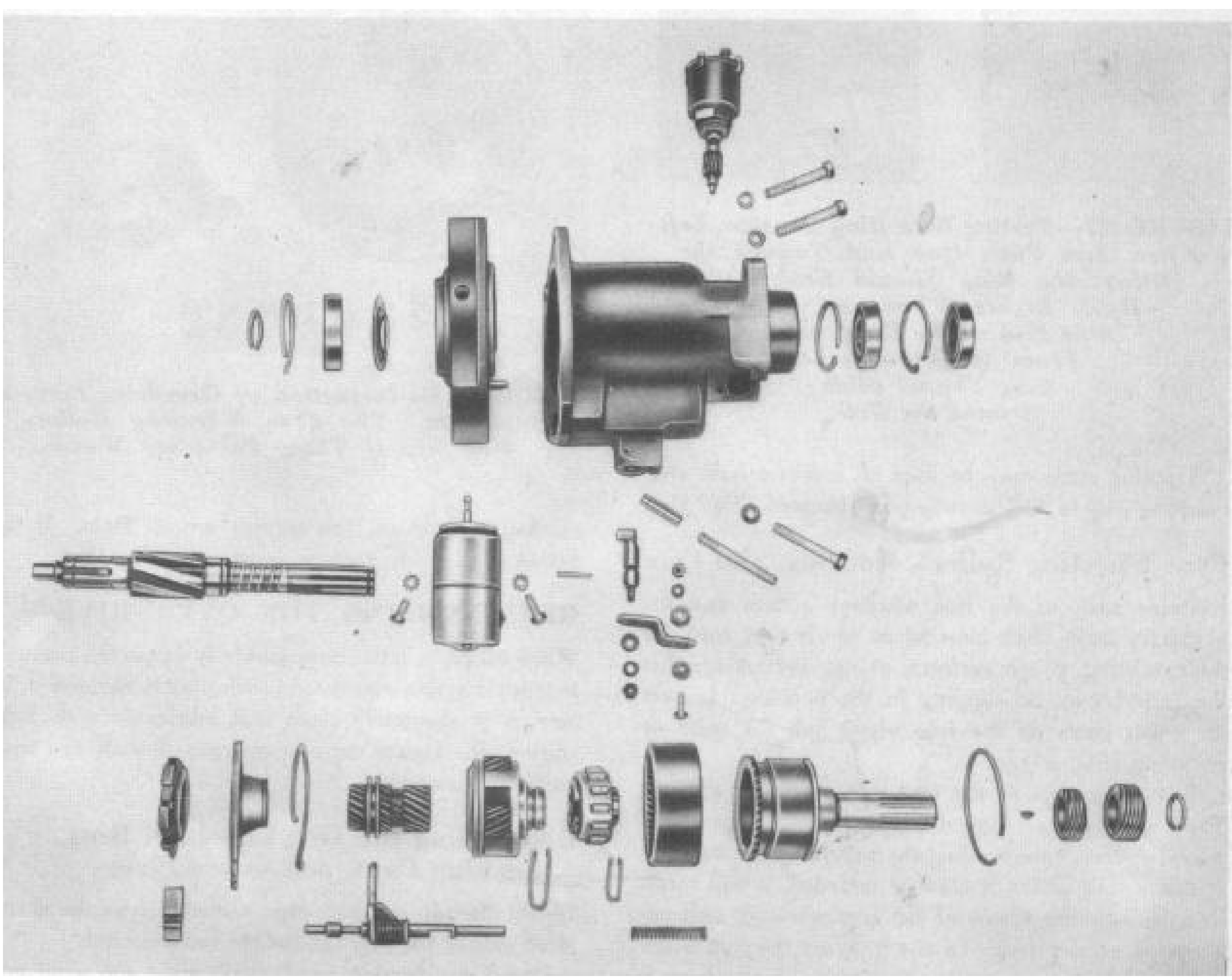


FIGURE 26—Overdrive Assembly ("Wasp" Series Shown)

Pinion Cage and Gears

Examine the pinion gears in the planetary pinion cage for worn, cracked, or chipped teeth. Rotate each gear to see that it does not bind on the pinion shaft. Then examine the oil slinger which is a part of the pinion cage. This slinger supplies lubrication to the pinion gears. If it is bent or otherwise damaged, it will not operate efficiently.

Sun Gear Hub and Balk Ring

Test the fit and tension of the balk ring on the sun gear hub. When pressure is applied in a direction that tends to close the ring, it should bind against the hub so that it will not return. When pressure is applied on the end of the ring in a direction that tends to spread or open the ring. it should slide around the hub (Fig. 27).

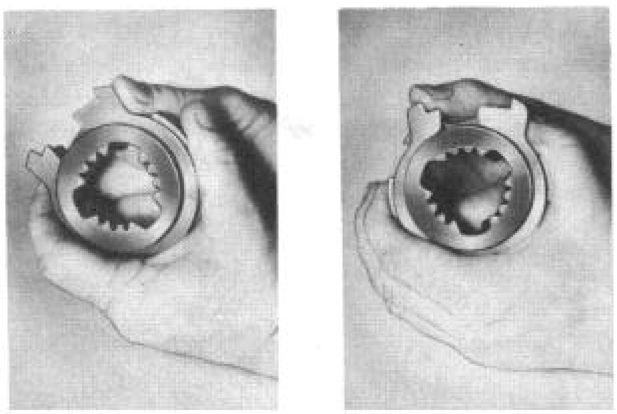


FIGURE 27—***Testing Balk Ring Tension. Left: When You Push One End Toward the Other, the Ring Should Grab and Hold. Right: When you Push One End of the Ring Away From the Other, the Ring Should Slide Around the Hub***

A spring scale may be used to measure balk ring tension-3-1/2 to 5-1/2 pounds pull required (Fig. 28).

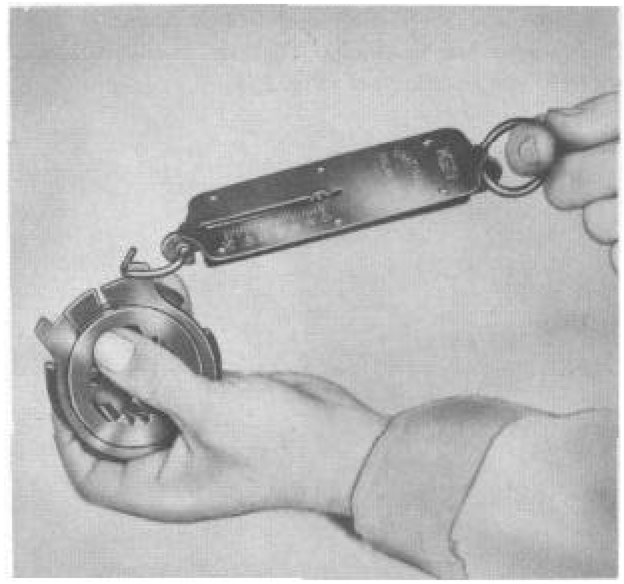


FIGURE 28—***Measuring Balk Ring Tension With Spring Scale-3-1/2# to 5-1/2# Pull***

Free Wheeling Rollers, Housing, and Cam

Examine each of the free wheeling rollers and the overdrive main shaft housing in which they turn for wear, scoring, rough surfaces, or any indications that the rollers may be slipping in the housing. Inspect the roller cams on the free wheel hub for wear or grooving (Fig. 29).

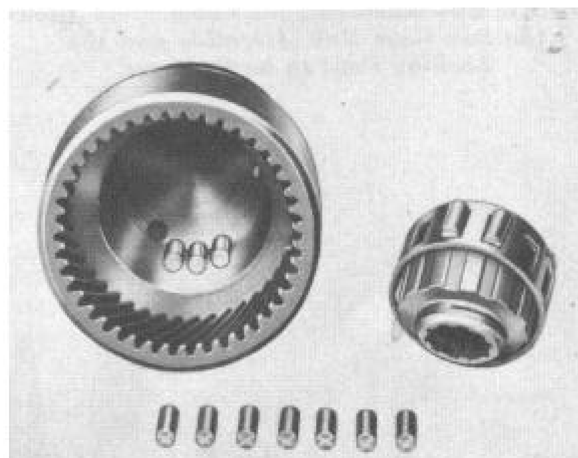


FIGURE 29—***Inspection of Overdrive Parts is Important. The Free Wheeling Rollers Will Slip if These Parts are Worn***

Test the action of the two cam retaining springs. These springs are designed to twist the cam in a clockwise direction, thus holding the rollers up on the cam. If this spring action is slow or retarded, it will result in a loud thump whenever the free wheeling unit engages on acceleration. To test it, grasp the cam roller retainer and turn it counter-clockwise. Then release it suddenly. If the retainer springs quickly back in a clockwise direction, the springs are all right. If the action is sluggish, replace the springs (Fig. 30).

REASSEMBLING THE OVERDRIVE

When all parts have been carefully inspected the unit is ready for reassembly. As each part is assembled, be sure it is absolutely clean and lubricated with light engine oil. Always use new gaskets, oil seals and snap rings in reassembly.

Reinstalling the Hub and Balk Ring,
Locking Pawl, and Cover Plate

Install the hub and balk ring assembly with the chamfered side of the ring against the sun gear hub.

Install the locking pawl, positioning the pawl and balk ring in the "locked-out" position, with the pawl

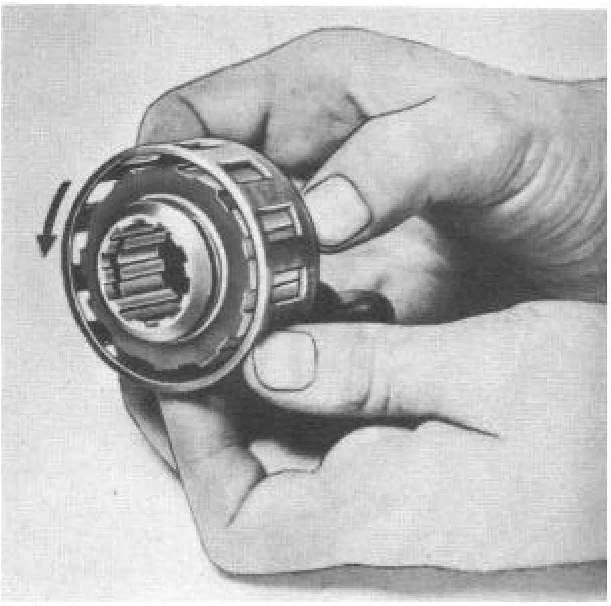


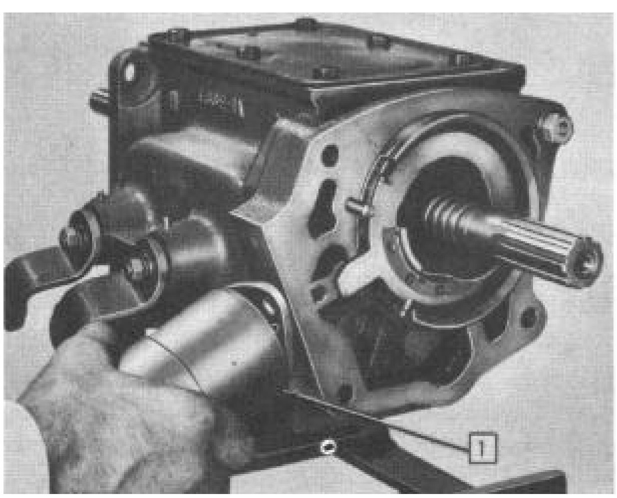
FIGURE 30—*When You Twist the Cam Roller Retainer Counter-Clockwise, the Two Springs Should Snap it Back Quickly*

on the step of the ring for correct installation of the solenoid.

Install the cover plate and trough in position and lock it in place with the large snap ring.

Reinstalling the Solenoid

Insert the solenoid plunger in the opening in the bearing adapter and engage it with the notch in the locking pawl. Turn the solenoid one-quarter turn counterclockwise to lock the pawl and plunger together. Pull the solenoid to be sure the plunger is locked with the pawl. Then install the two cap screws loosely (Fig. 311.

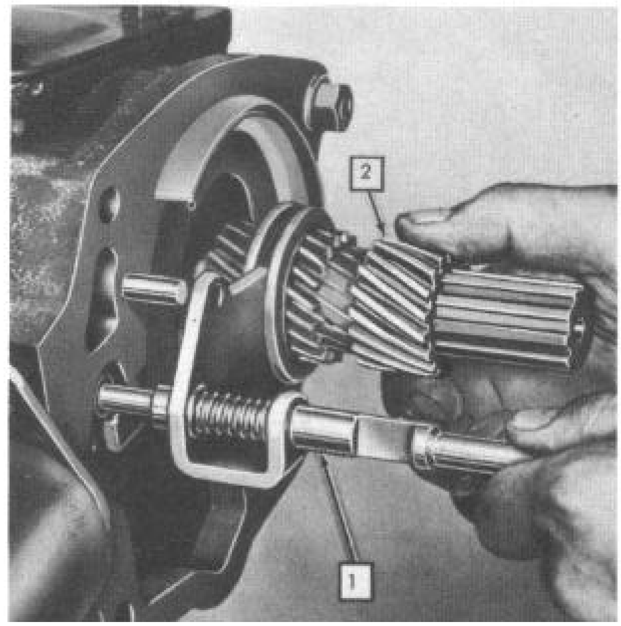


l. **Solenoid**

FIGURE 31—*Install the Solenoid by Turning It Counter-Clockwise so the Plunger Will Lock with the Pawl*

Reinstalling the Sun Gear and Shifter Rod Assembly

Install the fork of the shifter rod in the sun gear shift collar. Then hold them together as you slide the sun gear onto the main I spline 1 shaft and the shifter rod into the opening in the hearing adapter I Fig. 32 I .



1. Shifter Rod 2. Sun Gear

FIGURE 32—The Shifter Rod and Fork Assembly is Installed With the Sun Gear and Collar

Reinstalling the Pinion Cage and Cam

Install the pinion cage assembly on the main (spline shaft, being careful not to distort the oil slinger. Then slide the free wheeling cam assembly onto the shaft, line up the slots in the pinion cage with the slots in the free wheeling cam, and install the pinion cage retaining clip (Fig. 33).

Install the free wheeling cam retaining clip.

After installing the retaining clips, shift the sun gear in and out of engagement to insure clearance between the sun gear and the oil trough.

Reinstalling the Ring Gear and Main Shaft

Replace the ring gear on the overdrive main shaft and lock it in place with a snap ring (Fig. 341.

The Free Wheeling Rollers

Replace the free wheeling rollers in the free wheeling cam retainer. A small rubber band placed around the rollers will help to keep the rollers from dropping out while the main shaft and ring gear is being installed (Fig. 351. Now rotate the cage and roller assembly counterclockwise so that the rollers will be at the bottom of the cams. This will permit the

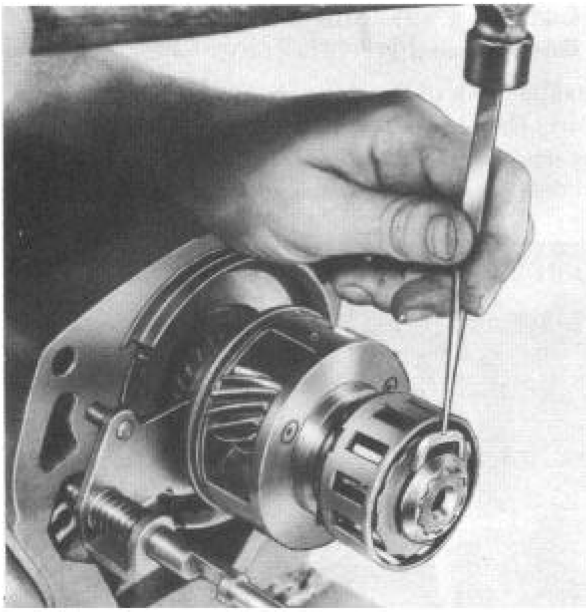
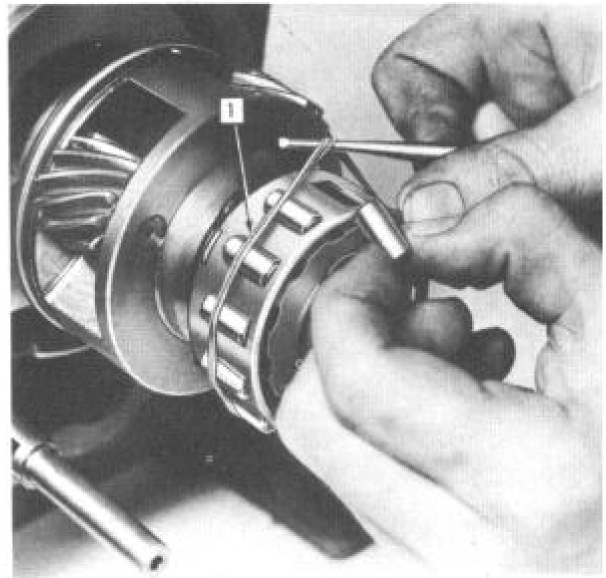


FIGURE 33—*With the Free Wheeling Cam and Pinion Cage on the Main (Spline) Shaft, Lock Them in Place With the Pinion Cage Retaining Clip and the Free Wheeling Cam Retaining Clip*

FIGURE 34—Install a Snap Ring to Hold the Ring Gear on the Main Shaft

installation of the overdrive main shaft and ring gear assembly (Fig. 36).



1. Rubber Band

FIGURE 35—*A Rubber Band Serves to Hold the Free Wheeling Rollers in Position until the Ring Gear and Main Shaft can be Installed*

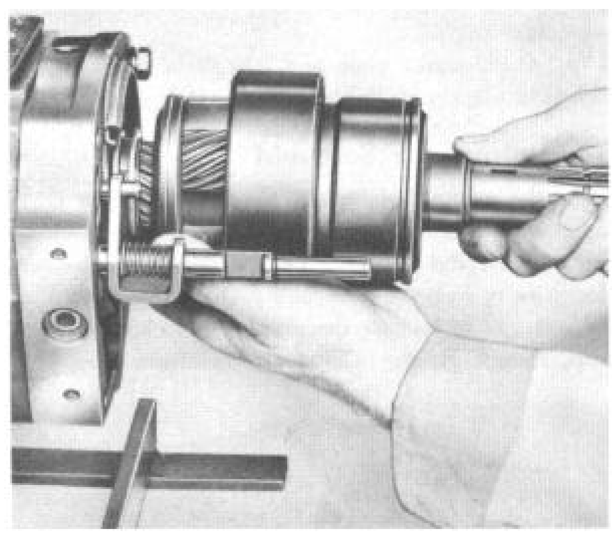


FIGURE 36—*Install the Main Shaft and Ring Gear on the Pinion Cage and Free Wheeling Cam*

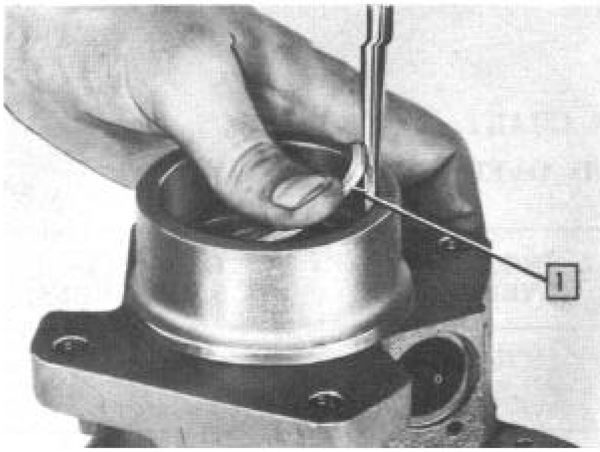
The Speedometer and Governor Drive Gears

Insert the Woodruff Key into the main shaft. Then install the governor and speedometer drive gears. The governor drive gear which is smaller in diameter, is installed against the shoulder on the main shaft.

Reinstalling the Main Shaft Bearing in the Case

Install the bearing inner snap ring in the overdrive case. Press the bearing in from the rear of the case until it seats against this

this ring. Then install the bearing outer snap ring (Fig. 37).



1. Snap Ring

FIGURE 37—*Install a Snap Ring on Each Side of the Overdrive Rear Bearing*

Reinstalling the Shift Shaft and Overdrive Case

Install the shift shaft oil seal, shift shaft, shifting lever, and the shifter rod spring in the overdrive case. Then remove the bolt holding the bearing adapter to the transmission case, and work the overdrive case onto the overdrive assembly. Remove plate adjacent to speedometer opening and insert a long punch through the opening to guide the shifter rod through the spring and case.

Install the stud spacer to maintain case alignment and replace the cap screws. Tighten securely.

Push the shift shaft into the case so that the operating cam will engage with the slot in the shift rod. Then install the lock pin to hold the shaft in position.

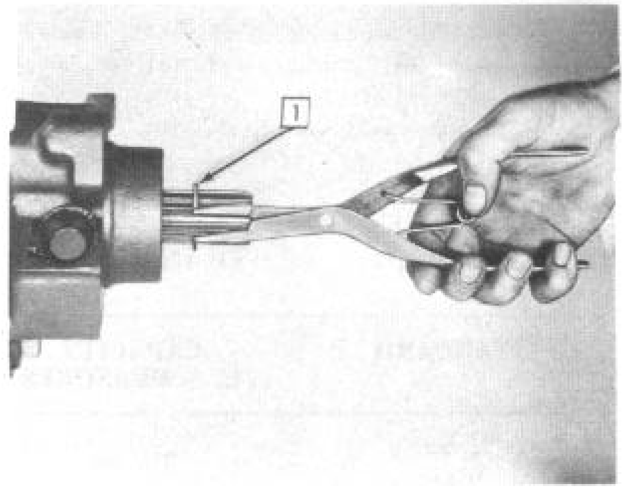
> NOTE: *Inspect the operation of the shift lever as follows: With the lever against the machined stop on the boss of the case, a slight free movement with no tension should be evident. Excessive movement with no tension indicates that the shift rod is binding in the case.*

Finally, tighten the solenoid cap screws.

Completing the Reassembly of the Overdrive

Install the main shaft snap ring. This snap ring is supplied in .087", .090", .093", .096", and .100" thicknesses. Use the largest size possible to prevent end play (Fig. 38).

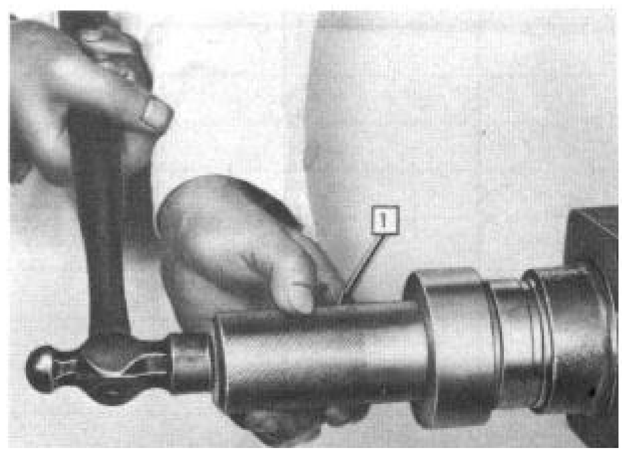
> NOTE: *In some overdrive units, an overdrive main shaft spacer (steel washer) is used. This spacer is installed between the rear bearing and snap ring on the main shaft.*



1. Snap Ring

FIGURE 38—*Use Snap Ring Pliers to Install the Snap Ring*

Then install the oil seal adapter and oil seal (the "Wasp" Series oil seal is installed in the overdrive case). Use Tool J-1354 oil seal installing tool for the "Hornet" and "Wasp" Series (Fig. 39) ; J-4485 on the "Rambler" Series.



1. Tool J-1354

FIGURE 39—*Install the Oil Seal*

Now install the governor. Then install the torque tube adapter on the overdrive case.

LUBRICATION OF THE OVERDRIVE

Check the lubricant level of the transmission and overdrive every 1,000 miles. Transmission and overdrive units should be filled to the drain plug level on the right side of both units.

Drain and clean twice a year, or every 10,000 miles, using only flushing oils. Do not use gasoline, kerosene. steam, etc.

For atmospheric temperatures above 32° Fahrenheit, use Mineral Oil Gear Lubricant SAE No. 90 in the transmission and overdrive.

Below 32° Fahrenheit, use SAE No. 80.

Where difficulty in shifting is experienced in subzero temperatures, dilute the transmission and overdrive oil as required, using light engine oil.

LUBRICATION CHART
TRANSMISSION AND OVERDRIVE

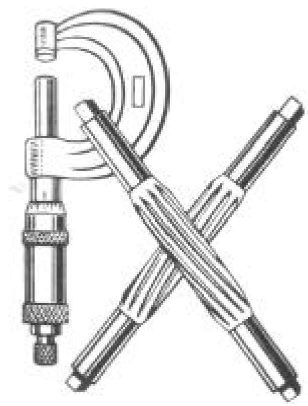
STANDARD	CAPACITY (U. S. MEASURES)	INCLUDING OVER-DRIVE	CAPACITY (U. S. MEASURES)
"Hornet" Series	2-1/4 pts.	"Hornet" Series	3-1/2 pts.
"Wasp" Series	2-1/4 pts.	"Wasp" Series	3-1/2 pts.
"Rambler" Series	1-1/2 pts	"Rambler" Series	2-3/4 pts

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



SHIFTING SYSTEM SECTION

ADJUSTING THE SHIFTING MECHANISM

Standard and Overdrive 2

Hydra-Matic 8

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DISASSEMBLING THE SHIFTING MECHANISM "HORNET" AND "WASP" SERIES

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ASSEMBLING THE SHIFTING MECHANISM "HORNET" AND "WASP" SERIES

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SHIFTING SYSTEM

SHIFTING SYSTEM SECTION

ADJUSTING THE SHIFTING MECHANISM

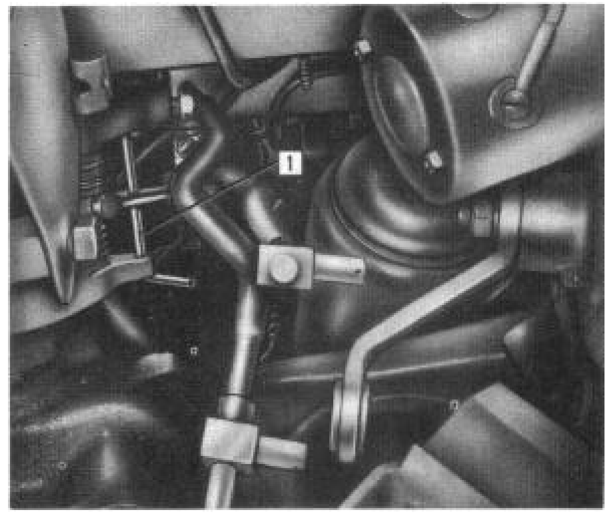
Standard and Overdrive Transmission

Place the gear shift lever in the neutral position. Disconnect the gear shift rods at the transmission shift levers, and place the levers in a neutral position.

Install an aligning tool by inserting in the small holes in the gear shift operating levers and the grooves of the bearing housing. A 6" (.1875") diameter rod can be used as an aligning pin (Fig. 1).

With the aligning tool in position and the transmission shift levers in neutral, adjust the shifting rods at the transmission end. After the rods have been adjusted and again connected to the shift levers, remove the aligning tool.

CAUTION: Be careful not to move the transmission levers out of the neutral position as the adjustment is being made.



1. Aligning Pin

FIGURE 1—*An Aligning Pin is Used to Retain the Operating Levers in a Neutral Position While Adjusting the Shifting Rods*

DISASSEMBLING THE SHIFTING MECHANISM

Standard and Overdrive Transmission

"Hornet" and "Wasp" Series

To remove the shifting mechanism from the steering jacket tube, remove the horn blowing parts, the steering wheel nut and the steering wheel.

Remove the screws that hold the bearing retainer to the steering jacket tube, and remove the bearing retainer (Fig. 3).

If equipped with directional signals, disconnect the wire terminals under the dash. Tag each wire for ease of identification at time of assembly.

Slide the rubber grommet upward on the jacket tube

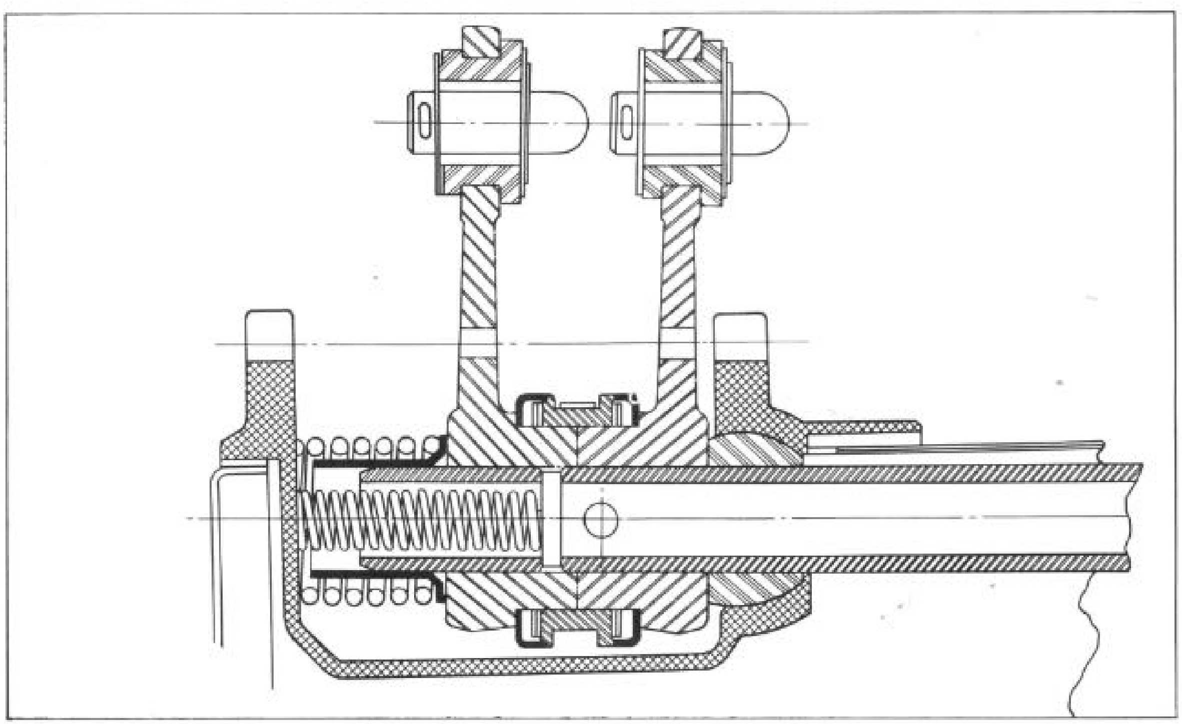


FIGURE 2—*Gear Shift Operating Levers and Bearing Housing Assembly—"Hornet" and "Wasp" Series*

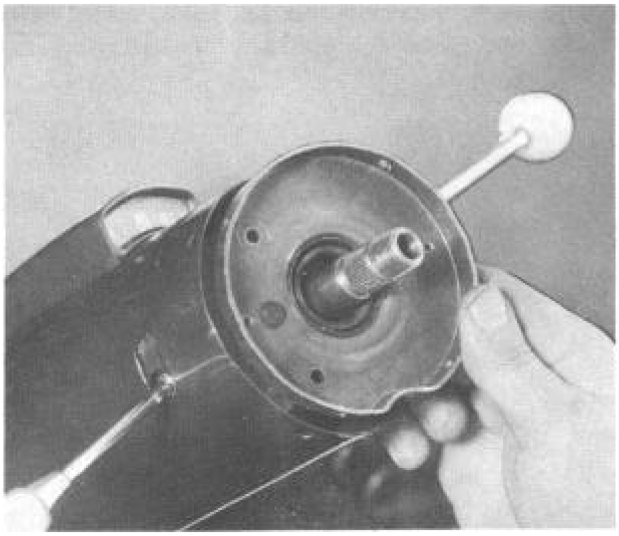


FIGURE 3—*Lift Bearing Retainer from the Steering Jacket Tube*

and fold the floor mat over toward the center of the floor. Then slide the rubber insulator pad up to the rubber grommet.

Remove the screws from the clutch and brake pedal opening cover and slide the cover up on the pedal shafts. Loosen the pedal cap screws and remove the pedals and cover.

Disconnect the gear shift rods from the gear shift operating levers. Loosen the clamp bolt at the lower end of the jacket tube and steering gear housing.

On the "Hornet" Series, remove the upper and lower front steering gear mounting bolts. Loosen the lower rear bolt about two turns, but do not remove. On the "Wasp" Series, remove the three upper bolts and loosen the lower bolt.

Disconnect the steering gear jacket tube bracket at the instrument panel, and remove the jacket tube and shifting assembly by raising it through the floor opening and over the steering gear tube (Fig. 4).

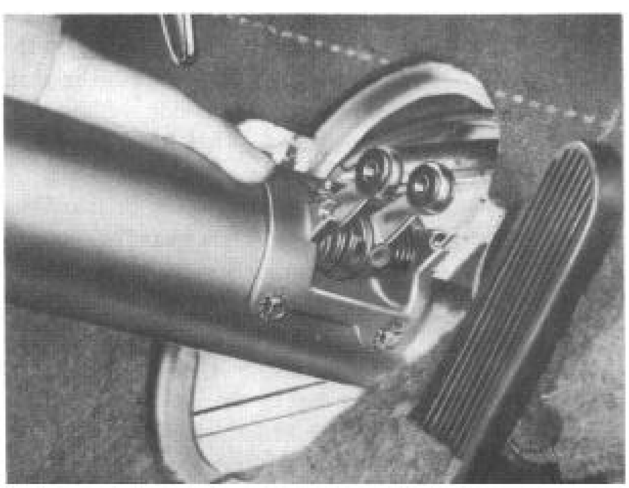
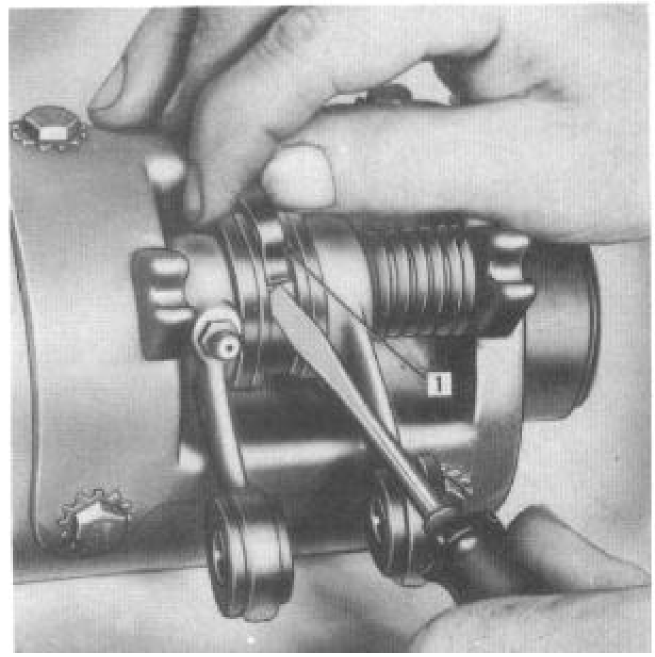


FIGURE 4—*Removing the Steering Gear Jacket Tube and Shifting Assembly*

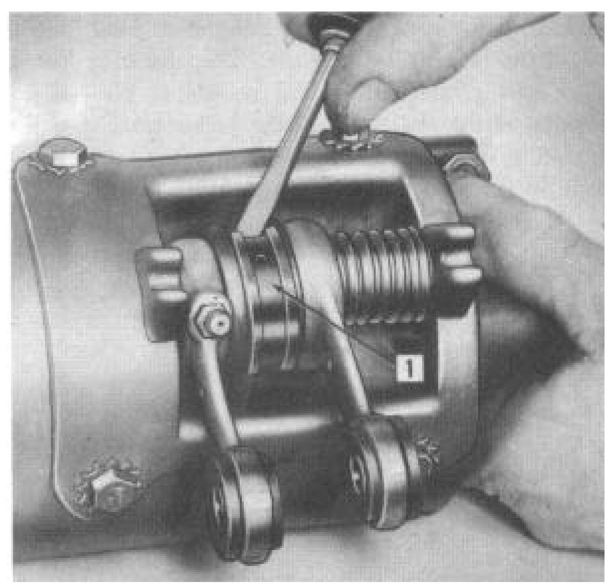
Place the jacket tube assembly on a cloth covered bench to protect the paint surface. Then remove the dirt seal spacer retainer (Fig. 5).



1. Dirt Seal Spacer Retainer

FIGURE 5—*Removing Dirt Seal Spacer Retainer*

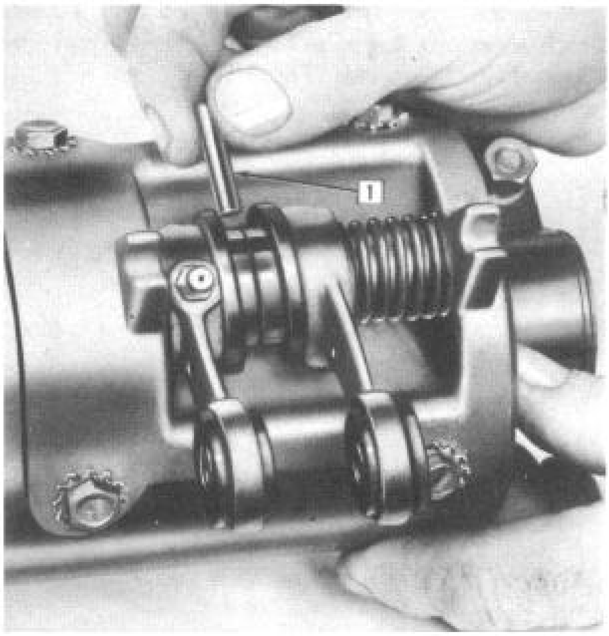
Remove the two halves of the dirt seal spacers (Fig. 6L



1. Dirt Seal Spacer

FIGURE 6—*Removing Dirt Seal Spacers*

Turn the operating levers upward, and with a small punch or drift, push the selector pin out of the operating shaft; turn the levers down, and remove the pin from the second and high operating lever (Fig. 7).



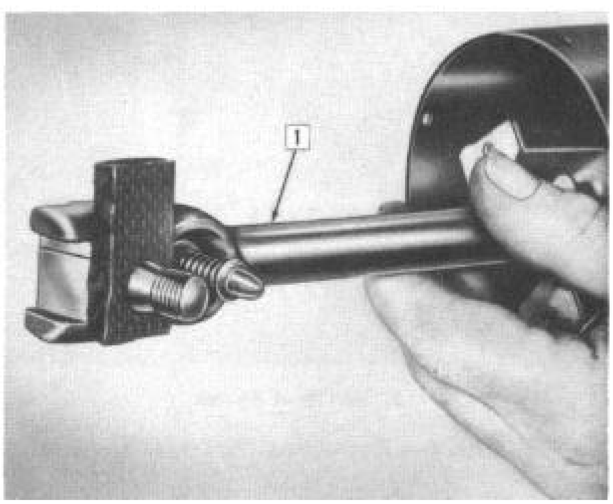
1. Selector Pin

FIGURE 7—*Removing the Selector Pin*

NOTE: *The selector pin can only be removed through the machined notch on the second and high operating lever; this lever contains the lubrication fitting.*

Remove the gear shift lever knob. A machined flat is provided, for a 3/8" wrench, to remove lever.

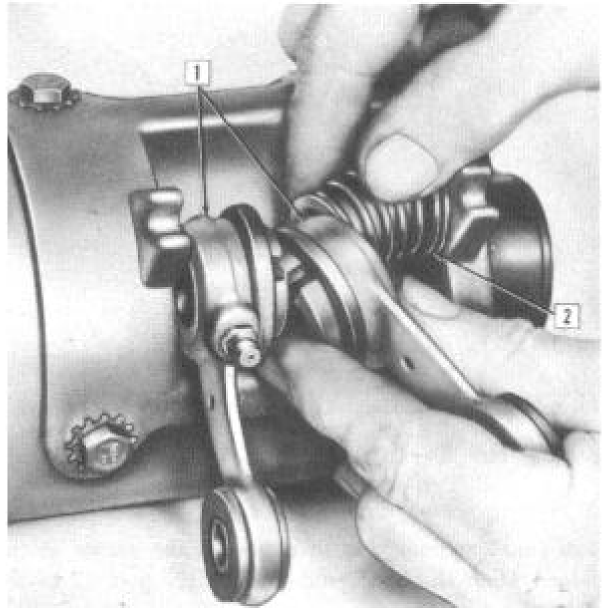
Remove the gear shift operating shaft by lifting it out of the jacket tube (Fig. 8). The operating levers, outer spring, and spacer will remain in the bearing housing at the lower end of the jacket tube after the operating shaft is removed. The inner spring may remain in the lower end of the operating shaft.



1. Gear Shift Operating Shaft

FIGURE 8—*Removing Gear Shift Operating Shaft*

Remove the gear shift operating levers, spacer, outer spring, and bronze fulcrum from the bearing housing (Fig. 9).



1. Gear Shift Operating Levers
2. Spacer and Outer Spring

FIGURE 9—Removing Operating Levers and Component Parts

Now remove the dirt seals from the operating levers.

To complete the disassembly of the shifting mechanism on "Hornet" and "Wasp" Series equipped with standard or overdrive transmissions, remove the bearing housing from the jacket tube if necessary.

ASSEMBLING THE SHIFTING MECHANISM

Standard and Overdrive Transmission

"Hornet" and "Wasp" Series

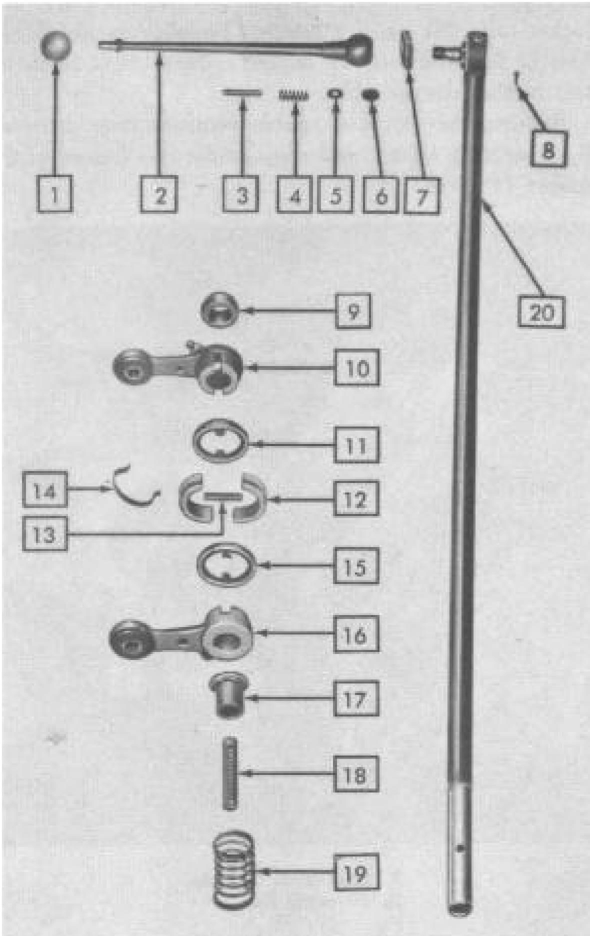
Install the gear shift operating bearing housing on the jacket tube. Replace the dirt seals on both gear shift operating levers locating the metal side of the seal toward the selector pin groove. This is to provide a hard bearing surface for the pin.

Apply a coat of lubriplate to the bronze fulcrum and place it in the bearing housing. Then insert the second and high, and reverse operating levers, outer spring, and spacer in the bearing housing.

Install the inner spring (holding it in place with lubriplate) in the lower end of the operating shaft and insert the shaft, from the top of the jacket tube, down through the bronze fulcrum and shift levers.

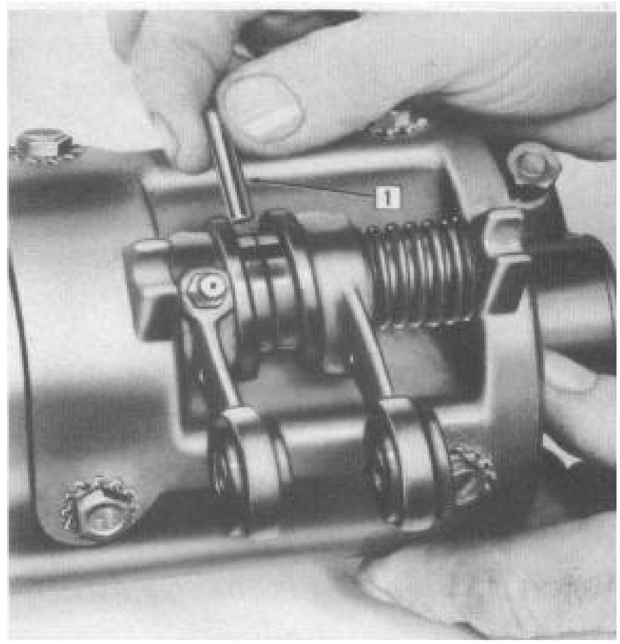
Align the operating shaft selector pin hole with the slot in the second and high shift lever, and insert the selector pin (Fig. 11).

Then install the two dirt seal spacers and



1. Lever Ball
2. Gear Shift Lever
3. Pressure Spring Pin
4. Pressure Spring
5. Pressure Spring Washer
6. Pressure Spring Washer Cushion
7. Gear Shift Damper
8. Cotter Pin
9. Operating Shaft Bronze Fulcrum
10. Gear Shift Operating Lever
11. Dirt Seal
12. Dirt Seal Spacer
13. Selector Pin
14. Dirt Seal Spacer Retainer
15. Dirt Seal
16. Gear Shift Operating Lever
17. Spacer
18. Inner Spring
19. Outer Spring
20. Operating Shaft

FIGURE 10—*Steering Post Shifting Assembly*



1. Selector Pin

FIGURE 11—*Installing the Selector Pin*

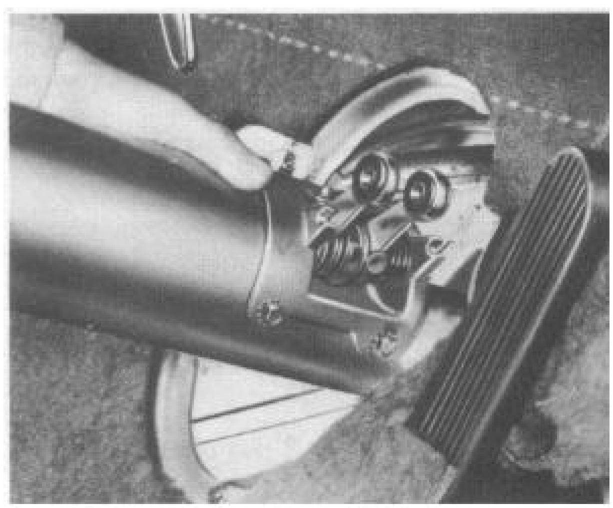


FIGURE 12—*Installing the Jacket Tube and Shifting Assembly*

dirt seal spacer retainer.

Apply lubriplate to the pressure spring pin. Apply lubriplate to the ball end of the gear shift lever and tighten the lever to the operating shaft. Install the gear shift lever ball.

Apply a coat of lubriplate to the rubber grommet at the lower end of the jacket tube. Then install the jacket tube assembly (Fig. 12) attaching the bracket to the instrument panel.

Tighten the clamp bolt at the lower end of jacket tube and steering gear housing and install the steering gear mounting bolts.

Install the shifter rods to the gear shift operating levers. Then install the bearing retainer (Fig. 13), steering wheel, and horn blowing parts.

NOTE: *If equipped with directional signals, connect wires to their respective terminals.*

Replace the clutch and brake pedal assembly and insulator grommet. Fold the floor mat back in place and slide the rubber grommet tight against the floor mat.

Pressure lubricate the operating shift levers. Then adjust the shift mechanism.

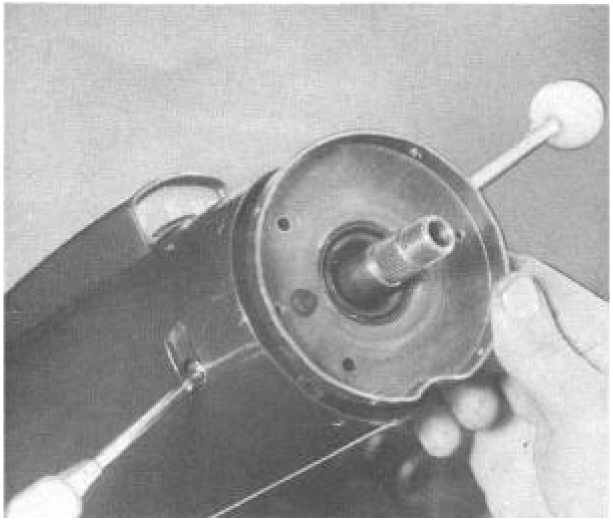


FIGURE 13—*Installing the Bearing Retainer*

DISASSEMBLING THE SHIFTING MECHANISM

Standard and Overdrive Transmission

"Rambler" Series

Remove the gear shift lever knob. Then remove the gear shift lever nut. After the nut is removed, push the lever toward the dash panel. This will loosen the chrome ball permitting it to slide from the lever (Fig. 14).

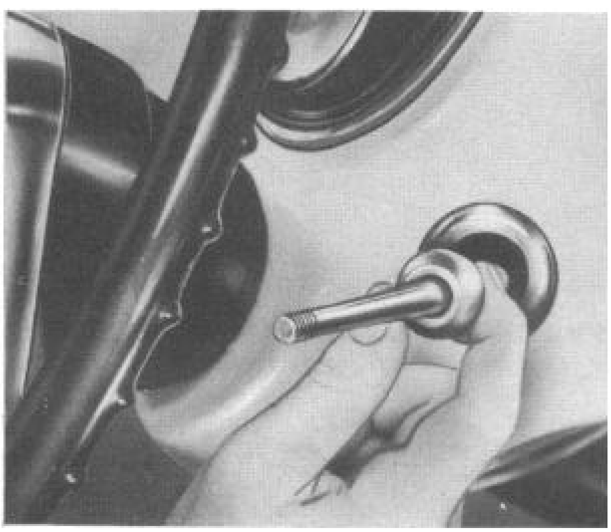
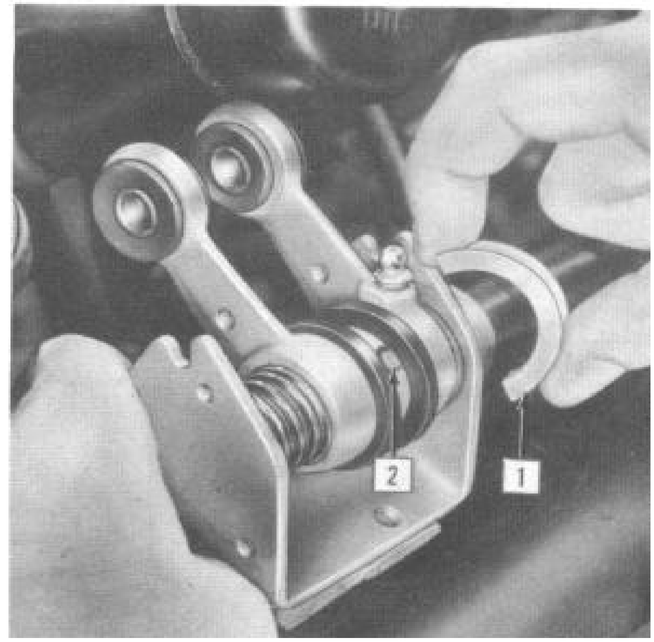


FIGURE 14—*To Remove the Chrome Ball, Push the Gear Shift Lever Toward the Dash Panel*

Disconnect the gear shift rods from the operating levers at the bottom of the steering jacket tube by removing the cotter pins, and lifting the rods out of the levers.

Remove the "U" bolt holding the operating lever housing and bracket to the lower end of the steering jacket tube. The entire bearing housing assembly can now be lowered into the engine compartment to facilitate further disassembly.

Remove the dirt seal spacer retainer from between the operating levers, and remove the two halves of the spacer (Fig. 15).



1. Dirt Seal Spacer
2. Selector Pin

FIGURE 15—*Remove the Dirt Seal Spacer*

Push out the selector pin part way only from the top, and remove the pin from the underside of the operating shaft. This will permit the remaining portion of the operating lever housing assembly to be removed and disassembled in the bench vise (Fig. 16).

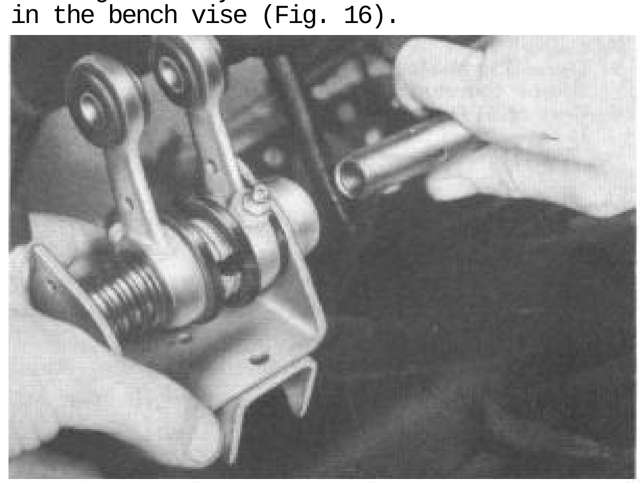


FIGURE 16—*Remove the Operating Lever Housing from the Operating Shaft*

Place the bearing housing in a vise and remove the large outer spring and spacer. This will permit the low and reverse, second and

and high operating levers, the bronze fulcrum, and the inner spring to be removed (Fig. 17) .

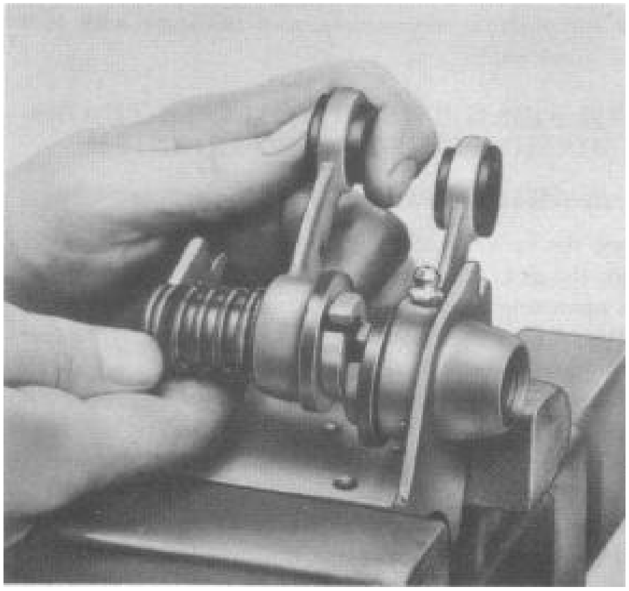


FIGURE 17—*Remove the Large Outer Spring and Spacer*

The gear shift lever and operating shaft can be removed from the passenger compartment to complete the disassembly.

ASSEMBLING THE SHIFTING MECHANISM

Standard and Overdrive Transmission

"Rambler" Series

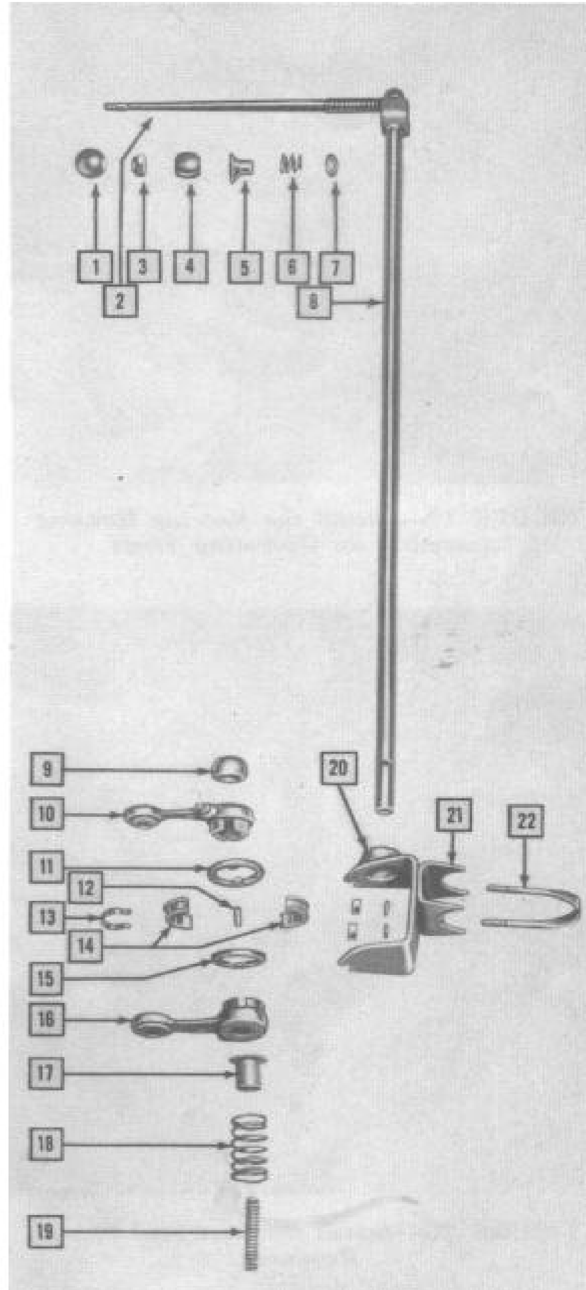
Apply a small amount of lubriplate to the bronze fulcrum and install it in the bearing housing.

Install the rubber dirt seals on both gear shift operating levers, locating the metal side of the seal toward the selector pin groove to provide a hard bearing surface for the pin. Place the operating levers in the bearing housing, and install the large outer spring and spacer against the low and reverse operating lever. Line up the holes in the operating levers and bronze fulcrum with the hole in the bearing housing to provide ease of assembly on the operating shaft.

Then assemble the bearing housing to the operating shaft (Fig. 19) .

Turn the operating shaft so that the hole in the shaft will index with the notches in the shifting levers, and install the selector pin. Then install the two halves of the dirt seal spacer and secure by installing the dirt seal spacer retainer (Fig. 20) .

Install the gear shift lever spring washer, pressure spring, and spring retainer on the gear shift lever and guide the lever through the hole in the instrument panel.



1. Lever Ball
2. Gear Shift Lever
3. Lever Nut
4. Chrome Ball
5. Spring Retainer
6. Pressure Spring
7. Washer
8. Operating Shaft
9. Bronze Fulcrum
10. Operating Lever, Second and High
11. Dirt Seal
12. Selector Pin
13. Dirt Seal Spacer Retainer
14. Dirt Seal Spacers
15. Dirt Seal
16. Operating Lever, Low and Reverse
17. Spacer
18. Outer Spring
19. Inner Spring
20. Bearing Housing
21. Bearing Housing Support Bracket
22. "U" Bolt

FIGURE 18—*Steering Post Shift Assembly "Rambler" Series*

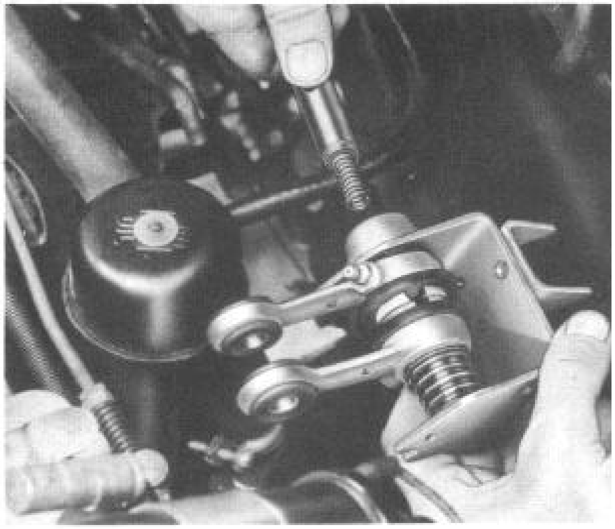


FIGURE 19—*Install the Bearing Housing Assembly on Operatin*

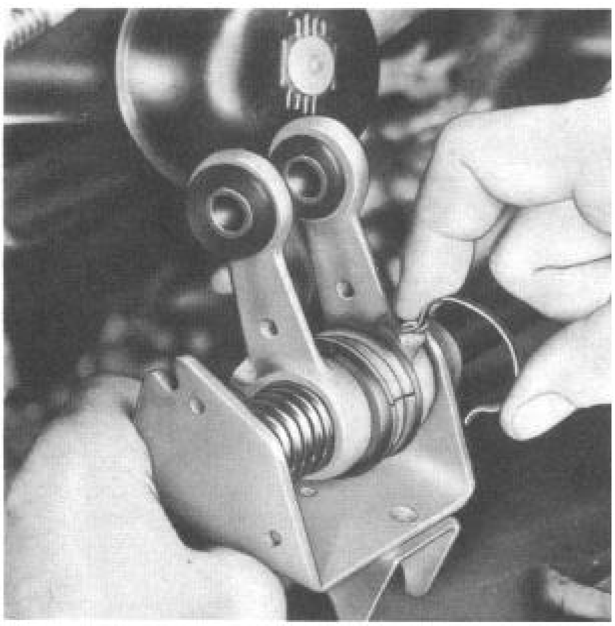


FIGURE 20—*Install the Dirt Seal Spacer Retainer*

Now install the chrome ball and lever nut. Then replace the gear shift lever ball.

Install the "U" bolt holding the bearing housing and support bracket to the lower end of the jacket tube.

NOTE: *Before tightening the "U" bolt securely, place the gear shift lever in the low gear position. Approximately 1-1/2" clearance should be provided between the lever and steering wheel. To obtain this clearance, move the bearing housing up or down on the jacket tube.*

The steering jacket tube may be loosened and turned clockwise, to provide sufficient clearance between the shift lever and instrument panel, when the lever is in the second gear position.

To complete the assembly, replace the shift rods, adjust the shifting mechanism, and lubricate with pressure lubricant.

ADJUSTING THE AUTOMATIC TRANSMISSION SHIFTING MECHANISM

Hydra-Matic Transmission

Place the selector lever in the D-3 position. This will place the gear shift operating lever against the stop on the operating lever housing bracket.

Disconnect the control rod at the transmission lever by removing the cotter pin and clevis pin.

Place the transmission shift lever in the D-3 position (third detent from front position). Adjust the clevis so that the clevis pin passes freely through the hole in the shift lever.

After this adjustment is made, lengthen the control rod by turning the clevis two full turns and connect the clevis to the shift lever.

NOTE: This adjustment will insure proper detent location in the transmission together with a full reverse engagement.

To adjust the gear shift selector pointer on the "Hornet" and "Wasp" Series, remove the Phillips screw from the lower end of the shroud on the steering gear jacket tube. The pointer can then be moved on the shaft by holding the shaft with pliers and turning the pointer by hand. The pointer is a press fit on the shaft.

The pointer on the "Rambler" Series is located on the selector shift lever. Adjustment is made by setting the lever in D-3 position and loosening the retaining screw and setting the pointer to correspond with the numeral 3.

Twin Ultramatic Transmission

Place the selector lever in Reverse position. This will place gear shift operating lever against the end stop on the operating lever housing bracket.

Disconnect the control rod at the transmission by removing the cotter pin and clevis pin. Place the transmission shift lever all the way to the downward position. This will place the inner shift lever stop against the transmission case insuring proper detent for reverse range.

Adjust the clevis on the control rod so that the clevis pin fits freely in the hole of the transmission shift lever and retain it in this position with a cotter pin.

NOTE: *This adjustment will insure proper detent location in the transmission and alleviate bending the inner lever stop by overshifting in reverse.*

DISASSEMBLING THE AUTOMATIC TRANSMISSION SHIFTING MECHANISM

"Hornet" and "Wasp" Series

Remove the horn blowing parts and remove the steering wheel. Then remove the gear shift lever knob and lever.

Remove the screw retaining the selector pointer light shroud to the jacket tube, and raise the shroud from the tube (Fig. 21) . Disconnect the light socket, wire, and bulb assembly to remove the shroud.

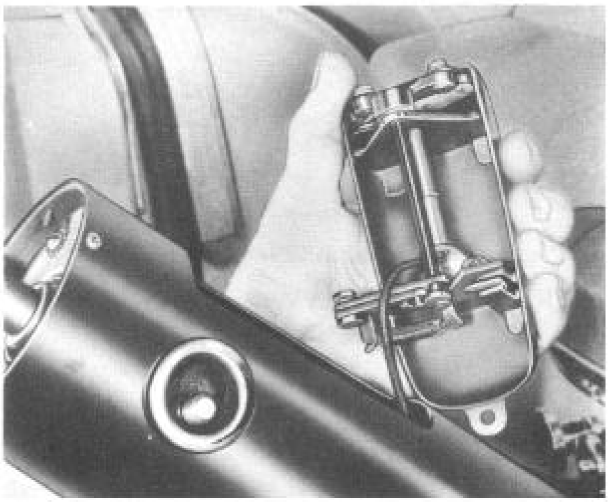


FIGURE 21—***Removing the Shift Selector Pointer Light Shroud***

Remove the bearing retainer from the jacket tube. If directional signal equipped, remove the two screws that hold the directional signal switch to the bearing retainer prior to removing the retainer.

Slide the rubber grommet up on the steering jacket tube and fold the floor mat toward the center of the floor; then slide the rubber insulator pad to the rubber grommet.

Remove the brake pedal opening cover mounting screws. Disconnect the brake pedal and move the cover from the brake pedal rod (Fig. 22).

Disconnect the transmission control rod by removing the cotter pin and lifting the rod out of the operating lever (Fig. 23).

Disconnect the starter switch rod from the operating shaft lever.

On the "Hornet" Series, remove the upper and lower front bolts from the steering gear housing and side sill. Loosen the lower rear bolt about two turns but do not remove (Fig. 24). On the "Wasp" Series, remove the three upper bolts and loosen the lower bolt. This will permit the jacket tube to be lowered for removal of the shifting mechanism.

Disconnect the jacket tube bracket at the instrument panel, and lower the jacket tube and steering gear assembly to provide clearance for the gear shift housing at the opening in the floor.

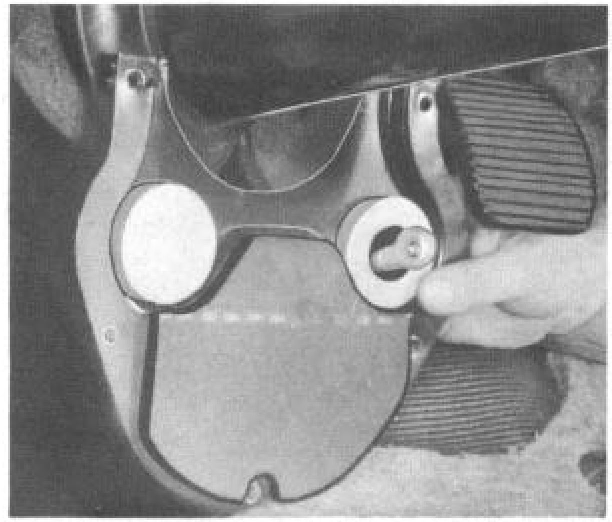


FIGURE 22—***Removing Brake Pedal and Opening Cover***

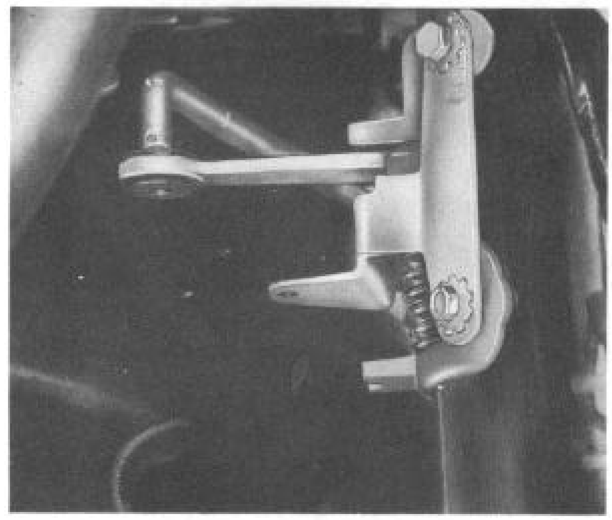
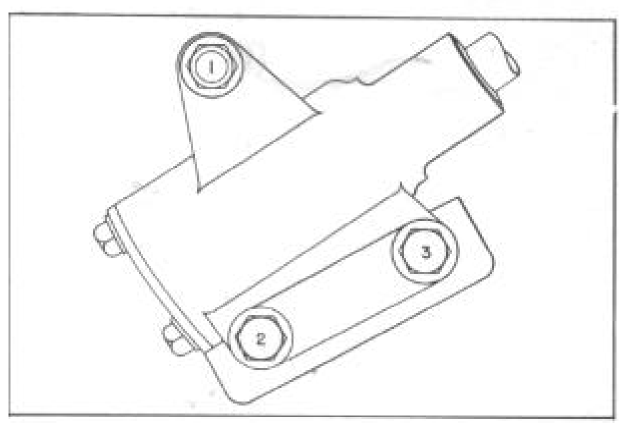


FIGURE 23—***Remove the Cotter Key and Control Rod from the Shift Lever***



1. **Upper Attaching Bolt**
2. **Lower Front Attaching Bolt**
3. **Lower Rear Attaching Bolt**

FIGURE 24—***Location of Steering Gear Housing to Side Sill Bolts "Hornet" Series***

at the opening in the floor. Loosen the clamp bolt at the lower end of the jacket tube and turn the jacket tube clockwise. Remove the two cap screws and two metal screws from the gear shift housing and remove the gear shift operating lever housing bracket (Fig. 25).

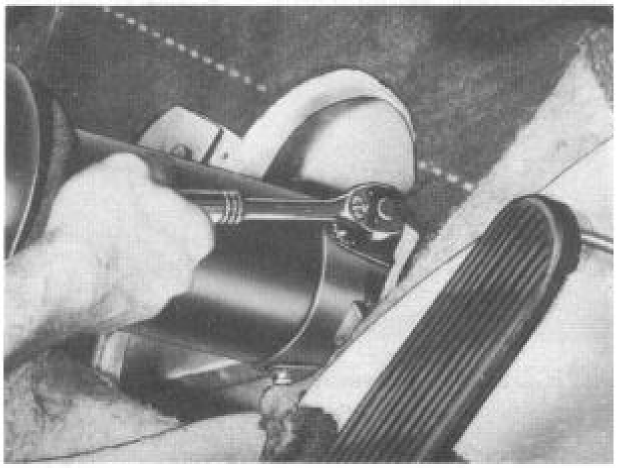
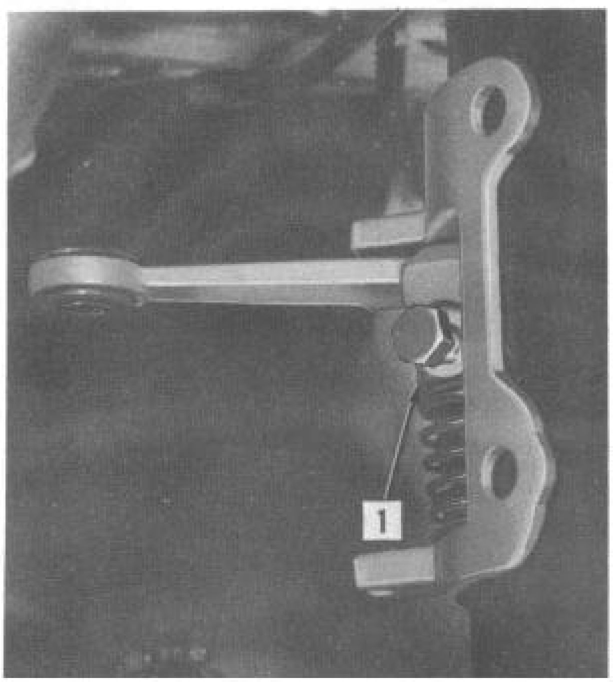


FIGURE 25—*Removing Metal and Cap Screws from Gear Shift Housing*

Remove the operating shaft fastening bolt (Fig. 26).



1. Fastening Bolt

FIGURE 26—*Remove the Operating Shaft Fastening Bolt*

Then remove the gear shift operating shaft from the upper end of the jacket tube.

Remove gear shift housing assembly (Fig. 27). Remove the starter switch rod from the operating lever. Then remove the operating lever, upper

Figure 27-*Removing the Shift Housing Assembly*

spring, lower spring and bronze fulcrum from the bearing housing (Fig. 28).

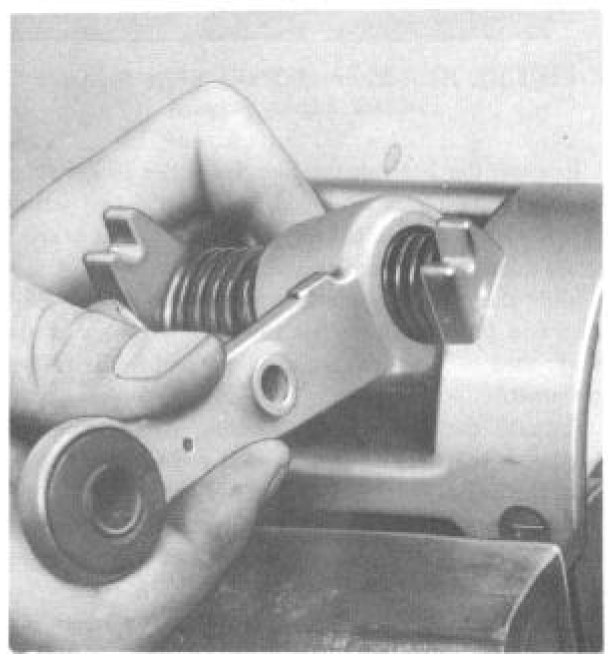
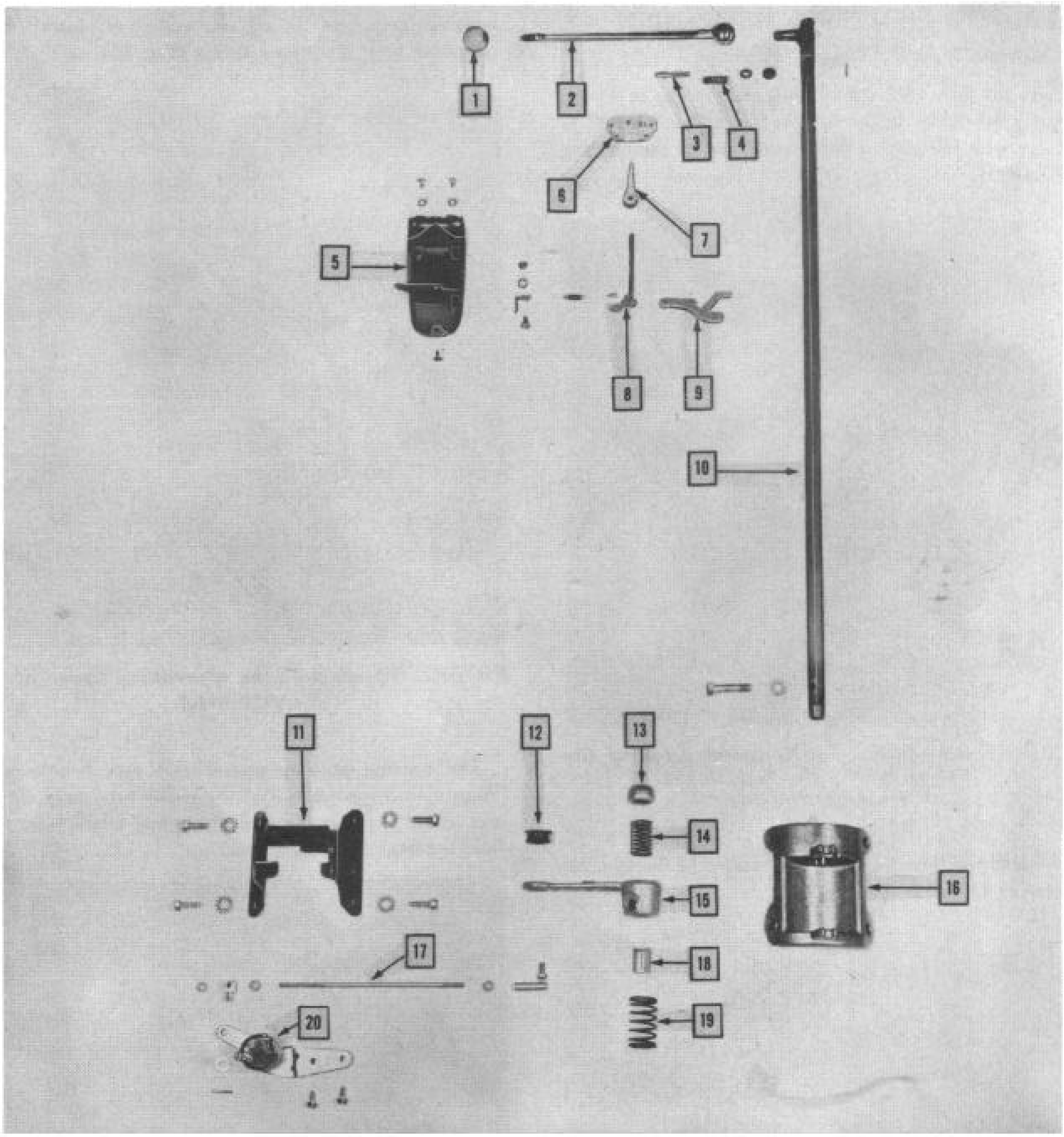


FIGURE 28—*Removing Gear Shift Operating Lever and Component Parts*

Remove the gear shift pressure pin and spring assembly from the gear shift operating shaft. This completes the disassembly of the Automatic Shifting mechanism.

To disassemble the gear shift selector pointer light shroud assembly, remove the anchor nut and screw



1. Lever Knob
2. Gear Shift Lever
3. Pressure Spring Pin
4. Pressure Spring
5. Gear Selector Pointer Shroud
6. Gear Selector Dial
7. Gear Selector Pointer
8. Gear Selector Pointer Shaft
9. Gear Selector Pointer Pickup Lever
10. Operating Shaft
11. Operating Lever Bracket
12. Operating Lever Grommet
13. Operating Shaft Fulcrum
14. Operating Shaft Upper Spring
15. Operating Shaft Lever
16. Operating Shaft Housing
17. Starter Switch Rod
18. Lower Spring Retainer
19. Operating Shaft Lever Spring
20. Starter Switch

FIGURE 29—Shifting Mechanism Assembly Sequence (Ultramatic Shown)

from the shroud; then remove the tension spring, anchor, and operating arm. Remove the pointer shaft retaining lock ("hairpin") and press or pry the gear selector pointer off of the shaft with a screw driver.

NOTE: *The pointer can be aligned on the shaft wtihout removing by holding the pointer shaft, and turning pointer on shaft. Parts shown in Figure 29.*

ASSEMBLING THE AUTOMATIC TRANSMISSION SHIFTING MECHANISM

"Hornet" and "Wasp" Series

Place the gear shift operating shaft housing in a vise. Apply lubriplate to the bronze fulcrum and install to index with the seat in the bearing end of the housing (Fig. 30).

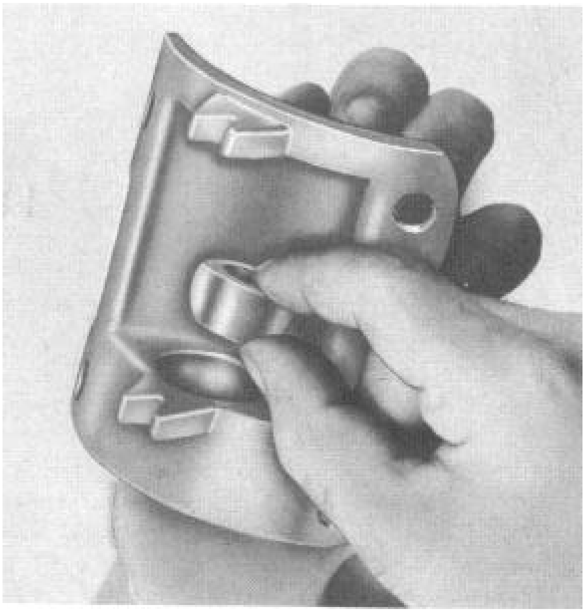


FIGURE 30—*Index the Rounded Edge of the Fulcrum with the Seat in the Bearing Housing*

Install the lower spring and retainer in the bearing housing (Fig. 31 I.

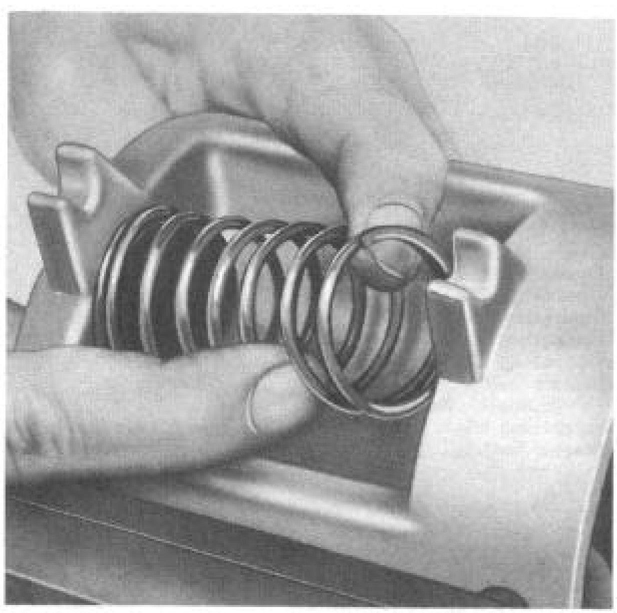


FIGURE 31—*Install the Lower Spring in the Bearing Housing*

With the lower spring in position in the bearing housing, compress the spring enough to install the operating lever and upper spring (Fig. 32).

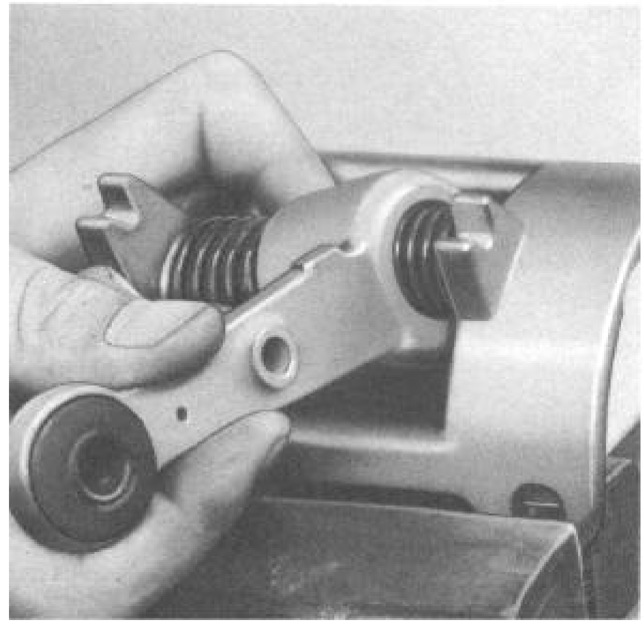


FIGURE 32—*Install the Operating Lever and Upper Spring*

The bearing housing assembly is now completed. Place it in the lower end of the jacket tube (Fig. 33) and install one of the metal screws just finger tight to hold the housing in position.

FIGURE 33—*Install the Bearing Housing on the Lower End of the Jacket Tube*

Install the gear shift pressure pin and spring assembly on the operating shaft and apply lubriplate to the pin. Then install the gear shift lever vibration damper.

Install the operating shaft down through the top of the jacket tube, and align the operating lever bolt hole with the hole in the shaft. Then install the shift lever fastening bolt. Install the gear shift selector lever and knob.

Remove the metal screw from the bearing housing that temporarily held the housing in position during assembly) and install the operating lever housing bracket.

Raise the jacket tube and steering column assembly and fasten the bracket to the instrument panel. Then tighten the clamp bolt at the lower end of the jacket tube.

Install the upper bearing retainer in the jacket tube and fasten the directional signal switch to the retainer. Install the steering wheel and horn blowing parts.

Replace the brake pedal and/or rod and floor hole cover, rubber insulator pad, floor mat and upper rubber grommet.

After assembly, if the pointer is off position it can be aligned on the shaft by holding the pointer shaft with pliers and turning the pointer on the shaft. Parts shown in Figure 29.

Connect the starter switch rod to the operating lever. Place the selector lever in neutral and adjust the rod.

NOTE: *Starter switch should only make contact in neutral. If contact can be made in drive range, the rod must be lengthened.*

DISASSEMBLING THE AUTOMATIC TRANSMISSION SHIFTING MECHANISM

"Rambler" Series

Remove the selector lever knob, pointer indicator and hexagon nut from the gear shift selector lever.

Disconnect the control rod from the gear shift operating lever and the "TV" lever from the carburetor throttle rod.

Remove the two wires from the starter switch. Then remove the four cap screws from the housing assembly and lift the starter switch housing bracket off of the bearing housing. Remove the fastening bolt from the gear shift operating lever. Lift the housing assembly off of the "U" clamp bracket and separate the housing from the gear shift operating shaft. Lower the operating shaft to remove the selector lever from the hole in the instrument panel. Then lift the operating shaft out through the passenger compartment.

Place the housing assembly in a vise and remove the gear shift operating lever and component parts.

The housing assembly, disassembly and assembly procedure is identical to the "Hornet" and "Wasp" Series.

ASSEMBLING THE AUTOMATIC TRANSMISSION SHIFTING MECHANISM

"Rambler" Series

Place the gear shift operating shaft housing in a vise. Apply lubriplate to the bronze fulcrum and install to index with the seat in the bearing end of the housing shown in Figure 30.

Install the large outer spring over the lower spring and retainer which is riveted to the bearing housing as shown in Figure 31.

With the larger outer spring in position, compress the spring enough to install the operating lever and upper spring as shown in Figure 32.

Install the starter switch spring and plunger on the operating lever, and retain it with a washer and cotter pin.

Install the operating shaft assembly through the hole in the floor panel and install the housing assembly to the lower end of the shaft. Align the hole in the shaft with the operating lever and install the fastening bolt.

Place the spring washers, pressure spring and spring retainer on the selector shift lever and insert the lever through the hole in the instrument panel. Install the chrome ball and lever nut; secure the nut in place being careful not to overtighten. Install the pointer and selector lever knob.

Fasten the housing assembly to the "U" clamp bracket at the lower end of the jacket tube.

Install the wires on the starter switch and connect the shift control rod to the gear shift operating lever. Connect the "TV" rod to the carburetor throttle rod.

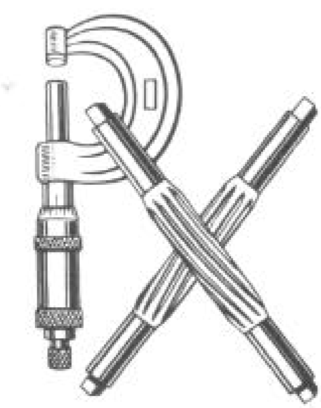
Place the selector lever in D-3; this will position the operating lever against the stop on the starter housing bracket. Adjust the pointer to correspond with the numeral 3 on the instrument panel.

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



BRAKES AND WHEELS—HUBS AND DRUMS SECTION

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BRAKES AND WHEELS - HUBS AND DRUMS

BRAKES AND WHEELS
HUBS AND DRUMS SECTION

The Lockheed Hydraulic System is used in conjunction with the Bendix Servo type brake on the "Hornet" and "Wasp" Series and the floating shoe type on the "Rambler" Series.

HYDRAULIC SYSTEM

The Hydraulic system should be kept free of dirt and moisture. It is advisable to drain the system and flush with pure alcohol once a year.

CAUTION: *Keep mineral oils, gasoline, or kerosene out of the system as they cause rubber cups to soften, swell, and distort resulting in failure.*

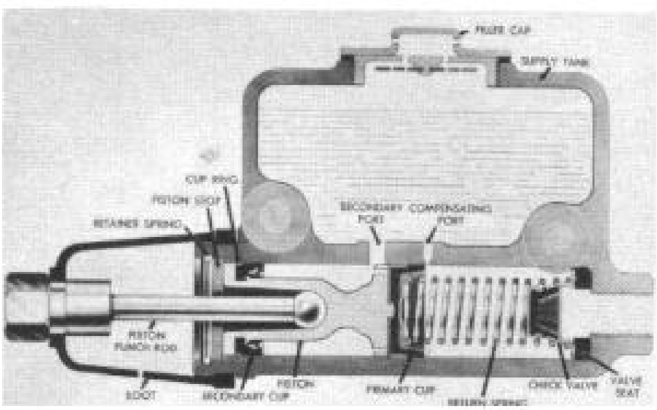


FIGURE 1—*Schematic Drawing, Master Cylinder Operating Parts. (Note that Primary Cup Barely Clears Compensating Port when Fully Retracted.)*

MASTER CYLINDER

The master cylinder (cast integrally with the reservoir) is the compensating type.

It contains the fluid actuating piston, return spring, check valve, and piston push rod which serves as the linkage between the piston and the brake pedal. The piston is equipped with a primary cup of synthetic rubber and a secondary cup of the same material (Fig. 1) . When extended, the piston push rod is housed in a rubber boot which serves to keep foreign matter out of the system. The cylinder is equipped with an intake or secondary port and a relief or compensating port opening into the reservoir. The master cylinder performs two functions:

It maintains a constant volume of fluid in the system at all times regardless of heating expansion. cooling contraction, or loss due to gravity seepage.

It also may be used as a pump during a "bleeding" operation.

Inspection and Assembly of Master Cylinder

When reconditioning a master cylinder, clean all component parts in alcohol. Check secondary and compensating port to be sure both are open. Examine the bore of the cylinder body for ragged edges, scores, pits, or rough surfaces. If it is necessary to hone the bore, check piston clearance which should not exceed .003". Inspect the check valve. If it is worn or damaged, the check valve must be replaced. Whenever a master cylinder is disassembled, the primary and secondary cup must always he replaced.

Upon reassembly, dip all component parts in Lockheed No. 21-B Hydraulic Brake Fluid.

WHEEL CYLINDERS

Each wheel cylinder contains a pair of opposed pistons fitted with rubber cups and a small compression spring to keep the cups tight against the pistons. The fluid pressure keeps the lips of the cups tight against the wheel cylinder walls.

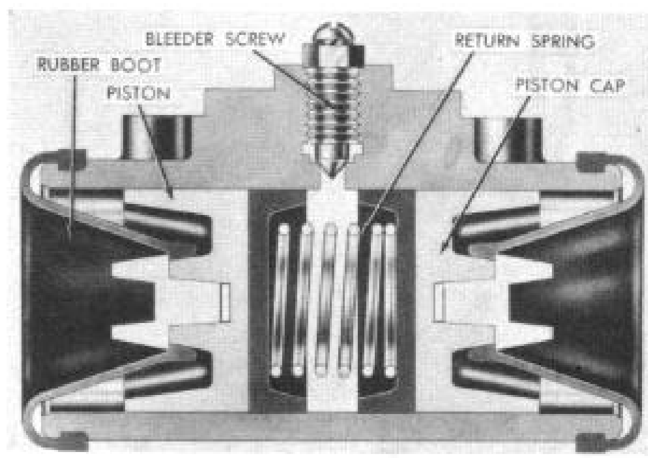


FIGURE 2—Wheel Cylinder

Inspection of Wheel Cylinders

After removing the wheel cylinders from the brake assembly, remove the boots from both ends of the cylinder. The pistons and cups are forced out of the barrel by the compression spring. Clean all component parts in alcohol. If the cylinder is scratched or pitted. it will be necessary to hone or replace to prevent loss of fluid or excessive cup wear. After honing operation, check piston clearance in bore; it should not exceed 003".

Whenever a wheel cylinder is disassembled, the operating cups must always be replaced. Upon reassembly. dip all component parts in Lockheed No. 21-B Hydraulic Brake Fluid.

BLEEDING HYDRAULIC LINES

Bleeding the entire brake system is necessary whenever a hydraulic line is disconnected from the master cylinder, or whenever the brake pedal is "spongy" on application. If a line is disconnected at one individual wheel, that wheel cylinder only must be bled.
Before bleeding, fill the master cylinder reservoir with Lockheed No. 21-B Hydraulic Brake Fluid.

> CAUTION: While removing the reservoir filler cap, extreme care must be exercised to prevent dirt from entering the reservoir and master cylinder, as dirt lodged between the pistons and the cylinder walls will cause failure.

Use a standard type pressure bleeder following the particular Manufacturer's instructions.
Where pressure bleeder equipment is not available, use the following method:

Attach a bleeder hose and allow it to hang in a clean container. Unscrew the bleeder connection 3/4 turn and depress the foot pedal to floor, tighten bleeder connection, and allow the pedal to return slowly to "off" position. Repeat the pumping action until enough fluid has passed through to expel all the air from the line. Do this at each of the four wheels.

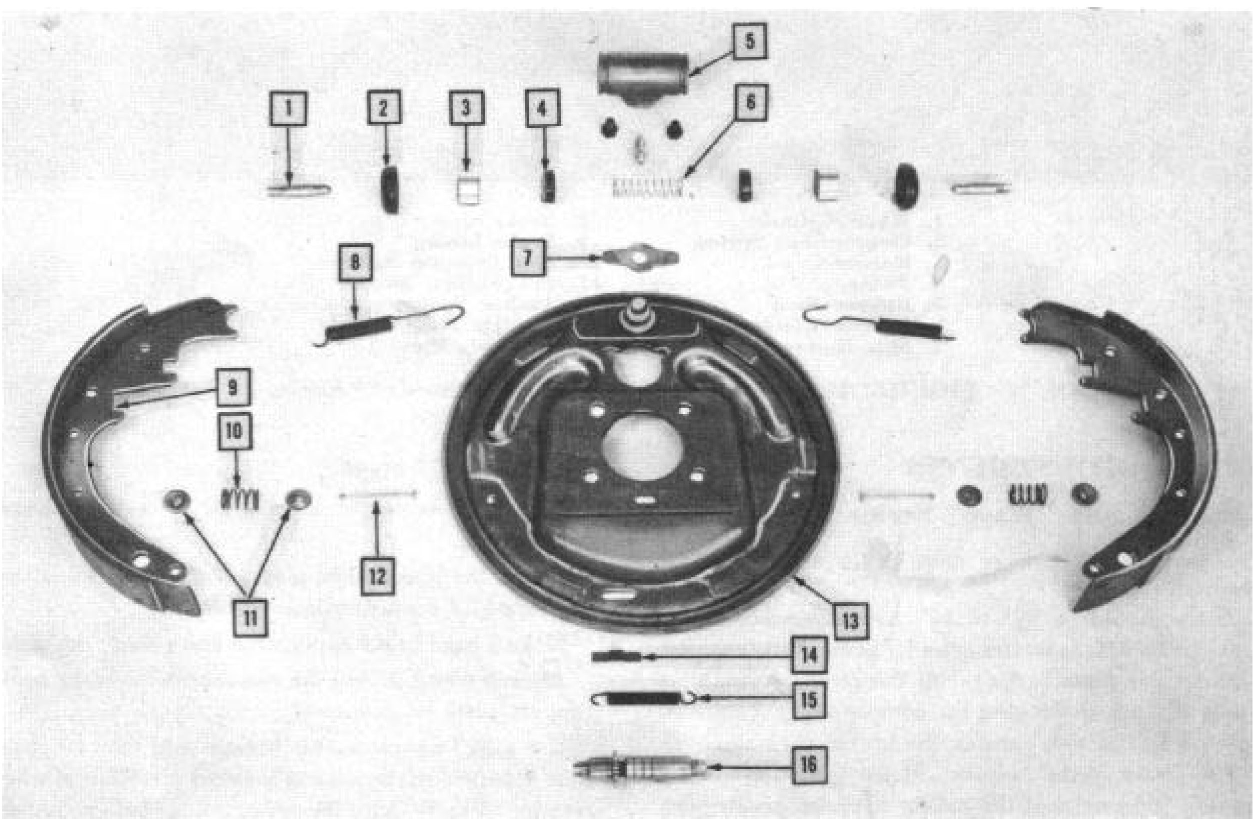
Watch the flow of fluid from the hose, the end of which should be kept below the surface of the fluid: when all air bubbles cease to appear, close the bleeder connection.

Fluid withdrawn in the bleeding operation should not be used again. Fluid should be replenished in the reservoir after each wheel cylinder is bled. When the bleeding operation is completed, the reservoir must be refilled to within 1/2" from the top.

To prevent brake drag, the compensating port (Fig. 11 must be open when the brake pedal is in released position. See "Brake Adjustment".

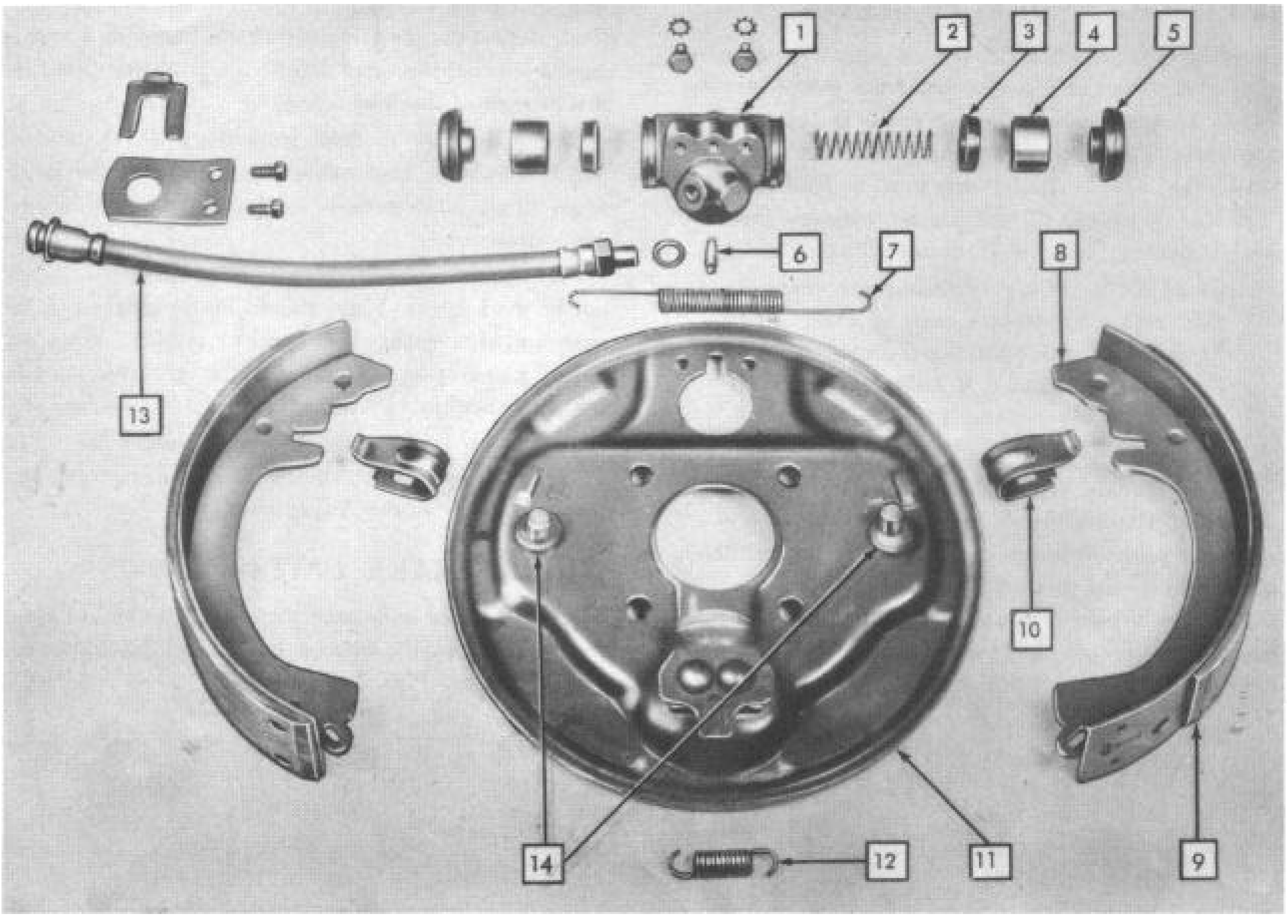
WHEEL BRAKE UNITS

The wheel brake units are composed of a support plate. two brake shoes, the wheel cylinder. and the brake shoe return springs (Figs. 3 and 4).



1. Link
2. Rubber Boot
3. Piston
4. Rubber Cup
5. Wheel Cylinder
6. Compression Spring
7. Shoe Guide Plate
8. Shoe Return Spring
9. Shoe and Lining
10. Shoe Hold Down Spring
11. Shoe Hold Down Spring Retainer
12. Shoe Hold Down Spring Pin
13. Brake Support Plate
14. Adjusting Hole Cover
15. Anchor Spring
16. Brake Shoe Adjusting Screw

FIGURE 3—*Front Brake Assembly "Hornet" and "Wasp" Series*



1. Wheel Cylinder
2. Compression Spring
3. Rubber Cup
4. Piston
5. Rubber Boot
6. Bleeder Connection
7. Shoe Return Spring
8. Brake Shoe
9. Brake Lining
10. Flat Pressure Spring
11. Brake Shoe Support Plate
12. Anchor Spring
13. Flexible Hose
14. Eccentric Pins

FIGURE 4—Front Brake Assembly "Rambler" Series

BRAKE ADJUSTMENTS

"Hornet" and "Wasp" Series

The parking brake lever must be in a full released position.

There should be 1/4" to 1/2" free movement of the brake pedal before master cylinder piston travel begins. Without this there is danger of the compensating port being cvered, destroying the compensating feature of the systergand also causing the brakes to drag.

The brake pedal adjustment is accomplished by varying the length of the master cylinder piston push rod.

Remove adjusting screw dust cover. Spread the brake shoes by rotating the star-wheel until the drums can just be turned by hand. Then back off the adjusting screw approximately 14 notches. Do this on all four wheels.

Reinstall adjusting hole covers in the support plates and lower the car to the floor and road test.

"Rambler" Series

The parking brake lever must be in a full released position.

Adjust the brake pedal play to 1/4" to I/9" by adjusting length of master cylinder push rod.

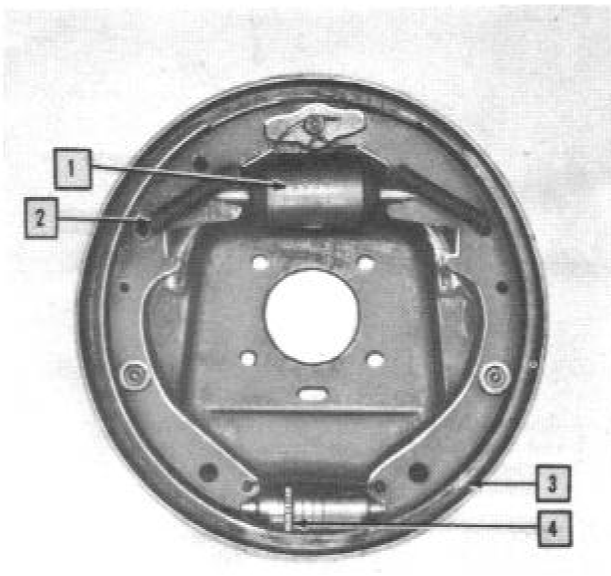
Make a hard brake application and release the pedal. At each wheel, adjust the two eccentrics in the brake support plate as follows:

Use a 3/8" square socket wrench and turn the front shoe eccentric in the normal forward direction of wheel rotation (Fig. 61 until the entire lining surface contacts the drum.

With a slight brake drag, rotate the wheel slightly in both directions centering the shoe.

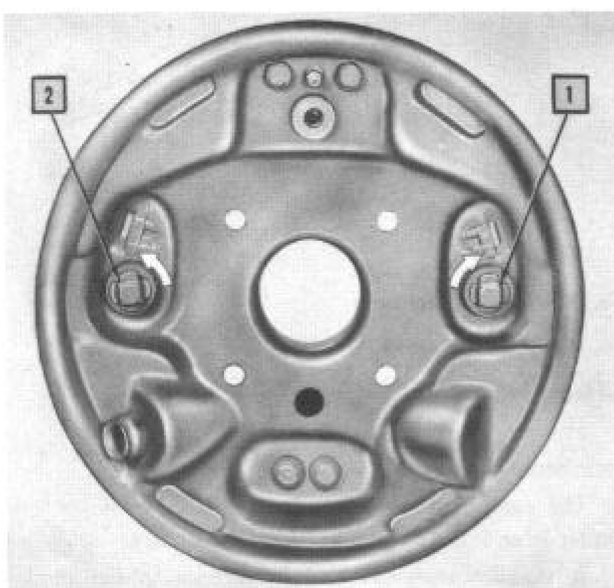
Back off the eccentric until the drum is just free without touching.

Repeat the procedure with the rear shoe eccentric, turning it in the opposite direction.



1. Wheel Cylinder
2. Return Spring
3. Brake Shoe and Lining
4. Star-Wheel Shoe Spreader

FIGURE 5—*Adjustment Location "Hornet" and "Wasp" Series*

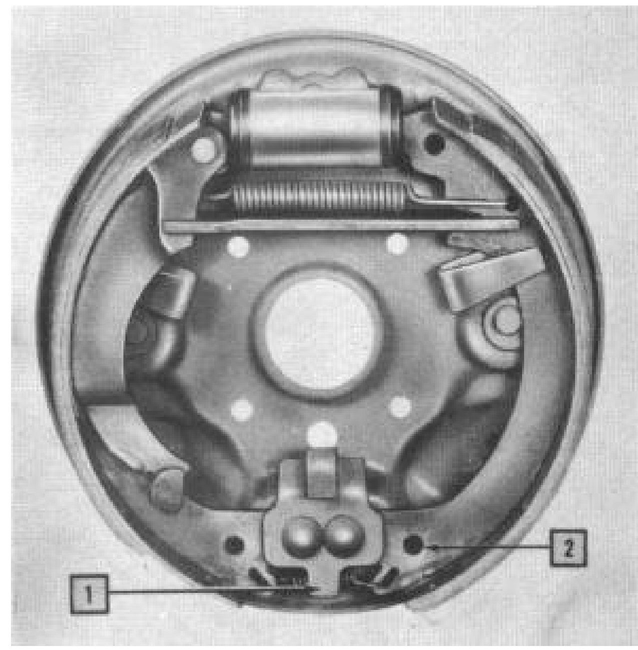


1. Clockwise View from Back
2. Counter-Clockwise View from Back

FIGURE 6—Eccentrics for Brake Shoe Adjustment "Rambler" Series

Anchor Lip Adjustment "Rambler" Series

The short lower coil spring, underneath the anchor lip, must retain the brake shoes in constant contact with the brake support plate with sufficient tension to prevent side movement of the brake shoes (Fig. 7). This is accomplished by bending the anchor lip slightly toward the brake support plate so that 15 pounds pressure is exerted by the coil spring to retain the shoes on the ledges of the support plate. This can be measured with a spring scale hooked to the end of the shoe. Note the pressure required to pull the shoe outward from the support plate.



1. Bend Here toward Support Plate
2. Attach Spring Scale here and Read Pressure. It should be 15 Lbs.

FIGURE 7—Anchor Lip Adjustment

PARKING BRAKE

The parking brake applies the rear brake 'shoes by means of cables connected between the hand lever and the rear brake support plates.

The parking brake is most easily applied by depressing the foot brake pedal to its full travel and simultaneously applying the hand brake lever.

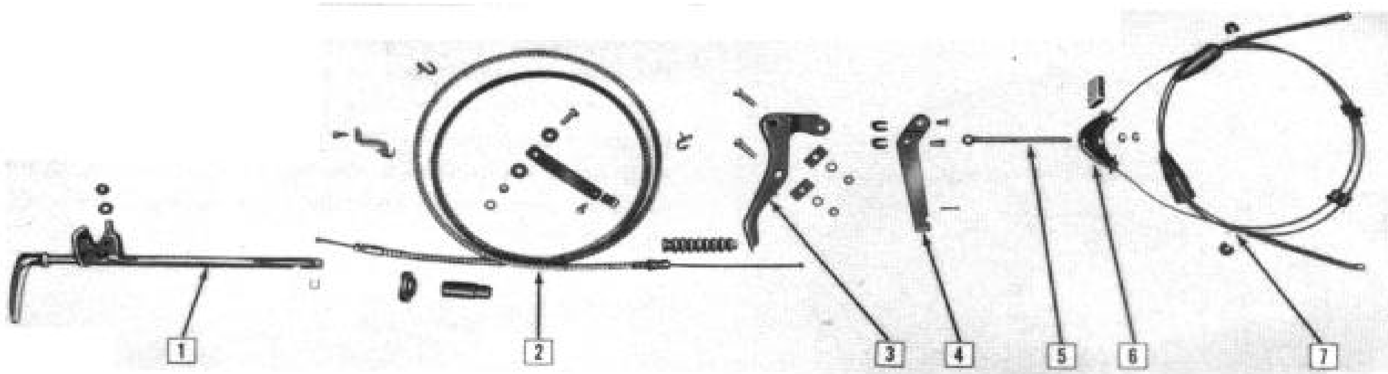
The principal parts of the hand brake assemblies are shown in Figures 8 and 9.

Parking Brake Adjustment

Withdraw the hand brake lever to the rear to provide a 31/2" clearance between the hand brake lever handle and bracket as shown in Figure 10.

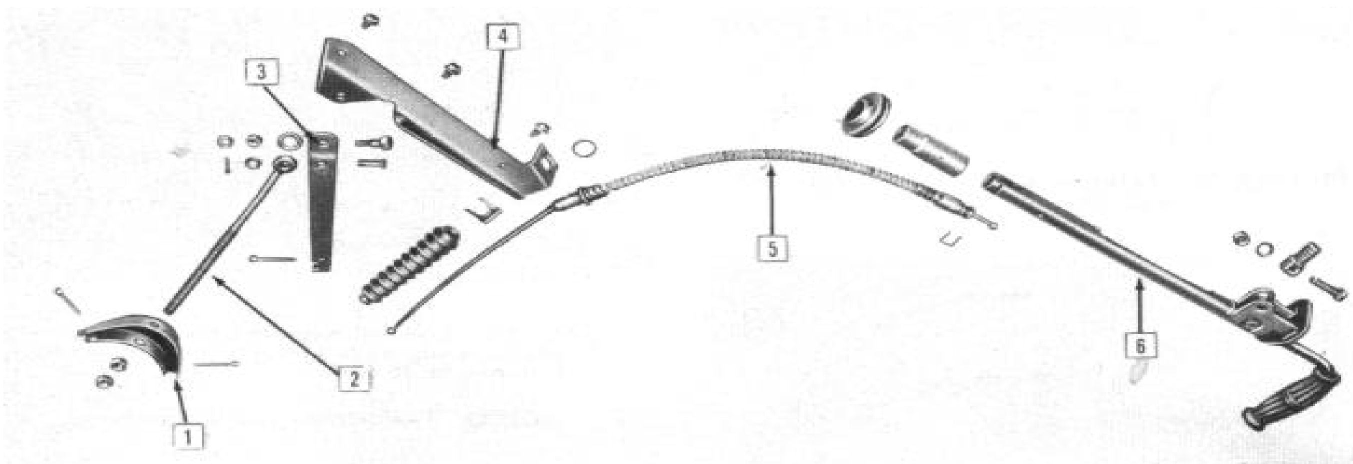
With the lever in this position, tighten the hand brake cable at the equalizer to a point where the rear brakes are fully applied. This will prevent possible brake drag (Fig. 11).

To release the parking brake, apply brake pedal pressure, turn the parking brake handle counterclockwise 70°, and push it into the released position.



1. Hand Brake Lever Assembly
2. Hand Brake Cable
3. Bell Crank Bracket
4. Bell Crank
5. Adjusting Rod
6. Hand Brake Cable Equalizer
7. Rear Brake Cable

FIGURE 8—*Hand Brake Lever Assembly "Hornet" and "Wasp" Series*



1. Hand Brake Cable Equalizer
2. Adjusting Rod
3. Bell Crank
4. Bell Crank Bracket
5. Hand Brake Cable
6. Hand Brake Lever Assembly

FIGURE 9—*Hand Brake Lever Assembly "Rambler" Series*

Mechanical Follow-up Cable Adjustment "Hornet" and "Wasp" Series

Disconnect cable from brake pedal and master cylinder piston push rod from brake pedal. Place a 31/2" spacer block between the brake pedal rod pad and floor mat. Depress pedal rod until pad contacts spacer block; retain in that position and adjust the mechanical follow-up cable length at the clevis end so that the clevis pin can be installed freely with no slack in the cable.

POWER BRAKES (TREADLE-VAC)

Power braking is a method of hydraulically applying the wheel brake units with power supplied by a pressure differential between engine vacuum and atmospheric pressure. It is actuated and controlled by a minimum amount of minimum amount of foot pedal pressure.

The combined vacuum power unit and master cylinder is an integral part of the brake system.

A vacuum reservoir tank is located in the intake manifold vacuum line. Should a failure occur in the vacuum system, this reserve supply of vacuum will allow the operator to make several power applications before the supply is completely depleted.

When this occurs, the brakes may be applied through physical effort alone as in a conventional braking system, but more physical effort is required due to the lack of a power assist.

The Treadle-Vac consists of three basic elements combined into a single unit, the vacuum power cylinder, piston and valve assembly, and hydraulic cylinder and reservoir assembly (Fig. 121.

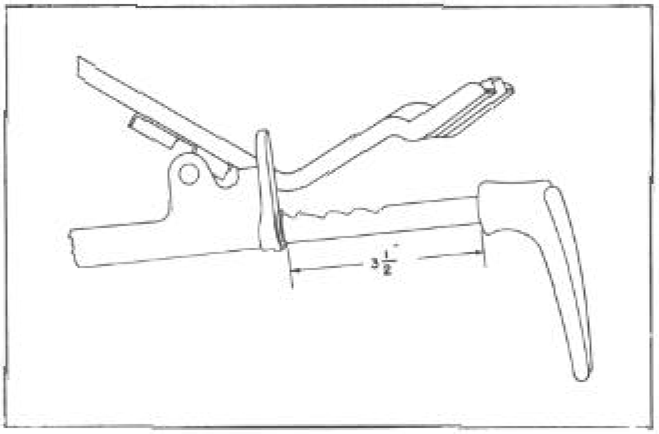


FIGURE 10—*Hand Brake Lever Adjustment "Hornet" and "Wasp" Series Shown*

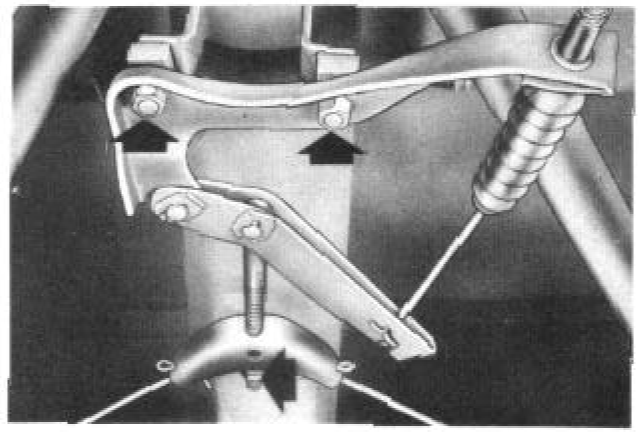


FIGURE 11—*Hand Brake Bell Crank "Hornet" and "Wasp" Series Shown*

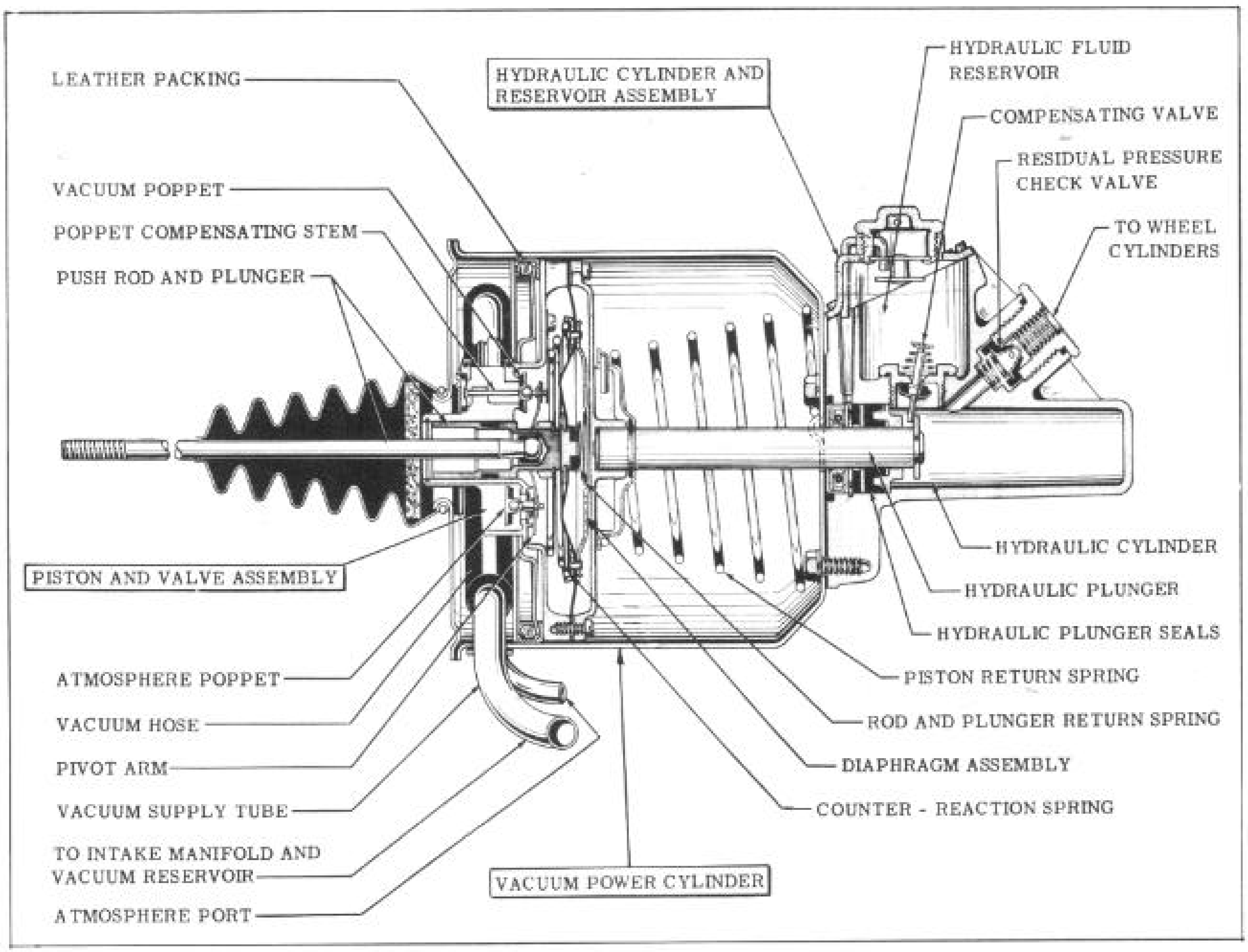


FIGURE ***12—Cross Section View Treadle-Vac***

OPERATION

Released Position

In the released position with the engine running, vacuum is transmitted through a check valve to the Treadle-Vac vacuum unit tube and vacuum reservoir tank. It passes through the vacuum tube to the closed vacuum poppet (Fig. 131.

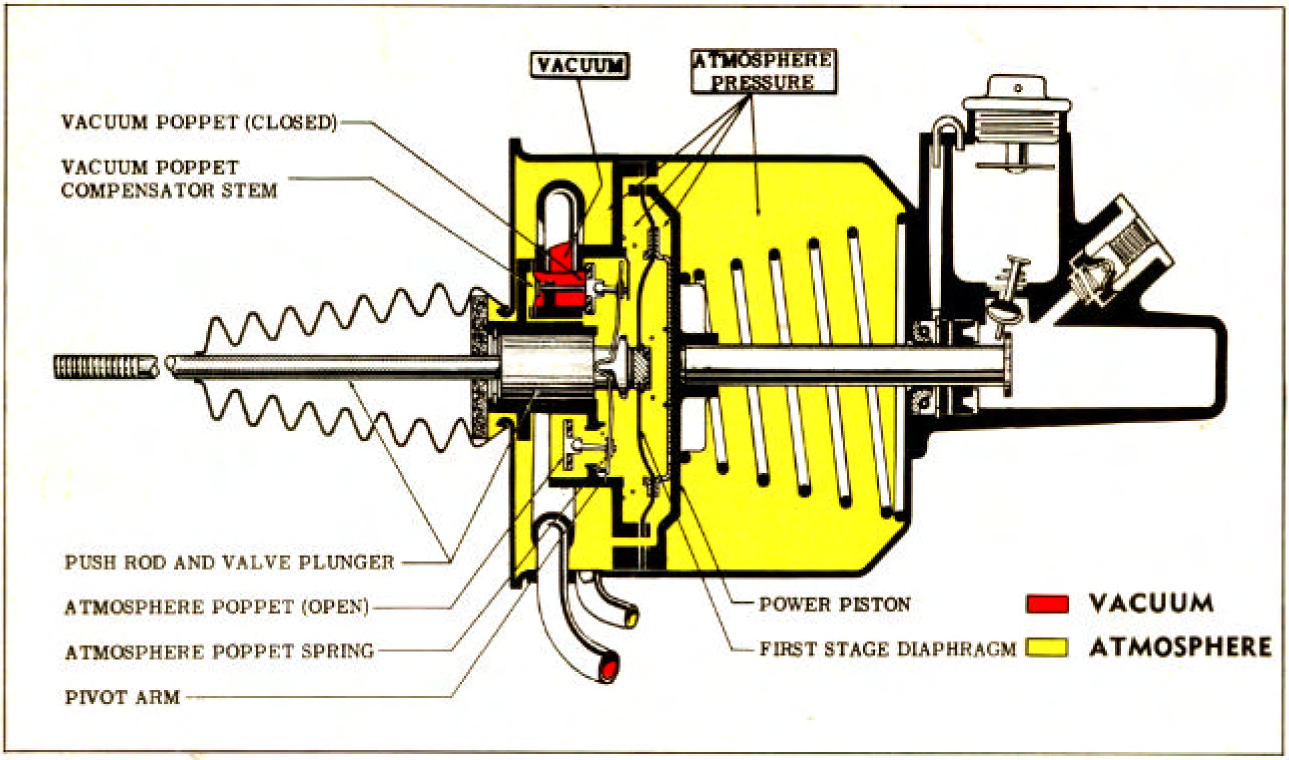


FIGURE 13—*Released Position*

Atmosphere after passing through the air cleaner enters the power cylinder. It then passes through the open atmospheric poppet to the left side of diaphragm assembly and through a passage in the front piston plate to the right side of the power piston.

Atmosphere also passes through a by-pass hole in the piston to the right side of the diaphragm assembly. A small hole in the diaphragm plate allows atmosphere to enter the first or inner stage of the diaphragm assembly.

A small passage in the piston at the vacuum poppet admits atmosphere to the left side of the vacuum poppet compensator diaphragm. With vacuum on the right side of the compensator stem diaphragm, a slight force is exerted on the vacuum poppet, partially balancing the force of differential pressure against the vacuum poppet. Both the power piston and the diaphragm assembly are now balanced in atmospheric pressure. The piston is held to the left in its released position by the piston return spring and the push rod and plunger assembly is held in position in the piston by the push rod return spring.

The piston return spring is attached to the master cylinder piston rod. It, therefore, holds the piston rod in the released position and the compensating port of the master cylinder open.

Applied Position

As the brake pedal is depressed, the push rod and plunger move to the right in the power piston allowing the pivot arm and atmosphere poppet spring to close the atmosphere poppet. After the atmosphere poppet closes, the pivot arm, which pivots freely on the push rod plunger, opens the vacuum poppet (Fig. 14).

The balancing force against the vacuum poppet, by the vacuum poppet compensator stem, reduces the force required to lift the poppet from its seat. Smoothness in the initial application of the power brake is thereby obtained.

With the vacuum poppet open, vacuum is transmitted to the left side of the diaphragm assembly and to the right side of the power piston. With vacuum on the right side of the piston and atmospheric pressure on the left side, a pressure differential is created which moves the piston to the right compressing the return spring.

As the power piston moves to the right, the hydraulic plunger moves to the right in the hydraulic cylinder. Initial movement of the plunger allows the compensating valve to seat, trapping fluid in the hydraulic cylinder.

Fluid under pressure then passes through the residual check valve and through the lines to the wheel cylinders.

With vacuum on the left side of the diaphragm assembly and atmospheric pressure on the right side, a reaction force is obtained. The reaction force is proportioned to the applying force acting on the power piston, thus giving the driver a complete feel of his brakes. A lighter degree of reaction is obtained against

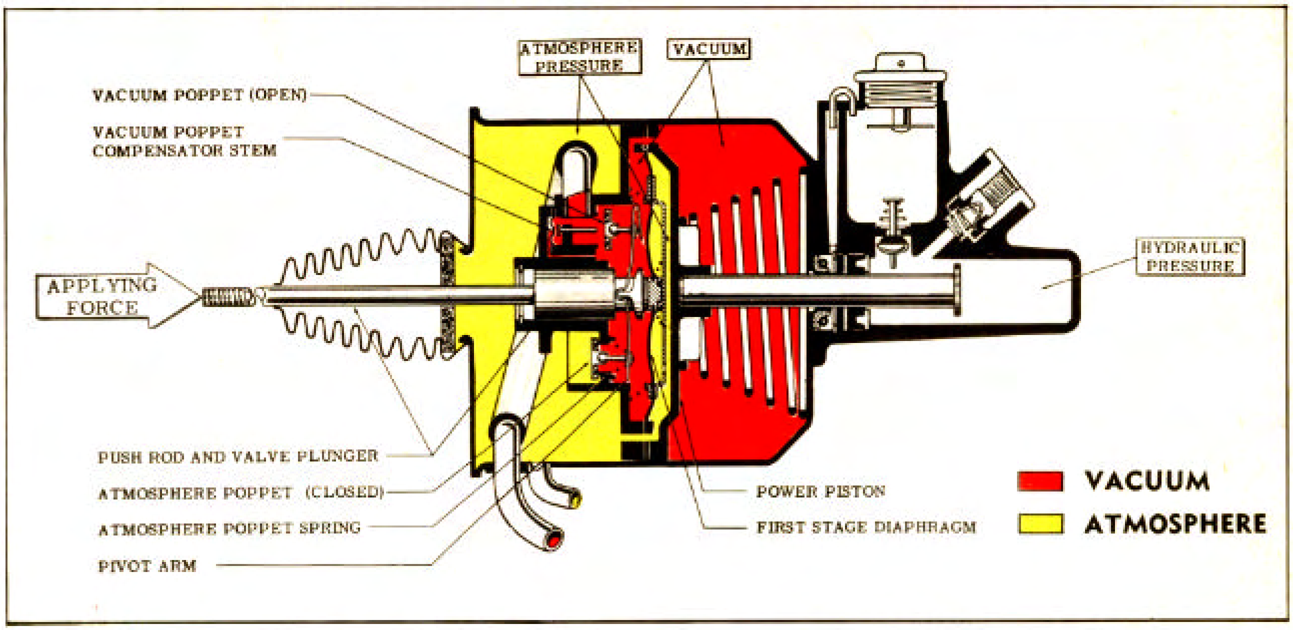


FIGURE 14—*Applied Position*

the push rod and plunger during initial application of the power unit by use of the inner "first stage" diaphragm. After initial application, the force of the counter-reaction spring is overcome and additional reaction force is obtained.

Holding Position

When the operator holds a steady pressure on the brake pedal during any phase of a braking operation, the reactionary force created within the power piston balances the physical pedal pressure and allows the power piston and rod plunger to reach a holding position. When this occurs, both the vacuum and atmosphere poppets are seated and the degree of vacuum at the right side of the piston and at the left side of the diaphragm assembly is sufficient to give the required degree of hydraulic pressure and corresponding reaction force until such a time when a further application or release takes place (Fig. 15).

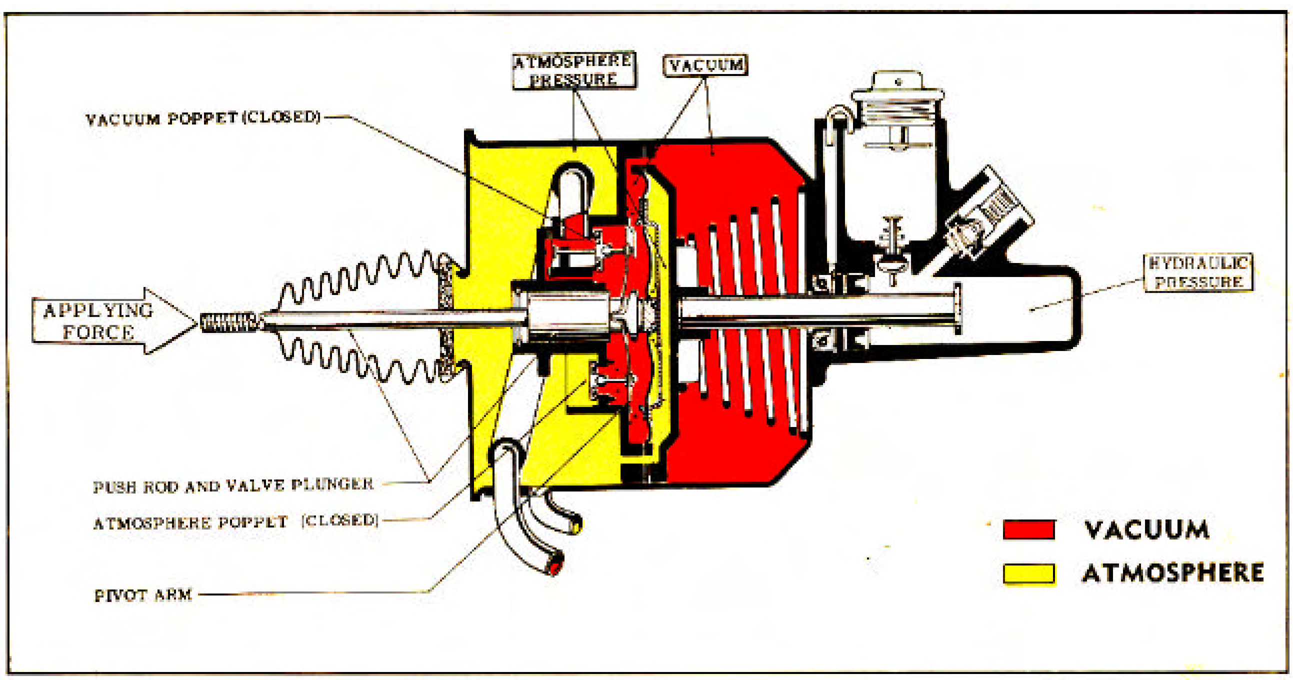


FIGURE 15—*Holding Position*

Residual Check Valve

During application, the fluid passing throaugh the master cylinder outlet causes the rubber lip of the residual check valve to expand allowing the fluid to pass to the lines and wheel cylinders. Upon release, the hydraulic pressure existing in the lines forces the residual check valve spring to compress moving the check valve slightly off its seat. As the pressure decreases, the residual check valve again seats holding a slight pressure in the lines and wheel cylinders preventing air from entering the system (Fig. 13).

POWER BRAKE UNIT DISASSEMBLY

Power Cylinder

NOTE: Always use extreme care in handling hydraulic system parts to prevent their coming in contact with mineral oil, gasoline, or kerosene. When overhauling the unit, always use repair kits.

Place the unit in a vise and remove the rubber dust guard retaining spring, dust guard, and felt washer from the end plate and plunger push rod.

Bend up two tabs on the end plate and remove the plate and gasket. Remove the vacuum hose from the tube attached to the vacuum cylinder. Remove the vacuum and atmospheric pressure tube assembly attaching screw and remove the assembly from the vacuum cylinder shell.

Remove power piston assembly from the vacuum cylinder shell.

Compress the vacuum piston return spring far enough so that the "C" washer can be removed from the groove in the master cylinder piston rod. The retaining plate and vacuum piston return spring can now be removed from the vacuum cylinder shell.

To insure proper reassembly, scribe a line across the ouside of the vacuum cylinder shell and master cylinder housing. Remove the three screws attaching the vacuum cylinder shell to the master cylinder.

Lift off the vacuum cylinder shell and remove gasket and rubber ring. Push master cylinder piston rod into master cylinder and remove the leather seal from the master cylinder (Fig. 16).

Master Cylinder

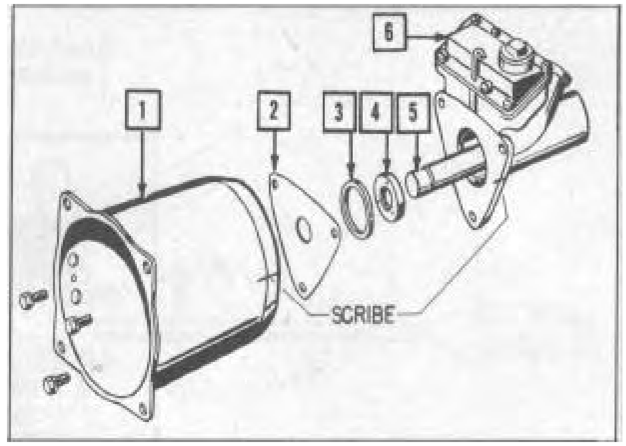
Remove cover and gasket and drain fluid.

Place the master cylinder in a vise. Use a 1-1/8" socket and remove the compensating valve from the master cylinder.

Loosen the outlet and residual valve fittings but do not remove them (Fig. 12).

Remove stop washer retaining ring with Tool J-4245 "Truarc" Pliers.

NOTE: *If ring is of Spirolox type, use a sharp pointed tool to pry end of ring out of groove.*

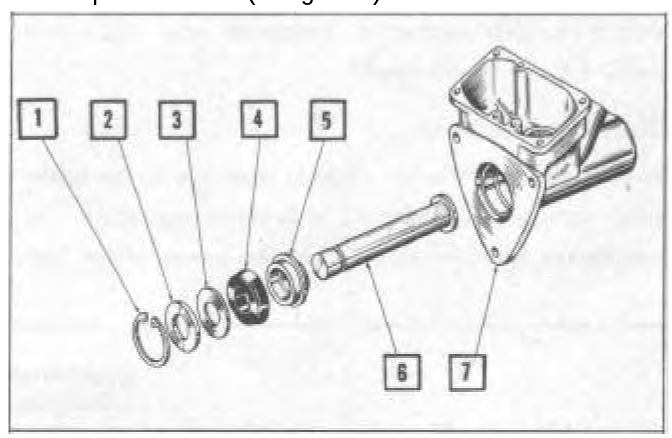


1. Vacuum Cylinder
2. Gasket
3. Rubber Ring
4. Leather Seal
5. Piston Rod
6. Master Cylinder Housing

FIGURE 16—*Removal of Vacuum Cylinder from Master Cylinder Housing*

Pull master cylinder piston rod out of master cylinder.

Remove stop washer, piston rod washer, cup and cup retainer (Fig. 17).



1. **Retaining Ring**
2. **Stop Washer**
3. **Piston Rod Washer**
4. **Cup**
5. **Cup Retainer**
6. **Piston Rod**
7. **Master Cylinder Housing**

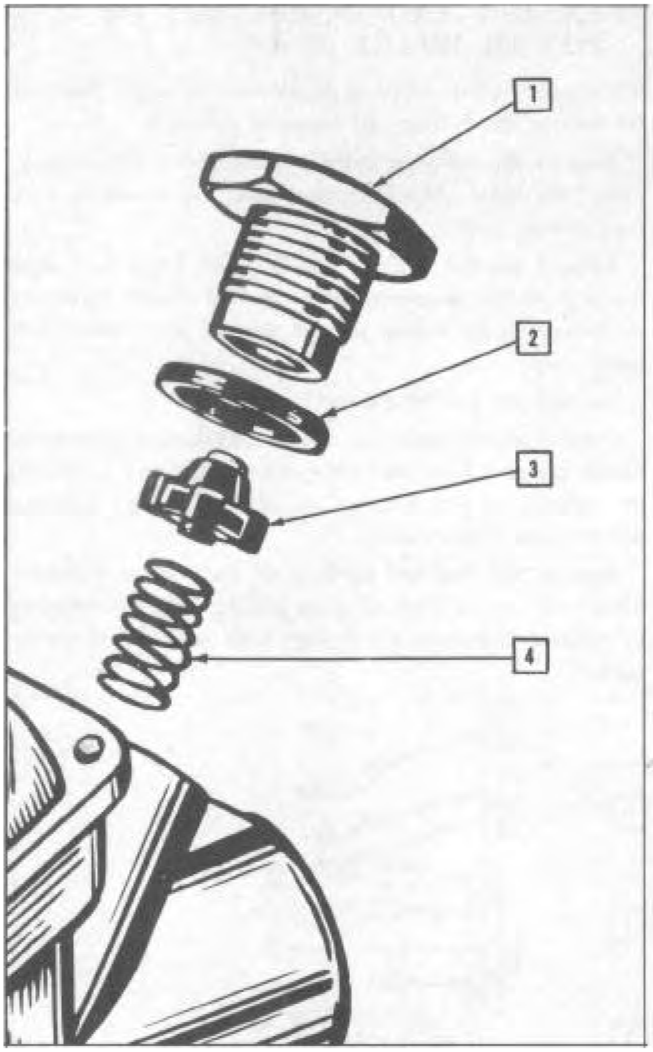
FIGURE 17—*Master Cylinder Piston Rod and Operating Parts*

Remove master cylinder from vise; hold it upside down and remove the outlet fitting and residual check valve assembly (Fig. 18).

Clamp compensating valve in vise and remove spring retainer, spring valve, and rubber seal (Fig. 19).

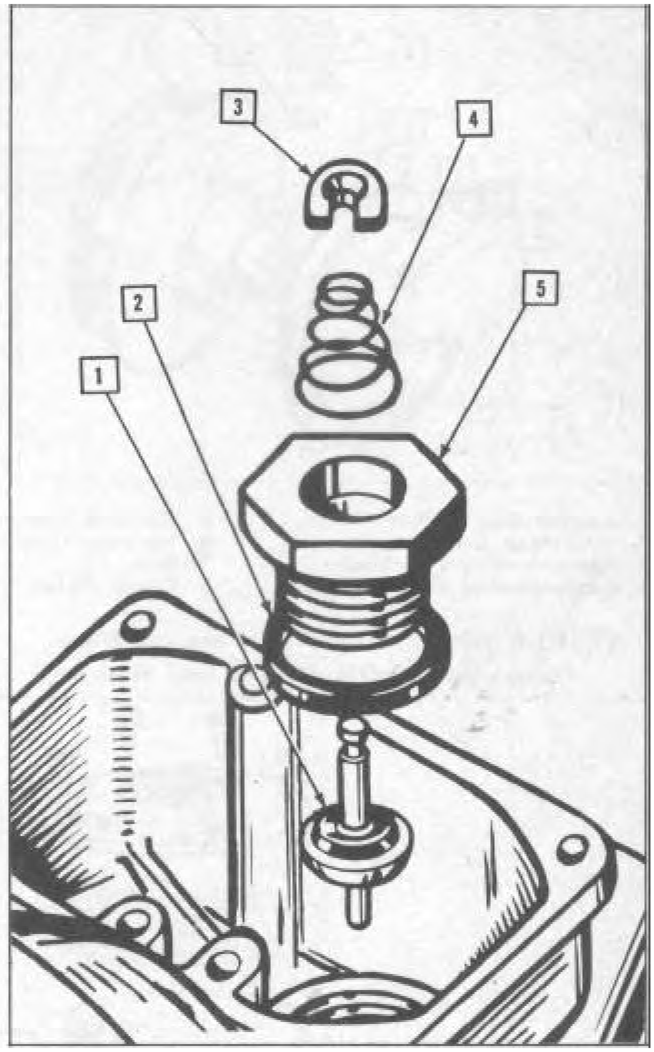
Vacuum Piston and Valve Assembly

Remove vacuum hose, tube, and tube seal from piston assembly.



1. Outlet Fitting
2. Outlet Fitting Gasket
3. Residual Check Valve
4. Spring

FIGURE 18—Residual Check Valve



1. Valve
2. Rubber Seal
3. Retainer
4. Spring 5. Fitting

FIGURE 19—Compensating Valve

Pull the rubber stop washer off the steel stop washer. Remove the two steel stop washer attaching screws and separate the washer, compensating stem diaphragm, and compensating stem from the piston assembly (Fig. 20).

To insure proper reassembly, scribe alignment marks on the front piston plate and piston and valve assembly plate.

Place the piston and valve assembly plate in a vise being careful not to damage the vacuum tube port surface.

Remove the five front piston plate attaching screws and separate the front piston plate, gasket, diaphragm assembly, and counter-reaction spring (Fig. 21).

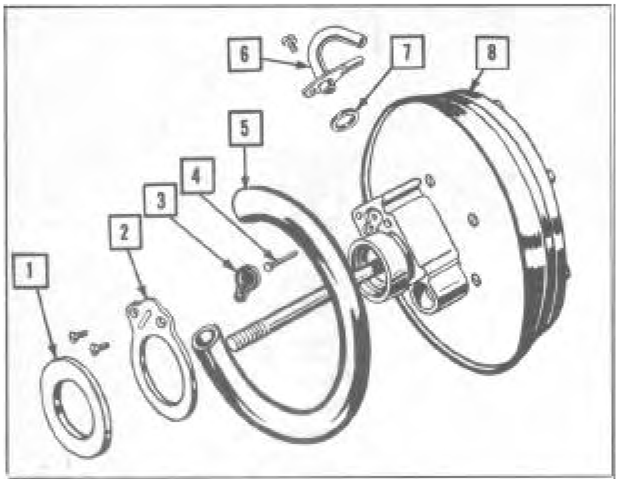
Remove vacuum poppet spring arm from piston plate. Using pliers, remove the two atmosphere poppet retaining clips (if necessary break clips).

Separate atmosphere poppet and spring from piston plate.

Remove push rod, plunger, and vacuum poppet assembly from the piston plate.

From the groove in bore of piston plate, remove plunger snap ring. Use a sharp tool to remove the spirolox ring from end of plunger and separate pivot washer and pivot arm from plunger. Remove with pliers, the two vacuum poppet retaining clips to separate poppet from pivot arm (If necessary break clips). Remove seal from outer diameter of plunger (Fig. 211.

Place piston plate on bench and remove the six retainer plate attaching screws and separate retainer plate, ring, wick, packing plate, and leather packing Fig. 22).



1. Rubber Stop Washer
2. Steel Stop Washer
3. Compensating Diaphragm
4. Compensating Stem
5. Vacuum Hose
6. Vacuum Tube
7. Seal
8. Power Piston

FIGURE 20—Removal of Vacuum Hose, Compensating Diaphragm, and Stem

CLEANING AND INSPECTION OF POWER BRAKE UNIT

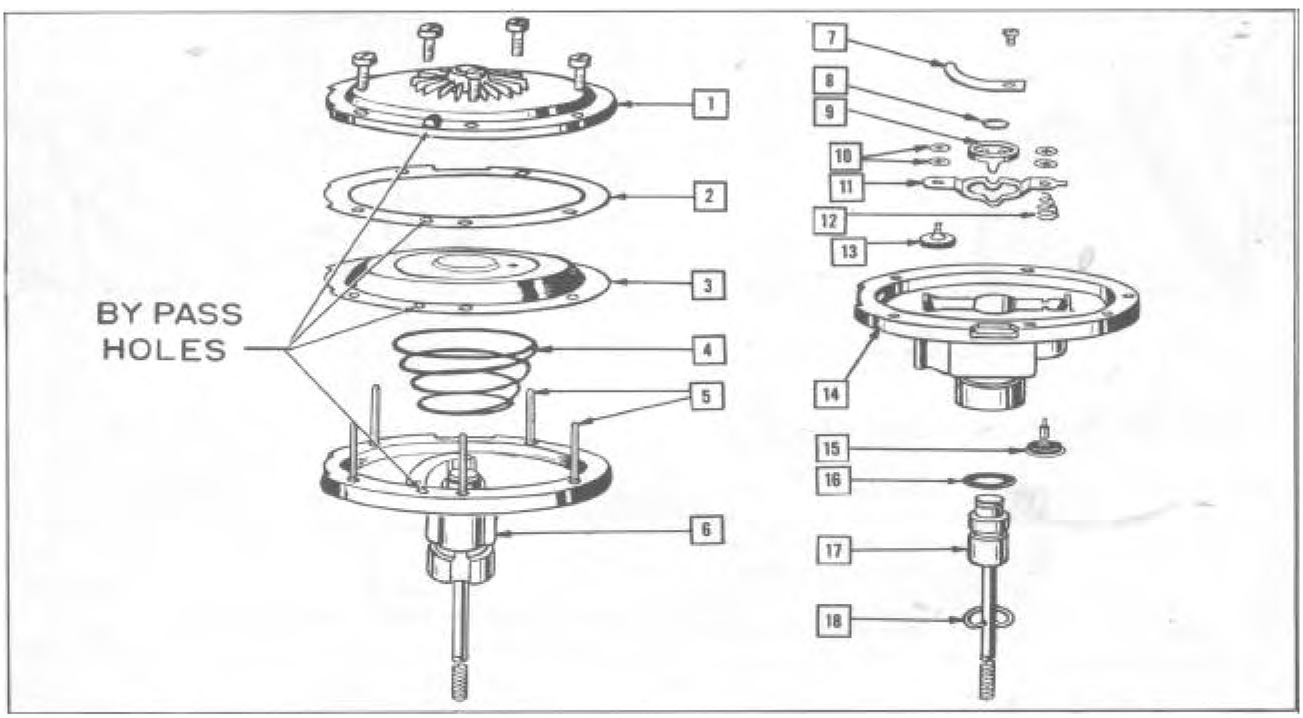
Thoroughly w ash all parts in alcohol. Use air pressure to remove fluid from all internal passages.

Inspect the vacuum cylinder shell bore for scoring. nicks, or dents. If slight, they may be removed with fine emery cloth.

Inspect master cylinder body. The bore, one inch down from the open end, must be free of any scratches or corrosion to insure proper seal of ,the master cylinder cup.
Inspect all gasket contact areas.

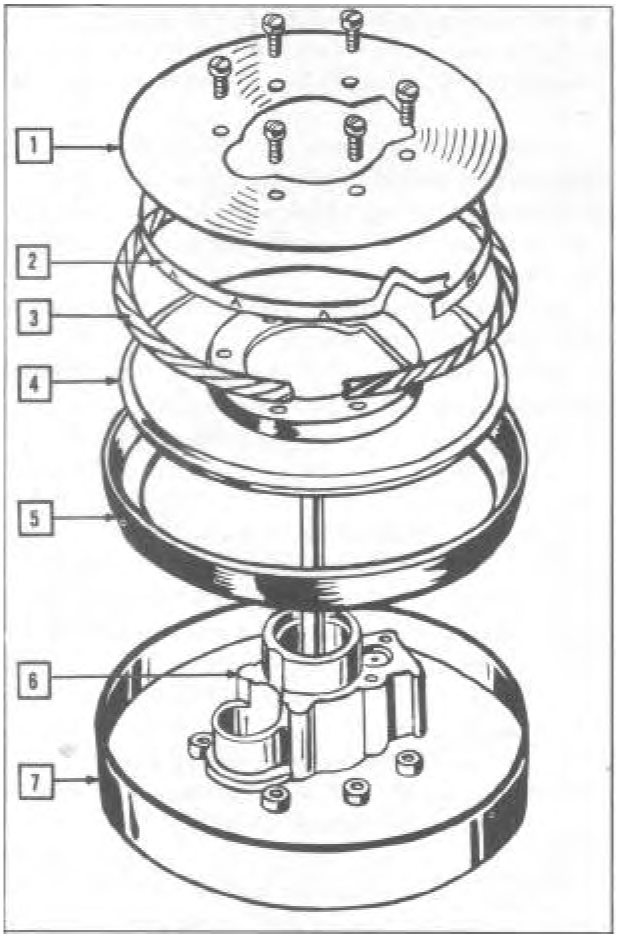
Inspect piston plates for cracks and damaged threads. Check plunger bore and poppet seats for any scratches or nicks. Do not attempt to refinish bore. Replace piston plate if necessary.

Inspect the finished surface of the master cylinder piston rod for any scoring or pitting. Do not attempt to refinish rod surface; replace with new rod if necessary.



1. Front Piston Plate
2. Gaskets
3. Diaphragm Assembly
4. Counter-Reaction Spring
5. Assembly Guide Pin J-5404
6. Piston and Valve Assembly Plate
7. Vacuum Poppet Spring Arm
8. Spirolox Ring
9. Pivot Washer
10. Clips
11. Pivot Arm
12. Atmosphere Poppet Spring
13. Vacuum Poppet
14. Piston and Valve Assembly Plate
15. Atmosphere Poppet
16. Seal
17. Plunger and Push Rod Assembly
18. Snap Ring

FIGURE 21—*Diaphragm and Valve Assembly*



1. **Retainer Plate**
2. **Expanding Ring**
3. **Wick**
4. **Packing Plate**
5. **Leather Packing**
6. **Piston and Valve Assembly Plate**
7. **Piston Assembly Ring J-5406**

FIGURE 22—Vacuum Piston Assembly

Inspect finished surface of push rod and plunger assembly for any scoring or pitting. Rod must pivot freely in the plunger without any noticeable end play. Do not attempt to refinish plunger surface; replace assembly if necessary.

Inspect vacuum cylinder end plate for possible distortion.

POWER BRAKE UNIT ASSEMBLE

Master Cylinder

Place a new gasket over threads of residual check valve fitting. Hold fitting in a vertical position and install the cone end of valve into fitting. Place the spring in the recess of the valve. With the master cylinder upside down, thread the residual check valve assembly into the master cylinder (Fig. 18).

Dip a new master cylinder cup in brake fluid and place the large side of the cup retainer to the lip side of the cup. Apply a film of brake fluid on the master cylinder piston rod and place retainer and cup onto the rod. Install the piston rod washer and piston rod stop washer against the cup (Fig. 17).

Clamp the master cylinder body in a vise and insert the piston rod assembly into the bore exercising care to prevent cutting the cup.

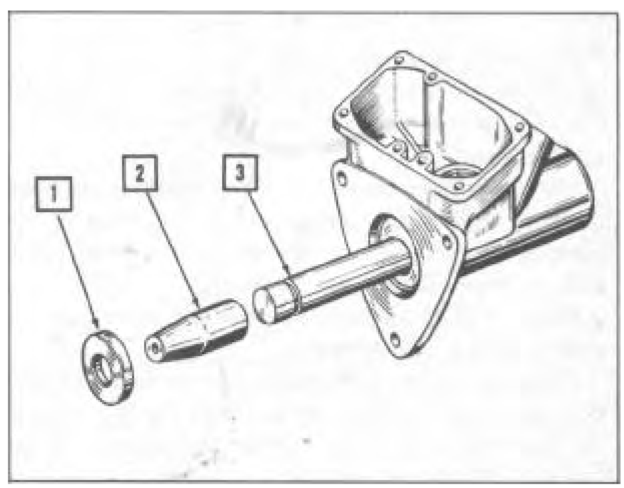
Install new retaining ring in recess of cylinder bore; use Tool J-4245 "Truarc" Pliers. Place a new rubber seal on the compensating valve fitting. Insert stem of new compensating valve into the threaded end of fitting. Place a new spring over valve stem with the large coil into the fitting. Compress the spring and install a new spring retainer onto the valve stem (Fig. 19).

Before installing the compensating valve into the master cylinder, push the master cylinder piston rod into the master cylinder; hold in this position while threading the valve fitting in place. This will insure that the operating stem of the valve is on the correct side of the master cylinder washer riveted in the end of master cylinder piston rod. Tighten valve fitting to a torque of 125 to 250 inch pounds.

Operate the piston rod manually and observe compensating valve action. Initial movement of piston rod should immediately allow the valve to straighten and seal.

Torque down the residual check valve fitting to 500700 inch pounds of torque. Reinstall master cylinder outlet fitting, cover, and new gaskets.

Pull out the master cylinder piston rod; install Tool J-5405 Seal Installer over the end of the piston rod. Install a new seal over the end of the tool with the lip of the leather toward the master cylinder. Press in place and remove tool (Fig. 231.



1. **Seal**
2. **Seal Installing Tool**
3. **Master Cylinder Piston Rod**

FIGURE 23—Installing Master Cylinder Leather Seal

Vacuum Cylinder Assembly

Place new hydraulic rubber seal in recess of master cylinder.

Position new paper gasket on master cylinder flange and reinstall the vacuum cylinder shell.

Check scribed alignment marks to insure proper reassembly.

Place large coiled end of piston return spring in power cylinder with hook end of spring between cap screw and raised projection in the bottom of power cylinder.

Place spring retainer over spring with hook end of spring in the notch on the retainer. Compress spring and install new "C" washer in groove of the master cylinder piston rod.

Assembly of Power Piston and Valve Assembly

Place a rubber seal on the push rod plunger with the lip pointing toward the push rod. Coat the plunger with lubriplate and install it into the bore of the piston plate; install lock ring (refer to Fig. 21).

Place stem of vacuum poppet in hole at rounded end of pivot arm and install two new retaining clips, one on top of the other. Place pivot arm and vacuum poppet assembly on end of plunger, install pivot washer, and engage Spirolox ring into groove at end of plunger.

Place vacuum poppet arm spring into recess of piston plate with end of spring contacting the vacuum poppet stem; install attaching screw.

Place atmosphere poppet spring between pivot arm and piston plate with large coil of spring towards atmospheric port. From opposite side of piston plate, insert atmosphere poppet stem through plate, spring, and pivot arm and install two new retaining clips, one over the other.

Power Piston Assembly

Place piston and valve assembly plate assembly on bench; install Assembly Guide Pins, Tool J-5404, (Fig. 21). Center reactionary spring on plate with small coil against plate.

Place diaphragm assembly on top of spring centering the large coil of the spring in the ring plate of diaphragm assembly. Place new gasket and front piston plate on top of diaphragm assembly.

Check scribed alignment marks and make sure bypass holes are aligned properly.

Compress spring and remove guide pins one at a time and replace with screws. Check the centering of the diaphragm assembly before tightening. Torque screws to 25-40 inch pounds.

Place Piston Assembly Ring, Tool J-5406, on a bench and install the sleeve and piston plate assembly into ring with sleeve up (Fig. 22).

Position new leather packing on the piston with the lip up; place packing plate inside packing, aligning holes in packing plate to holes in piston plate.

Cut a new cotton wick to correct length. Dip it in vacuum cylinder oil and place it inside the leather packing.

Install expanding packing ring so that projections will point up and into wick. Compress lock end of ring and engage notch with hook near the other end. Place retainer plate over the assembly ; align holes and cutout in place.

Install and tighten the five screws sufficiently to prevent any vacuum leakage.

Insert vacuum poppet compensating stem and compensating diaphragm into recess of piston plate.

The by-pass slot of diaphragm should face outward.

Attach steel stop washer to piston hub with the two retaining screws.

Soften the adhesive side of the rubber stop washer with gasoline and place it on the steel stop washer.

Install seal in vacuum port, hook tube assembly to piston plate, and insert attaching screw. Attach vacuum hose to tube assembly (Fig. 20).

Apply a thin film of vacuum cylinder oil to the inside of the vacuum cylinder.

insert the piston and valve assembly into the vacuum cylinder. Align the end of the vacuum hose with the hole at side of the vacuum cylinder shell for vacuum inlet tube.

When aligned, engage the hooked end of the piston return spring between the webs on the back side of the piston. Operate the piston, by hand, several times and make sure it will maintain its correct alignment during operation. If the alignment is not maintained, it will be necessary to rotate the piston to relocate.

Install gasket and tube and plate assembly to cylinder shell.

Install the vacuum hose. Operate piston to check that the vacuum hose does not contact the vacuum cylinder shell during the stroke.

Install the end plate and gasket. Crimp the locking tabs.

Assemble felt valve rod washer on valve rod.

Dip small end of rubber valve rod guard into brake fluid. Install on valve push rod and attach to the end plate. Place valve rod guard retainer in position.

Maintenance

1,000 Miles	Check the brake fluid level. Fill to with-in 1/2" of filler opening.
5,000 Miles	Check all vacuum and brake fluid connections for leakage.
10,000 Miles	Check brake pedal linkage; check linings and drum condition. Clean air cleaner. Clean check valve on mani fold.

Pedal Linkage Adjustment

Remove clevis pin and detach push rod assembly from operating bell crank. Loosen lock nuts and adjust thelength of the push rod so that the power unit will be in the completely released position when the brake pedal rod cushion is up against the floor pan.

To prevent any contact during operation, a minimum of 3/4" clearance must be maintained between the center line of the push rod to bell crank clevis pin and the outer surface of the front adjusting link lock nut.

Testing Power Brake System

Road test the car by applying the brakes at the speed of approximately 20 M.P.H. If the vehicle does not stop evenly and quickly and the pedal has a spongy action, it is an indication that air is present in the hydraulic system. Bleed the system in the usual manner.

With the engine stopped and the transmission in neutral, make several pedal applications to eliminate all vacuum from the system. Depress the brake pedal and hold in this position. The pedal should hold a steady position. If the pedal gradually falls away under this pressure, the hydraulic system is not functioning properly.

Depress the pedal and hold in that position while the engine is started. If the vacuum system is operating correctly, the pedal will tend to fall away under the foot pedal pressure and at the same time less pressure will be required to hold the pedal in that position. If this action is not felt, the vacuum power system is not operating properly.

POSSIBLE DIFFICULTIES AND CORRECTIONS

CONDITIONS AND PROBABLE CAUSE	CORRECTIONS
Hard Pedal (Mechanical Condition)	
Glazed Linings	Clean and Adjust
Grease or Brake Fluid on Lining	Correct Leak—Reline Brakes
Bind in Pedal Linkage	Free Up and Lubricate
Hard Pedal (Vacuum Failure)	
Faulty Vacuum Check Valve	Clean or Replace
Collapsed Vacuum Hose	Replace
Plugged Vacuum Fittings	Clean or Replace
Reserve Tank Leaking	Replace
Hard Pedal (Power Unit)	
Internal Vacuum Hose	If Loose, Replace—Clean Interior of Power Cylinder Shell
Vacuum Leaks in Power Piston	Recondition Power Piston
Restricted Air Cleaner	Clean or Replace
Atmospheric Poppet Not Sealing	Replace Poppet Valve
Vacuum Cylinder to Master Cylinder Vacuum Leak	Recondition Power Unit
Bind in Push Rod and Plunger Action	Check Operation and Lubriplate
Grabbing Action in Brakes	
Grease or Brake Fluid on Linings	Correct Leak—Reline Brakes
Rough or Scored Drums	Clean and Turn Down
Reactionary Diaphragm Leak	Replace
Counter-Reaction Spring Broken	Replace
Restricted Diaphragm Passage	By-Pass Hole in Gasket not in Alignment—Clean Passage
Faulty Pivot Arm and Vacuum Poppet Action	Check Operation—Replace
Bind in Push Rod and Plunger Action	Check Operation and Lubriplate
Pedal Goes to Floor	
Brake Adjustment	Adjust
Air	Bleed Brake Lines
Brake Fluid Leak	Correct—Bleed
Brake Drum Cracked	Replace
Compensating Valve Leak	Replace Valve—Bleed
Master Cylinder Plunger Seal Leak	Recondition —Bleed

POSSIBLE DIFFICULTIES AND CORRECTIONS

CONDITIONS AND PROBABLE CAUSE	CORRECTION
Brakes Do Not Release Properly	
Improper Brake Adjustment	Adjust
Pedal Linkage Binding	Free Up
Friction in the Master Cylinder Piston Rod Stroke	Leather Seal Bind
Residual Check Valve	Replace—Bleed
Interference in Vacuum Piston Stroke	Rubber Vacuum Line should Maintain Om during the Piston Stroke. If Hose Move by Relocat-ing the Piston on the Return Spring
Excessive Power Piston Packing Friction	Check Cylinder Shell and Piston Packing for
Compensating Valve Sticking	Replace Valve--Bleed
Piston Return Spring Broken	Replace
Brake Shoes Return Spring Broken	Replace
Brake Shoe Bind on Backing Plate	Apply Lubriplate
Bind in Push Rod and Plunger Action	Check Operation and Lubriplate
Restricted Air Passage in Piston Plate	Check Alignment—Clean
Restricted Air Cleaner	Clean or Replace

BRAKE SPECIFICATIONS

Series	"Hornet"	"Wasp"	"Rambler"
Type of Mechanism	Lockheed Hydraulic	Lockheed Hydraulic	Lockheed Hydraulic
Make	Bendix Servo	Bendix Servo	Bendix Floating Shoe
Total Foot Braking Area	191 Sq. In.	160 Sq. In.	104.3 Sq. In.
Lining Size— Width x Length			
Primary—Front	2-1/2" x 9-3/8"	2-1/4" x 8-1/2""	2" x 9-7/8"
Rear	2" x 9-3/8"	1-3/4" x 8-1/2"	1-1/4" x 8-27/64"
Secondary—Front	2-1/2" x 12"	2-1/4" x 11"	1-3/4" x 7-11/16"
Rear	2" x 12"	1-3/4" x 11"	1" x 8-27/64"
Pedal Free Play Without Power Brakes	1/4" to 1/2"	1/4" to 1/2"	1/4" to 1/2"
Drum Diameter, Inches	11"	10"	9" Front 8" Rear
Front Wheel Cylinder Bore, Diameter	1-1/8"	1-1/8"	1"
Rear Wheel Cylinder Bore, Diameter	15/16"	15/16"	13/16,,
Master Cylinder Bore, Diameter	1"	1"	1"
Piston Clearance, Inches Wheel and Master Cylinder	.001" to .003"	.001" to .003"	.001" to .003"
Master Cylinder Piston Rod Diameter, Inches (Power Brakes Treadle Vac)	21/32"	21/32"	

WHEELS AND TIRES

Series	"Hornet"	"Wasp"	"Rambler"
Wheel Size	15"	15"	15"
Tire Size			
Standard	7.10 x 15"	6.70 x 15″	6.40 x 15"
Tire Pressure			
Cold Front and			
Rear Wheels	24 Lbs.	14 Lbs.	24 Lbs.

TIRE WEAR

Abnormal tire wear can be caused by improper inflation pressures, wheel balance, mechanical irregularities, or misaligned front suspension.

A tire severely cupped is mainly due to loose steering connections, loose wheel bearings, or any excessive looseness throughout the front suspension. An uneven brake adjustment, out-of-round brake drums, may also cause rapid and uneven tire wear.

A tire which is worn only on one side of the tread is normally caused by excessive positive or negative camber. The extent of camber wear is largely due to the amount of camber angle in relation to the type or shape of local road surfaces.

Tread wear very similar in appearance may also be caused by driving at high speeds on turns. This is known as "Cornering" tread wear and cannot be corrected by the changing of the camber angle.

An incorrect toe-in or toe-out adjustment will cause one edge of the tire tread to wear to a "feathered edge." This is noticed by a rounded off edge on one side and sharpness on the other. This actually means that the tire is slipping sideways or scuffing as it travels down the road.

If the "feathered edge" is on the inner sides of the tread, either on one or both tires, it indicates that one or both tires have excessive toe-in; while the same condition on the outer sides of the treads indicate excessive toe-out.

In some instances, one front tire may indicate toe-in wear, while the opposite tire indicates toe-out wear. When this condition is encountered, the steering goemetry must be checked and set to specifications.

This condition can also be caused by bent steering arms, with the result that the inside wheel on both turns, either toes-in or toes-out in excess.

Inflation Pressures

One of the most important factors in tire care is to maintain proper inflation. In order to maintain the correct inflation pressure, tires should be checked when cold. The effect of three types of inflation pressures are shown in Figure 24.

The inflation pressure recommended by the tire manufacturer is the most effective pressure to use in order to maintain efficient balance, riding comfort. tire life, and smooth steering.

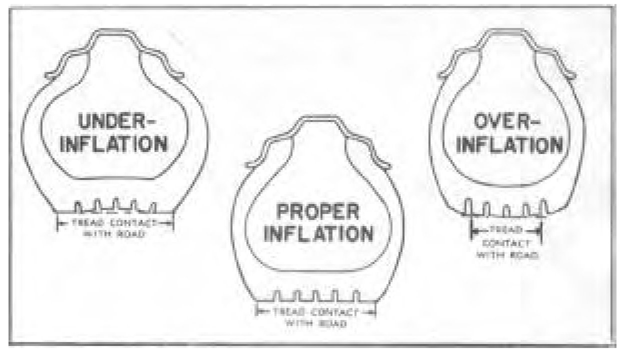


FIGURE 24—*Effect of Inflation Pressures*

Whenever the air pressure is either greater or less than recommended, the balance of forces in the tire is upset. Results are abnormal wear and premature failure.

Wheel Balance

Tire and wheel balance is very important both for preventing excessive tire wear and for ease in handling the car.

There are four factors involved in wheel balance and each one must be considered.

Radial run-out is the unevenness of tread caused by an eccentric wheel or tire (Fig. 251.

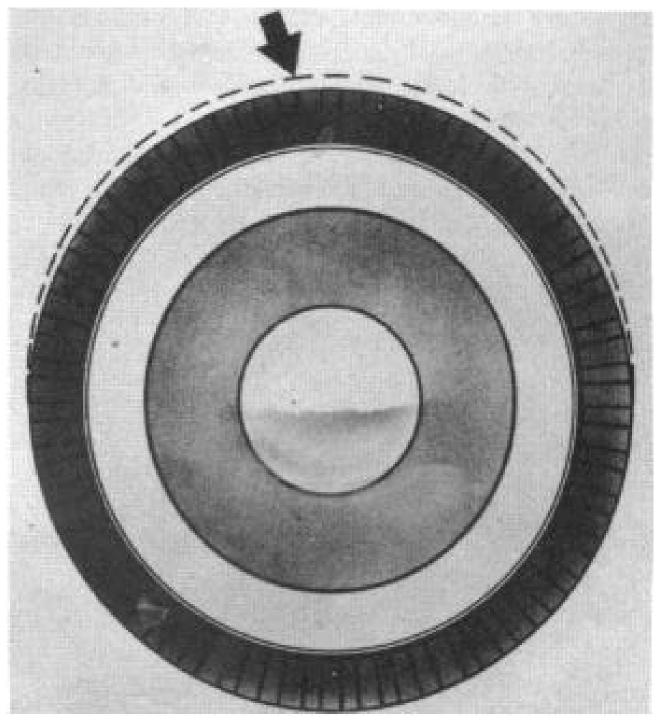


FIGURE 25—*Radial Run-Out*

To correctly inspect a wheel for excessive run-out, the wheel should be mounted by means of the mounting lug either on a hub or an off-the-car type balancer.

The radial run-out is checked at the tire bead seat (Fig. 26) not the outer rim of the wheel. This run-out should not exceed .062" or 1/16" of an inch.

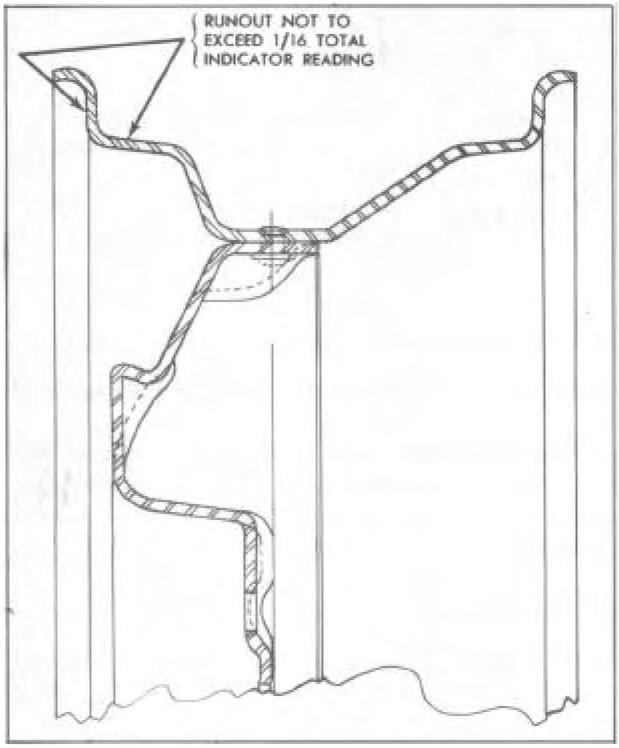


FIGURE ***26—Check Wheel for Run Out***

To check whether the run-out is in the wheel or the hub, mark the high spot on both the wheel and hub with a "+" sign, then mark the low spot on the wheel and hub with a "—" sign. By placing the high spot "+" mark 180° from its former position and rechecking the run-out, the run-out high limit should be at the same "+" mark on the wheel. If the high limit is at the "+" mark on the hub. then the hub has the run-out.

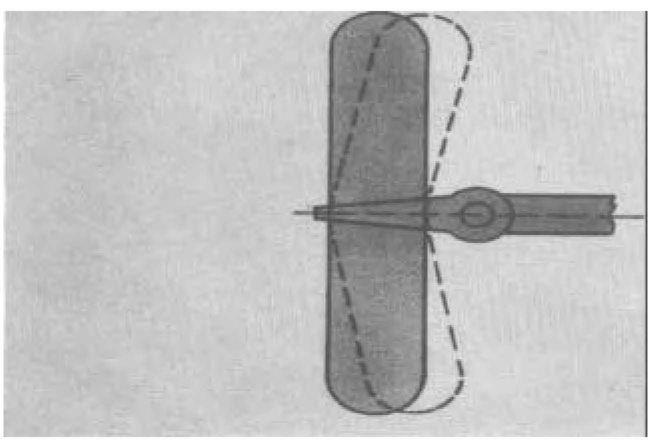


FIGURE 27—Lateral Run-Out

Lateral run-out is the side movement of the wheel caused by a bent hub or wheel (Fig. 27). Lateral run-out can be checked in the same manner as radial run-out. However, the reading is taken at the inner vertical bead flange (Fig. 26).
Static unbalance is an unequal distribution of weight around the center of rotation (Fig. 28).

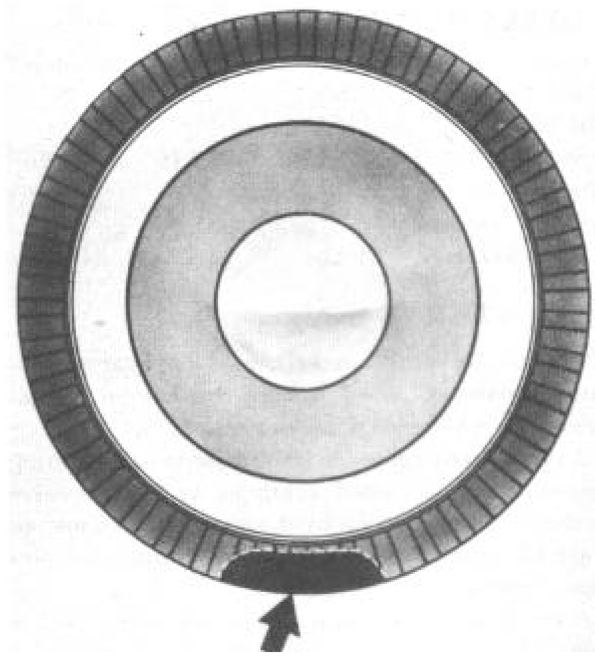


FIGURE 28—*Static Unbalance—When Wheel Weight is not Evenly Distributed around the Hub as a Center, the Heavy Point Goes to the Bottom*

Dynamic unbalance is an unequal distribution of weight around the vertical center line of the wheel (Fig. 29).

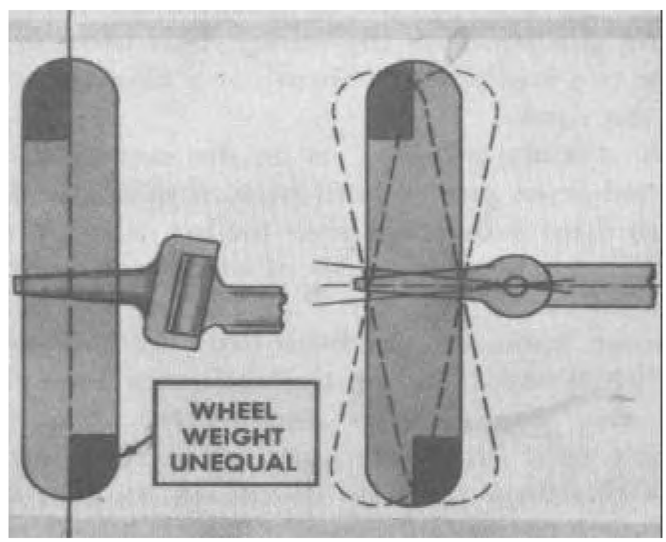


FIGURE 29 — *Dynamic Unbalance — When Wheel Weight is not Evenly Distributed around the Plane of Rotation, High Speeds Result in Wheel Wobble*

Rotation of Tires

To equalize tire wear, it is recommended that the tires be interchanged after the first 2,500 miles, and every 5,000 miles of service thereafter. Follow the rotation procedure as illustrated in Figure 30.

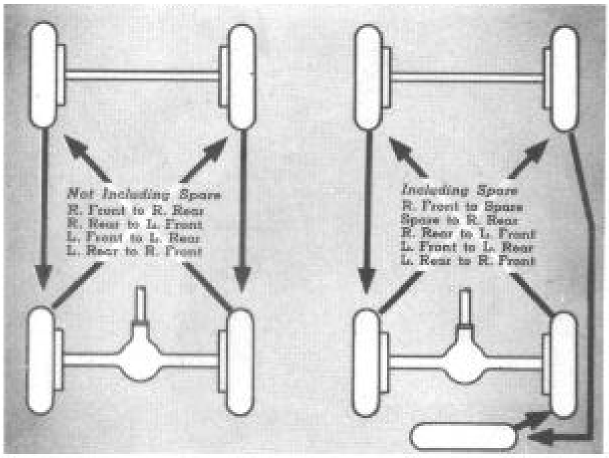


FIGURE 30—*Tire Rotation*

FRONT WHEEL BEARINGS

The front wheel bearings are of the taper roller bearing type. The front wheel bearing assembly consists of the inner and outer roller bearings, their cups, and a grease

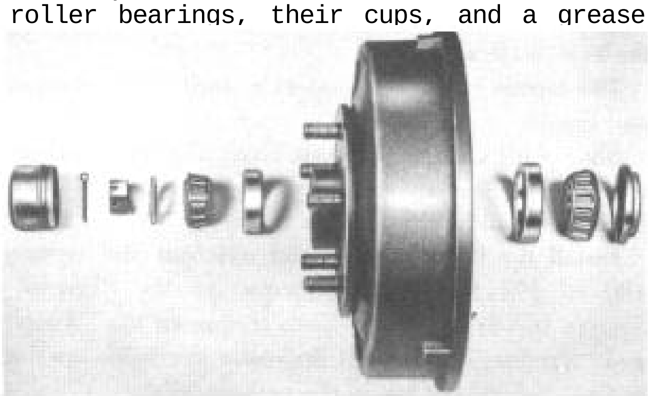


FIGURE 31—*Front Wheel Bearing Assembly "Wasp" Series Shown*

When repacking front wheel bearings, clean all parts in a suitable solvent and inspect bearings and cups for excessive wear. Replace any questionable parts. Always use a new seal upon reassembly.

Pack the bearings with a good recommended bearing grease, then mount the wheel on the wheel spindle. To adjust the wheel bearings, rotate the wheel while tightening the wheel spindle nut. Tighten the nut until it is firmly seated and will cause a drag on the wheel. Back off on the adjusting nut to the first castellation or until the cotter pin hole is aligned. The wheel should now be free to rotate but without play in the hub and bearings.

Install a new cotter pin and lock it to the nut and spindle. Install the inner and outer hub caps.

REAR WHEEL BEARINGS
(AXLE SHAFT)

Rear Axle Shaft Bearing Removal

Attach Rear Hub Puller 1-736-B to the rear wheel hub I Fig. 32) and remove the hub.

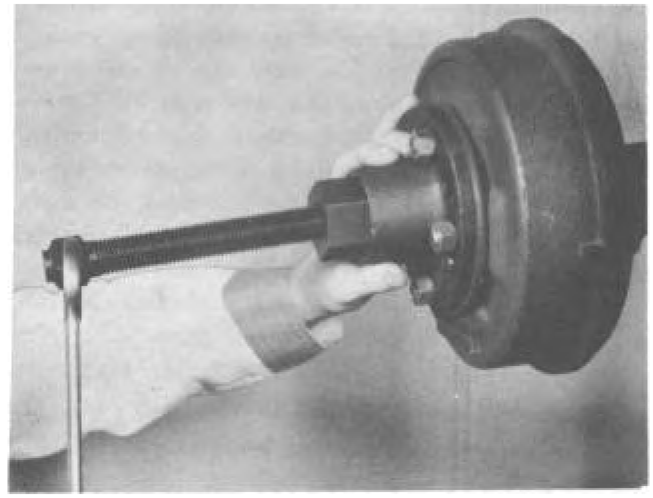


FIGURE 32—Rear Hub Puller J-736-B Removes Rear Wheel Hubs without Damaging Internal Axle Parts

Check the axle shaft end play using End Play Checking Tool J-2092; note the end play.
Remove the cap screws attaching the brake support plate to the axle tube. Slide the oil seal, support plate, and shims off the axle (Fig. 33). The oil seal on the "Rambler" Series is located between the support plate and the axle tube. The shims should be measured, using a micrometer to determine the amount that should be reinstalled at the time of assembly. Inspect the brake support plate for elongated attaching bolt holes.
To remove the axle shaft, install special axle shaft puller (J-2498-A) to the axle as shown in Figure 33 and pull the axle shaft out of the housing. Then slip the bearing cup off the shaft. The bearing cone is a press fit on the axle shaft and must be removed. using an arbor press.

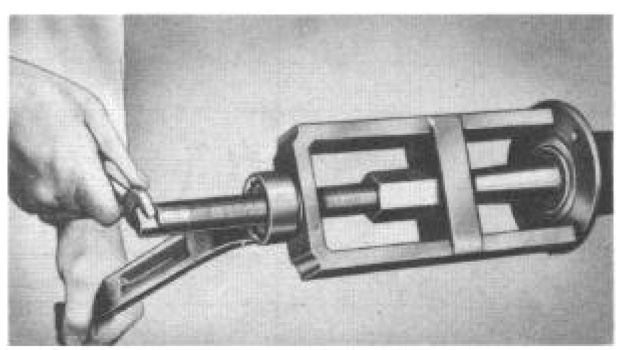


FIGURE 33—*Axle Shaft Removal with J-2498-A*

Axle Shaft Bearing Installation

The axle shaft bearings have no provision for lubrication after assembly. These hearings should be packed with a good quality wheel bearing lubricant before the reassembly operation. Press axle shaft bearings onto the axle shafts with the small diameter of the cone toward the outer tapered end of the shaft using Bearing Replacing Tool J-2995. The inner axle oil seal is extremely important. Always use new seals when reassembling an axle. Soak the seals in light lubricating oil to make them soft and pliable and to prevent being burned in operation. Install the seal using the shaft oil seal replacer (J-2539 on the "Hornet" Series, J-2626 on the "Wasp" Series, and J-4484 on the "Rambler" Series). Install the axle shafts indexing the splined end with the differential side gears.

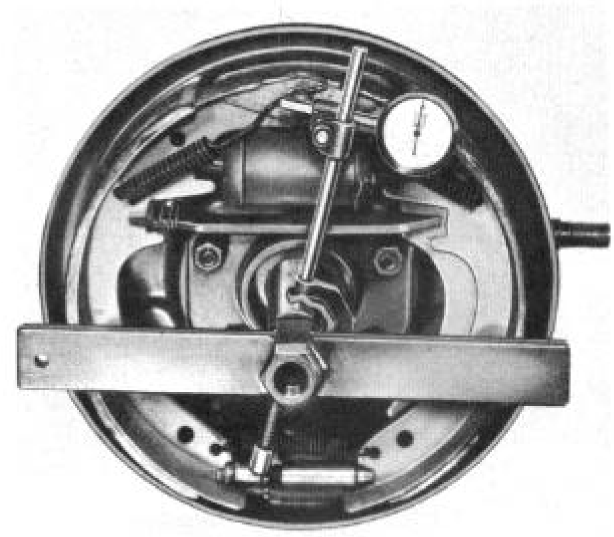
NOTE: *The "Hornet" Series right .hand axle shaft is 11-/2" longer than the left one.*

Install the outer bearing cup, using axle shaft bearing cup replacer J-1433-1.

Install the original shims onto the axle with the drain hole aligned with the hole in the axle tube (if the end play was checked at the time of disassembly and required correction, a correction can be made at this time). Install the brake support plate, spacer, and oil seal. The "Rambler" Series oil seal is installed behind the brake support plate. Tighten the support plate bolts to 50-55 foot pounds torque on the "Hornet," and 30-35 foot pounds on the "Wasp" and "Rambler" Series.

When checking axle shaft end play, strike the end of each axle shaft with a lead hammer to seat the bearing cups against the support plate.

Attach Axle Shaft End Play Tool J-2092 to the end of one shaft, affix a dial indicator to the support plate or the tool, and check the play when pushing and pulling on the axle shaft (Fig. 341. End play should be .002" to .004"



Add shims to either side to increase end play, remove shims to decrease end play. Note the position of the thrust block. There should be a minimum of 1/16;" clearance between the thrust block and the differential pinion shaft.

Inspect the hub key for a snug fit in the keyways of the axle shaft and hub.

The tapers of the hub and axle shaft must be clean and dry.

Slide the hub onto the axle shaft aligning the keyways; install the key and press the hub onto the shaft. The key should be flush with the hub.

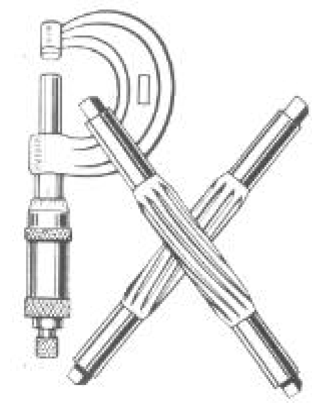
Install the thrust washer and axle nut and tighten 180 to 190 foot pounds torque on the "Hornet" Series; 160 to 165 foot pounds torque on the "Wasp" and "Rambler" Series. (If the cotter key holes are not in line, tighten the nut to the next castellation.)

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



REAR AXLE AND PROPELLER SHAFT SECTION

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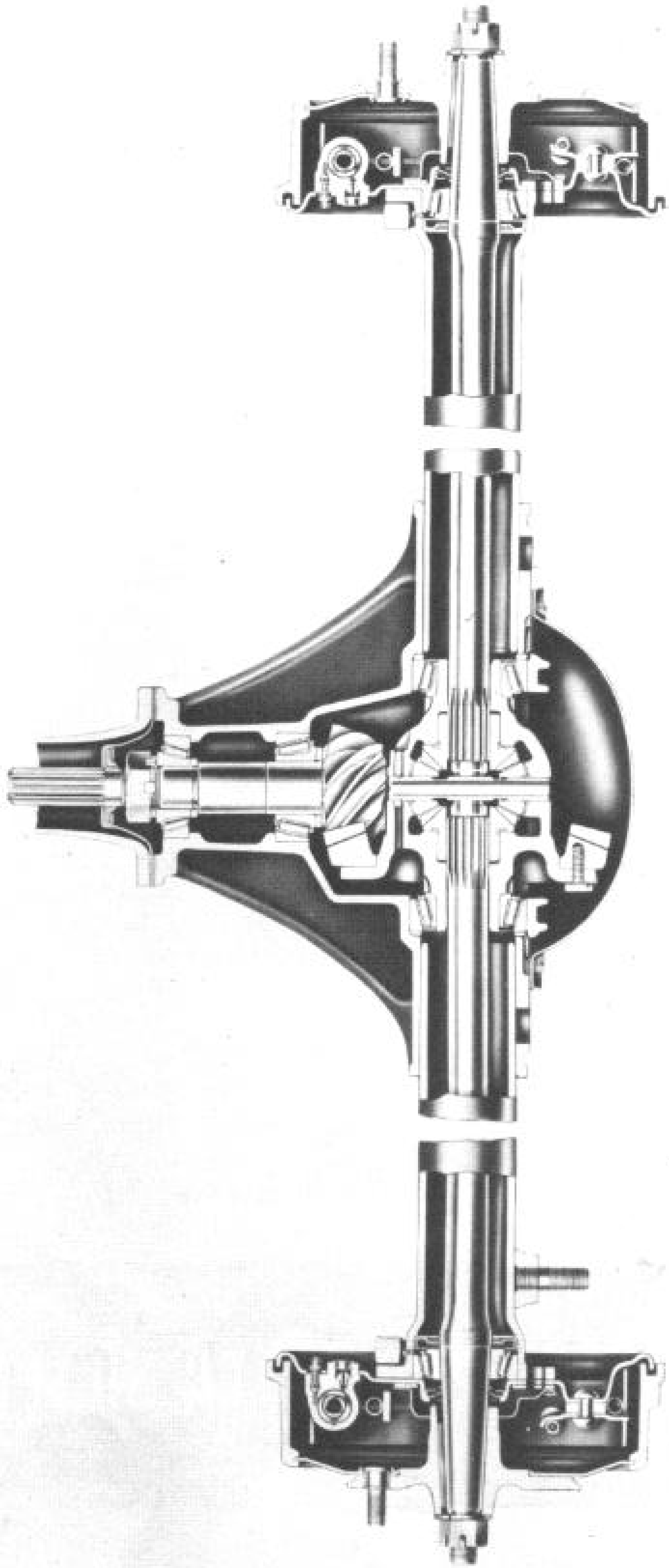


"Wasp" Series Rear Axle Assembly

REAR AXLE AND PROPELLER SHAFT SECTION

REAR AXLE DISASSEMBLY

Axle Assembly Removal

Remove the plug at the bottom of the axle housing and allow the lubricant to drain from the axle.

An axle flushing solution can be used in the axle to degrease the parts before the actual disassembly is started. This practice will save time during disassembly as the parts will be free from lubricant and may be handled and inspected easily.

"Hornet" and "Wasp" Series

Raise and support- the rear of- the body.

Disconnect the hand brake cable at the bell crank and the hand brake cable housing at the bracket.

Then disconnect the torque tube from the transmission, the rear brake hose at the bracket on the body floor pan, the rear springs and shock absorbers from the axle tube, and the rear axle stabilizer bar at the axle tube.

Roll the axle free from the car and disconnect the truss rods, torque tube, and propeller shaft from the rear axle.

The method of propeller shaft attachment to the rear axle is illustrated in Figures 1 and 2.

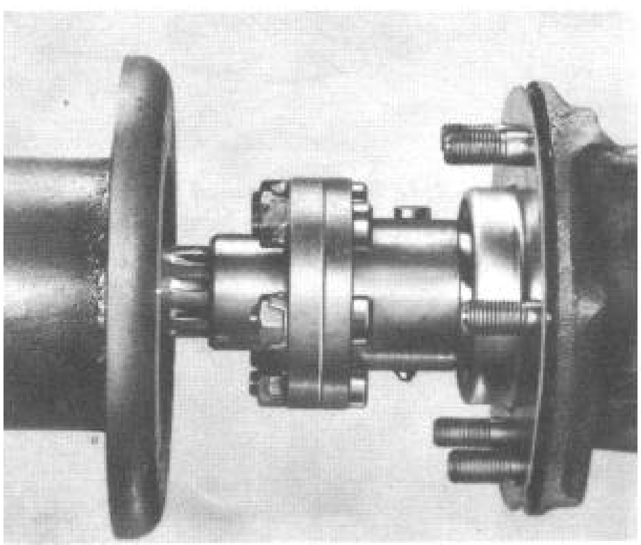


FIGURE 1—*Rear Axle and Propeller Shaft Companion Flange "Hornet" Series*

The "Wasp" Series incorporates the "slip" type coupling. The propeller shaft and coupling can be slipped off the pinion shaft when breaking the connection between the propeller shaft and rear axle, Figure 2.

Place the rear axle on suitable stands to facilitate overhaul.

"Rambler" Series

Raise and support the rear of the body.

Remove the rear wheels and rear wheel hubs.

Then disconnect and remove the hand brake cables from the brake assemblies.

Remove the propeller shaft using Coupling Nut Wrenches J-4486 (Fig. 3).

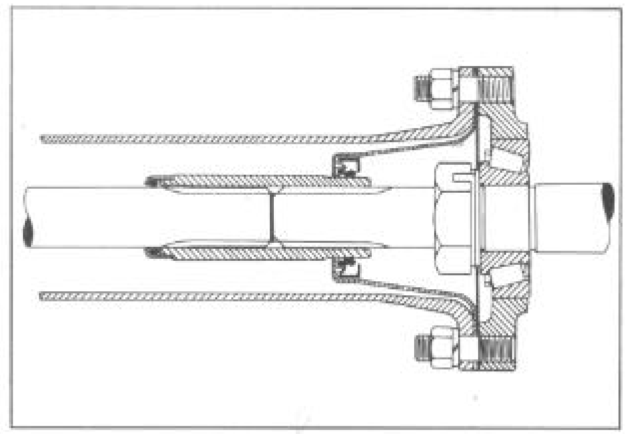


FIGURE 2—*"Slip" Type Coupling "Wasp" Series*

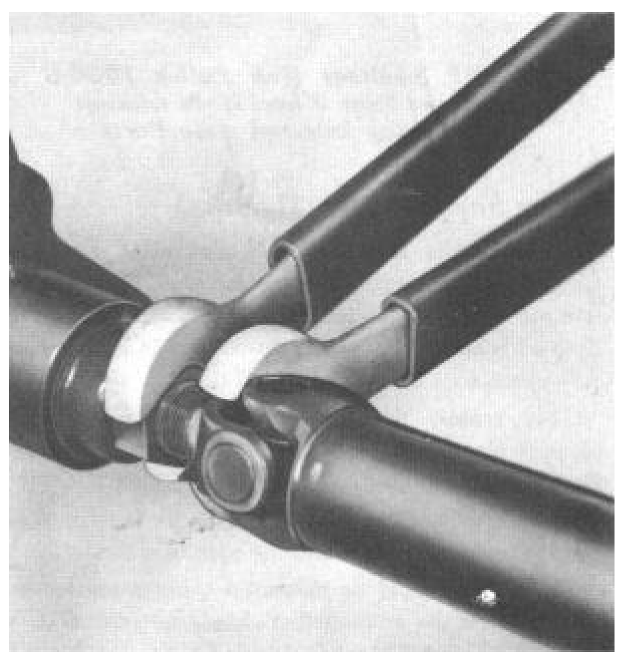


FIGURE 3—*Loosening "Rambler" Series Propeller Shaft Coupling*

The coupling nut dust shield will serve as a puller to partially remove the propeller shaft from the rear axle pinion. Disconnect the rear shock absorbers, the rear brake line at the bracket on the body floor pan, and the rear springs from the body.

The axle and springs may be removed from the car as an assembly.

Remove the rear springs to provide adequate room to work on the axle.

Install the axle on suitable stands to facilitate overhaul.

Hub and Drum Removal

Rear Hub Puller J-1644-B or J-736-B, attached to the rear wheel hub (Fig. 4) should be used to remove the hub. The use of a "knock-out" on the end of the axle shaft may cause damage to the rear wheel bearings or the thrust block.

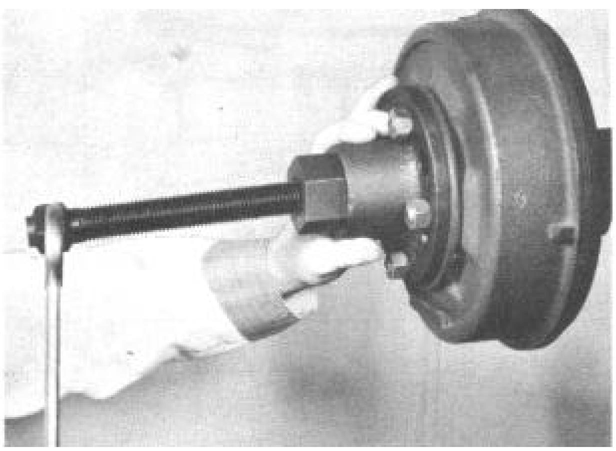


FIGURE 4—*Rear Hub Puller 1-736-B Removes Rear Wheel Hubs without Damaging Internal Axle Parts*

Brake Support Plate Removal

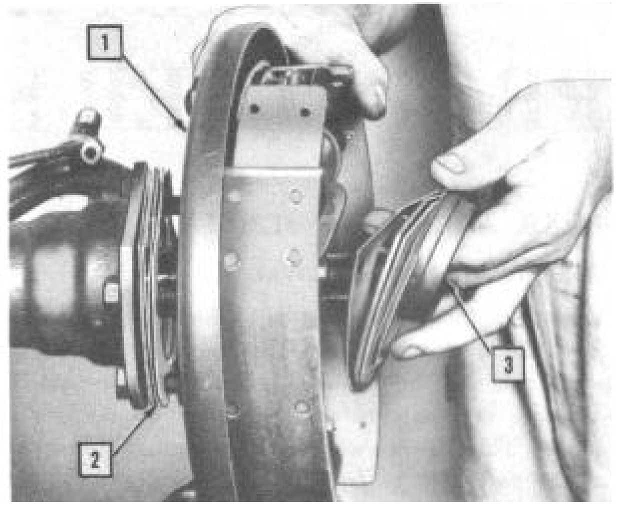
First check the axle shaft end play using End Play Checking Tool J-2092; note the end play. This practice will aid in setting the correct end play clearance at the time of reassembly. (Refer to section "Checking and Adjusting Axle Shaft End Play.")

Then remove the cap screws attaching the brake support plate to the axle tube. Slide the oil seal, support plate, and shims off the axle (Fig. 5).

The oil seal on the "Rambler" Series is located between the support plate and the axle tube.

The shims should be measured using a micrometer to determine the amount that should be reinstalled at the time of assembly.

Inspect the brake support plate for elongated attaching bolt holes.



1. Support Plate
2. Shims
3. Oil Seal

FIGURE 5—*Removing the Brake Support Plate "Hornet" Series*

Axle Shaft Removal

Attach special axle shaft puller (J-2498-A) to the axle as shown in Figure 6 and pull the axle shaft out of the housing. Then slip the bearing cup off the shaft.

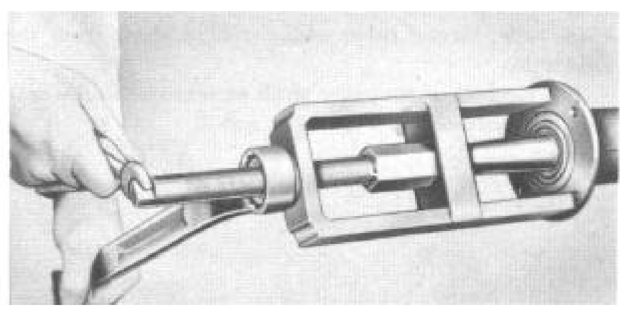


FIGURE 6—*Axle Shaft Removal With J-2498-A The bearing cone is a press fit on the axle shaft and must be removed using an arbor press (Fig. 7).*

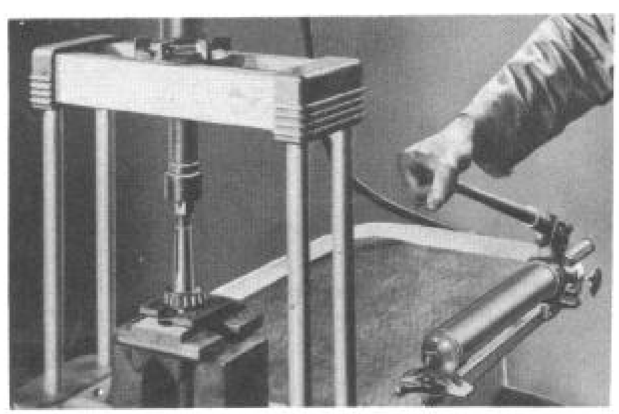


FIGURE 7—*Use an Arbor Press to Remove the Wheel Bearing From the Axle Shafts*

Inspecting Axle Shafts

Install a differential side gear on the spline of the rear axle shaft and place the shaft between lathe or similar type centers.

Use an accurate dial indicator and check the run out at the center of the finished surface of the side gear hub. This run out should not exceed a total of .007" (Fig. 8).

Then using the dial indicator, check the run out at the machined surface adjacent to the bearing. This should not exceed .003" (Fig. 9).

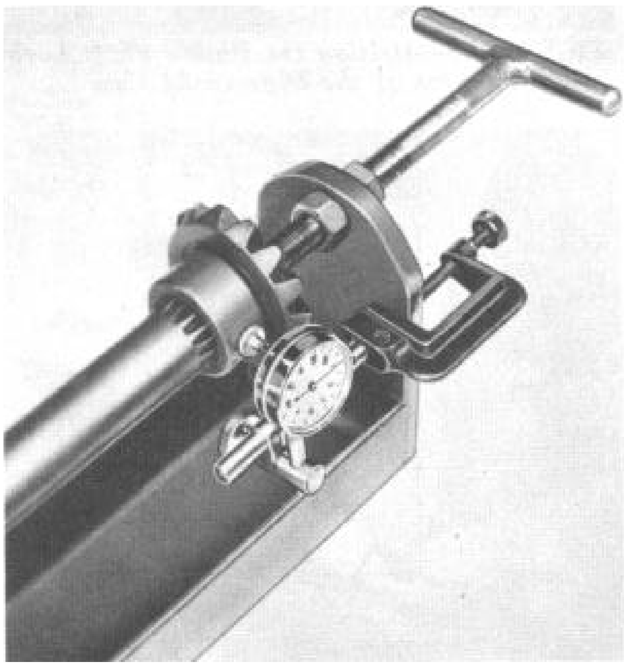


FIGURE 8—***Check the Axle Shaft Inner End for Run Out***

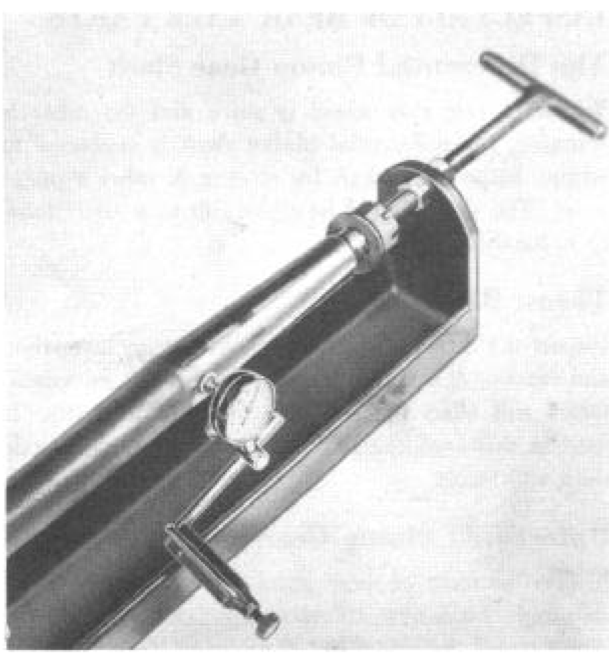


FIGURE 9—***Check the Axle Shaft Outer End for Run Out***

Inspecting the Axle Housing

A bent axle or housing may put an excessive strain on axle parts and make the axle noisy. It is, therefore, important to inspect the axle housing for straightness.

Place two straight-edges across the flanges of the housing and measure the distances between their ends (Fig. 10). If the straight-edges are parallel within %2" at a distance of 11" from the tube center, the housing is serviceable. Make this inspection two ways - rizontally and vert
FIGURE 10—Inspecting Rear Axle Housing for
a Bent or Sagged Condition. Dimensions "A"
and "B" Should be Equal Within 3/32"

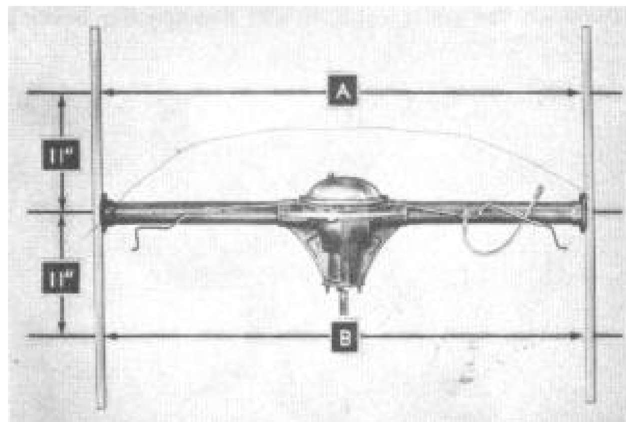


FIGURE 10—***Inspecting Rear Axle Housing for a Bent or Sagged Condition. Dimensions "A" and "B" Should be Equal Within 3/32"***

Differential Removal

Remove the differential cover bolts. Note the ratio tag which is held on by one of these bolts and reinstall it at time of assembly.

Before removing the differential from the housing, mark the bearing caps with a center punch to insure reassembling in exactly the same positions.

Two bars inserted in the differential (Fig. 11) and pried against the housing will lift the assembly out of the housing. Care should be taken to prevent damaging the bearing cups, rollers. and shims.

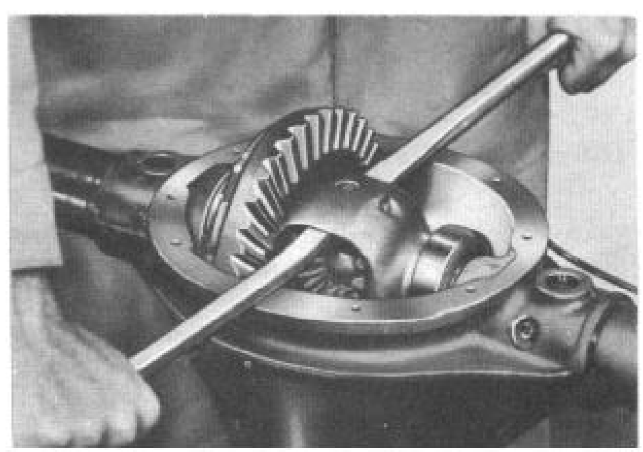


FIGURE 11—***Prying the Differential Out of the Axle Housing***

Tie the side bearing shims to their respective bearing caps and cups to prevent misplacement whenever the differential is removed. This is done if the bearings are in good condition and are to be re-used.

Differential Side Bearing Removal

A puller (J-2497) is used to remove the side bearing cones from the differential case (Fig. 12). When using this tool, be sure it pulls on the bearing cone in such a manner that the rollers are free. If the puller bears on the roller cage, it will damage the bearing.

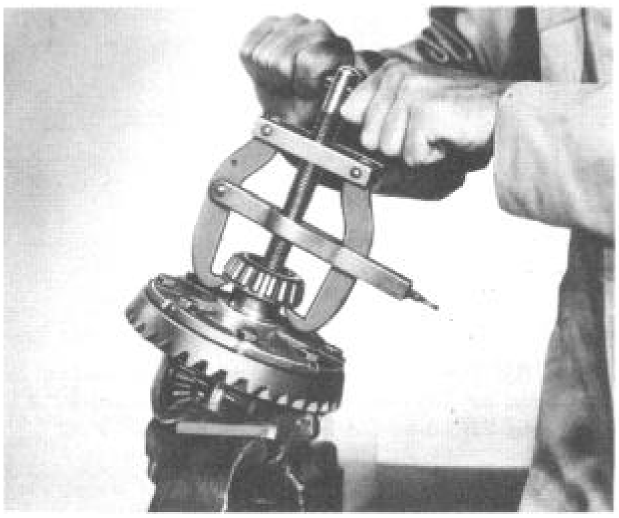


FIGURE 12—*Pulling Differential Side Bearing Using Puller J-2497*

Ring Gear Removal

Remove the cap screws that attach the ring gear to the differential case.

Using a brass drift, tap the ring gear from the case. Do not nick the ring gear face of the differential case or drop the gear.

> CAUTION: *Do not chisel or wedge the ring gear from the case.*

Differential Pinion Gears and Shaft Removal

Use a 3/16" diameter drift at least 3" long to drive out the lock pin that holds the differential pinion shaft in place (Fig. 13).

The pinion shaft can then be driven out and the thrust block can be dropped out through the differential side gear (Fig. 14).

Roll the differential pinion gears around on the side gears until they can be lifted out through the holes in the case. Then lift out the side gears and their thrust washers.

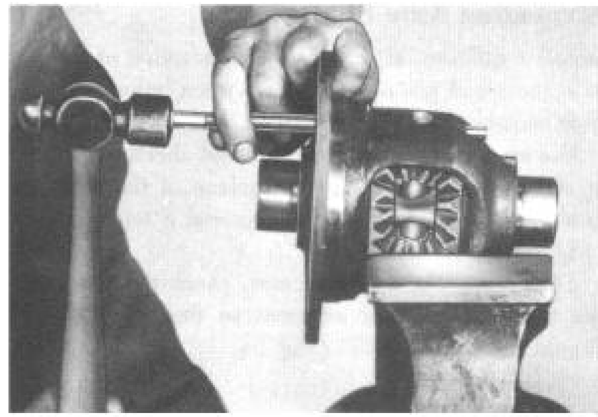


FIGURE 13—*Driving the Pinion Shaft Lock Pin Out of the Differential Case*

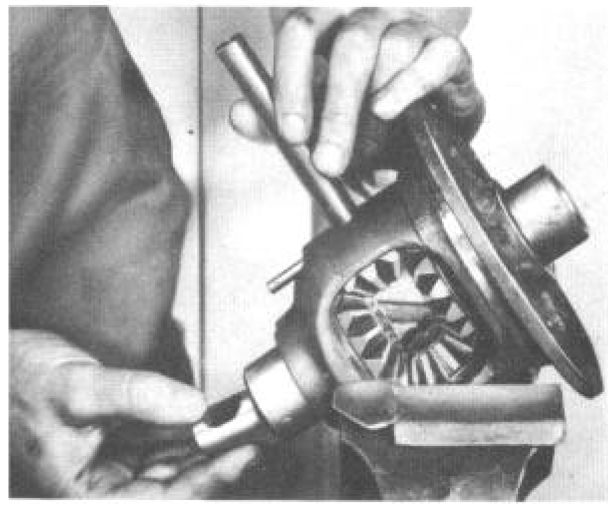


FIGURE 14—*Removing the Differential Pinion Shaft and Thrust Block*

INSPECTION OF REAR AXLE PARTS

The Differential Pinion Gear Shaft

Whenever one rear wheel is stuck and the other is spinning, the differential pinion shaft is subjected to strain. Inspect this shaft for scoring or other signs of wear. The shaft should be a press fit to a .010" loose fit in the differential case.

Thrust Block

Inspect the thrust block for excessive wear, distortion, and cracks. A thrust block that has been worn or distorted will affect the end play of the axle shafts. If used in this condition, excessive end play of the axle shaft will result.

Differential Pinion Gears

Inspect the teeth of these gears for excessive wear or chipping. Fit a new differential pinion shaft into the gear to see if the hole is out of round or worn. Discard the thrust washers. New ones will be used during assembly.

Differential Side Gears

Inspect side gear for worn, cracked, or chipped teeth. The gear should be a snug fit on the axle shaft spline. Also inspect the fit on the side gear in the differential case bore. This clearance should not exceed .007". This play must be corrected or it will cause excessive backlash in the drive line. The differential side gear clearance between the case and gear should be 0" to .008", .004" desired. Where a differential assembly is to the tight side, it will be acceptable, if not more than eight foot-pounds of torque applied to either side gear will rotate the internal gears. If the gears need replacement, pinion and side gears should be replaced as a set.

Differential Case

Inspect side bearing surfaces for nicks or burrs. Small nicks or burrs may be dressed down with a stone or smooth file.

Ring Gear

Inspect all the teeth of this gear for wear, cracks, or chipping. Then examine the tooth contact pattern to see if the gear has been meshing correctly with the pinion gear.

If the tooth pattern indicates that the ring and pinion have not been meshing correctly, BOTH GEARS SHOULD BE REPLACED BECAUSE IT IS IMPOSSIBLE TO ADJUST WORN GEARS FOR QUIET OPERATION.

Whenever replacement of either the ring gear or the pinion gear is necessary, always replace both gears. These gears are run-in and lapped together at the factory as matched sets.

Inspect the ring gear attaching screws for elongation resulting from excessive tightening and replace any screws that are elongated.

Pinion Gear and Shaft Removal "Hornet" Series

Inspect the rear axle companion flange for face run out using a dial indicator (Fig. 15). The run out should not exceed .002".

Remove the pinion shaft nut, using the pinion shaft nut socket tool (J-1411), while holding the pinion shaft flange. Use extreme care to avoid damage to the flange surfaces.

Remove the companion flange. This is a press fit, use flange puller J-2984 (Fig. 16). DO NOT DRIVE THE FLANGE OFF THE SHAFT. The oil seal may now be removed.

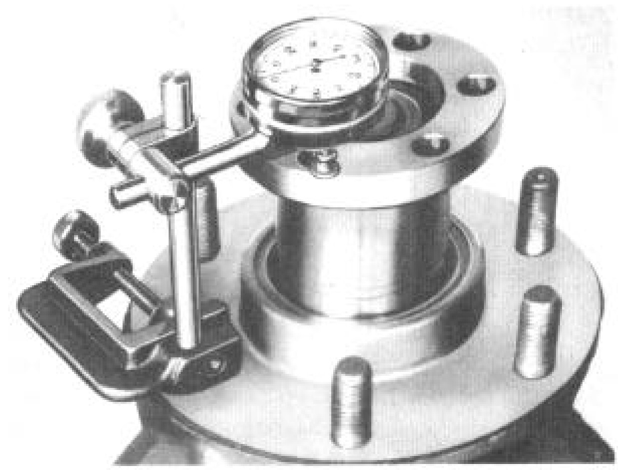


FIGURE 15—*Inspect Rear Axle Companion Flange Face Run Out*

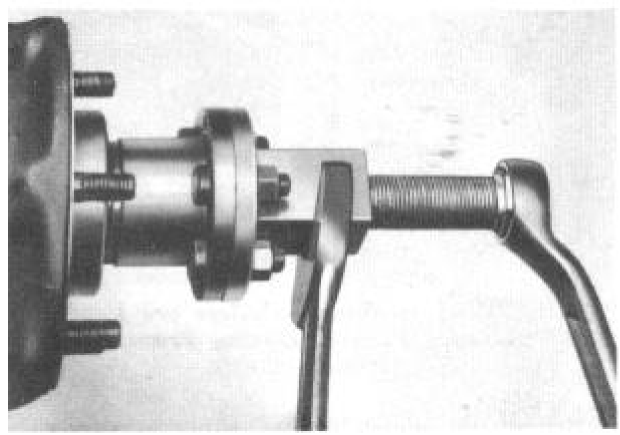


FIGURE 16—*Remove the Rear Axle Pinion Flange With Tool J-2984*

"Wasp" Series—Hydra-Matic Equipped

Remove the companion flange with puller J-2984. "Wasp" and "Rambler" Series
Remove the oil seal, bend back the lip of the pinion nut lock, and remove the pinion nut. This can be done by holding the pinion shaft with the pinion holding tool and spacer (J-2496) and loosening the nut using a double offset box wrench.

All Series

Tap the end of the pinion shaft lightly with a .fiber hammer to free the front bearing cone from the pinion shaft and remove the bearing.

A thick shim is located between the bearing and a shoulder on the pinion shaft. This shim controls the pinion bearing preload, therefore, tag the shim to identify it at the time of reassembly.

The pinion gear and rear bearing may now be removed from the rear of the housing.

Pinion Bearing Cups

A recess is located behind each pinion bearing cup to provide a means of driving the cup from the housing. The cups should be driven out of the housing using a brass punch.

> CAUTION: *Keep the cups square in the bore to prevent damaging the cup bores.*

Pinion Bearing Removal

The pinion bearing is a press fit on the pinion shaft. Attach pinion bearing remover (J-2245-A "Hornet" Series, J-2244 for the "Wasp" and "Rambler" Series) and remove the pinion bearing using a press (Fig. 17).

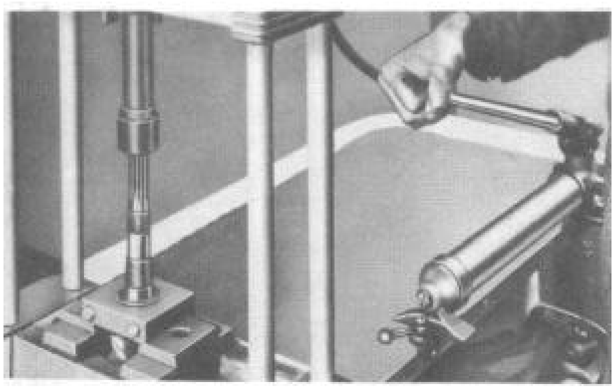


FIGURE 17—*Special Pullers are Used to Remove Pinion Bearing From the Pinion Shafts*

Remove the pinion bearing adjusting washer located between the bearing and the pinion gear.

This washer is used to adjust the pinion depth in the housing and should be tagged to identify it at assembly.

Pinion Gear and Shaft Assembly Inspection

The pinion and ring gear should be inspected to determine if they are a matched set. Numbers or marks are etched on the rear face of the pinion gear and the edge of the ring gear. The first mark on the pillion should be the same as the mark on the ring gear to indicate a matched set. The second number is preceded by a plus or minus sign to indicate the corrected pinion cone setting (Fig. 18). If the second number is zero, there will be no plus or minus sign as the pinion setting requires no correction.

Inspect the oil seal surface for wear or roughness and the pinion splines for damage caused by a worn or loose coupling.

Pinion Bearings

Inspect pinion bearings, cones, cups, and rollers for excessive wear, over-heating, or scoring. If replacement is required, replace both the cone and the cup.

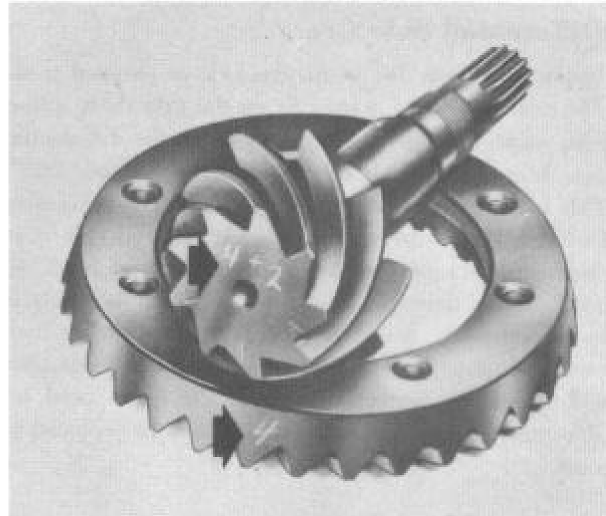


FIGURE 18—*Markings on Ring and Pinion Gear Indicate a Matched Set*

Cleaning Parts

All parts should be thoroughly cleaned with a good cleaning solution prior to assembly. If the parts are not to be reassembled immediately, cover to protect from dust or dirt.

Rear Axle Housing Inspection

The housing should be inspected for cracks, sand holes, or burrs, deep scratches, or nicks on the gasket or oil seal areas. A stone or smooth file can be used to remove nicks or burrs. The bearing cup bores should be carefully inspected for burrs or nicks caused by removing bearing cups. Inspect and clean the axle tubes.

REAR AXLE ASSEMBLY

To insure a uniform method of adjusting rear axles, all specifications for correct adjustment are established on the basis of dry parts.

New thrust washers and oil seals should be installed at time of assembly,

Assembling the Differential Gears

Install thrust washers on the side gears, the oil pocket side toward the gear (Fig. 20) and install the gears in the bores of the differential case.

Install thrust washers behind the differential pinion gears and mesh the gears with the side gears so the holes are opposite and in line with each other.

Roll the gears around until the gear holes are aligned with the differential pinion shaft hole in the case.

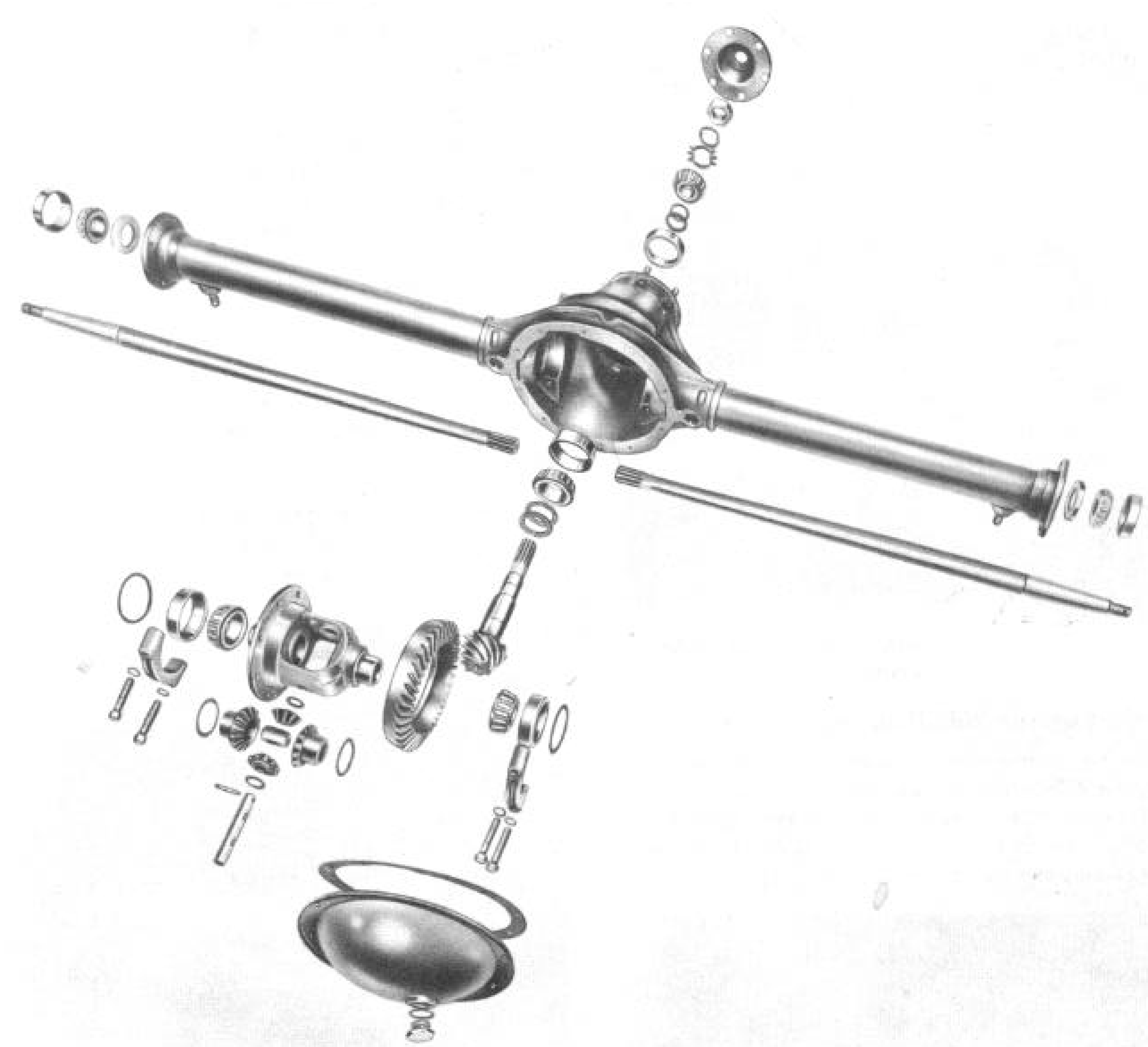


FIGURE 19—*Rear Axle, "Wasp" Series*

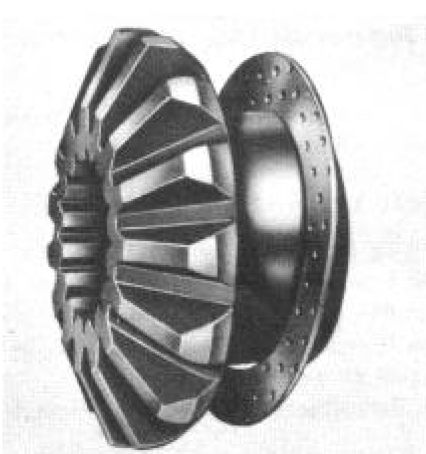


FIGURE 20—*Thrust Washer Installed With the Oil Pockets Toward the Gear*

The pinion gear shaft is installed with the lock pin hole in line with the lock pin hole in the differential case.

Prior to pressing the differential pinion shaft in place, install the thrust block through a side gear, aligning the hole in the block with the differential pinion shaft.

Press differential pinion shaft in place and measure the clearance between the differential side gear and case. This clearance should not exceed .008" However, the side gears should not fit tight enough to require more than eight foot pounds torque to turn the differential gears. This may be checked by installing an axle shaft and using a torque wrench to turn the shaft. Then drive the lock pin into place.

Differential Side Bearing Replacement

The differential side bearings are pressed onto the case using side bearing replacer J-2646 on the "Hornet" Series and J-5364 and handle J-875-5 on the "Wasp" and "Rambler" Series (Fig. 21).

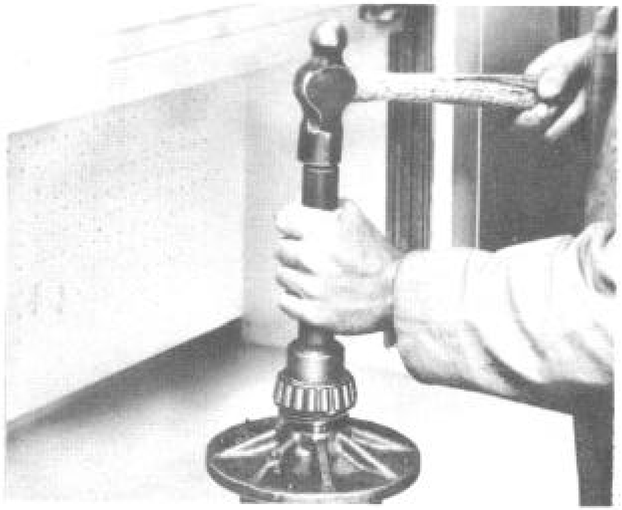


FIGURE 21—*Replacing Differential Side Bearings*

Adjusting the Side Bearings

Place the bearing cup over each side bearing and install the differential case assembly in the axle housing.

Install a .070" ("Hornet" Series) or a .075" shim ("Wasp" or "Rambler" Series) on each side between the bearing cup and the housing (Fig. 22).

FIGURE 22—*Install Shims Behind Each Side Bearing Cup to Adjust Side Play*

Then test the assembly for side play by rotating it. Eliminate all side play by installing progressively thicker shims.

"Hornet" Series shims are available in thicknesses from .070" to .100" in .002" variations. "Wasp" and "Rambler" Series are available in thicknesses from .075" to .098" in .002" variations.

If an additional thickness of shims is required to eliminate side play on the "Hornet" Series, thin shims .003", .005", or .010" may be installed between the cone and the differential case. For the "Wasp" or "Rambler" Series, use "Hornet" pinion depth adjusting shims.

When side play is eliminated, a slight bearing drag is noted. Then install the respective bearing caps and tighten with a torque wrench to 105-110 foot pounds on the "Hornet" Series and 55-60 foot pounds on the "Wasp" and "Rambler" Series.

Recheck the differential for side play excessive bearing drag.

Attach a dial indicator to the axle housing and check the ring gear face of the differential case for "run out" (Fig. 23). The "run out" should not exceed .002".

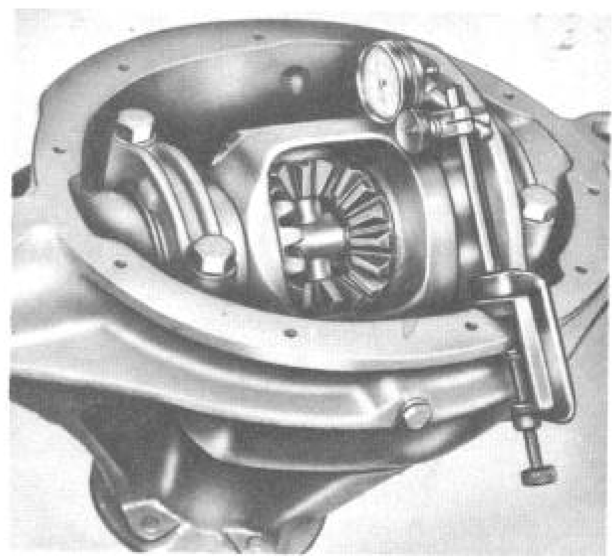


FIGURE 23—*Check the Ring Gear Face of the Differential Case for Run Out*

Remove the case from the housing, retaining the shims used to eliminate the side play.

Ring Gear Installation

Place the ring gear on the differential case.

Bolt the ring gear to the differential case with cap screws and new locks. In some cases, two 3/8"-24 x 1" cap screws installed in opposite holes may he used as guides to pull the gear into position.

Tighten the cap screws to 50-55 foot pounds torque.

Installing the Pinion Gear and Bearings

The pinion bearing cups are installed using pinion bearing cup replacing tools (Figs. 24 and 25).

FIGURE 24—*Installing Front Pinion Bearing Cup*

Front bearing tool J-2531 is used for the "Hornet" Series; J-2532 for "Wasp" and "Rambler" Series.

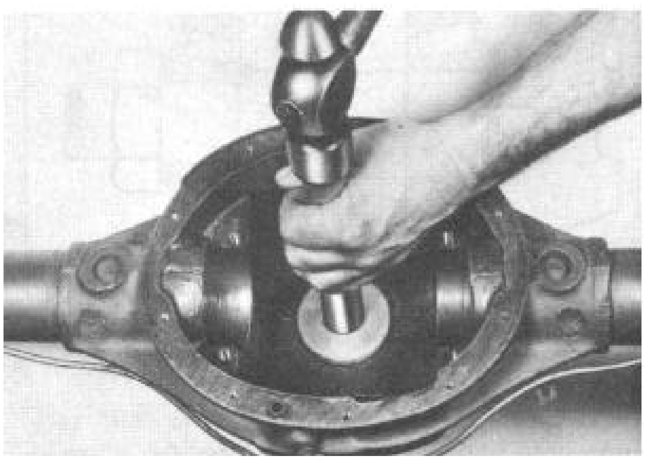


FIGURE 25—*Installing Rear Pinion Bearing Cup*

Rear bearing tool J-2533 is used for the "Hornet" Series; J-5367 "Wasp" and "Rambler" Series.

CAUTION: Drive the bearing cups straight into clean bores.

Pinion Depth Adjustment

To compensate for machining tolerances, the pinion and ring gears are factory tested for tooth contact and quietness. This test is conducted at a standard cone setting and varied to obtain correct tooth contact and quietness.

The amount of this variation is etched on the rear face of the pinion gear (Fig. 18).

The gear is marked "Plus" or "Minus" the number of thousandths that the gear varies above or below standard. Thus "Plus" ( ) means the pinion gear is closer to the center line of the axle than standard and the "Minus" (–) means farther from the center line.

When using a new ring and pinion set or a new rear bearing, use a new adjusting washer. Adjusting washers are available in two sizes, .105" and .125", plus .003", .005", and .010" shims to obtain various thickness combinations. Various methods of determining the correct thickness of adjusting washer may be used.

Method No. 1

Rear axle drive pinion gauge J-5223-A with side bearing bore adapters to fit each axle may be used to adjust the pinion depth (Fig. 26).

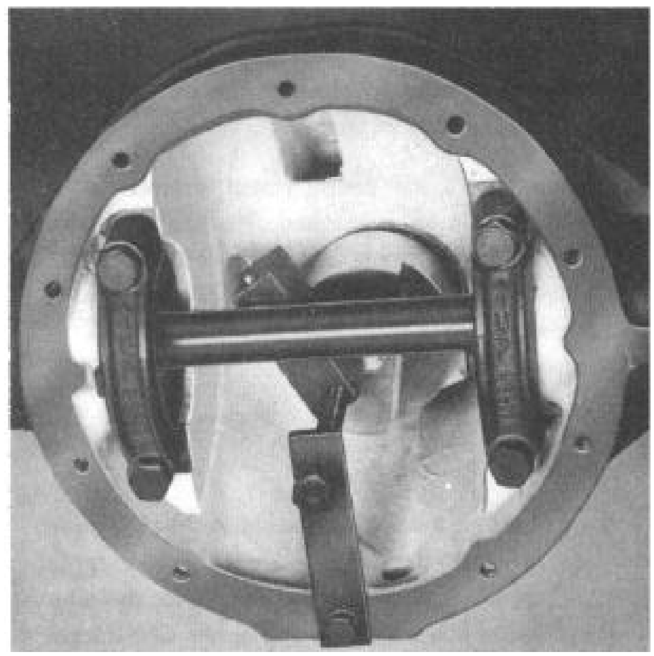


FIGURE 26—*Rear Axle Pinion Setting Gage*

Place the rear pinion bearing cone in the bearing cup. Press the cone and revolve it to "set" the rollers.

Bolt the gauge plate J-6099-1 over the bearing cone so it does not touch the housing at any point. The bolt runs down through the bearing and is secured at the pinion end by a cross piece and thumb screw.

Be sure the differential bearing bores in housing are clean. Install the arbor with the adapters squarely seated in the side bearing bores in the housing. Install differential bearing caps and tighten bolts finger tight.

The adapters slide on and off the arbor. Use adapters J-5223-5 for the "Hornet" Series and adapters J-5223-17 for the "Wasp" and "Rambler" Series.

The gauge block is held in place against the spacer by the clamp. The gauge plunger pad can be moved to contact the gauge arbor by loosening the thumb screw in the end of the gauge block. After contact is made, tighten the thumb screw.

Remove the gauge block. Use a two to three inch micrometer and measure the distance from end of anvil to top of plunger head as shown in Figure 27.

This measurement represents a portion of the distance from the rear face of the pinion to the center line of the rear axle.

The spacer has two thicknesses, the larger thickness is used to adjust the "Hornet" Series pinion depth; the thinner is used to adjust the "Wasp" and "Rambler" Series.

The distance from the rear face of the pinion to the rear axle center line on the "Hornet" Series is 4.500" and the distance on the "Wasp" and "Rambler" Series is 3.8125." The spacer represents a fixed portion of the distance plus a constant of 2.500."

The constant of 2.500" is used in either case. Any variations from this measurement will be used to select the washer required plus the use of the pinion reading of plus or minus.

For example: If the measurement arrived at is 2.617" and the pinion is marked + .002," subtract 2.500" from 2.617," which is .117" minus the .002" pinion marking. The shims and washers to be used should measure .115."

Method No. 2

Note the inspection marks on the old and new pinion gears and measure the thickness of the old depth washer. Compare the inspection mark on the new pinion and use a depth washer and shims to compensate for the difference.

For Example: If the old pinion is marked +2 and the new pinion is marked –3, there is a difference of .005" away from the ring gear in these two pinions. Therefore, the new depth washer must be .005" thicker than the old one. If the old washer is .123", the new one must be .128". In this case, use a .125" washer plus a .003" shim totaling .128".

Pinion Bearing Installation

Slide the proper depth washer and new shims that have been selected onto the shaft against the pinion gear. Using bearing replacing tool J-2995 for the "Wasp" and "Rambler" Series, press the bearing tight against the washer and the gear. The larger diameter of the bearing should be toward the gear.

A piece of steel tubing 11%6" inside diameter approximately 8" long may be used to install the rear pinion bearing onto the pinion of the "Hornet" Series.

Then install the pinion gear assembly in the housing.

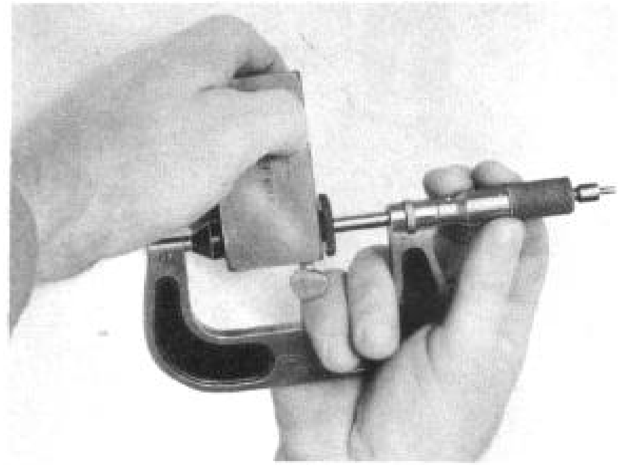


FIGURE 27—***Measuring Distance from Rear Face of Pinion Gear to Rear Axle Center Line***

Preloading Pinion Bearings

Rear axle pinion bearings are preloaded to compensate for expansion due to heat and loads of operation.

The preload is adjusted by selective shims installed between the front bearing and the shoulder on the pinion shaft (Fig. 28).

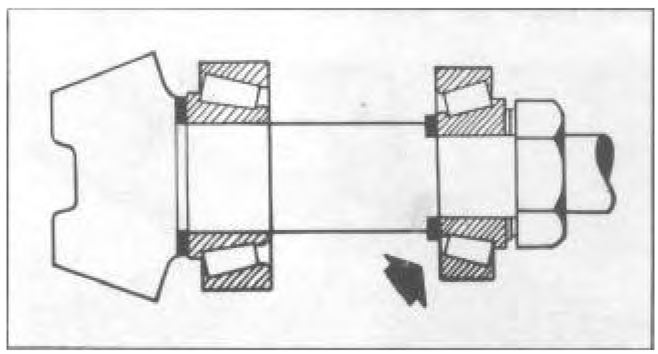


FIGURE 28—***Pinion Bearing Preload Shim Location***

A thickness range of .106" to .138" in .001" variations can be obtained by using a combination of two of the following size' shims which are supplied for service installations:

.53"	.063"
.54"	.064"
.056"	.066"
.58"	.068"
.59"	.069"

Install the same thickness of shims as removed and install the front bearing. If the adjusting washer thickness was changed, compensate for this change.

"Hornet" Series

Use pinion holding and spacer tool J-2496 and install the spacer in place of the companion flange. Tighten the pinion nut 125 to 150 foot pounds torque.

"Wasp" and "Rambler" Series

The bearing is held in position by the pinion nut, thrust washer, and lockwasher; tighten the pinion nut 90 to 100 foot pounds torque.

All Series

The pinion holding tool and spacer J-2496 is used in combination with a spring scale to get inch-pound readings. The tool is so designed that the splined ends are exactly 6 inches from the center of the handle. Attach the spring scale to the center of the handle, pull the tool in a circular rotation (Figs. 29 and 30), note the reading in pounds on the scale and multiply it by 6. This determines the number of inch-pounds needed to turn the shaft. To eliminate the effect of gravity, turn the axle up so that the pulling effort is on a horizontal plane.

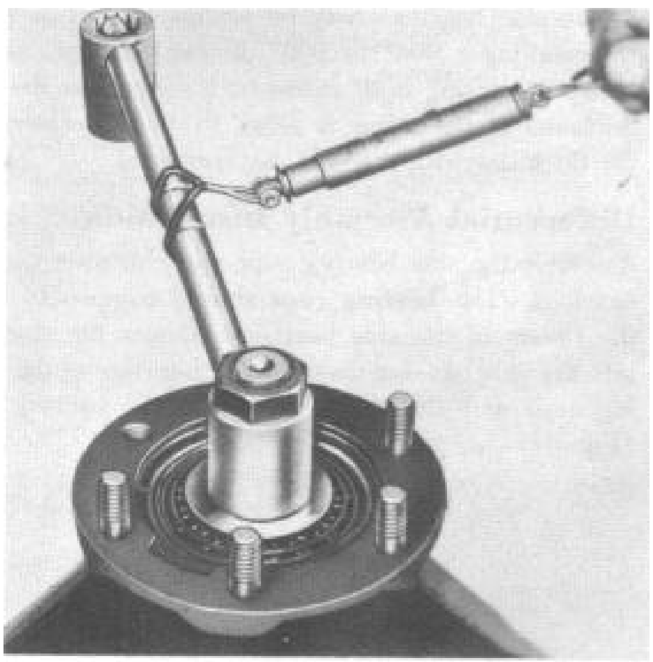


FIGURE 29—*Checking Pinion Bearing Preload "Hornet" Series*

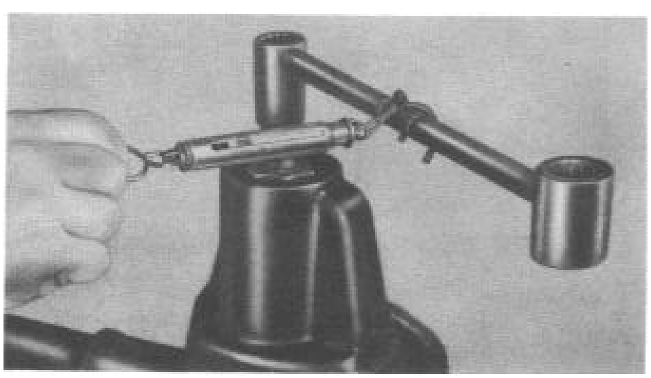


FIGURE 30—*Checking Pinion Bearing Preload "Rambler" Series*

The "Hornet" Series requires 15 to 18 inch-pounds and the "Wasp" and "Rambler" require 12 to 14 inch-pounds preload.

In the example shown, it requires 21/2 pounds at 6 inches, or 15 inch-pounds to turn the shaft (within the limits for the "Hornet" Series).

If the preload is too high, increase the thickness of the shims, if it is too low, decrease the thickness.

"Hornet" Series

Remove the spacer tool and install a new oil seal.

The companion flange is then installed using companion flange installer J-1375 (Fig. 31).

Install the lockwasher and pinion nut and tighten 125 to 150 foot pounds torque.

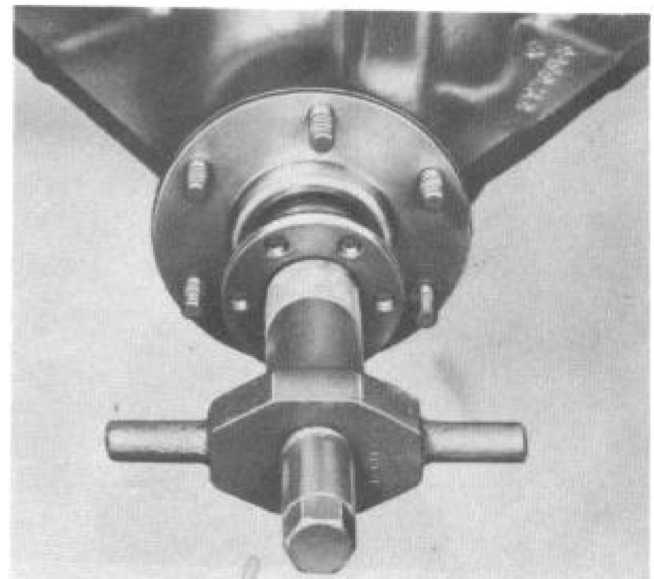


FIGURE 31—*Use 1-1375 to Install the Companion Flange*

"Wasp" and "Rambler" Series

Install the lockwasher next to the bearing then the plain thrust washer and nut. Tighten the nut 90 to 100 foot pounds torque. Install the pinion oil seal on the "Wasp" Series. Use tool J-4485 to install the pinion oil seal on the "Rambler" Series (Fig. 32).

"Wasp" Series—Hydra-Matic Equipped

Press the pinion shaft companion flange onto the pinion shaft while supporting the shaft from the rear to prevent damage to the bearings or axle housing.

Ring Gear and Pinion Backlash Adjustment

The differential assembly may now be installed in the housing using the shims selected to remove the side play. The bearing caps should be tightened (105-110 foot pounds torque on the "Hornet," 55-60 foot pounds "Wasp" and "Rambler"). Attach a dial indicator to the housing with the button contacting the drive side of a tooth on the ring gear and at right

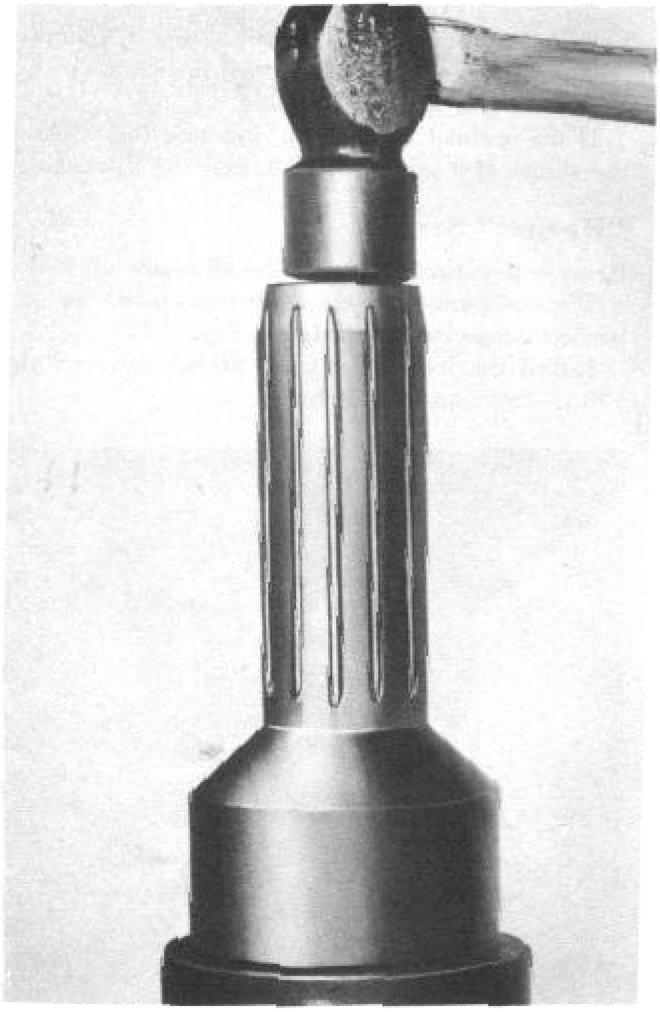


FIGURE 32—*Installing Pinion Oil Seal "Rambler" Series*

angles to it (Fig. 331. "Rock" the ring gear and note the movement of the gear as registered on the dial indicator. The backlash or play of the ring gear should be .002" to .006"..004" desired.

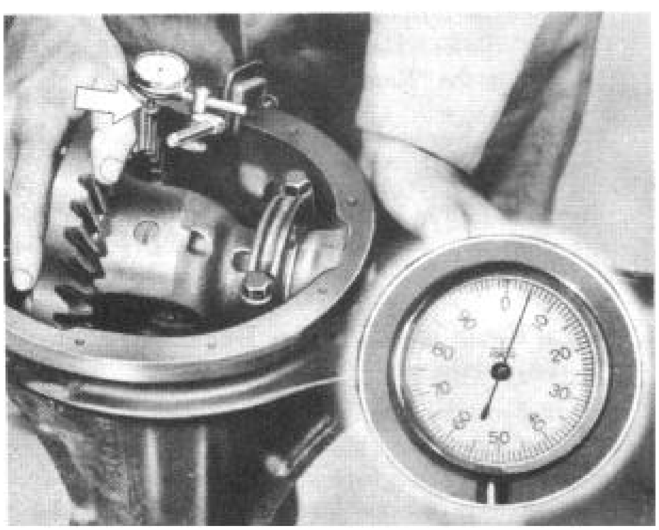


FIGURE 33—*Checking Ring Gear and Pinion Backlash*

Adjust the backlash as follows: To increase backlash, install a thinner shim on the ring gear side and a thicker shim on the opposite side; to decrease backlash, reverse the procedure. However, do not change the total thickness of the shims.

For example: The side play was removed with .090" shims on each side totaling .180". The backlash is checked and found to be .011". To correct the backlash, add .006" to the shim on the ring gear side and subtract .006" shim from the opposite side. This will result in a .096" shim on the ring gear side and .084" shim on the other side. The backlash will be .005". The total shim thickness remains .180".

Preloading Differential Side Bearings

The rear axle differential bearings are preloaded to compensate for the heat and loads during operation. The correct preload is .004" to .008".

The side bearings may be preloaded in two ways; by installing a .004" to .008" thicker shim on one side or by increasing both shims in thickness so the total thickness of the shims is .004" to .008" greater than the thickness with the side play removed.

Differential Assembly Installation

Assemble the side bearing cups and shims on the side hearings. The bearing cups should completely cover the rollers of the side bearings. Lower the assembly into the axle housing until the bottom edge of the bearing cups and shims are started in the bearing bore (Fig. 341.

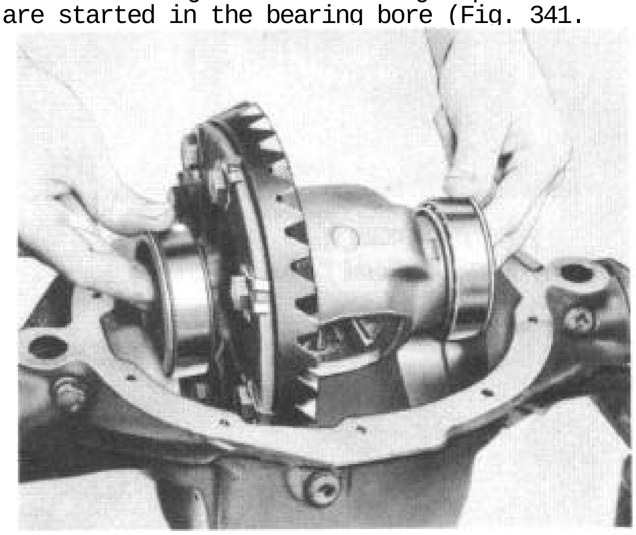


FIGURE 34—*Install the Differential Assembly*

Keep the differential assembly square in the housing and push it down as far as possible. Using a soft hammer, tap the outer edge of the bearing cups until seated in the housing.

CAUTION: *Do not distort the shims by hammering them into the housing.*

Install the bearing caps and tighten (105 to 110 foot pounds torque "Hornet" and 55 to 60 foot pounds

"Wasp" and "Rambler" Series). Preloading the side bearings may change the backlash setting, therefore, recheck the backlash and correct if necessary.

Tooth Contact Inspection

Inspect the tooth contact pattern to insure that the ring and pinion gears are adjusted properly. Paint eight or ten teeth of the ring gear with a light coat of red lead in oil.

Turn the ring gear around until the painted section of the ring gear is in contact with the pinion gear. Turn the pinion with a wrench while holding the ring gear with the other hand. This causes the two gears to turn under load and impresses a pattern on the painted section of the ring gear (Fig. 35). Impress a pattern on both drive and coast side of ring gear teeth. This is the tooth contact pattern, the pattern that is the final proof of the adjustments.

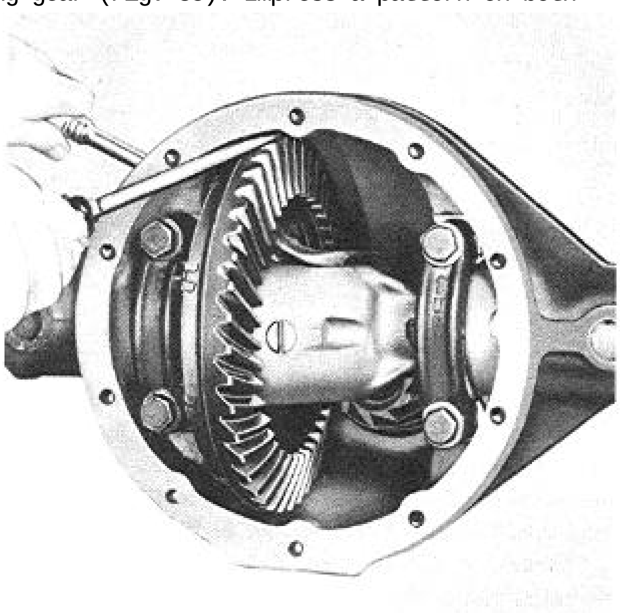


Figure 35-*Checking Tooth Contact Pattern Under Load*

If all adjustments are correct, the tooth contact pattern will be distributed over the central part of the tooth as in Figure 36-A.

If the pattern is high on the ring gear, as in Figure 36-B, it means the pinion is too far from the ring gear: In that case, move the pinion toward the ring gear by placing a thicker washer or shim between the pinion gear and bearing.

If the pattern is low on the ring gear tooth, as in Figure 36-C, the pinion is too close to the ring gear. Then move the pinion away from the ring gear by placing a thinner washer or shim between the pinion gear and bearing.

If the pattern is toward the small end or "toe" of the tooth, as in Figure 36-D, the ring gear is too close to the pinion. In that case, move the ring gear away from the pinion by putting a thinner shim on the left side and a thicker shim on the right.

If the pattern is at the large end or "heel" of the tooth, as in Figure 36-E, the ring gear Is too far from the pinion. Then move the ring gear toward the pinion by putting a thinner shim on the right side and a thicker shim on the left side.

When making "toe" or "heel" adjustments, be sure to keep the same total thickness of shims at the side bearings.

Axle Shaft Bearing Installation

The axle shaft bearings have no provision for lubrication after assembly. These bearings should be packed with a good quality wheel bearing lubricant before the assembly operation.

Press axle shaft bearings onto the axle shafts with the small diameter of the cone tow ard the outer tapered end of the shaft

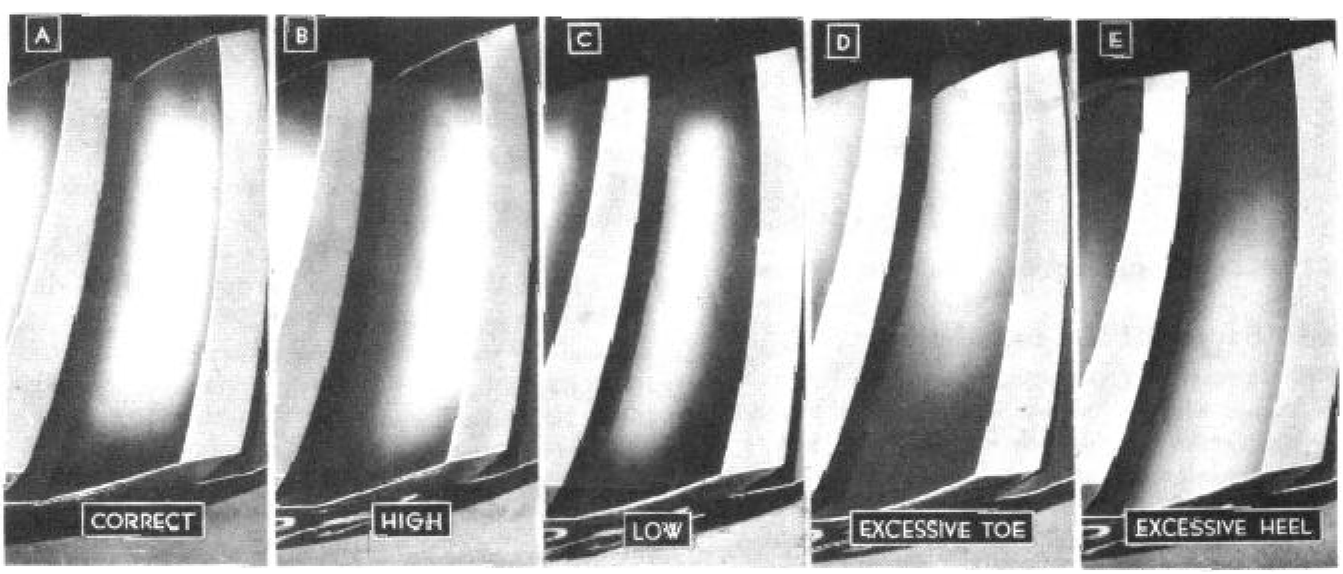


FIGURE 36—*Tooth Contact Patterns. "A" Illustrates Correct Tooth Pattern Which is Centrally Located on the Tooth*

using bearing replacing tool J-2995.

Axle Shaft Installation

The inner axle oil seal is extremely important. Always use new seals when reassembling an axle. Soak the seals in light lubricating oil to make them soft and pliable and to prevent being burned in operation. Install the seal using the shaft oil seal replacer (J-2539 on the "Hornet" Series, J-2626 on the "Wasp" Series, and J-2159 on the "Rambler" Series) (fig. 37).

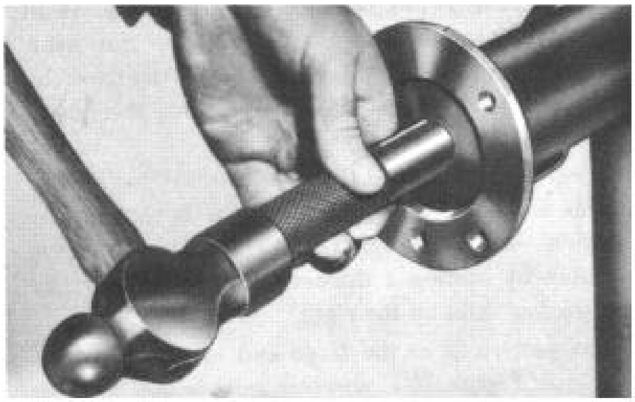


FIGURE 37—*Installing Inner Oil Seal "Wasp" Series*

Install the axle shafts indexing the splined end with the differential side gears.

NOTE: *The "Hornet" Series right hand axle shaft is 11/2" longer than the left one.*

Install the outer bearing cup using axle shaft bearing cup replacer J-1433-1 as shown in Figure 38.

FIGURE 38—*Installing Axle Shaft Bearing Cup*

Brake Support Plate Installation

Install the original shims onto the axle with the drain hole aligned with the hole in the axle tube (if the end play was checked at the time of disassembly and required correction, a correction can be made at this time). Install the brake support plate, spacer, and oil seal. The "Rambler" Series oil seal is installed behind the brake support plate. Tighten the support plate bolts to 50-55 foot pounds torque on the "Hornet" and 30-35 foot pounds "Wasp" and "Rambler" Series.

Checking and Adjusting Axle Shaft End Play

Strike the end of each axle shaft with a lead hammer to seat the bearing cups against the support plate.

Attach axle shaft end play tool J-2092 to the end of one shaft, affix a dial indicator to the support plate or to the tool, and check the play when pushing and pulling on the axle shaft (Fig. 39). End play should be .002" to .004".

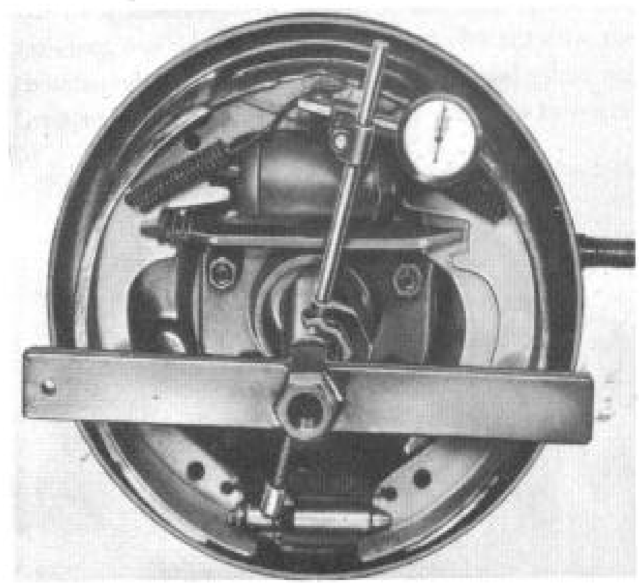


FIGURE 39—Checking Axle Shaft End Play

Add shims to either side to increase end play, remove shims to decrease end play. Note the position of the thrust block. There should be a minimum of 1/16" clearance between the thrust block and the differential pinion shaft.

Wheel Hub Installation

NOTE: *This operation is performed on the "Rambler" Series after the rear axle has been installed in the car.*

Inspect the hub key for a snug fit in the keyways of the axle shaft and hub (Fig. 40).

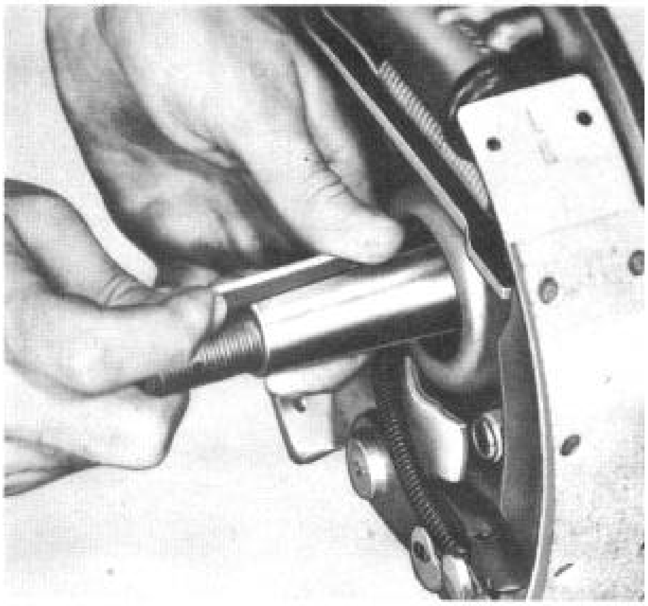
The tapers of the hub and axle shaft must be clean and dry.

Slide the hub onto the axle shaft aligning the keyways; install the key and press the hub onto the shaft. The key should be flush with the hub.

Install the thrust washer and axle nut and tighten 180 to 190 foot pounds torque on the "Hornet" Series; 160 to 165 foot pounds torque "Wasp" and "Rambler" Series. (If the cotter key holes are not in line, tighten the nut to the next castellation.)

Completing the Assembly

Reinstall the axle in the car, fill the axle with specified hypoid lubricant, which is included with each rear axle assembly or gear



set from service stock. Inspect the housing vent; a closed vent will cause pinion seal or axle oil seal failure. The vent is a small drilled hole, located on a horizontal center line at the rear side of the left axle tube, adjacent to the spring mounting.

REAR AXLE INSTALLATION
"Hornet" and "Wasp" Series

Install the propeller shaft torque tube and truss rods on the rear axle. The propeller shaft companion flange bolts should be tightened 30-35 foot pounds torque on the "Hornet" Series and the Hydra-Matic equipped "Wasp"
The "Wasp" Series equipped with standard and overdrive transmissions has the "slip" type coupling. The propeller shaft with the coupling can now be installed on the pinion shaft. Lubricate the ground surface on the coupling and the torque tube rear oil seal with rear axle lubricant. Do not crimp the lip of the oil seal. The torque tube oil seal should seal and contact the coupling on the ground surface of the coupling. Slide the propeller shaft front universal joint onto the transmission main shaft, raise the rear axle into position, and reassemble the torque tube to the transmission.
Install the rear springs, brake line, hand brake cables, and bleed the brake lines.

"Rambler" Series 100" Wheelbase
and 108" With Hydra-Matic
Transmission

Slide the propeller shaft onto the transmission main shaft until it is bottomed on the shaft. Then mark the front universal joint at the rear of the transmission oil seal and again remove the propeller shaft.

Install the propeller shaft on the rear axle pinion, and install the rear springs on the axle tubes.
The axle assembly is then installed on the car. Install the brake lines, shock absorbers, springs, brake cables, and the wheel hubs.
With the body supported at the body side sills, permit the rear axle assembly to hang freely with the shock absorbers fully extended. Adjust the propeller shaft so the scribe mark is %2" to the rear of the transmission oil seal. Tighten the coupling to 300 foot pounds torque. Bleed the brake lines.

108" Wheelbase With Standard and
Overdrive Transmission

Install the rear springs on the axle tubes. Install the axle assembly on the car and connect the rear propeller shaft to the pinion shaft. Then install the brake lines, shock absorbers, springs, brake cables, and wheel hubs.
Bleed the brake lines.

Final Inspection
The rear axle should then be road tested to determine if all the adjustments and corrections are satisfactory.

AXLE DIAGNOSIS
Test No. 1

With the engine warmed up and the overdrive locked in conventional gear position, drive at ten miles per hour. Listen carefully and keep driving at this speed until thoroughly familiar with all car noises.
Now gradually increase the speed until the car reaches forty-five miles an hour. As the car is gaining speed, notice any changes in the running gear noises; notice the speed at which each noise comes in and goes out.
Then release the accelerator, and without using the brakes, allow the car to slow down. Again make a note of every change in sound and the speed at which each change takes place.
It will probably be found that every sound comes in and leaves at the same speeds on both acceleration and deceleration.

Test No. 2

Step the car up to fifty miles per hour, shift into neutral, turn off the ignition, and allow the car to coast until it comes to a stop. Listen again to all the running noises. Notice at very low speeds a low pitched sound will come in; this is tire noise, not axle noise.
While making this test, note again all the changes in running noise and the speeds at which they come in and go out. Any of the noises noted in Test No. 1 which also appear in Test No. 2 can be eliminated as axle noise because, on this test, the axle is not under

load and will produce no noise other than bearing noise.
If. however, there are any noises which appeared in the first test but did not appear in the second test, they may be in the rear axle. To find out. make Test No. 3.

Test No. 3

Park the car with the engine running and apply the parking brakes. Then slowly accelerate the engine, comparing again all noises with those heard in the previous tests. Any sounds still left from Test No. 1 which are heard in this test can be disregarded. They are probably muffler, air cleaner, or body vibrations.

Test No. 4

Finally raise the rear wheels off the ground, put the car in gear, and run the engine. Now analyze the noises that haven't been eliminated to see if they actually come from the rear axle.

PROPELLER SHAFT SECTION

TORQUE TUBE REMOVAL

Raise and support the rear end of the body.
Disconnect the hand brake cable at the equalizer and remove the hand brake bell crank assembly from the torque tube.
Disconnect the rear stabilizer bar at the rear axle tube.

"Hornet" Series

Remove the truss rods at the axle tubes and at the center bracket on the torque tube.
Disconnect the torque tube from the transmission adapter and move the axle and tube to the rear.
Disconnect the rear of the torque tube from the rear axle housing and move the tube forward. This will permit the propeller shaft flange to be disconnected I Fig. 41 I.
When reinstalling the propeller shaft, use new locks on the companion flange nut. Tighten the flange nuts 30 to 35 foot pounds torque.

"Wasp" Series—Standard and Overdrive Transmission

Disconnect the truss rods at the center bracket. Then disconnect the trunnion bracket from the adapter by removing the rear nuts from the dowel studs (Fig. 42
Move the torque tube and axle to the rear to clear the studs.
Disconnect the torque tube from the rear axle housing and move the tube forward.
The coupling is a slip fit on the pinion shaft and interference fit on the propeller shaft. It can be slid off the pinion shaft. To remove the coupling, place the propeller shaft in a vise and drive the coupling off with a lead or soft-faced hammer.

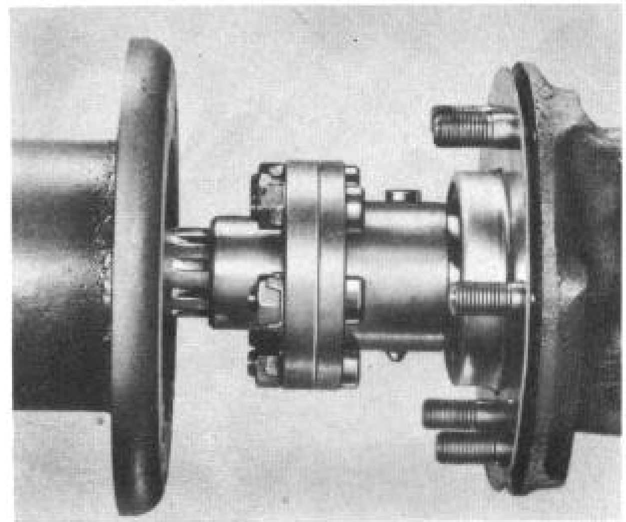
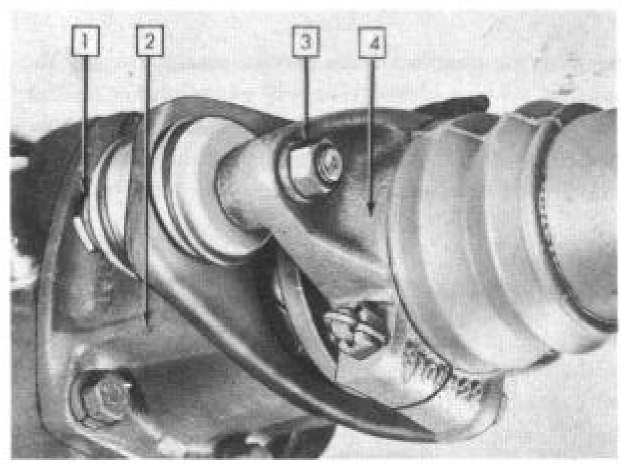


FIGURE 41—*"Hornet" Series Propeller Shaft Companion Flange*



1. Front Stud Nuts
2. Adapter
3. Rear Stud Nuts
4. Trunnion Bracket

FIGURE 42—*Remove Trunnion Bracket Rear Nuts*

"Wasp" Series Hydra-Matie Equipped

The propeller shaft utilizes a companion flange similar to the "Hornet" Series (Fig. 43).
NOTE: When pressing the companion flange onto the pinion shaft, support the pinion from the rear to prevent damage to the bearings or the housing.

PROPELLER SHAFT COUPLING INSTALLATION
"Wasp" Series—Standard and Overdrive Transmission

Install the propeller shaft oil seal and oil seal retainer on the propeller shaft.
Butt the propeller shaft at the forward end

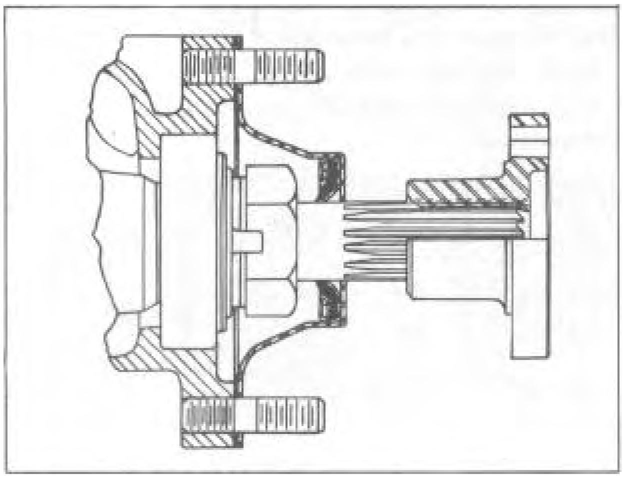


FIGURE 43—*Rear Axle Companion Flange "Wasp" Hydra-Matic Equipped*

against a wood block and drive the coupling on the propeller shaft with a lead or soft-faced hammer.

Tap the retainer and oil seal on the coupling.

CAUTION: *DO NOT INSTALL THE SEAL AND RETAINER ON THE COUPLING PRIOR TO ITS INSTALLATION ON THE PROPELLER SHAFT AS THE SEAL WILL BE DAMAGED.*

The coupling must be driven on the propeller shaft to the shoulder on the splined area inside the coupling. Install the spacer.

Install the torque tube rear oil seal. Lubricate the ground surface on the coupling and the torque tube rear oil seal with rear axle lubricant. The propeller shaft with the coupling can now be installed on the pinion shaft. Do not crimp the lip of the oil seal.

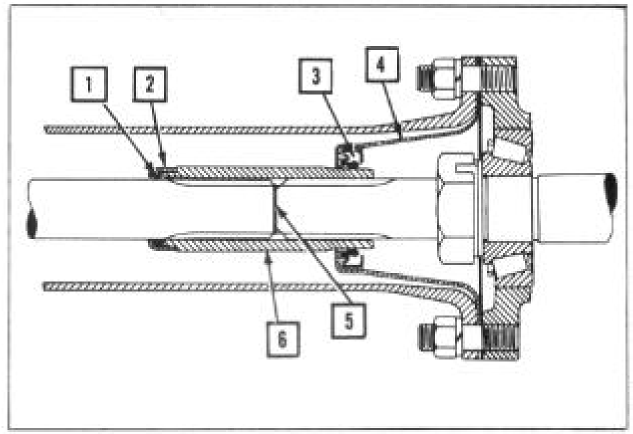
The torque tube oil seal should seal and contact the coupling on the ground surface of the coupling (Fig. 44).

PROPELLER SHAFTS

The propeller shaft on the "Hornet" and "Wasp" Series (standard transmission or overdrive) are solid steel shafts, splined at each end; at the front end for the universal joint which is a light press fit. The rear end of the "Hornet" propeller shaft is also splined with a companion flange riveted in place. The "Wasp" is splined for the "slip" type coupling.

The propeller shaft on the "Hornet" Series is removed and installed from the front of the torque tube. The "Wasp" Series shaft is removed and installed from the rear of the torque tube.

The "Hornet" "6" and "Wasp" Series equipped with Hydra-Matic transmission have one piece tubular shafts incorporating a universal joint at the transmission end and a companion flange at



1. Propeller Shaft Coupling Oil Seal
2. Propeller Shaft Coupling Oil Seal Retainer
3. Torque Tube Rear Oil Seal
4. Torque Tube Rear Oil Seal Retainer
5. Spacer
6. Propeller Shaft Coupling

FIGURE 44—*"Slip" Type Propeller Shaft Coupling*

rear axle end.

The "Hornet" "V-8" Series equipped with "Ultramatic" transmission has the same type one piece tubular propeller shaft as the "Hornet" "6" equipped with Hydra-Matic transmission.

The 100" Wheelbase "Rambler" Series and 108" Wheelbase with Hydra-Matic transmission, incorporate a one piece tubular shaft with a universal joint at each end and a coupling and nut at the rear axle end.

The 108" Wheelbase "Rambler" with standard and overdrive transmissions has a two piece propeller shaft with a center bearing in a rubber insulated retainer supported by a cross-member.

Propeller Shaft Removal "Rambler" Series-100" Wheelbase and 108" Hydra-Matic Transmission

Raise and support the rear of the body at the side sills and the rear axle at the center of the housing.

Loosen the propeller shaft coupling using propeller shaft coupling wrenches J-4486. Disconnect the rear shock absorbers at the rear axle tubes, the hand brake cable at the adjusting yoke, and the rear brake hose clip from the body floor pan.

Remove the rear spring front bracket attaching nuts, and lower the rear axle, continuing to support the body, thus lowering the rear spring front brackets from the floor pan.

Move the axle assembly to the rear sliding the propeller shaft yoke off the transmission main shaft splines.

Then remove the propeller shaft from the pinion shaft.

"Rambler" Series-108" Wheelbase, Standard Transmission and Overdrive

Remove the propeller shaft coupling nut from the coupling. Tap the coupling off the pinion shaft splines with a soft-faced hammer.

Remove the nuts from the propeller shaft center bearing retainer studs (Fig. 45).

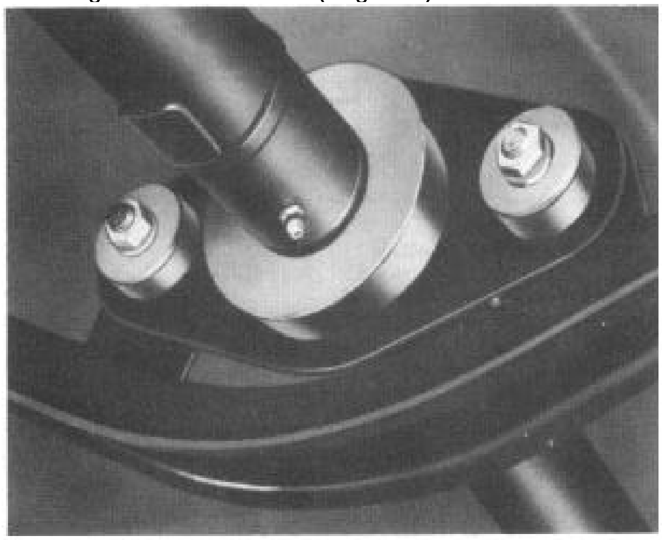


FIGURE 45—Propeller Shaft Center Bearing Retainer

Disconnect the crossmember from the support brackets at the side sills.

Remove the crossmember from the car.

The propeller shafts and center bearing can then be removed from the car as an assembly (Fig. 46).

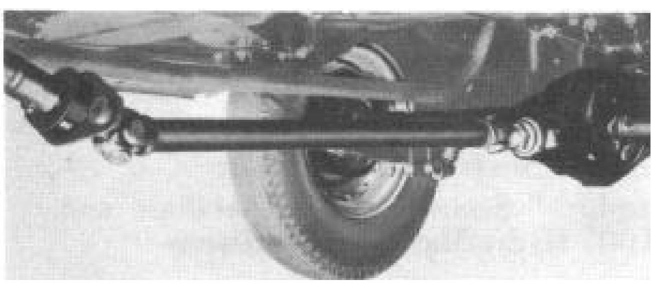


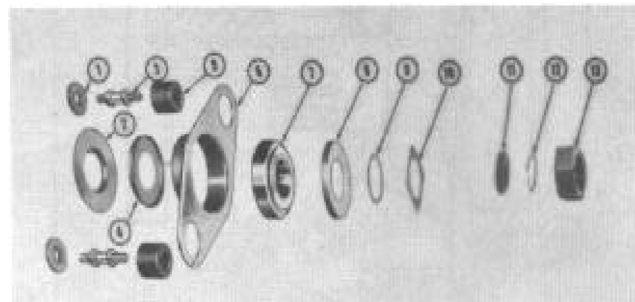
FIGURE 46—*Propeller Shafts and Center Bearing Removal*

Place the front propeller shaft in a vise. Turn back the propeller shaft bearing lock to allow the propeller shaft center bearing lock nut to be removed.

The rear propeller shaft can now be removed by sliding the splined slip joint from the front propeller shaft. The lock nut will still remain on the splined slip joint. Remove the felt washer and the felt washer retainers.

The nut can then be removed from the slip joint. The propeller shaft center bearing spacer, cover, center bearing and retainer, bearing cover, and dust shield can now be removed.

The center bearing can be removed from the center hearing retainer with a brass drift.
NOTE: The yokes of the universal joints must be in alignment when the propeller shaft is reassembled.



1. Washer
2. Dust Shield
3. Retainer Stud
4. Bearing Cover
5. Insulator
6. Retainer
7. Center Bearing
8. Bearing Cover
9. Spacer
10. Lock Nut
11. Felt Washer
12. Felt Washer Retainer
13. Lock Nut

FIGURE 47—*Propeller Shaft Center Bearing and Retainer*

Propeller Shaft Installation

"Rambler" Series 100" Wheelbase and 108" Wheelbase Hydra-Matic Transmission Equipped

To permit the correct location of the propeller shaft when assembling on the car slide the propeller shaft onto the transmission main shaft until it is "bottomed". Mark the propeller shaft front yoke adjacent to the oil seal and remove the shaft.

Install the propeller shaft on the rear axle pinion shaft. Move the rear axle assembly to the rear and slide the front universal joint yoke onto the transmission main shaft.

Loosen the rear spring front eye bolt and tilt the front bracket so that the rear holes are aligned with the studs in the floor pan.
Raise the rear axle assembly aligning the rear spring front bracket with the studs and .tighten.

Reinstall the brake hose clip, hand brake cable, and the rear shock absorbers.

Permit the rear axle assembly to hang freely, the shock absorbers fully extended, and move the shaft to the front or rear to locate the mark on the propeller shaft %2" to the rear of the transmission oil seal. Then tighten the propeller shaft coupling nut to 300 foot pounds torque.

PROPELLER SHAFT CENTER BEARING

Prelubricated, rubber-mounted ball bearings are used on the "Hornet" and "Wasp" Series equipped with standard or overdrive transmissions.
The "Wasp" Series with 4.4:1 (8:35) axle ratio is equipped with two center bearings installed

as illustrated in Item "B," Figure 48.

The bearings are retained on the propeller shaft with snap rings and/or a machined shoulder to the rear of the bearing.

To facilitate the removal and installation of the propeller shaft center bearing, the shaft is machined .003" undersize from the front of the shaft to the bearing seat. Therefore, to remove the bearing from the shaft, it must be driven from the tear to the front of the shaft. The bearing is replaced from the front of the shaft and driven to the rear.

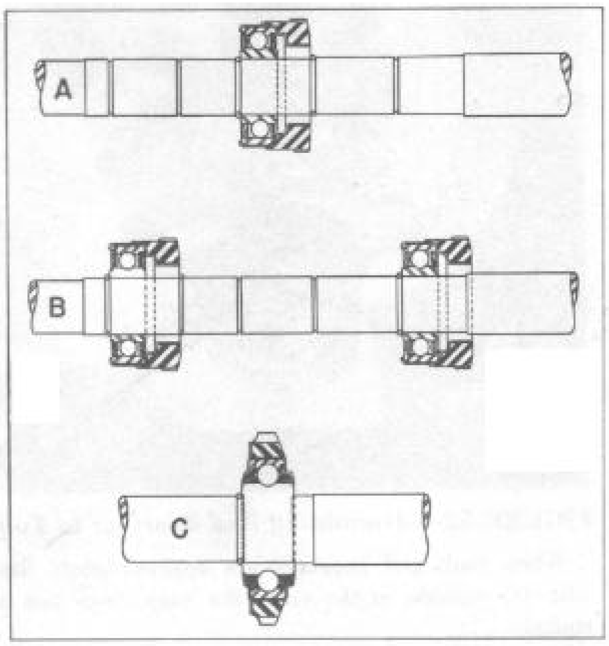


FIGURE 48—(4) *"Wasp" Series Propeller Shaft Center Bearing with 4.1:1 (9:37) Rear Axle Ratio. (B) "Wasp" Series Propeller Shaft Center Bearing with 4.4:1 (8:35) Rear Axle Ratio. (C) "Hornet" Series Propeller Shaft Center Bearing*

The center bearing used on the "Rambler" Series, 108" Wheelbase with standard and over-drive transmission, is illustrated in Figure 47.

TRUSS RODS

"Wasp" Series

In assembling the torque tube to rear axle truss rods, both rods should be tightened uniformly at the front bracket and locked in place so that the torque tube is in proper alignment with the rear axle.

TORQUE TUBE TRUNNION BRACKET ADJUSTMENT

"Wasp" Series—Standard and Overdrive Transmission

The front of the torque tube has a coarse pitch thread on which the trunnion bracket operates.

This bracket is slotted on the underside and is provided with an adjustable clamp screw. This clamp screw should be drawn up tight enough to remove excess clearance without setting up friction. The trunnion bracket must be free to move on the tube.

When the rear end of the propeller shaft is against the pinion shaft and the torque tube is secured to the axle housing, the front end of the propeller shaft must protrude from 1/8 to 1/4 inch beyond the front face of the trunnion bracket as shown in Figure 49. A projection of less than 1/8" may cause contact between the universal joint slinger and the bracket. More than 1/4" will make the slinger ineffective.

Lubricate sparingly every 1,000 miles using pressure lubricant. A rubber boot is provided to protect the threaded section against road dirt.

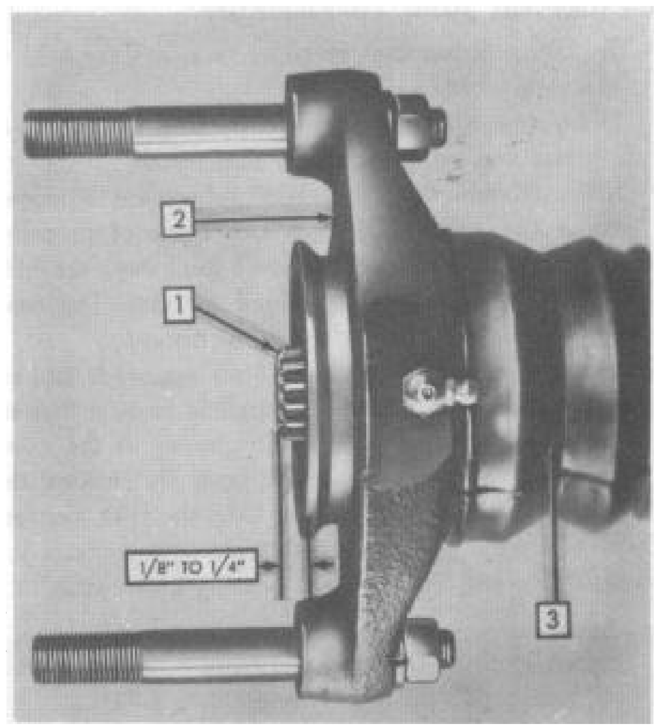


FIGURE 49—*Trunnion Bracket Adjustment*

"Wasp" Series—Hydra-Matic Transmission

Adjust the trunnion bracket so that the forward edge of the dust shield is in alignment with the center line of the universal joint bearing cups.

REAR AXLE TRACK BAR (STABILIZER)

"Hornet" and "Wasp" Series

The function of the rear axle track bar (stabilizer) is to maintain vertical alignment between the rear axle and the body, irrespec-tive of the spring movements (Fig. 50).

Always check the connection at the rear axle and body bracket. Looseness at these points can produce noise and bodv swav.

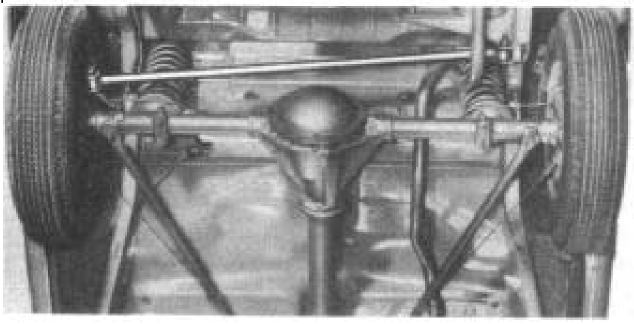


FIGURE ***50—Rear Axle Track Bar***

UNIVERSAL JOINTS

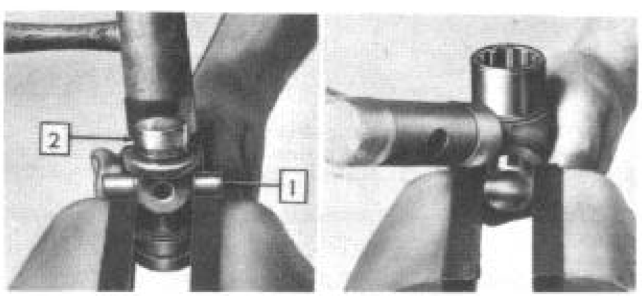
Universal Joint Disassembly

The four end bearings or roller retainers are held in yoke ends by snap rings.

The snap rings are removed by securing the joint in a vise and using a hammer and punch.

The "Rambler" Series 108" wheelbase equipped with a two piece shaft uses two types of propeller shafts. The Spicer type universal joint cups are held in place by a snap ring behind the cup. The snap rings can be removed with a screw driver.

After the snap rings have been removed, the assembly should be placed on parallels or in a vise as shown in Figure 51 with the trunnions of the cross resting on the parallels or vise jaws. By striking the suspended yoke with a soft hammer, the yoke member will be driven down to a point where it contacts the cross. This will leave the end bearing protruding.



1. Trunnions **2. End Bearings**

FIGURE 51—*Removing End Bearing From the Yoke*

Carefully clamp the projecting end bearing in a vise and then strike the yoke member with a soft hammer until the bearings are completely released. The end bearings should be a tight press fit in the yoke.

Universal Joint Assembly

Install cross in yoke and partially assemble end bearings with new cork seal washers in place. Rest one of the end bearings on a flat plate as shown in Figure 52 and drive on the other end bearing with a soft hammer.

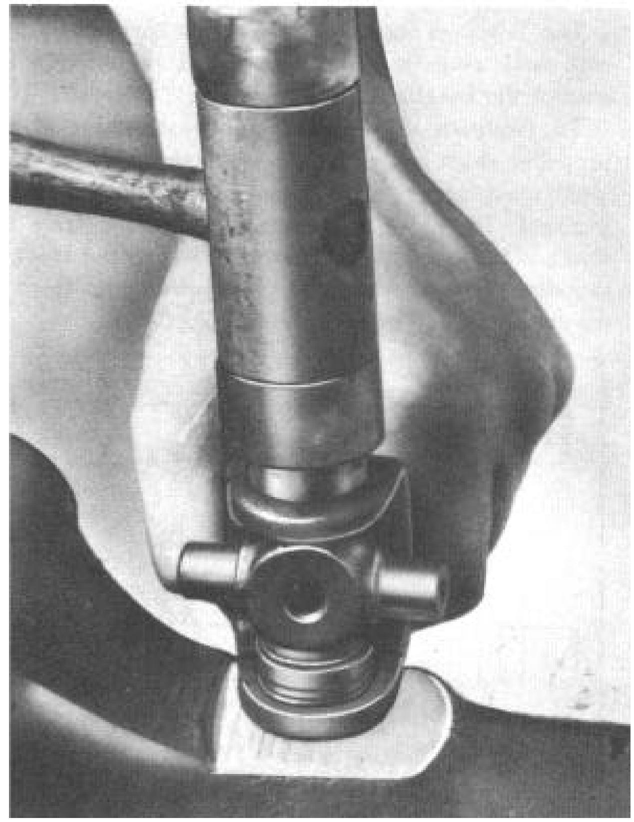
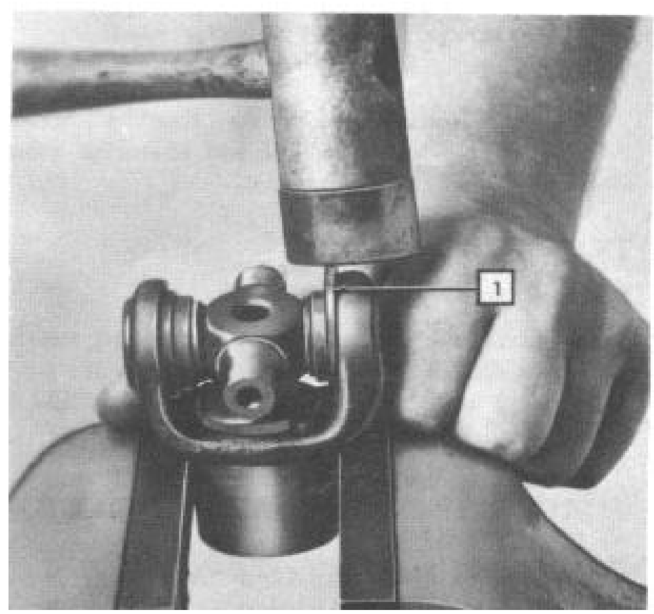


FIGURE 52—*Assembling End Bearings to Yoke*

When both end bearings are approximately flush with the outside of the yoke, the snap rings are installed.

Always use new snap rings and make sure that they are securely seated in the grooves of the end bearings. After both snap rings are in place, support the cross in a vise as shown in Figure 53 and tap yoke lightly with a soft hammer



1. Snap Rings

FIGURE 53—*Installing Snap Rings*

so that the snap rings are seated against the inside surface of the yoke.

Lubrication

Universal joints not provided with lubrication fittings are lubricated at time of assembly for the normal life of the part.

Unless dismantled for other service reasons, it is not necessary to lubricate them.

The Spicer type used on 108" wheelbase "Rambler" Series with a two piece propeller shaft is equipped with lubrication fittings. Lubricate at 1,000 mile intervals with SAE #140 Mineral Oil. USE HAND GUN ONLY.

TORQUE CHART

	Recommended Torque in Foot Pounds (All Parts Clean and Dry)		
Description	**"Hornet"**	**"Wasp" and "Rambler"**	
Ring Gear to Case Screw	50-55	50-55	
Differential Bearing Cap Screw	105-110	55-60	
Drive Pinion Nut	125-150	90-100	
Propeller Shaft Coupling Nut ("Rambler")		250-300	
Propeller Shaft Coupling Flange Screw Nut	30-35	30-35	"Wasp" Hydra-Matic
Wheel to Hub Nut	70-80	70-80	
Rear Wheel Hub to Shaft Nut	180-190	160-165	
Rear Brake Support Plate Screw Nut	50-55	30-35	

REAR SPRING SPECIFICATIONS

Series	Free Height	Loaded Height	Rate Lbs. Per Inch After Loaded Weight
"Hornet" and "Wasp" Less Wheel Carrier	177-7/8"	10-9/16" at 870 Lbs. ± 25 Lbs.	125 Lbs. ± 5 Lbs.
With Wheel Carrier	....	10-7/16" at 940 Lbs. ± 25 Lbs.	135 Lbs. ± 5 Lbs.
Heavy	16-3/4" Minimum	11-1/4" at 870 Lbs. ± 25 Lbs.	170 Lbs. ± 5 Lbs.
"Rambler" Series 100" Wheelbase (Light 5 Leaf)	7-7/8" centerline of eyes to top of main leaf	1-5/16" ± 1/8" at 650 Lbs.	100 Lbs. ± 6 Lbs.
(Heavy 6 Leaf)	7" centerline of eyes to top of main leaf	1-15/16" ± 1/8" at 700 Lbs.	125 Lbs. ± 6 Lbs.
108" Wheelbase (Light 5 Leaf)	8-1/2" centerline of eyes to top of main leaf	15/16" ± 1/8" at 670 Lbs.	100 Lbs. ± 5 Lbs.
(Heavy 5 Leaf)	7-1/8" centerline of eyes to top of main leaf	15/1/16" ± 1/8" at 760 Lbs.	125 Lbs. ±

NOTE: *When heavy rear springs are installed, heavy shock absorbers must he installed in both the front and the rear.*

SPECIFICATIONS	**"Hornet"**	**"Wasp"**	**"Rambler"**
Type	Semi-Floating	Semi-Floating	Semi-Floating
Drive Gear Type	Hypoid	Hypoid	Hypoid
Ring Gear and Pinion Backlash	.002"—.006"	.002"—.006"	.002"—.006"
Axle Shaft End Play	.002"—.004"	.002"—.004"	.002"—.004"
Pinion Shaft Bearing Tension	15" lbs.-18" lbs.	12" lbs.-14" lbs.	12" lbs.-14" lbs.
Pinion Bearing Adjustment	Shims	Shims	Shims
Differential Side Bearing Preload	.004"—.008"	.004"—.008"	.004"—.008"
Lubrication Capacity	4 pts.	3 pts.	3 pts.
Type of Lubricant	SAE 90 HYPOID**	SAE 90 HYPOID*	SAE 90 HYPOID*
Rear Axle Ratio (Standard)	4.1:1 (10-41)	4.1:1 (9:37)	3.8:1 (9-34)
Rear Axle Ratio (With Overdrive)	4.4:1 (9-40)	4.4:1 (8:35)	4.4:1 (8.35)
Rear Axle Ratio			
(With Hydra-Matic)	3.2:1 (13-41)	3.6:1 (12.43)	3.3:1 (13-43 I
(With Ultramatic)	3.5:1 (11-39)		

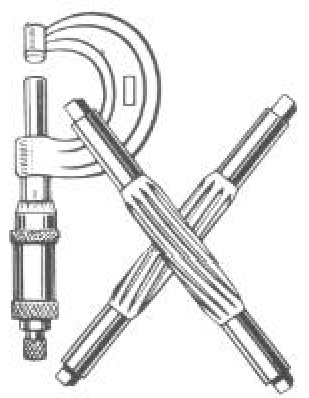
*NOTE: *HYPOID REAR AXLE LUBRICANT IS TO BE USED IN ALL NEW ASSEMBLIES OR FOLLOWING THE INSTALLATION OF REPLACEMENT PARTS. After the rear axle has been run-in, or at the recommended drain and refill period, an SAE #90 All-Purpose, Multi-Purpose, or other brand designation lubricant may be used as long as it is suitable for Hypoid Rear Axle Service. Naturally, the results of such use are the responsibility of the lubricant supplier or servicing dealer.*

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



FRONT SUSPENSION—STEERING GEAR SECTION

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FRONT SUSPENSION — STEERING GEAR

FRONT SUSPENSION-STEERING GEAR SECTION

FRONT SUSPENSION

The front suspension is an independent linked parallelogram type. The left or right assemblies may be removed as well as the complete assembly for bench overhaul.

The coil springs are located between the upper seats of the steering spindle support and a seat in the wheelhouse panel.

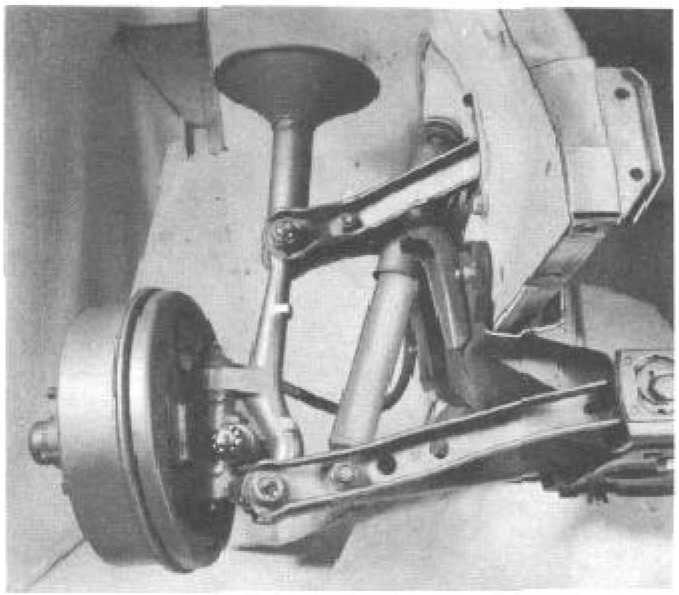


FIGURE 1—*Front Suspension Assembly "Hornet" and "Wasp" Series*

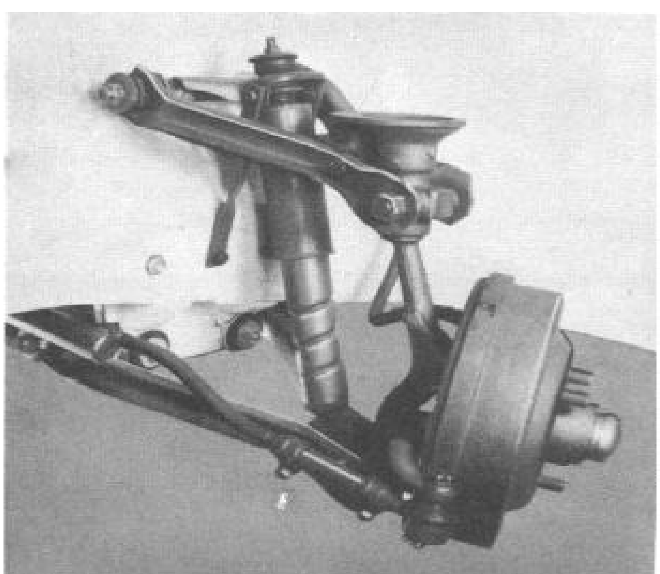


FIGURE 2—*Front Suspension Assembly "Rambler" Series*

STABILIZER BAR
"Hornet" Series

The greater weight of this series requires the use of a front stabilizer bar to provide complete control of body roll.

FRONT COIL SPRINGS Spring Removal—
"Hornet" and "Wasp" Series

The front coil spring may be removed using two front coil spring compressors J-5224.
Remove the two rebound bumpers from the upper control arms and raise the front end of the car to permit the spring to extend to its full rebound position. The coils will then be sufficiently separated to facilitate installing the compressor tools.
Install the upper section of one compressor on the highest coil of the spring and the lower section of the other compressor on the lowest coil (Fig. 3).

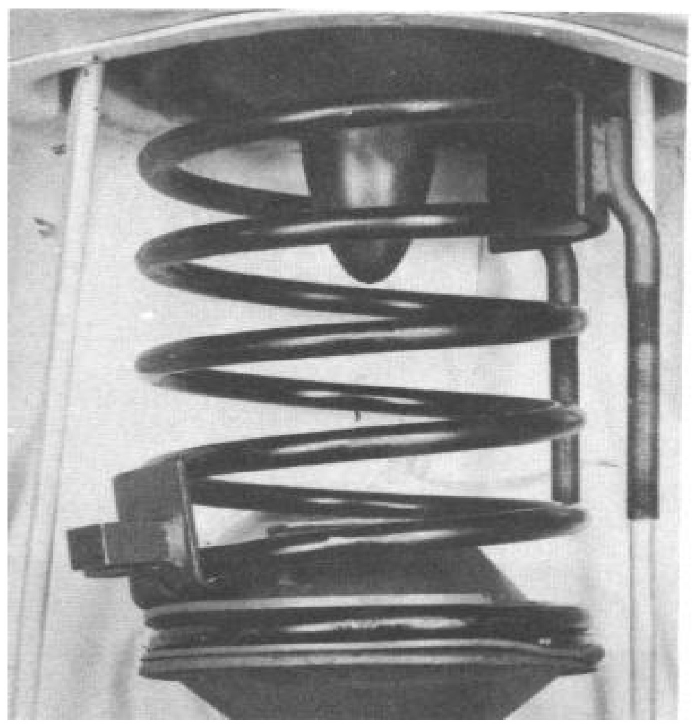


FIGURE 3—*Installing Compressor Tools on Coil Spring—"Hornet" and "Wasp" Series*

Lower the front end of the car to partially compress the spring with car weight; however, maintain support under the front end. Install the remaining sections of the compressors enclosing

five coils as illustrated in Figure 4.
Raise the front of the car and remove the front wheel, hub, and drum as an assembly.
Tighten the compressors evenly until the spring can be removed (Fig. 4).

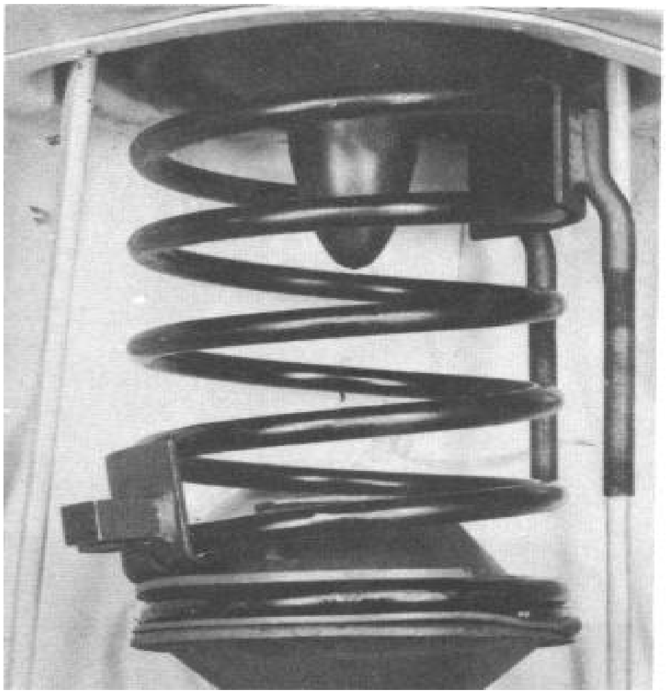


FIGURE 4—*Removing the Compressed Spring*

Two lower spring seats and a 5/8" or 3/1" bolt or threaded rod 18" long may be used to facilitate the removal and installation of the spring compressors when a new spring is to be installed (Fig. 5).

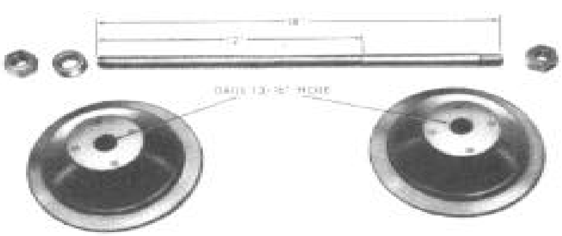


FIGURE 5—*A Spring Compressing Tool May be Fabricated From Two Lower Spring Seats and a 5/8" or 3/4" Bolt or Threaded Rod 18" Long*

"Rambler" Series

The front coil spring may be removed using two front coil spring compressors KMO-735.
Install the spring compressors enclosing nine coils.
Compress the front spring evenly; raise and support the front of the car and remove the spring.
The spring may be compressed for installation or removal of the spring compressor tools as outlined for the "Hornet" and "Wasp" Series.

Spring Installation
"Hornet" and "Wasp" Series

The spring may be compressed with two spring seats and threaded rod as illustrated in Figures 6 and 7 to permit installing the spring compressor tool J-5224.

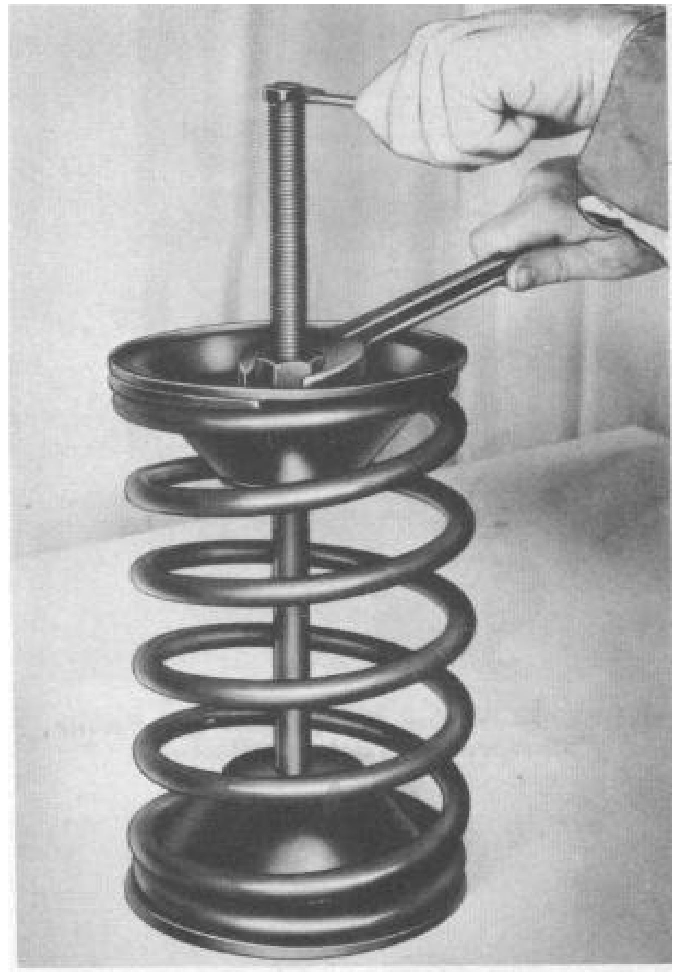


FIGURE 6—*Compressing the Spring to Install the Spring Compressors*

Assemble the spring cushions and spring seats on the compressed spring. Install the spring assembly on the seat of the steering spindle support.

CAUTION: *The lip of the lower spring seat MUST engage the seat of the spindle support to prevent the spring from slipping off during operation.*

Raise the outer end of the lower control arm, loosen, and remove the spring compressors.
Reinstall the front wheel, adjust the bearings, and install rebound bumpers.

"Rambler" Series

Install the coil spring compressors KMO-735 and compress the spring. Assemble the seat cushions and seats on the spring and install the spring assembly on the seat of the knuckle

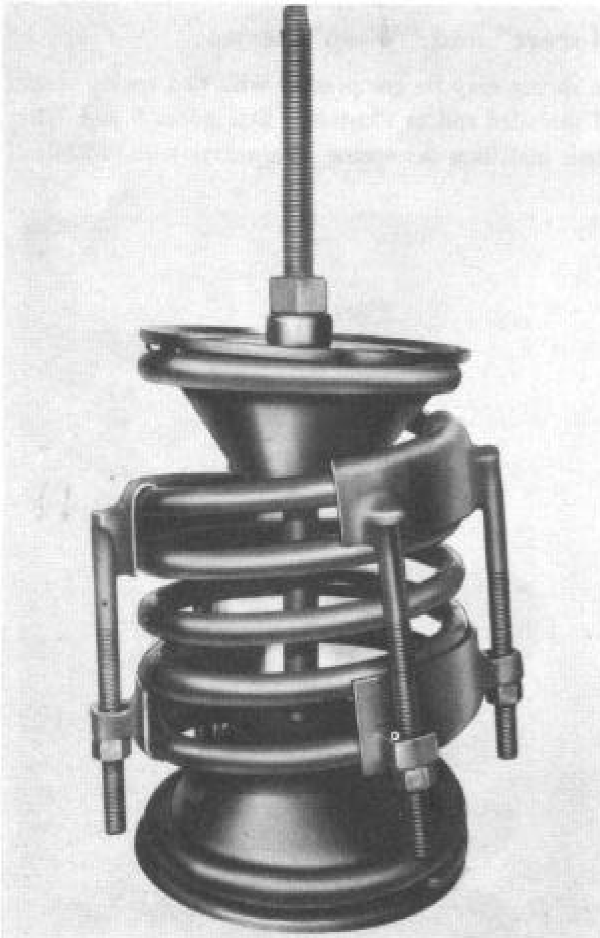


FIGURE 7—*Spring Compressed for Spring Compressor Tool Installation*

pin.

CAUTION: *The lip of the lower spring seat MUST engage the seat of the knuckle pin to prevent the spring from shifting during operation.*

UPPER AND LOWER CONTROL ARMS

Upper Control Arm "Hornet" and "Wasp" Series

The upper control arms contain rubber insulated bush- ings installed in the inner end of the arms. The control arms are attached to the mounting bracket on the wheelhouse panel and the steering spindle support, at the outer end (Fig. 8).

Removal

The upper control arm may be removed for replacement without removing the entire assembly.

Remove the front spring, then the front or rear arm by disconnecting at the steering spindle support, at wheelhouse panel mounting bolt, and the control arm spacer.

"Rambler" Series

The upper control arms are attached to the pivot bars by means of rubber insulated bushings (Fig. 9).

The upper control arm trunnion incorporates needle bearings. The knuckle pin is retained in the trunnion by a castellated nut as illustrated in Figure 10. A

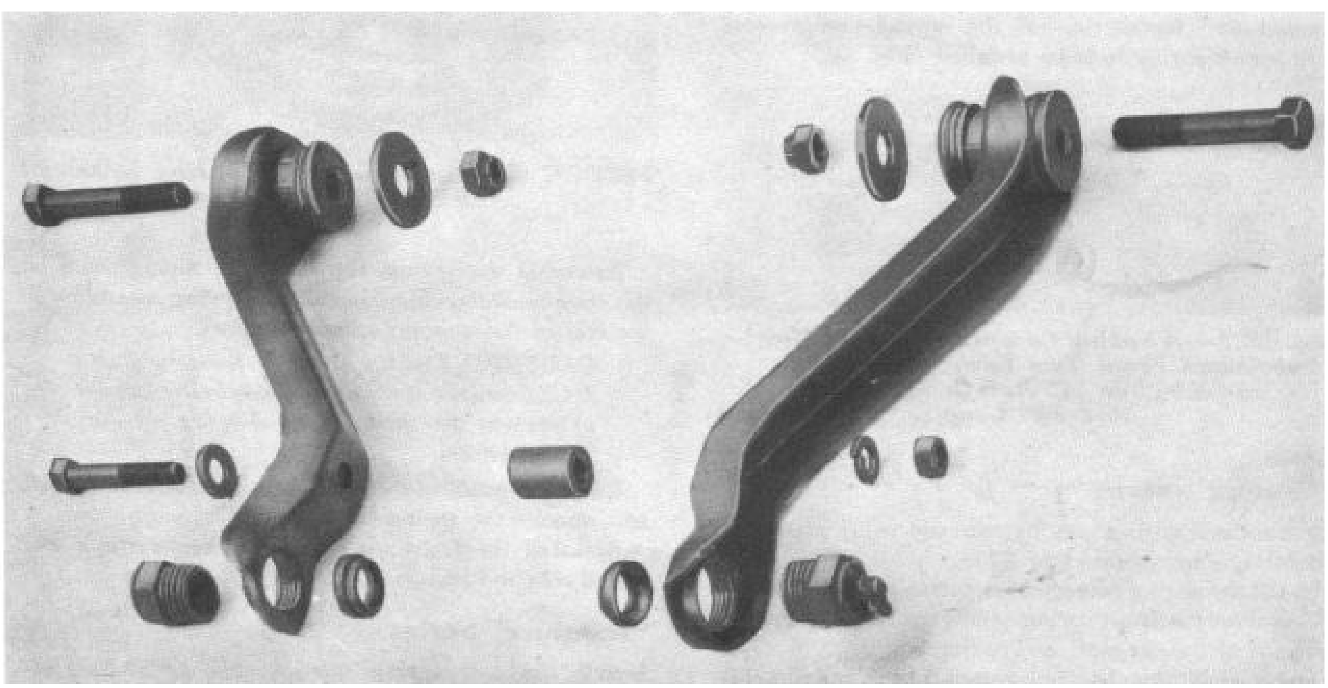


FIGURE 8—*Upper Control Arm Assembly Sequence--"Hornet" and "Wasp" Series*

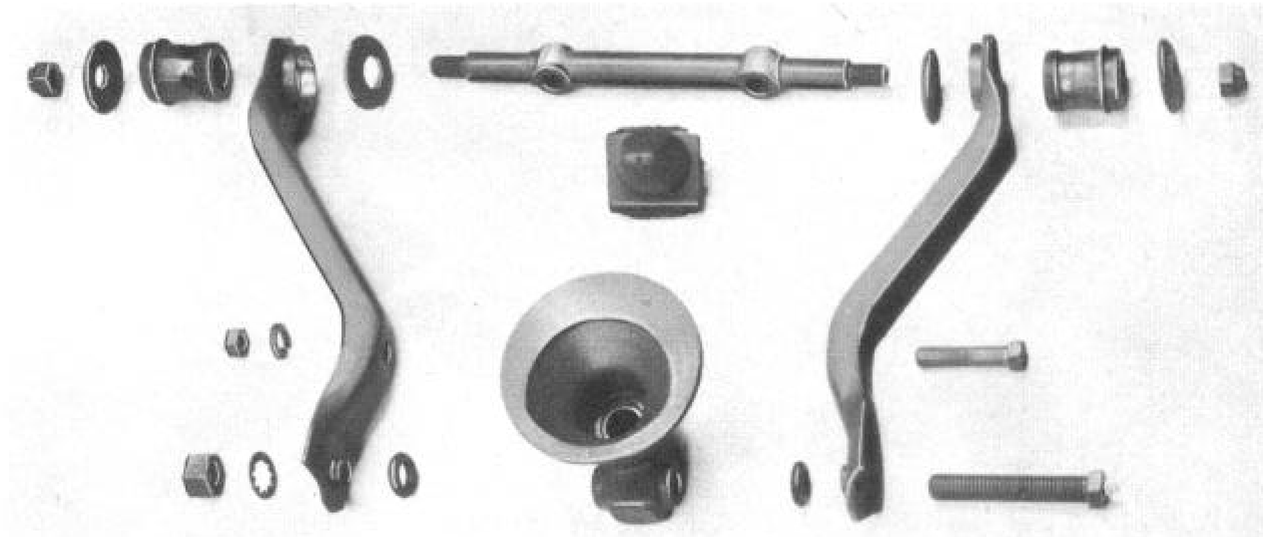


FIGURE 9 - ***Upper Control Arm Assembly Sequence - “Rambler” Series***

thrust bearing installed on the knuckle pin between the lower side of the upper trunnion and a shoulder on the knuckle pin absorbs the end thrust of the knuckle pin.

The upper control arm is attached to the upper trunnion with a screw and lock nut. The trunnion screw has a larger thread diameter at the head than at the end. Therefore, the screw MUST be started into the same control arm when being reassembled to insure a tight fit.

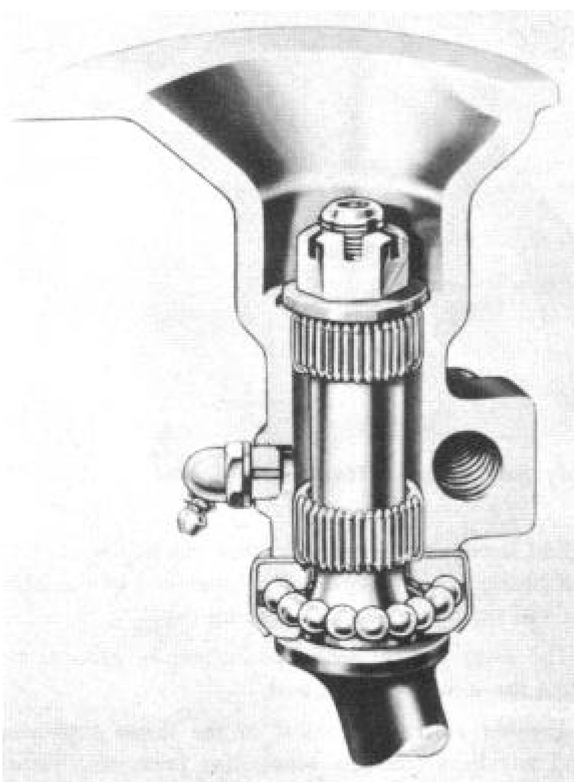


FIGURE 10—*Upper Control Arm Trunnion "Rambler" Series*

Lower Control Arms
"Hornet" and "Wasp" Series

The lower control arms are attached to a removable mounting bracket attached to the body side sill by bolts and rubber insulators. The inner end of the lower control arms contain rubber bushings. The outer end of the control arms are attached to the spindle support with internal and external threaded metal bushings (Fig. 11).

The lower control arms may be removed individually after removing the front spring. Disconnect at the lower shock absorber mounting, spindle support, and at the mounting bracket. To install the lower control arms on the mounting bracket, connect the shock absorber and tighten the attaching bolt 150-175 Foot Pounds torque. Then install and tighten the bushings in the arm and onto the spindle support centering the support between the control arms.

"Rambler" Series

The lower control arm is attached to the lower trunnion with a conventional internal and external threaded metal bushing and to the pivot bar with rubber insulated bushings (Fig. 12).

The rubber bushings are pressed into the control arms. The bushings may be removed by driving straight out of the control arm; do not turn or twist as this may enlarge the opening in the control arm.

New bushings may be pressed into the control arm until the flange on the bushing is 1/2" from the control arms (Fig. 13).

The lower control arm trunnion bushings MUST be tightened to 125 Foot Pounds torque.

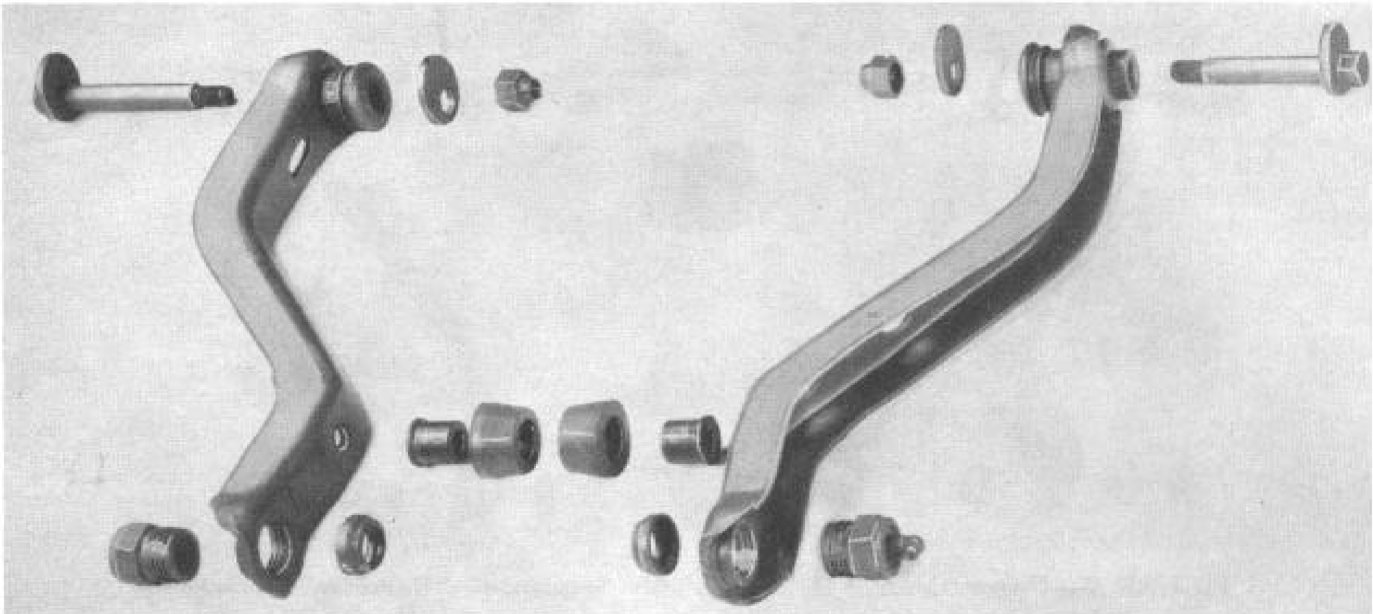


FIGURE 11—*Lower Control Arm Assembly Sequence—"Hornet" and "Wasp" Series*

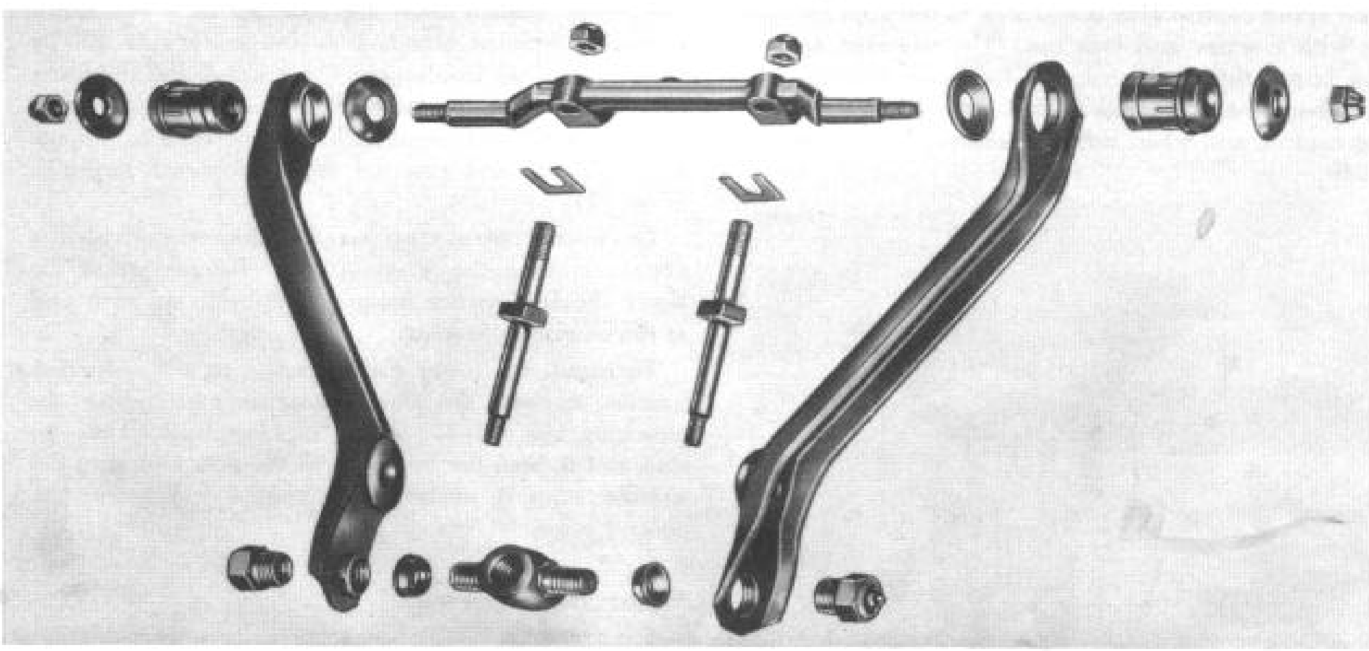


FIGURE 12—*Lower Control Arm Assembly Sequence—"Rambler" Series*

STEERING SPINDLE AND SUPPORT
"Hornet" and "Wasp" Series

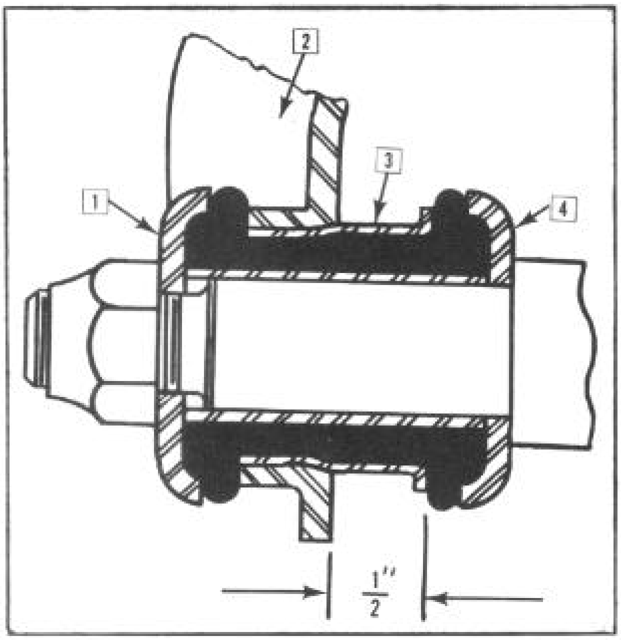
The steering spindle support is attached to the control arms by pivot pins and conventional internal external threaded bushings. The pivot pins are locked into place by wedge type lock pins (Fig. 14).

The steering spindle is attached to the spindle support by a steering spindle pivot pin and locked to the pivot pin with the steering arm.

End thrust on the spindle pivot pin is absorbed by ball bearings (7) between the upper end of the pivot pin and the upper support bushing cap.

The pivot pin oil seals are located in grooves between the spindle and support.

A relief valve is installed in the lower expansion plug to relieve excessive lubricating pressures. Lubricate the pivot pin until lubricant comes out of the valve



1. Lower Control Arm Pivot Bar Washer—Outer
2. Lower Control Arm
3. Lower Control Arm Pivot Bar Bushing—Inner
4. Lower Control Arm Pivot Bar Washer

FIGURE 13—*Bushing Installed in Control Arm —"Rambler" Series*

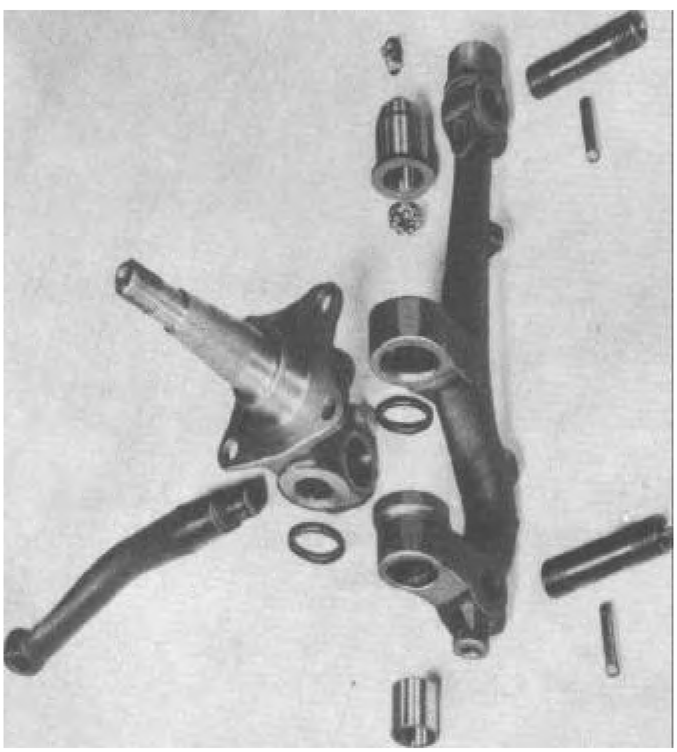


FIGURE 14—*Steering Spindle and Support Assembly Sequence "Hornet" and "Wasp" Series*

Pivot Pin Removal and Installation "Hornet" and "Wasp" Series

Remove the wheel, hub, and drum as an assembly. Then remove the brake support plate.

The steering arm is removed with remover J-1373.

Removing the grease fitting at the top of the spindle support to provide access to and drive the pivot pin out of the spindle and support. Use pivot pin driver Set J-479 to drive the pivot pin down, forcing out the expansion plug and relief valve. When removing the pivot pin, use care to prevent losing the seven ball bearings.

Pivot pin bushing remover and replacer tool J-990 is used to remove and replace the pivot pin bushing and upper thrust ball cup (upper bushing)

The bushing and thrust ball cup are hardened and ground, therefore, no reaming or burnishing is required.

The short pivot pin remover is helpful when installing the thrust ball bearings.

When installing the spindle in position in the spindle support, shim stock will prevent damage to the grease seals and facilitate assembly.

Lubricate the bushings and top of pivot pin with viscous grease prior to assembly.

STEERING KNUCKLE PIN AND SPINDLE "Rambler" Series

The steering knuckle pin is threaded to screw into the lower control arm trunnion. Screw the steering knuckle pin into the lower trunnion until there is approximately 1/4" clearance between the shoulder on the knuckle pin and the trunnion.

The knuckle pin should be installed in this manner to prevent bottoming on extreme turns and insure maximum bearing on the knuckle pin threads.

The upper control arm trunnion incorporates needle bearings and is retained on the knuckle pin by a castellated nut and pin.

> NOTE: *Two self-tapping screws must be removed to permit lock pin removal on the "Rambler" Series.*

A thrust bearing installed on the knuckle pin between the lower side of the upper trunnion and a shoulder on the knuckle pin absorbs the end thrust of the knuckle pin (Fig. 15).

FRONT WHEEL ALIGNMENT

Hard steering and abnormal tire wear is usually the result of incorrect front wheel alignment. Therefore, the front wheel alignment should be adjusted according to specifications.

Caster and Camber Adjustment "Hornet" and "Wasp" Series

The lower control arm attaching bolts are provided

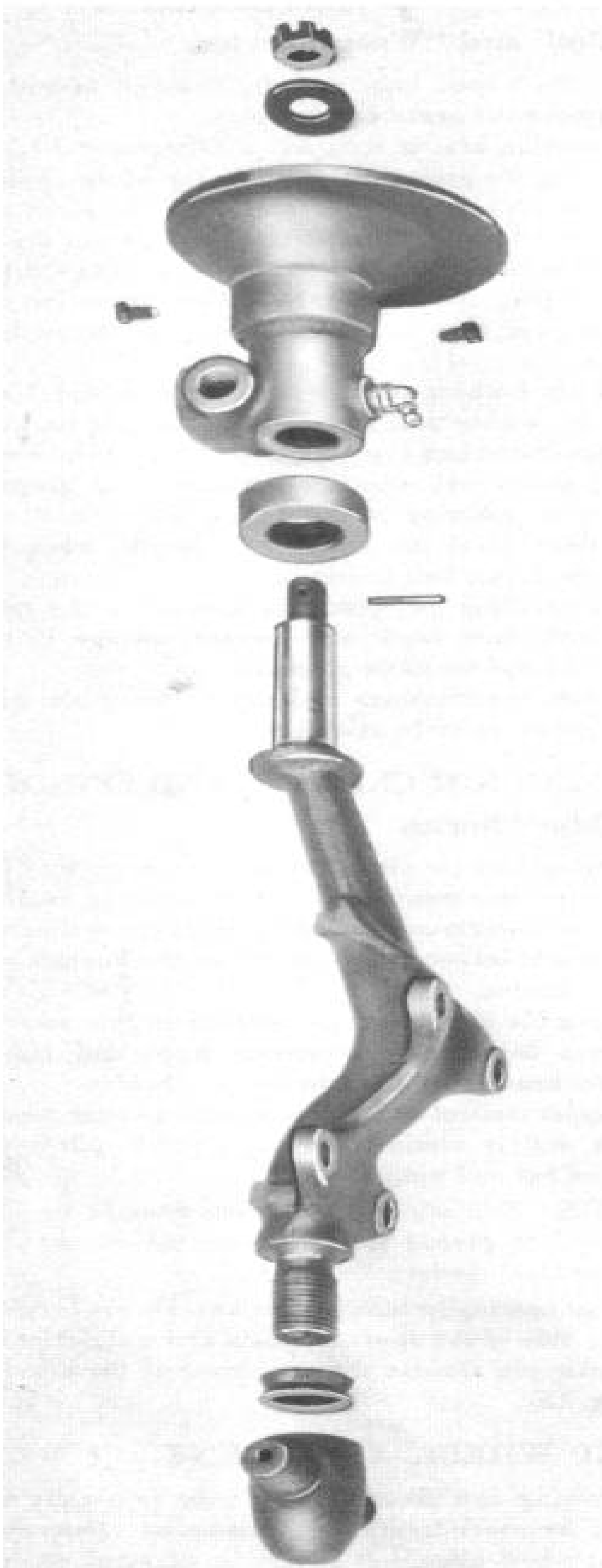


FIGURE 15—*Steering Knuckle Pin Assembly Sequence—"Rambler" Series*

with eccentric washers, one attached to the bolt and the other keyed to the threaded end of the bolt. Loosening the attaching bolt nut will permit turning the bolt and the eccentrics to provide adjustment of 0° to 1/2° positive caster (1/2° to 1° on Power Steering equipped cars) and 1/4° positive to 1/4° negative camber.

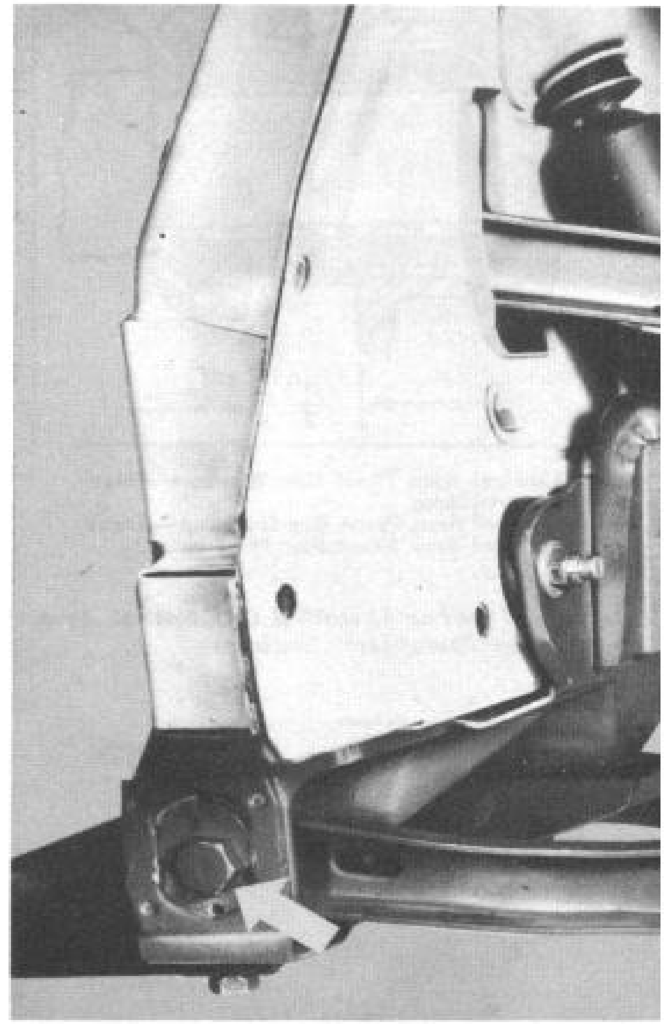


FIGURE 16—*Caster and Camber Adjusting* Eccentric—"Hornet" and "Wasp" Series

"Rambler" Series

"C" type spacers are installed between the lower control arm pivot bar and the shoulder of the mounting stud. Increasing or decreasing the number or thickness of "C" spacers at either the front or rear mounting stud permits adjusting the caster angle to 3/4° to 1-1/4° positive.

Increasing or decreasing equally at both the front and rear will change the camber angle for adjustment of 1/4° to 3/4° positive.

NOTE: *The lower control arm pivot bar brace must be loosened prior to making caster or camber adjustments. When reinstalling the brace, the attaching bolts must be tightened 90 to 95 Foot Pounds torque.*

Toe-in Adjustment

Toe-in is the difference in measurement between the front and rear of the front wheels at approximately eight inches from the road surface. The front of the wheels should be closer than the rear. Turning the tie rod adjusting tubes adjusts the toe-in.

With the wheels in the straight ahead position and the steering wheel and gear centered, turn the adjusting tubes equally in opposite directions to obtain a toe-in setting of 1/16" to 3/16" on the "Hornet" and "Wasp" Series and 1/6" to 1/8" on the "Rambler" Series without disturbing the steering wheel spoke position.

To correct the steering wheel spoke position after the correct toe-in is obtained, the tie rod tubes are turned equally in the same direction.

Prior to tightening the adjusting tube clamps, square the tie rod ball sockets on the studs and align the tie rod stud in the center or slightly above center of the cross tube opening. This will prevent the stud from contacting the side of the cross tube opening.

Steering Geometry

The steering geometry (toe-out on turns) depends upon the steering arms and is checked by means of turn tables. The toe-in must be correct prior to this check.

The turning angles should read as follows:

LEFT TURN

Series	**Left Wheel**	**Right Wheel**
"Hornet"	26°	20°
"Wasp"	24°	20°
"Rambler"	25°	21-1/2°

RIGHT TURN

Series	**Left Wheel**	Right Wheel
"Hornet"	20°	26°
"Wasp"	20°	24°
"Rambler"	21-1/2°	25°

Errors in setting of the outside wheel are usually due to bent steering arms.

King Pin Inclination

The king pin inclination is not adjustable independently of camber. If incorrect, the steering spindle support must be replaced.

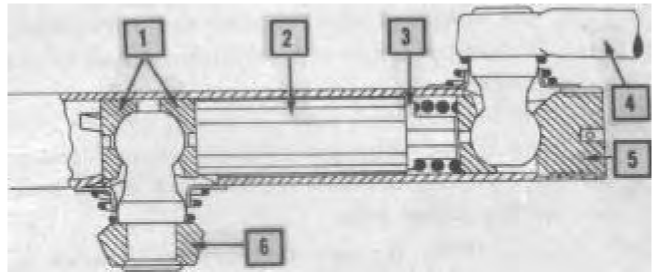
Turning Radius

Turning radius stop screws are provided on the pitman arm to provide adjustment of turning radius limits.

Steering Linkage

The steering linkage is of the relay type utilizing adjustable ball and socket joints in the cross tube and spring loaded non-adjustable tie rod ends connecting the tie rods to the steering arms.

Adjust the ball and socket joints by tightening the adjusting plug until solid contact is attained. Then loosen to the first cotter pin hole, not to exceed 1/4 turn or less than 1/8 turn.



1. Hall Seats
2. Spacer
3. Spring Plug
4. Tie Rod
5. Adjusting Plug
6. Pitman or Idler Arm

FIGURE 17—*Cross Sectional View Steering Linkage*

STEERING GEAR

The steering gear is of the worm and roller type. A three-tooth cross shaft roller is used on the "Hornet" and "Wasp" Series while a two-tooth roller is used on the "Rambler" Series (Fig. 18).

Needle bearings are installed in the steering gear housing cross shaft bore on the "Hornet" Series while bushings are used on the "Wasp" and "Rambler" Series. External adjustments have been provided to eliminate all play in the steering gear. Raise the front wheels of the car and inspect the steering linkage

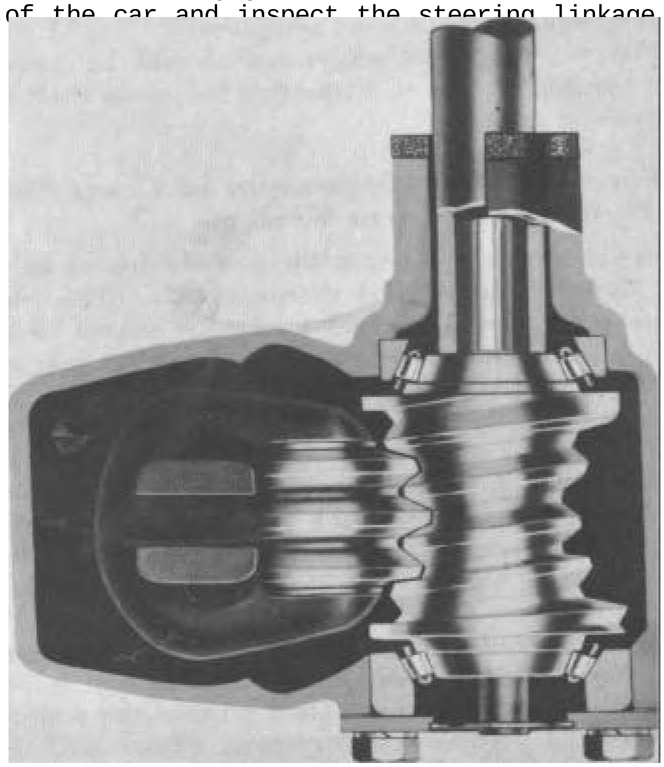


FIGURE 18—*Worm and Roller Steering Gear*

ball and socket joints, wheel bearings, and steering knuckle pin for looseness. Correct if required prior to making adjustments on the steering gear.

Worm Bearing Adjustment

Turn the steering wheel about one turn from the straight ahead position and secure the wheel to prevent any movement.

Worm bearing end play is determined by shaking the front wheel sideways noting any end movement that may be felt between the steering wheel hub and the steering jacket tube.

CAUTION: *Be sure the movement noted is not looseness in the steering jacket tube bearing.*

If end play is present, adjust the worm bearings by loosening the four cover cap screws about one-eighth inch.

Separate the top shim, using a knife blade, and remove. Do not mutilate the remaining shims or gaskets. Reassemble the cover and reinspect for end play.

Remove only one shim at a time to prevent adjusting the worm bearings too tight which will cause the steering gear to become too hard to turn.

Steering Gear Alignment

Loosen the mounting bolts just enough to allow the gear to shift on the frame and line up at the angle determined by the height setting of the jacket tube bracket. Then retighten the frame bracket bolts. Loosen the jacket tube bracket, allow it to match the gear column position, and retighten.

The steering gear alignment should be inspected and corrected prior to inspecting the cross shaft roller and worm mesh.

Inspection and Adjustment of Cross Shaft Roller and Worm Mesh

Turn the steering wheel to the mid-position of its turning limits (pitman arm disconnected). This should place both steering wheel spokes an equal distance from a horizontal position and the steering gear roller on the worm high point. If the steering wheel is removed, the wide flute on the upper end of the worm tube should be centered to the bottom.

Shake the pitman arm sideways to determine the amount of clearance between the worm and cross shaft roller. A movement in excess of 1/32" of the pitman arm indicates the roller and worm mesh must be ad-justed.

Adjustment of the cross shaft roller and worm mesh is accomplished by removing the locking cap from the external adjusting screw. Then remove the star lock- washer and tighten the external screw. DO NOT OVERTIGHTEN. After each adjustment, reinspect for proper mesh by shaking the pitman arm.

Steering Gear Removal "Hornet" and "Wasp" Series

The steering gear complete with jacket tube is removed up through the' access opening in the toe-board. Disconnect the shift rods at the shift levers and pitman arm from cross shaft. Use pitman arm puller J-1376 to remove pitman arm. Remove the mounting bolts at the steering gear housing and disconnect at the instrument panel bracket. Then pull steering wheel using puller J-4630A.

Disconnect all wires, under the dash, that are attached to the jacket tube; tag all wires for identification.

"Rambler" Series

The steering gear is removed from the bottom of the car without removing the jacket tube. The steering wheel (using steering wheel puller J-5290) and pitman arm (using pitman arm puller J-4490) must be removed and the cooling system drained to permit removing the radiator to water pump coolant line.

POWER STEERING

The power steering equipment is of the linkage type consisting of an oil reservoir, oil pump, oil flow control valve, oil pressure relief valve, control valve, and power cylinder.

The oil reservoir contains a filter element to prevent the circulation of dirt through the system. The system is also vented and filled at the reservoir.

The oil pump is an engine driven type pump mounted on the front side of the engine.

The oil flow control valve located in the pump cover controls the maximum volume output to prevent hydraulic noise and overheating of the oil.

The relief valve located within the flow control valve is pre-set to control the maximum pressure output. This valve prevents excessive pressure to build up in the system which may damage parts.

Principle of Operation

Oil is supplied to the pump from the reservoir. Oil is then directed from the pump to the inlet or pressure port of the cylinder and valve assembly through passages to the control valve.

The control valve consists of a sleeve type housing containing the necessary passages and ports. Located in the precision bore of the housing is a movable valve spool, two reaction pistons, and a stud ball follower. Lands and grooves on the valve spool indexing with the ports in the housing control the direction of oil flow. A stud attached to the pitman arm extends through the control valve housing and can move laterally in either direction.

The valve spool is normally centered by oil pressure on the reaction piston as well as spring pressure. When the valve spool is in the centered position, it directs oil pressure to both sides of the power cylinder. The oil return ports are also partially open so there is relatively low pressure in the system. This is an open center system in which the oil pressure is variable depending upon the amount of effort that is required to turn the wheels (Fig. 19).

When a left turn is made, the movement of the pitman arm stud shifts the valve spool to the right. The valve spool opens the pressure port and closes the return port to the right side of the power cylinder. The return port is opened and the pressure port is closed to the other side of the power cylinder. The oil pressure then moves the cylinder and valve assembly providing power assistance. Displaced oil from the power cylinder is returned to the reservoir through the right groove of the valve spool.

Oil pressure is also directed from the left groove through a passage in the spool to the reaction piston. This oil pressure is equal to the oil pressure present in the left hand groove in the spool. Therefore, as soon as the pitman arm stops moving, the spool is hydraulically and spring centered, and power assistance is stopped.

Actually the turning effort on the steering wheel must overcome the spring and oil pressure on the ends of the spool before the spool can be moved which results in a sense of "feel" for the driver (Fig. 20).

The right turn operation is accomplished in the same manner as the left turn with the exception that the valve spool is moved to the left (Fig. 21).

Disassembly and Assembly Procedure

Removal

Disconnect the oil hoses, the piston rod from the side sill bracket, and the tie rods from the cylinder and valve assembly.
Remove the pitman arm stud adjusting nuts, washers, cushions, and spacers. Remove the cylinder and valve assembly from the pitman arm stud for bench overhaul. The pitman arm stud is permanently attached to the pitman arm on the "Hornet" Series.

Control Valve

Punch mark the end plug to insure accurate reassembly and remove the plug.

Tap the end of the assembly on a block of wood to remove the valve components. Do not pry on any of the valve units; nicking or scratching may result.

Do not disturb the inner plug. It is factory installed and staked in position. Changing this plug location will change the spool to port alignment in the neutral position.

The "Hornet" valve spool inner components may be replaced in service as well as the "0" rings. However, the valve spool is not supplied due to the possibility of improper spool to port alignment of the replacement part.

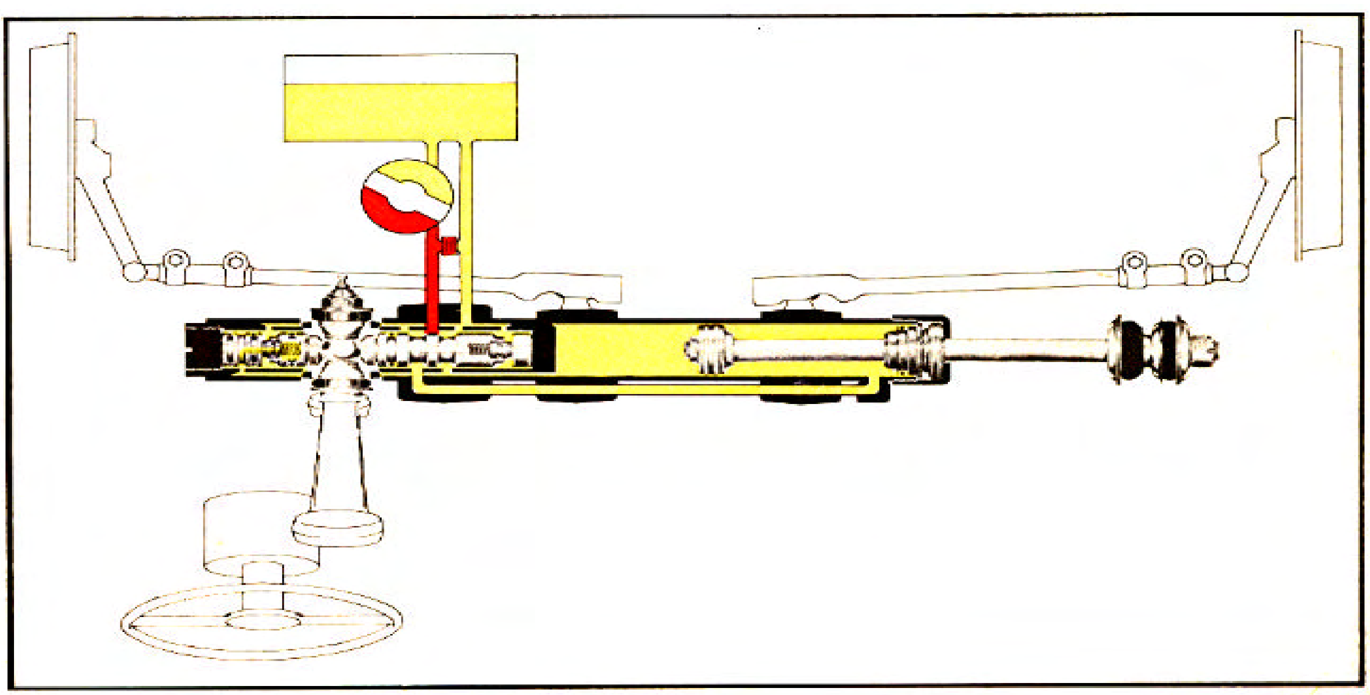


FIGURE 19—*Schematic Oil Circuit—Centered Position*

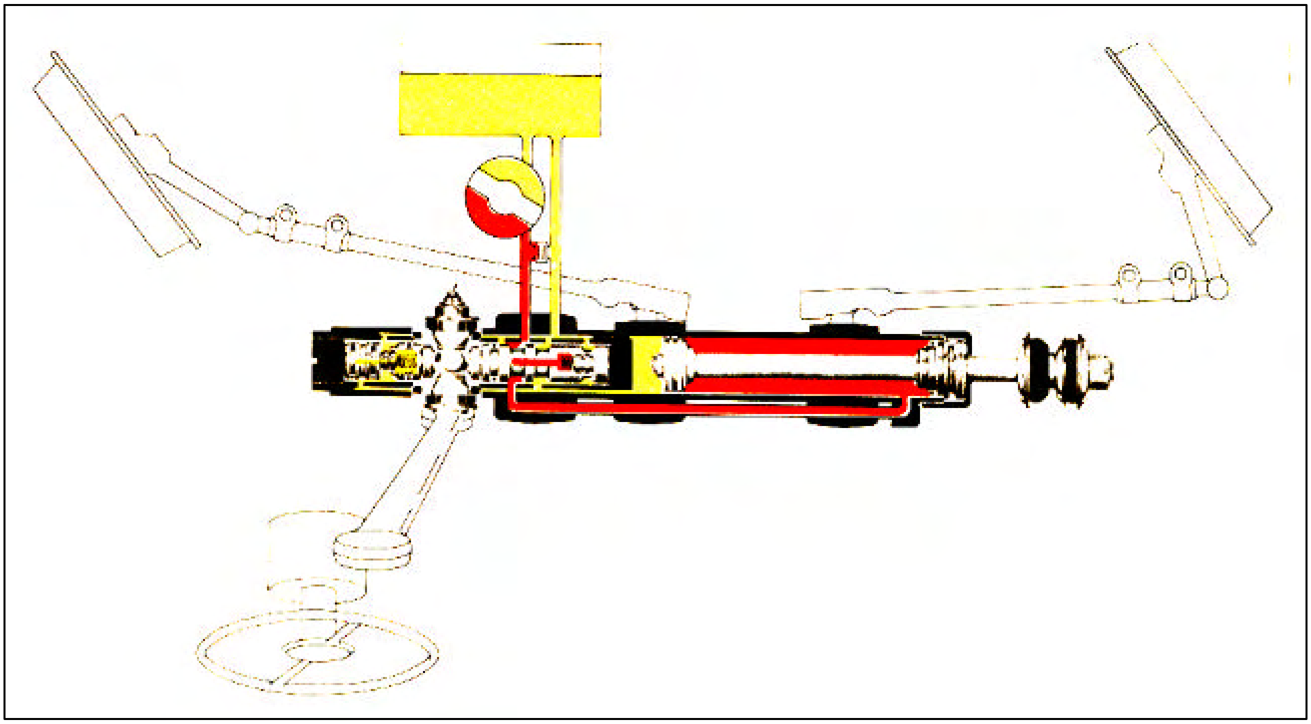


FIGURE 21—*Schematic Oil Circuit—Left Turn*

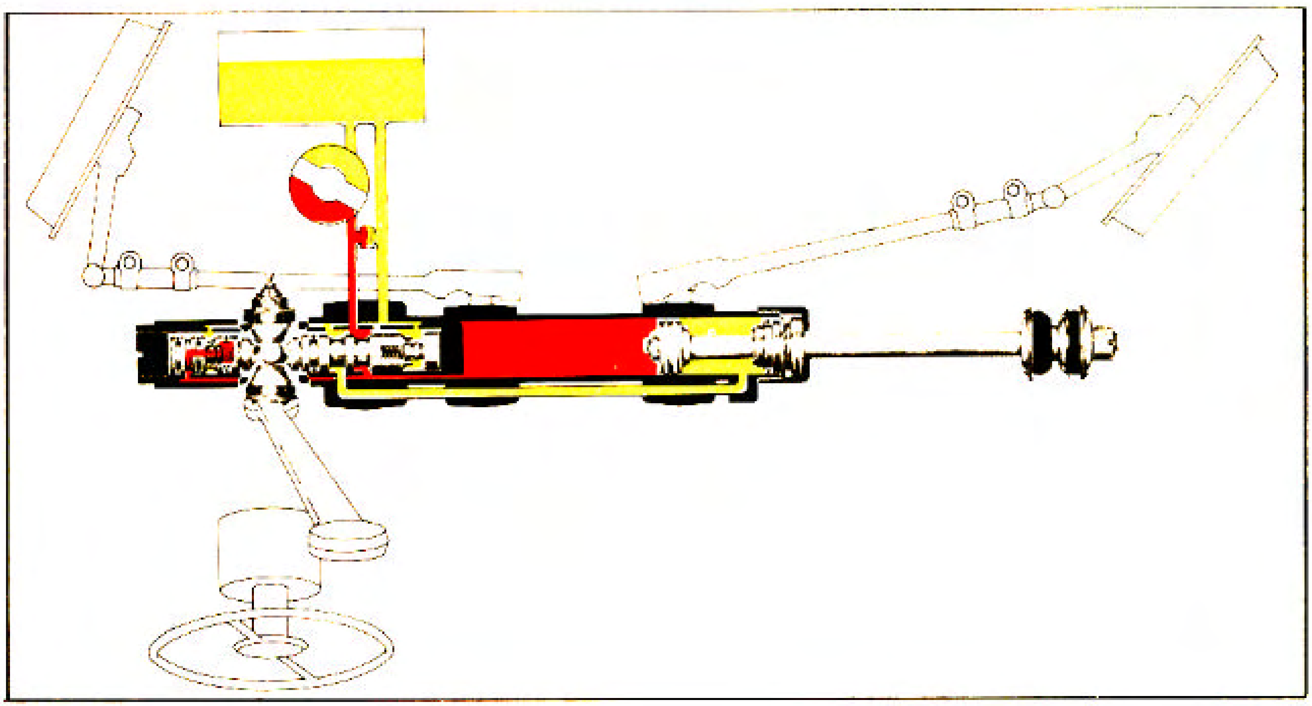


FIGURE 22—*Schematic Oil Circuit—Right Turn*

"Wasp" Series valve parts will be supplied only with the cylinder and valve assembly as the total length of the components must be held to close tolerances to maintain correct valve spool port alignment.

New "0" rings should be installed whenever the valve is disassembled.

When reassembling the valve, use caution to prevent cutting the "0" rings. The end plug should be reinstalled and tightened to the original marked position. Final adjustment of the spool is accomplished by a road test.

Power Cylinder

Remove the plug from the end of the cylinder and carefully pull the piston and piston rod from the cylinder.

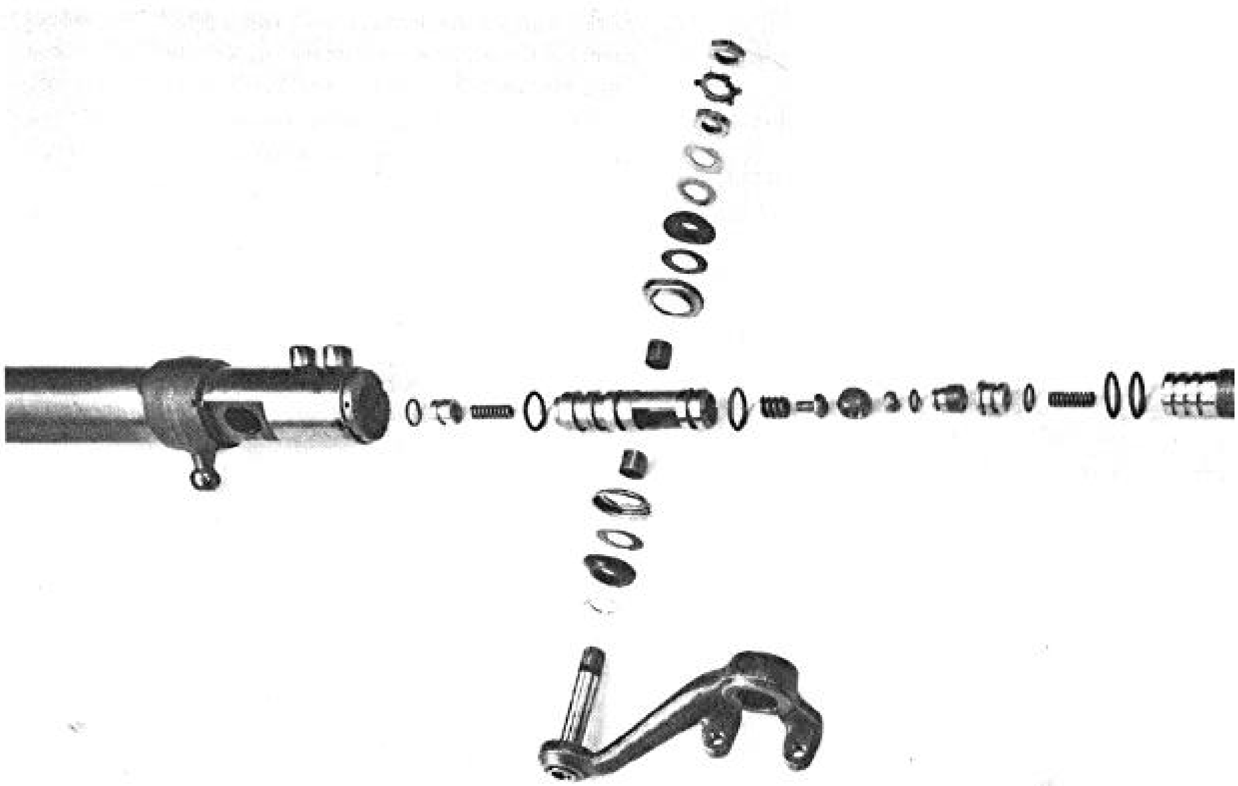


FIGURE 22—*Control Valve Assembly—"Hornet" Series*

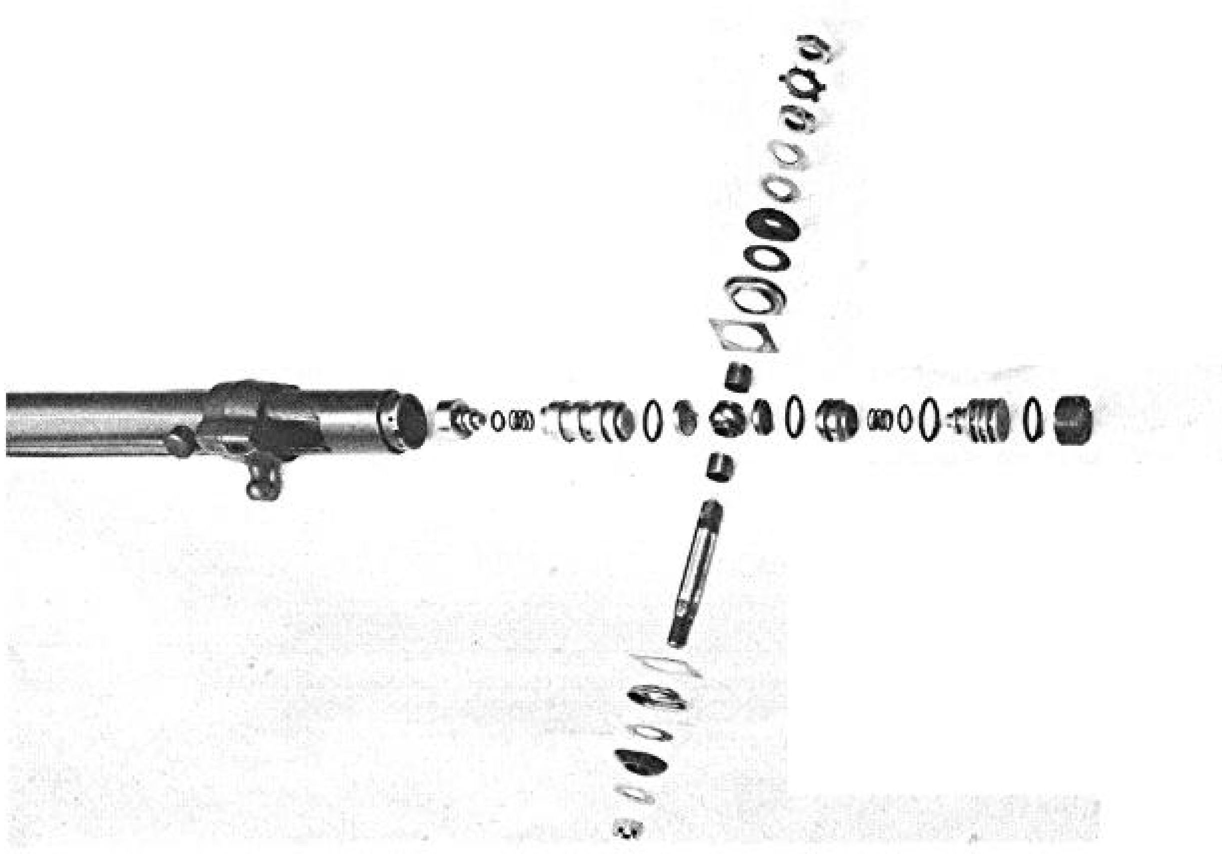


FIGURE 23—*Control Valve Assembly—"Wasp" Series*

cylinder.

The piston rod guide will be removed with the piston and rod assembly.

A punch may be used to remove the felt dirt seal located in the plug.

Install a new seal flush with the surface of the plug using Tool J-5619 Seal Installer which will not damage the raised inner diameter of the seal.

Two seals are installed in the piston rod guide. One is an "0" ring installed on the inner end and the other is a "T" shaped seal, the shape of which is maintained by fibre washers.

This seal is located in the outer end of the guide under a removable metal retainer.

The piston and rod will be serviced as an assembly as it is important that the piston and rod concentricity be maintained.

The piston rings should be replaced if there is evidence of wear or leakage.

The power cylinder on the "Hornet" Series contains a replaceable inner tube in which the piston operates.

Reinstalling the Cylinder and Valve Assembly

When reinstalling the cylinder and valve assembly the pitman arm stud and component parts should be reassembled in the valve housing and the valve nousing end installed on the pitman arm.

Tighten the inner nut on the stud until there is sufficient tension on the rubber cushions to prevent rattles and grease leakage and still permit free movement of the stud. Over-tightening the stud will cause poor recovery from turns and binding when steering.

When the stud has been correctly adjusted, the outer lock nut should be tightened and the lock washer tabs bent to hold both nuts.

After the cylinder and valve assembly have been reinstalled in the car, the lines must be bled by performing several complete power operated turns and refilling the reservoir.

The car must be road tested for final centering adjustment as follows:

The screw plug in the valve housing may be turned in or out 1/6 of a turn at a time, road testing after each adjustment. The plug should not be adjusted more than 1/2 turn in either direction. If the adjustment cannot be made with a 1/2 turn, the cylinder and valve should be replaced.

Turn the plug "IN" if:
- Left turn is too hard
- Right turn is too easy
- Poor recovery from right turns, but good recovery from left turns
- Car wanders to the right

Turn the plug "OUT" if:
- Right turn is too hard
- Left turn is too easy
- Poor recovery from left turns; good recovery from right turns
- Car wanders to the left

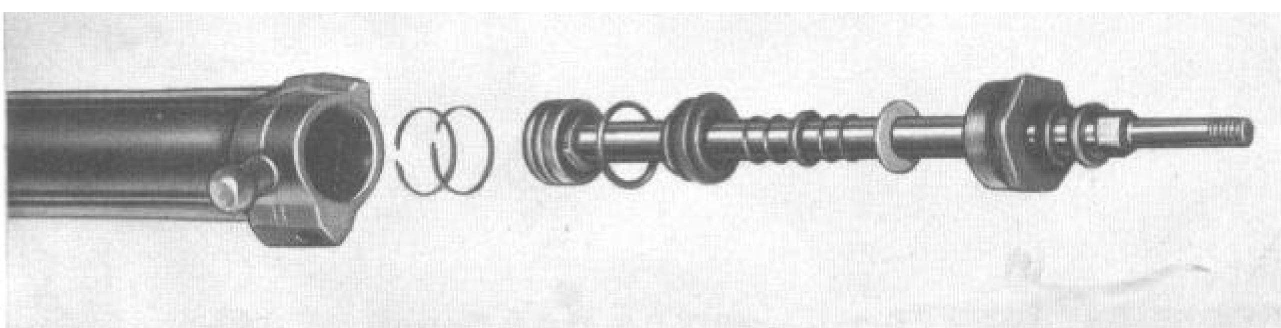


FIGURE 24—***Cylinder Assembly Sequence-"Wasp" Series Shown***

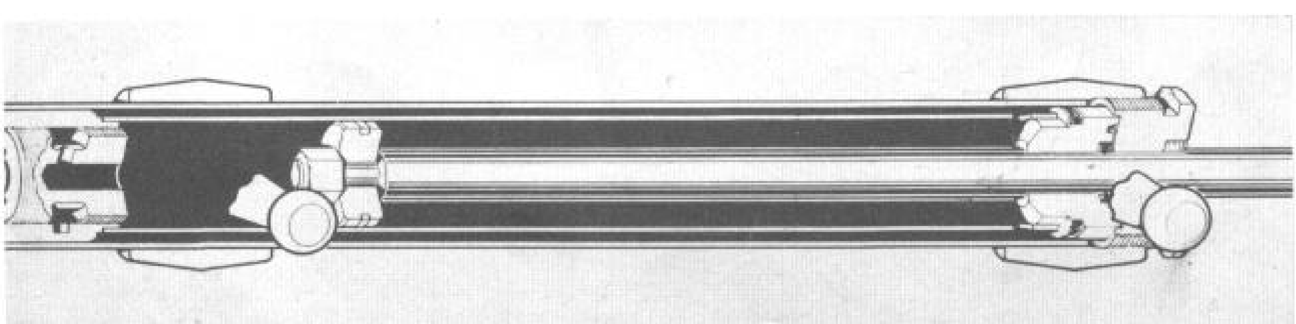


FIGURE 25—***Cylinder Assembly Sequence-"Hornet" Series Shown***

Oil Pump
"Hornet" V-8 Series

The pulley is keyed to a straight shaft and retained by a bolt and washer. To remove the pulley, remove the retaining bolt and tap lightly on the end of the pump shaft while pulling on the pulley.

Remove the pump body to cover retaining cap screws and separate the pump body from the cover. When separating these parts, be sure the pulley shaft is pointing downward to prevent accidentally dropping the pump rotors.

Mark the rotors before removing them from the pocket to insure reassembling with the faces in the same relative position. The radial location is unimportant. The rotors become lapped-in during normal operation and require this face location attention to insure normal and quiet operation.

The inner or drive rotor is keyed to the pump shaft with a special round pin type key.

After the shaft has been removed and the rotors cleaned, nest the rotors in the pocket in the same operating position and inspect for proper clearances. The tooth nose clearance should not exceed .008" clearance and the end clearance (clearance between face of rotor and pump cover) should not exceed .0025" clearance. If in either case the clearances are excessive, the rotor set should be replaced.

To remove the pump shaft bearing and oil seal, first remove the bearing snap ring using pliers J-4245. The shaft and bearing may then be removed as an assembly.

The factory sealed lubricated ball bearing is a tight press fit on the shaft. To install a new bearing, use bearing Installer J-5440 and press the bearing tight against the shoulder of the shaft.

The pump shaft oil seal is located in the pump body and is removed using combination pump shaft seal and power cylinder seal puller J-5503. Lubricate the lip of the new seal with Lubriplate and press the seal into the pump body with the lip toward the rotors.

Seal Installer J-5441 is used to press the seal into the housing until it is solidly in place.

NOTE: *The seal should not be collapsed or distorted when pressed into the body.*

The oil flow control and pressure relief valves located in the pump cover are precision machined and select fitted at time of assembly.

Unscrew the valve cap adapter. This will be under spring tension. Remove the flow control valve spring and the metal orifice plate.

The flow control valve containing the pressure relief valve may now be removed from the cover.

Depress the pressure relief valve with a punch and remove the snap ring from the end of the flow control valve using pliers J-5403 to remove the pressure relief valve and spring.

Clean and inspect the valves for freedom in the bores; remove all burrs with crocus cloth.

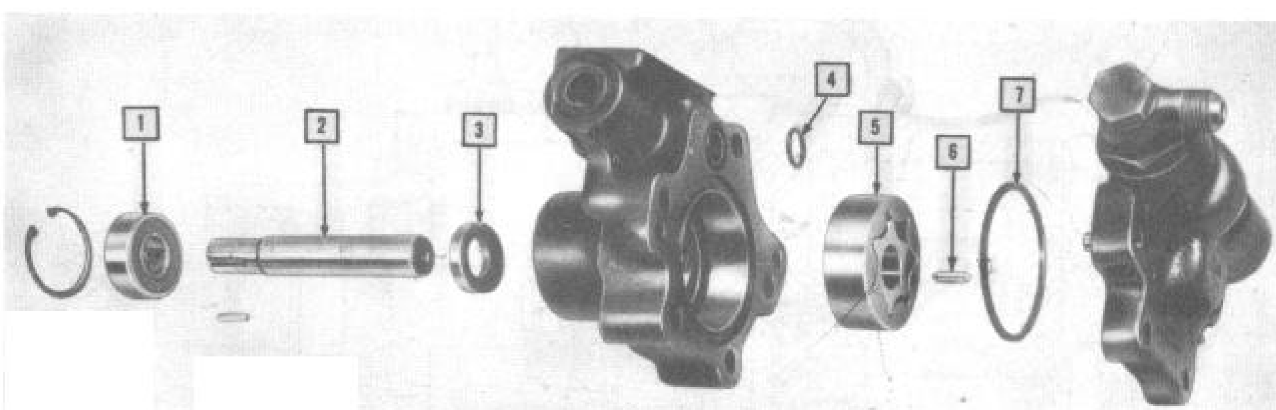
Clean and inspect the pump body and cover shaft bushings, the rotor pocket bushing in the body, and rotor bearing faces for excessive wear or scoring. If replacement of any of these parts is required, install either a new body or new cover depending on the location of the worn parts.

All parts are to be thoroughly clean.

NOTE: *Do not wipe parts with a cloth.*

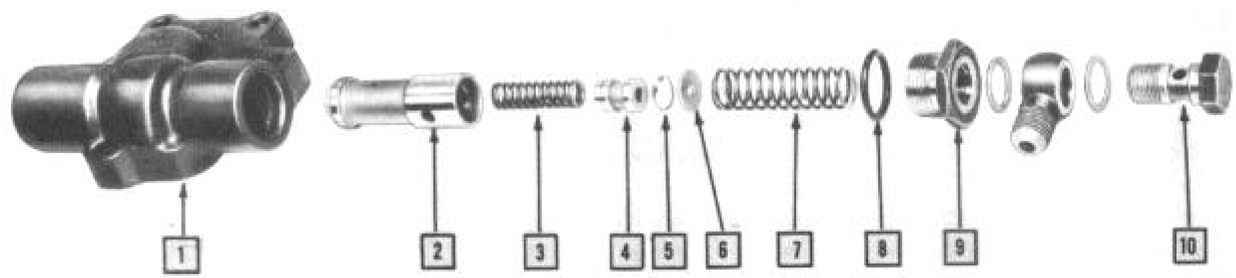
Prelubricate all parts as they are assembled.

Install the oil seal in the pump body; then install the shaft and bearing assembly and the snap ring.



1. Pump Shaft Bearing
2. Pump Shaft
3. Pump Shaft Seal
4. "0" Ring Gasket
5. Rotors
6. Rotor Lock
7. Gasket

FIGURE 26—Assembly Sequence of Pump Body, Cover, Shaft, and Rotors—"Hornet" V-8 Series Shown



1. Pump Cover
2. Flow Control Valve
3. Relief Valve Spring
4. Relief Valve
5. Snap Ring
6. Orifice Plate
7. Flow Valve Spring
8. "0" Ring
9. Valve Cap Adapter
10. Pump Outlet Fitting

FIGURE 27—*Oil Flow Control and Relief Valve Assembly Sequence—"Hornet" V-8 Series Shown*

Place the rotor key in the recess of the shaft and install the rotors, noting their position. Install the large rubber gasket in the recess around the rotor pocket bushing and the "0" ring in the recess of the pump inlet port. Always use new gaskets and "0" rings—NEVER use gasket cements or sealers.
Assemble the cover on the body; it is located by dowels.
Install and tighten the bolts 30 to 35 foot pounds torque.
Install the pressure relief valve spring in the flow control valve. The relief valve is installed with the smooth end toward the outside. Hold the valve against the spring tension and reinstall the snap ring.
Place the orifice plate in the recess of the valve above the snap ring.
Carefully install the valve assembly in the pump cover, the flow control valve spring, and then the valve cap adapter with a new "0" ring.
Prior to installing the pump on the car, rotate the pump shaft at least twelve revolutions by hand to insure proper clearances, detect foreign particles that may lodge between the rotors, and to insure initial lubrication.

"Hornet" 6 and "Wasp" Series

The pulley is keyed to a straight shaft and retained by a nut, lockwasher, and flat washer. To remove the pulley, remove the

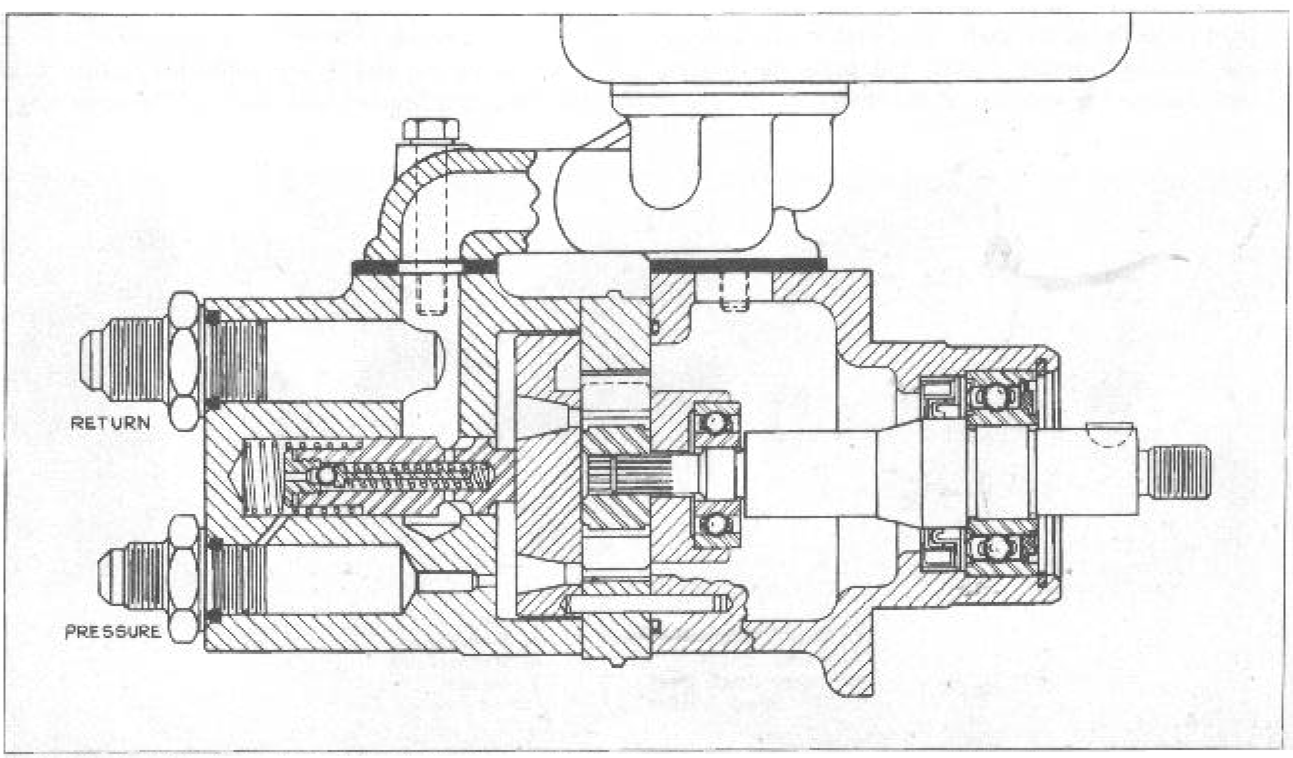


FIGURE 28—Cross Section Power Steering Pump Assembly "Hornet" 6 and "Wasp" Series

FIGURE 28—*Cross Section Power Steering Pump Assembly "Hornet" 6 Series Shown*

retaining nut and tap lightly on the pump shaft while pulling on the pulley.

Remove the reservoir cover and drain the reservoir. The reservoir may be removed from the oil manifold by removing the two cap screws inside the reservoir.

The oil manifold is attached to both the pump cover and pump body and must be removed for pump disassembly.

Mark the pump cover, rotor ring, and pump body with a punch to insure proper alignment at reassembly.

Remove the pump cover "0" ring seal, control valve and spring, pressure plate, and aligning pins.

Mark the pressure plate position.

Then remove the rotor ring and the pump rotor with the twelve vanes.

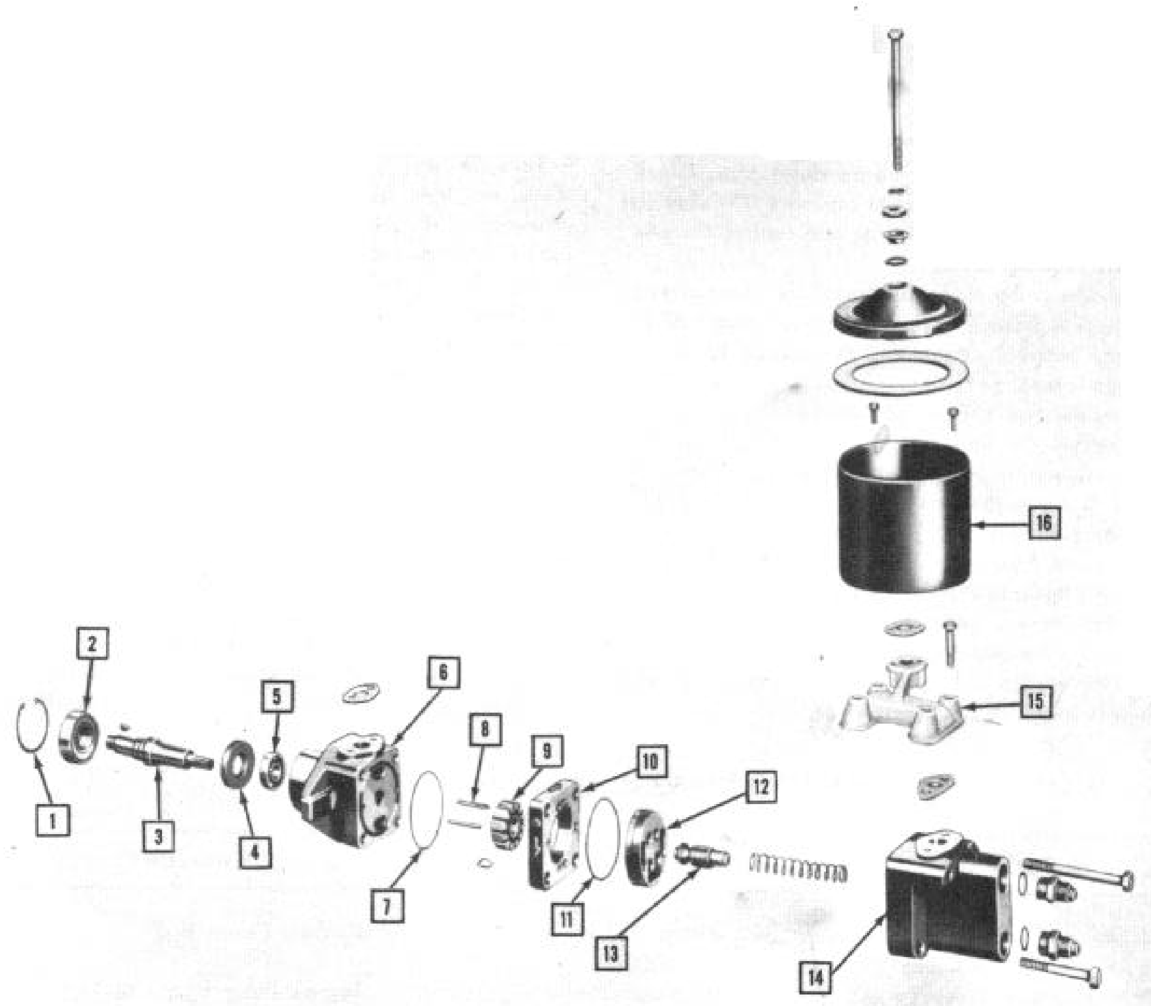
The shaft bearing is retained in the pump body with a "Tru-arc" snap ring. Remove the pump pulley shaft key. The shaft and bearing is removed as an assembly after the snap ring is removed by tapping lightly on the splined end of the shaft with a brass drift.

Remove the shaft oil seal from the pump body, using care not to damage the inner bearing.

Large outer bearing may be removed from the shaft.

Assembly

Inspect all parts after thoroughly cleaning in a clean solvent and blowing dry.



1. "Tru-are" Snap Ring
2. Outer Bearing
3. Pump Shaft
4. Seal
5. Inner Bearing
6. Pump Body
7. "0" Ring
8. Guide Pins
9. Rotor
10. Rotor Ring
11. "0" Ring
12. Pressure Plate
13. Control Valve
14. Pump Cover
15. Pump Manifold
16. Reservoir

FIGURE 29—***Power Steering Pump Assembly Sequence "Hornet" 6 and "Wasp" Series***

The large outer bearing is installed on the threaded end of the shaft with the stamped face of inner race to the front.

Install inner bearing and shaft oil seal; press on the outer edge of the seal only.

NOTE: *A protective sleeve is installed in the oil seal. Remove after the seal is installed.*

Apply "AQ-ATF" type "A" fluid to the oil seal and assemble the shaft into the pump body using care as shaft is a light press fit in the inner bearing. Install snap ring.

Install "0" ring in groove of pump body and the two dowel pins in the pump body. The rotor is installed on the splined end of the shaft and the twelve vanes assembled in the rotor with the radius edges toward the outer edge of the rotor.

Assemble the rotor ring on the dowel pins aligning the location marks.

NOTE: *Prelubricate rotor parts with "AQ. ATF" type "A" fluid when assembling.*

Install the pressure plate on the dowel pins, (small arrow on pressure plate on the top) the "0" ring in pump cover, control valve spring and control valve in front face of pump cover.

Attach the pump cover, tightening the cover screws 25 to 30 foot pounds torque and the oil manifold to the pump assembly tightening the screws 12 to 15 foot pounds torque.

Reassemble reservoir on oil manifold.

Reassemble the pump on the engine. Adjust the belt tension so that belt will not deflect more than 1/4" midway between the power steering pump and the water pump pulleys.

Loosen the hose connections at the control valve and fill the hoses to remove all air.

Fill the reservoir prior to connecting the hoses to permit filling the pump to eliminate air.

Start the engine and operate for approximately ten minutes to bleed air from the system.

CAUTION: *Do not turn steering wheels during this initial ten minute period.*

Check and refill reservoir. Inspect system for external leaks.

NOTE: *Air bubbles circulating through the pump will result in noise. Normally, three or four days operation is required to dissipate the air bubbles from the system. This condition is best prevented by careful bleeding at time of reassembly.*

Oil Pressure Check

Inspect the reservoir for correct fluid level; if low, fill to the proper level with Hydra-Matic Transmission fluid type "A".

Inspect all hoses and connections for evidence of external leakage.

Install oil pressure gauge J-5548 in the main oil line at the control valve assembly. Start the engine and allow the oil to circulate for several minutes to warm the oil.

Turn the wheels against the curbing or other obstacle and hold tension on the wheel. Note the oil pressure. It should be 650 to 900 P.S.I. on the "Hornet" V-8 Series, and 500 to 800 P.S.I. on the "Hornet" 6 and "Wasp" Series. Turn the wheel in the opposite direction and note the reading. If there is a variation between the left and right turns, internal leakage is evident. If the pressure is low, stop the engine and disconnect the gauge from the cylinder and valve assembly and cap the pressure line.

Restart the engine and note the reading; if it is 650 to 900 P.S.I. "Hornet" V-8 Series, or 500 to 800 P.S.I. "Hornet" 6 and "Wasp" Series, the pump is operating properly. If the pressure is low, the pump belt or fan belt may be slipping. With the belt tension correct and there is low pressure, the trouble exists in the pump.

NOTE: *Do not run the last check for a period longer than is necessary to obtain a steady pressure reading.*

POWER STEERING DIAGNOSIS GUIDE

CONDITION	CAUSE	CORRECTIONS
Hard Steering or Lack of Sufflcient Power Assistance or Poor Recovery from Turns	Bent Piston Rod	Replace Piston Rod
	Low Oil Pump Pressure	Inspect Pump Operation and Correct
	Insufficient Oil Flow in System	Inspect Pump Flow Control Valve; Inspect Oil Hoses for Restriction
	Internal Leak in Control Valve	Disassemble Control Valve Inspect and Correct

CONDITION	CAUSE	CORRECTION
Hard Steering or Lack of Sufficient Power Assistance or Poor Recovery from Turns (Continued)	Internal Leak in Cylinder	Disassemble Cylinder, Inspect, and Correct
	Front Wheel Alignment Incorrect	Align Front Wheels
	Steering Spindle Pivot Pins Binding	Inspect for Worn or Tight Trunnions
	Steering Linkage Tight	Adjust Steering Linkage Ball Joints
	Steering Gear Adjustment too Tight	Readjust Steering Gear
	Binding Valve Spool in Control Valve	Disassemble Valve and Inspect for Nicks or Burrs Both Series Adjust Valve of Cylinder and Valve Assembly--
	Pitman Arm Stud Binding	Adjust Pitman Arm Stud for Correct Rubber Cushion Tension
Lack of Power Assistance in One Direction	Steering Gear Binding	Adjust Steering
	Bent Piston Rod	Replace Piston Rod
	Valve in Cylinder and Valve Assembly Incorrectly Adjusted	Adjust Valve of Cylinder and Valve Assembly
	Incorrect Front Wheel Alignment	Realign Front Wheels
Car Wanders from Straight Ahead without Force Holding Steering Wheel	Pitman Arm Stud Binding on Cylinder and Valve Assembly	Adjust Stud Tension Properly
	Valve of Cylinder and Valve Assembly not Adjusted Properly or Sticking	Adjust Valve Correctly
Poor Recovery from Turns	Piston Rod Bent	Replace Piston Rod
	Front Wheel Alignment Incorrect	Align Front Wheels
	Valve in Cylinder and Valve Assembly Incorrectly Adjusted or Sticking	Adjust the Valve of Cylinder and Valve Assembly
Noisy Operation	Pump Pulley Shaft Key Loose	Replace Pump Shaft Key or Replace Pump Shaft and/or Pulley
	Restricted Air Vent in Reservoir Cover	Remove Cover and Clean Vent
	Pump Bearing Worn	Replace Bearing
	Pump Bushings Worn	Replace Pump Cover or Body
	Dirt in Pump	Disassemble Pump and Clean, Flush System
	Pitman Arm Stud (Rattles)	Adjust Pitman Arm Stud or Replace Worn Parts

FRONT WHEEL ALIGNMENT SPECIFICATIONS

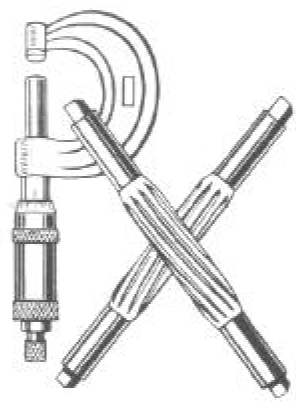
	"Hornet"	"Wasp"	"Rambler"
Turning Angle			
Inside Wheel	26°	24°	25°
Outside Wheel	20°	20°	21-1/2°
Kingpin Angle	3° 36"	3° 36"	8-1/2°
Caster Angle without Power Steering	0° to 1/2° 1/2° Desired	0° to 1/2° 1/2° Desired	3/4° to 1-1/4° 1° Desired
Caster Angle with Power Steering	1/2° to 1° 1° Desired	1/2° to 1° 1° Desired	....
Camber	1/4° Neg. to 1/4° Pos. 0° Desired	1/4° Neg. to 1/4° Pos. 0° Desired	1/4° to 34° Pos. 1/2° Desired
Toe-in	1/16" to 3/16"	1/16" to 3/16"	1/16" to 1/8"

FRONT SPRING SPECIFICATIONS

Series	**Free Height**	**Loaded Height**	**Rate Lbs. Per Inch After Loaded Weight**
"Hornet" 6 Cylinder	17-1/2" to 18"	8-5/8" to 1000# Plus or Minus 25#	115# Plus or Minus 5#
"Hornet" V-8	18-1/4"	8-5/8" to 1200# Plus or Minus 30#	125# Plus or Minus 5#
"Wasp"	17-13/16" to 18-5/8"	8-5/8" at 920# Plus or Minus 25#	100# Plus or Minus 5#
"Rambler" Standard and Overdrive w/o Air Conditioning	18"	10-3/8" at 755# Plus or Minus 20#	110# Plus or Minus 4#
Hydra-Matic w/o Air Conditioning and Standard Trans-mission with Air Conditioning	18"	10-3/8" at 810# Plus or Minus 22#	110# Plus or Minus 4#
Hydra-Matic and Overdrive with Air Conditioning	18-3/8"	10-3/8" at 845# Plus or Minus 22#	110# Plus or Minus 4#

HUDSON

TECHNICAL SERVICE MANUAL



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WEATHER EYE SYSTEM

WEATHER EYE SYSTEM

WEATHER EYE

The Weather Eye is designed to provide clean, fresh filtered air for summer driving and fresh filtered and heated air within the car for winter driving. It is, therefore, very important to know how the Weather Eye functions and is operated to obtain the best possible results.

SUMMER DRIVING

The damper control which operates the cowl vent damper, dash inlet, and heater duct damper is located to the left side of steering column on the instrument panel on the "Hornet" and "Wasp" Series (Fig. 1).

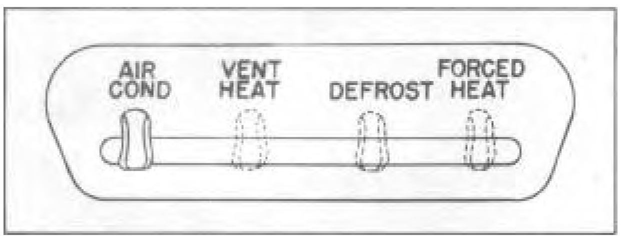
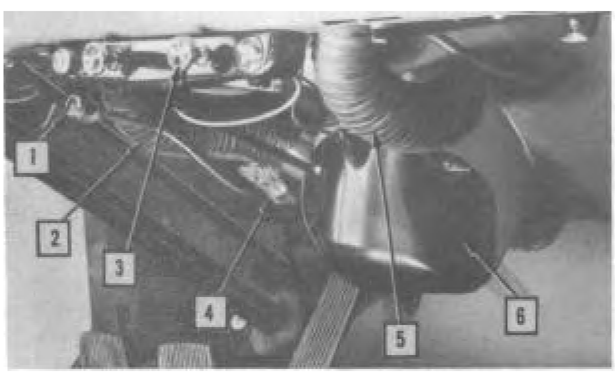


FIGURE 1—*Damper Control—"Hornet" and "Wasp" Series*

The "Rambler" Series cowl ventilator control knob and cable, which operates the cowl ventilator damper, is located at the right side of the steering column below the control panel (Fig. 2).



1. Cowl Ventilator Control Knob (Knob "IN", Damper in Open Position)
2. Left Defroster Duct
3. Heater Switch and Water Valve Control
4. Water Control Valve
5. Right Defroster Duct
6. Heat Deflector

FIGURE 2—*Cowl Ventilator Damper Control Knob—"Rambler" Series*

The cowl ventilator damper should be open at all times except when washing the car. Move the damper control lever to "Air Condition" position to completely close the cowl ventilator damper on the "Hornet" and "Wasp" Series. Pull the knob out on the "Rambler" Series to close the cowl ventilator damper.

During summer operation, with the water control valve in the fully closed position and the cowl vent damper open, air entering the cowl ventilator passes over a rain shedder baffle to prevent moisture from entering the car. Air entering the open cowl ventilator is screened, filtered, and circulated within the car. For added circulation of fresh filtered air, the rear quarter ventilators on sedans and rear windows on two door models should be opened slightly.

WINTER DRIVING

The Weather Eye is a part of the engine cooling system and depends on normal engine operating temperature and air flow through the cowl ventilator to heat the interior of the car.

> NOTE: *For most efficient operation in extreme cold weather, a 180° thermostat is recommended when using a permanent type of antifreeze.*

With the cowl ventilator damper and the water control valve open, fresh air enters the cowl ventilator and is filtered and heated as it passes through the heater core to the heat distribution ducts along the toe panel in the "Hornet" and "Wasp" Series and through the heater opening in the dash panel in the "Rambler" Series. It is then circulated within the car at average driving speeds. Added heat can be obtained in the rear passenger compartment by opening the rear quarter ventilator or rear window slightly.

A heater fan located directly behind the heater core may he utilized to circulate fresh filtered air while driving in slow traffic with the water control valve fully open. The amount of fresh air desired can be controlled by movement of the control knob to modify the cowl ventilator damper opening. The "Hornet" and "Wasp" damper opening may be modified by moving the damper control knob toward the "Air Condition" position on the control panel, or the damper can be closed completely by moving the control to this position from "Vent Heat." The "Rambler" cowl ventilator damper position can be varied by pulling the control knob out.

DEFROSTING

Windshield defrosting is accomplished by the combination heater and defroster fan located behind the heater core.

The fresh air is forced in through the open cowl ventilator while the car is in motion or drawn in at idle or slow speed by the combination heater and defroster fan and deflected to the defroster ducts; in turn, directed through the air openings at the bottom of the windshield onto the glass. In de-icing where warmer air is required, it is necessary to open the water control valve wide open to allow more heated air to be directed to the windshield.

The "Hornet" and "Wasp" Series damper control is moved to the "Defroster" position to place the inlet damper in the proper position to deflect the heated air to the defroster ducts and still deliver a portion of the heated air to the heat distribution duct along the toe panel.

To defrost or de-ice in the "Rambler" Series, the cowl ventilator must be open, the water valve control pulled out to the maximum position, and the blower motor turned on. The blower motor will provide additional force to the ram air to deflect it to the defroster ducts.

"Forced Heat" position on the "Hornet" and "Wasp" Series damper control places the inlet damper into position to deliver blower forced heated air to the heat distribution duct along toe panel. This position is used in slower driving conditions, such as city traffic and driving below twenty miles per hour.

WATER VALVE CONTROL SWITCH

The Weather Eye control switch is a combination electric rheostat switch and water valve control. The "Hornet" and "Wasp" Series control switch is illustrated in Figure 3. The "Rambler" Series is illustrated in Figure 2.

FIGURE 3—*Heater Switch and Water Valve Control—"Hornet" and "Wasp" Series*

To open the water control valve on the "Hornet" and "Wasp" Series, the valve control and switch knob is moved horizontally from the left, "LOW" position to the right, "HIGH" position. To open the water control valve on the "Rambler" Series, the control switch is pulled "OUT"; to close, it is pushed "IN". In both cases, moving the control valves to the full open position allows the full flow of water to pass through the heater core.

When the Weather Eye switch is turned clockwise from the "OFF" position, the combination heater and defroster motor operates at high speed. The speed is decreased as the switch is turned gradually to the right.

Water Valve Control and Switch Assembly Removal

"Hornet" and "Wasp" Series

Remove the glove box and the glove box mounting panel.

Remove the heater control knob. Remove the switch assembly by removing the mounting screws from the rear of the instrument panel. Disconnect wire from the switch and the cable from the control shaft (Fig. 4).

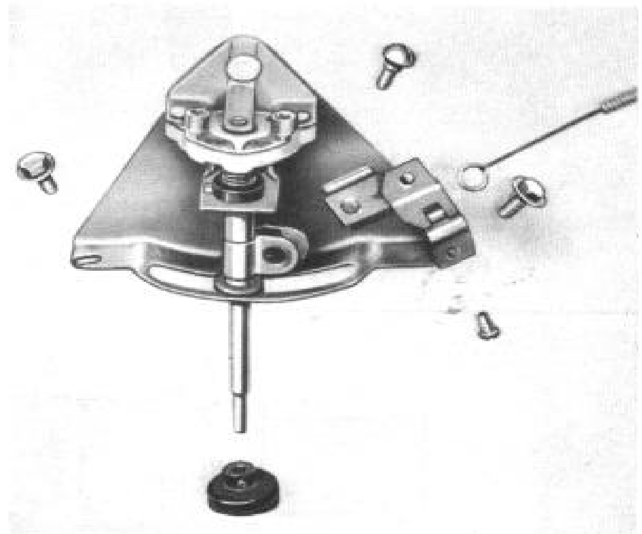


FIGURE 4—*Water Valve Control and Switch Assembly—"Hornet" and "Wasp" Series*

"Rambler" Series

Insert a small screw driver between the switch bracket and switch control stop collar (Fig. 5). This will allow the control knob and shaft to be unscrewed from the threaded end of the control cable. Then pull the shaft and knob straight out.

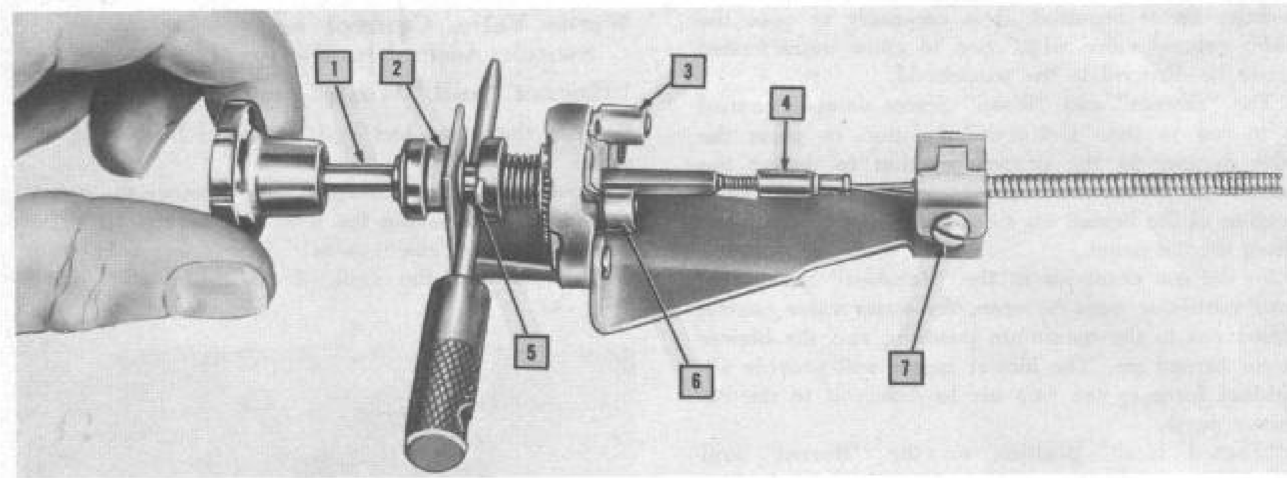
The switch can be withdrawn from the instrument panel after the French mounting nut has been removed.

Disconnect the switch wires from the connectors and the cable conduit from the clamp.

> NOTE: *Upon installation, the control knob and shaft must be screwed completely into the threaded end of the cable, then backed off two full turns to allow free operation of the heater switch.*

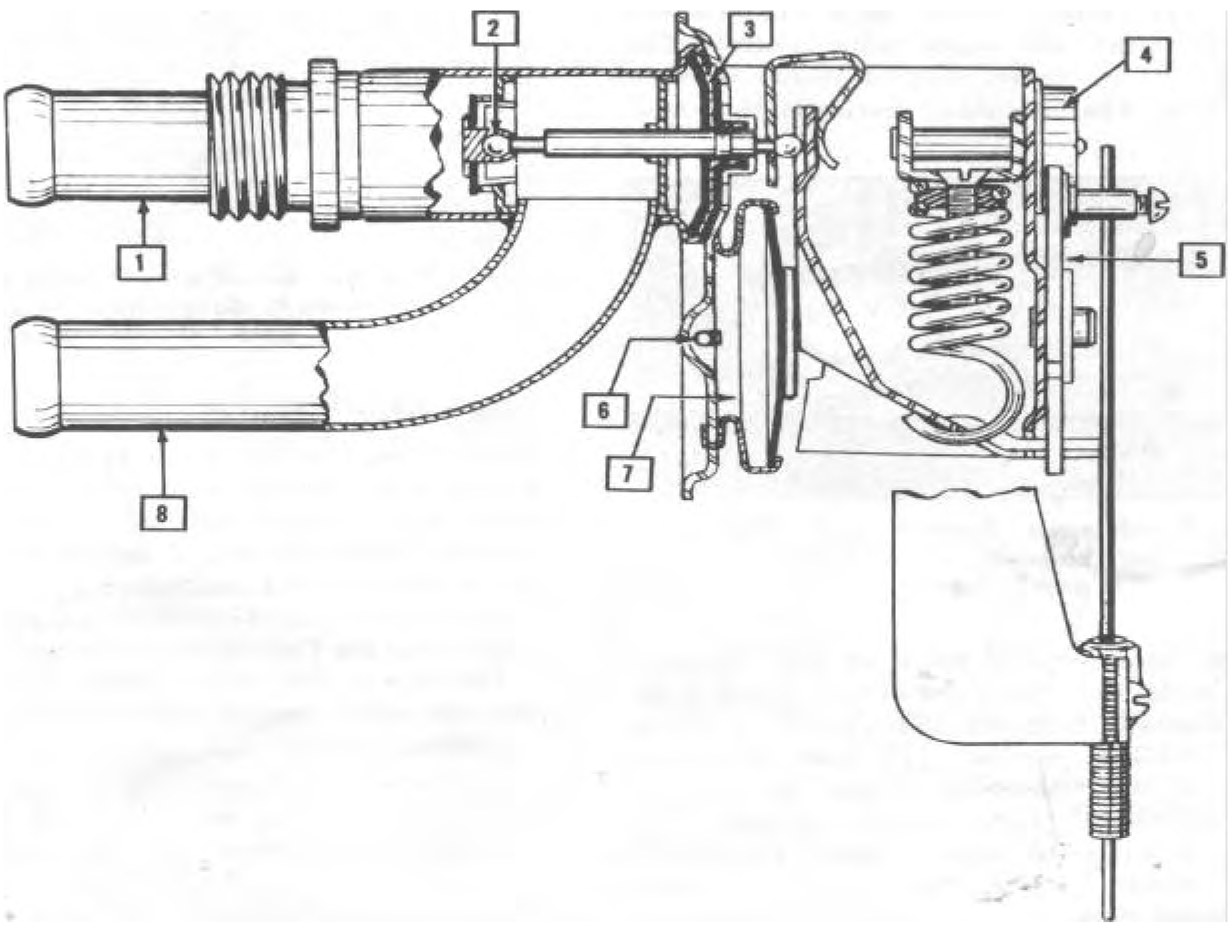
WATER CONTROL VALVE

The water control valve position is operated manually. Thermostatically it controls the amount of coolant passing through the heater core in any position except "Low" or "High" (Fig. 6).



1. Control Switch Shaft and Knob Sweated Together
2. French Mounting Nut
3. Ignition Switch to Heater Switch Terminal
4. Control Cable Threaded End
5. Switch Control Stop Collar
6. Heater Motor Wire Terminal
7. Control Cable Conduit Clamp

FIGURE 5—*Water Valve Control and Switch Assembly—"Rambler" Series*



1. Valve Outlet Tube to Upper Heater Core Tube
2. Water Valve and Metering Guide
3. Water Seal
4. Manual Control Roller
5. Operating Cam
6. Capillary Tube
7. Bellows
8. Water Inlet Tube from Cylinder Head

FIGURE 6—*Water Control Valve*

The thermostat incorporated in the valve has a flexible capillary control tube leading from a small gas filled chamber and bellows to a position directly behind the heater core in the "Rambler" Series (Fig. 7).

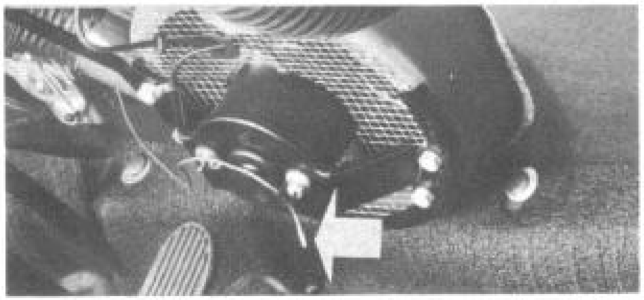


FIGURE 7—*Water Control Valve Capillary Tube Location—"Rambler" Series*

The "Hornet" and "Wasp" Series water control valve thermostat capillary tube is located in the air flow path in the heat distribution duct (Fig. 8).

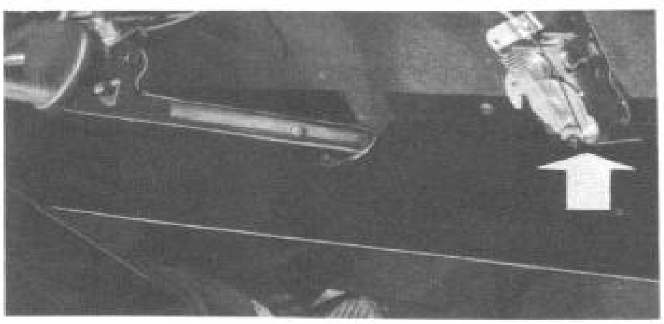


FIGURE 8—*Water Control Valve Capillary Tube Location—"Hornet" and "Wasp" Series*

Automatic Control

With the water control valve locked in the complete "LOW" position or in the full "HIGH" position, the automatic feature will not operate.

Intermediate positions of the control knob will govern the automatic control. The temperature of the air surrounding the capillary tube controls the volume of water flow through the heater core by thermostatic action. Passenger comfort will determine the correct control knob position.

Water Control Valve Adjustment

The water control valve cable adjustment is of extreme importance. To correctly adjust the water control valve cable, the control knob on the dash must be in the "OFF" position and the water control valve cam must be in the "CLOSED" position prior to retightening the cable securely in the clamp.

The equalizer spring on the "Hornet" and "Wasp" Series water control valve serves as a counterbalance for the bellows spring to prevent movement of the valve without control operation.

COWL VENTILATOR DAMPER ADJUSTMENT

"Hornet" and "Wasp" Series

To adjust the cowl ventilator damper control cable, place the damper control knob in the "Air Condition" position. Close the cowl ventilator damper by moving the control arm of the damper to the upper movement of its travel. The loop of the Boden wire is placed on the control arm of the damper and the cable housing fastened to the clip bracket on the heater hopper box side allowing enough room for control arm movement.

"Rambler" Series

Push the control knob into the full "OPEN" position. Locate the damper control arm to the upper or "OPEN" position. Retract the cable 1/8" to allow for cable movement in the conduit. Clamp the cable securely.

INLET DAMPER ADJUSTMENT

"Hornet" and "Wasp" Series

Place the damper control in the "Air Condition" position. The inlet damper control arm located on the left hand side of the right hand heater duct is placed in the upper position of its travel. The Boden wire loop is placed on the control arm of the damper and the cable housing is installed in the clip bracket on the heater duct allowing enough room for the control arm to travel in its complete movement.

AIR FILTER

Removal

"Hornet" and "Wasp" Series

Remove the heater hopper box cover and remove the filter. The filter is held in place by a hold down spring in the cover (Fig. 9).

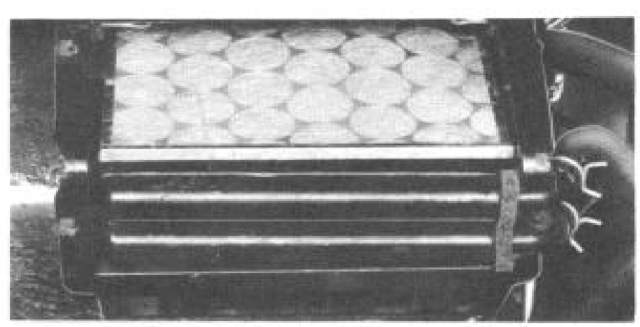


FIGURE 9—*Air Filter Location*

"Rambler" Series

Disconnect the cowl ventilator damper cable from the damper arm.
Remove heater core cover and filter mounting screws (Fig. 10).

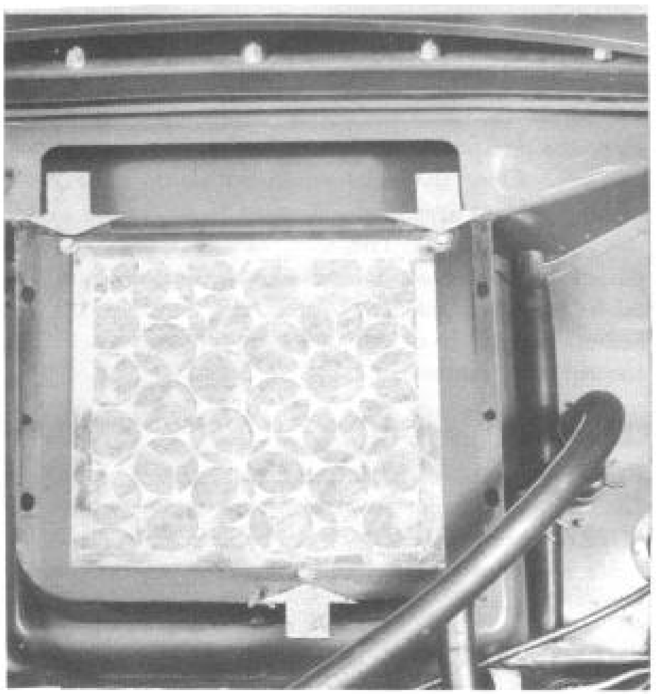


FIGURE 10—*Removal of Air Filter— "Rambler" Series*

NOTE: *The air filter should be changed every Spring and Fall. Under dusty operating conditions, the filter should be changed more frequently.*

HEATER CORE REMOVAL

"Hornet" and "Wasp" Series

Open the water control valve to the "High" position. Drain at least a quart and a half of coolant from the cooling system to drain the heater core.
Remove the heater hopper box cover and air filter. Disconnect the heater hoses from the heater core (Fig. 11).

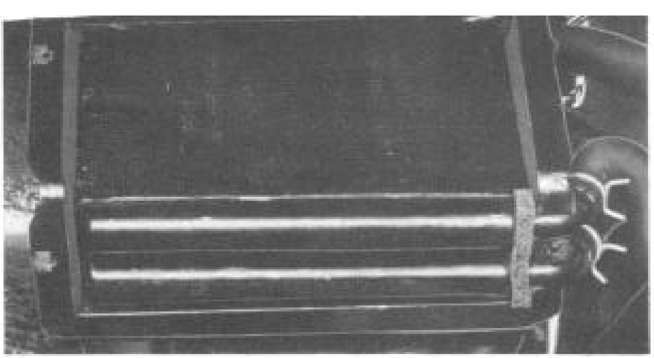
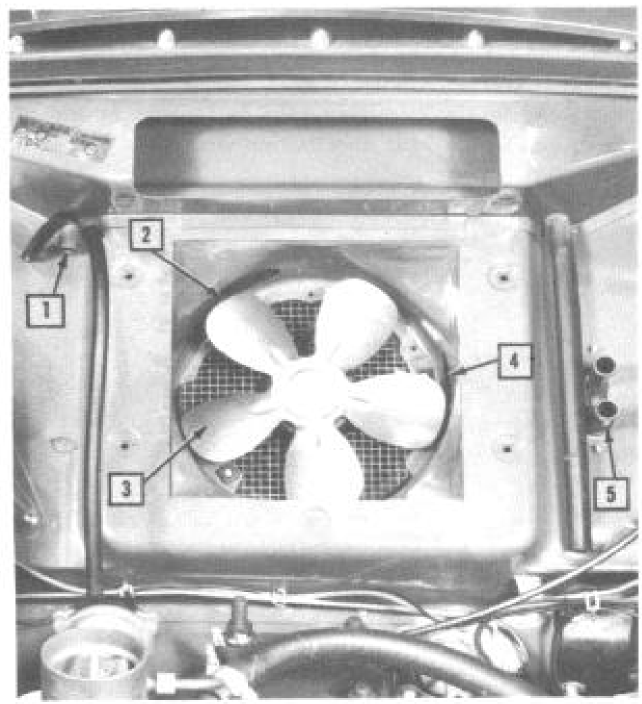


FIGURE 11—*Heater Core Removal*

The heater core is held in place by the heater hoses when they are attached to the heater core and the heater hopper box cover. After the removal of the cover and the hoses, the heater core is removed by sliding it forward and out of the heater hopper box. In position, it rests on the front flange of the heater hopper box and at the rear of the hopper box on a rubber gasket and flange.

"Rambler" Series

Open the water control valve.
Drain at least a quart and a half of coolant from the cooling system to drain the heater core.
Remove the heater hopper box cover and air filter.
Remove the screws that attach the heater core to the cowl chamber and remove heater core (Fig. 12).



1. **Cowl Ventilator Chamber Drain**
2. **Defroster Air Duct Opening**
3. **Heater and Defroster Fan**
4. **Defroster Air Duct Opening 5. Water Control Valve**

FIGURE 12—*Heater Core Removed— "Rambler" Series*

HEATER AND DEFROSTER MOTOR REMOVAL

"Hornet" and "Wasp" Series

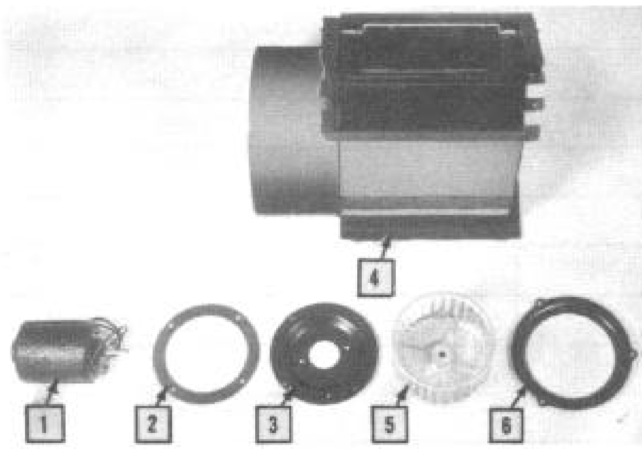
Open the water control valve.
Drain a quart and a half of coolant from the cooling system to drain the heater core.
Remove the heater hopper box cover, air filter, and heater core.

Remove the inlet ring located on the inside of the heater hopper box.

Remove the fan from the heater and defroster motor shaft and remove from heater hopper box through heater hopper box cover opening.

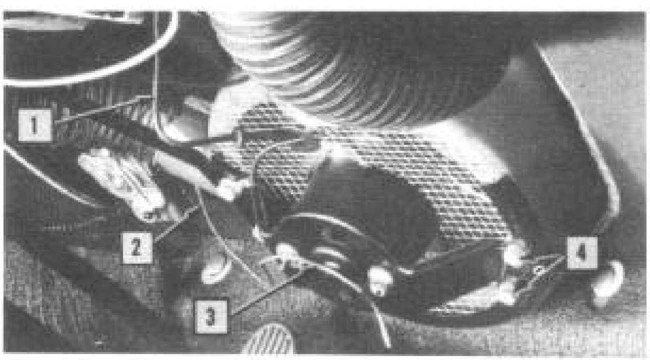
Disconnect heater and defroster motor wire lead at connector.

Remove heater and defroster motor from motor housing and remove from hopper box through heater hopper box cover opening.



1. **Heater and Defroster Motor**
2. **Motor Mounting Plate**
3. **Motor Mounting Gasket**
4. **Heater Hopper Box**
5. **Heater and Defroster Fan**
6. **Inlet Ring**

FIGURE 13—*Heater Hopper Box Assembly*



1. **Heaer and Defronster Motor Wire**
2. **Heaer and Defroster Motor Ground Wire**
3. **Water Valve Capillary Tube**
4. **Motor Bracket Mounting Screw**

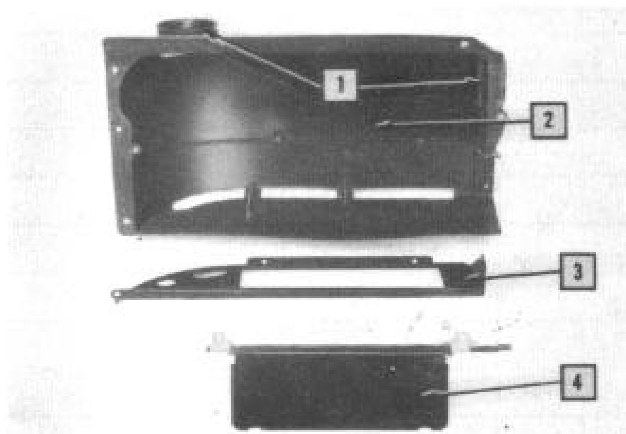
FIGURE 14—*Heater and Defroster Motor Connections and Mountings—"Rambler" Series*

"Rambler" Series

Remove the heat deflector (Fig. 14). Disconnect motor wire and ground wire. Remove the water control valve, capillary tube clip, and move capillary tube aside.

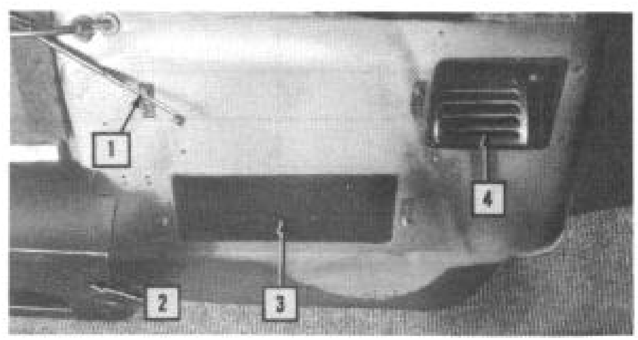
Remove motor and bracket. The heater motor screen reinforcement and motor screen is removed after removing the fan from the motor shaft.

The motor and mounting bracket is then accessible for further disassembly.



1. **Defroster Duct Openings**
2. **Heater Duct (Rear View)**
3. **Damper Mounting Plate**
4. **Inlet Defroster and Heater Damper Assembly**

FIGURE 15—*Heater Duct Assembly—"Hornet" and "Wasp" Series*



1.**Heater and Defroster Inlet Control Cable**
2. **Heat Distribution Duct**
3. **Inlet—Heater Hopper Box to Heat Duct**
4. **Inlet—Blower Motor to Heat Duct**

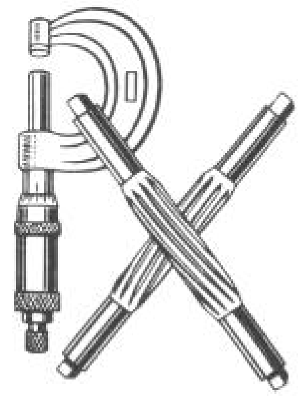
FIGURE 16—*Heater Inlets—"Hornet" and "Wasp" Series*

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



ALL SEASON AIR CONDITIONING

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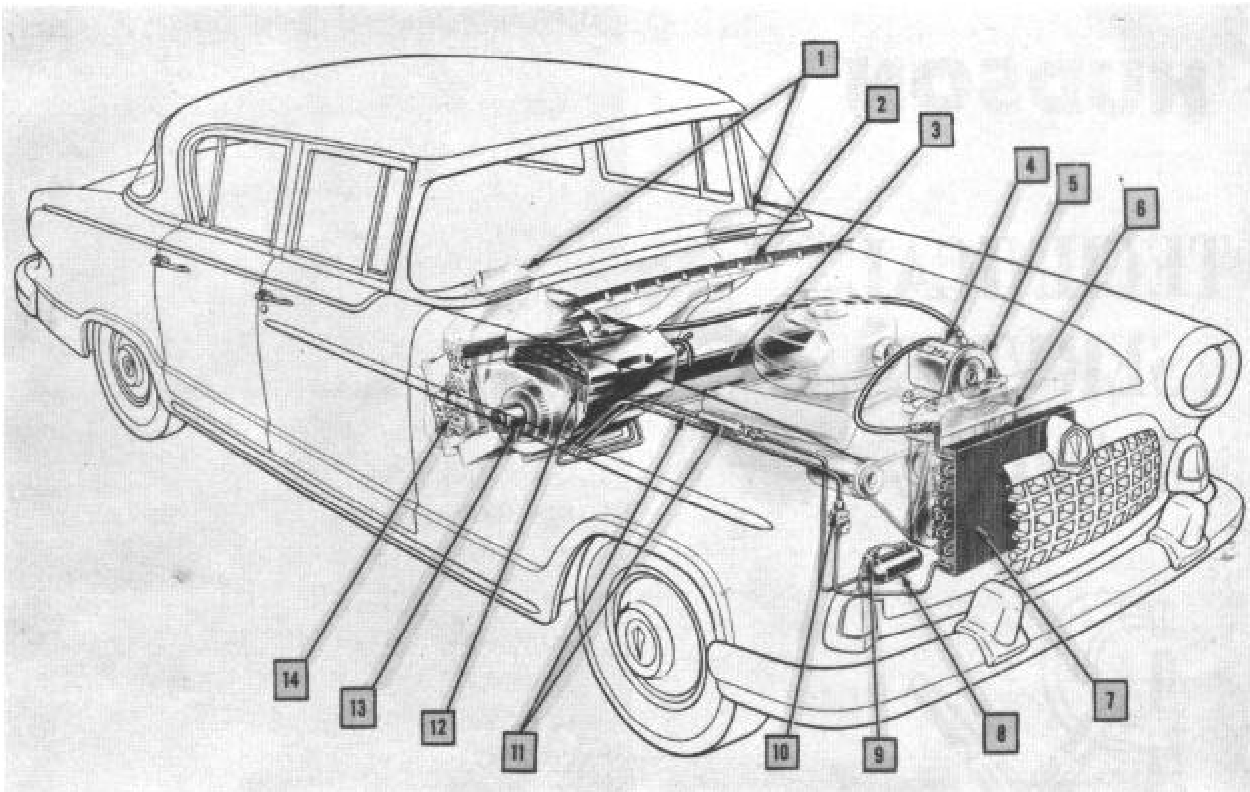
ALL SEASON AIR CONDITIONING SYSTEM

ALL SEASON AIR CONDITIONING SYSTEM



1. Air Discharge Outlets
2. Fresh Air Intake
3. Heat Distribution Duct
4. Compressor
5. Magnetic Clutch and Pulley
6. Idler Pulley, or Power Steering Pump Pulley if so Equipped
7. Condenser
8. Receiver
9. Check Valve
10. Solenoid By-pass Valve
11. Filter and Liquid Indicator
12. Heater Core (Heating Unit)
13. Blower Motor and Fan
14. Evaporator (Cooling Unit)

FIGURE 1—*All Season Air Conditioning System*

The All Season Air Conditioning System is very similar in function and operates on the same basic principles as the modern home refrigerator. However, due to the adaptation and the layout in the passenger car, various components will vary somewhat.

The introduction of a certain amount of fresh air, when air conditioning a passenger car, is desirable for personal comfort, primarily to prevent the accumulation of undesirable smoke or odors in the car. Also, the air is cooled at somewhat higher temperatures than in a refrigerator. A temperature differential of 15 to 20 degrees lower than the outside air is desired in air conditioning. It is not necessary to "pull the air down" to a low temperature that might be uncomfortable to the passengers.

Air conditioning may be defined as the simultaneous control of all of the factors affecting both the physical and chemical condition of the atmosphere within any structure.

The prime factors which are to be considered in air conditioning are temperature, humidity, distribution, and cleanliness of air within an enclosure.

Temperature Control

The control of temperature involves the regulation of the temperature to a comfortable degree. Human beings possess a capacity to sense the "heat" and "cold" in objects or in surroundings only insofar as their body temperature is. different.

Heat is a positive condition, a form of energy (Kinetic Energy—motion) which cannot be destroyed. Heat, though not visible in itself, can be measured quantitatively. The basic units of heat measurements are: Degrees, Fahrenheit which denotes the temperature of the heat in a substance and B.T.U. (British Thermal Unit) which denotes the quantity of heat present in the substance.

Cold is the absence of heat or the lack of heat. Then heat being energy cannot be destroyed and cold is the lack of heat, consequently, a thing or place is cold to the extent that heat has been removed from it. Heat always moves from a warm object or place to a colder object or place. Refrigeration is a process developed to remove heat from objects or places.

The control of temperature in air conditioning is accomplished by transferring heat from a place where it is not wanted to a place where it makes no difference.

Lowering the temperature inside the car by modified refrigeration to a comfort zone, namely 15 to 20 degrees below that of the outside temperature is done in the case of passenger car air conditioning. The outside ambient temperature may be high, humid or dry, and uncomfortable in respect to comfort. Ambient temperature is the surrounding temperature around a place or object.

Humidity Control

The ambient air may be humid or dry. The air within an enclosure such as the car will be correspondingly affected as a certain amount of fresh air is used in the air conditioning cycle. All atmospheric air, unless specially treated, contains a certain amount of moisture in the form of water vapor. The amount of water vapor present varies from day to day depending upon the weather conditions.

A high relative humidity of the air is one factor that is predominant in personal discomfort. Humidity is the amount of moisture in the air in the form of gaseous vapor. Relative humidity is the ratio of the weight of water vapor present in a given sample of air at a given temperature to the weight of water vapor which would be present in the same sample, if the air were saturated at the same temperature and pressure. It should be noted that air at any fixed temperature can only hold a definite known quantity of water. At higher temperatures, air is capable of holding more moisture than at lower temperatures. Hence, if the temperature of saturated air is lowered, the excess water vapor will condense.

In air conditioning or refrigerating the air, the air is dehumidified by lowering the moisture content of the air. This is possible by lowering the temperature of the air below the dew point and consequently condensing some of the moisture out of the air. The water vapor condenses on the cold evaporator core and the liquid is drained off.

This is a basic principle in the control of humidity in air conditioning.

To reduce the relative humidity completely in an air conditioning system is not desirable. Relative humidity does have a significant effect on comfort within a fairly wide temperature range. The normal "comfort zone" for people has been found to exist within a temperature range of 67º to 91º and the relative humidity range of 30 per cent to 70 per cent. Combinations of temperatures and relative humidities outside of this range produce various types of discomfort.

Control of Distribution and Cleanliness

The control of distribution, motion, and cleanliness is carried on at the same time. Approximately 30 per cent fresh air is introduced into this particular system. At the point of introduction, the air is cleaned of dust and foreign material in passing through the filter provided for this purpose. The blower in the system will recirculate the air in the car through the cooling unit, consequently, the air temperature is being constantly lowered. The air is being freshened by the addition of the fresh air being introduced into the car. The entrance of fresh air added to the volume already present will serve to mildly pressurize the car interior. Air will then leak outward carrying with it smoke, odors, and carbon dioxide. Pressurizing the car prevents entrance of hot dusty air. The air being circulated is returned and carried over the evaporator and cooled in a continuous cycle, thus again cooling the air. It must be remembered, to effectively air condition the car, all windows should be closed and remain closed during the time the air conditioner is being used.

To accomplish the foregoing controls in air conditioning, a mechanical means must be employed. Mechanical refrigeration or mechanical air conditioning is the system used.

Means of Producing Refrigeration

A substance or body is said to be refrigerated when heat is removed from the substance or body faster than it can gain heat. Whenever this condition exists, the temperature of the substance is lowered or reduced.

Refrigeration may be produced by several methods. The vapor compression system is employed in the "All Season Air Conditioning System". In the compression system, a suitable liquid is evaporated in the cooling unit at a low pressure and then compressed to a high pressure in the mechanical compressor and then condensed to a liquid again in a condenser completing the refrigeration cycle. *This method utilizes the "Latent Heat" or hidden heat of vaporization to produce the desired refrigerating effect.*

"Latent heat of evaporation" is defined as the quantity of heat necessary to evaporate or convert one pound of liquid to vapor without a change of temperature of the liquid.

Thus, the latent heat of evaporation for water is 970 B.T.U., since it takes 970 B.T.U. to evaporate one pound of water at 212°F. and atmospheric pressure to steam at the same temperature and pressure.

The latent heat of evaporation of different substances differ considerably from each other.

For example, latent heat of evaporation for Freon-12 is 71.95 B. T. U. at atmsopheric pressure as compared to that of water which is 970 B.T.U.

The Refrigerant

The fluid, when used as a cooling medium, may be termed a "Refrigerant"; the term refrigerant as used is defined as a chemical used in compression systems to produce the desired cooling effect or refrigeration by using the latent heat of vaporization of that particular chemical.

An important factor in selecting a liquid refrigerant is a suitable boiling point. For example, Freon-12 boils at –21.7°F. at atmospheric pressure of 14.7 pounds per square inch or zero pounds per square inch gauge pressure at sea level. Freon-12 is a chemical used in most applications of refrigeration or air conditioning.

Some of the characteristics of Freon-12, which is used as the refrigerant in the "All Season Air Conditioning System", are as follows:

Non-toxic, unless combined with flame.
Non-inflammable and non-explosive.
Non-corrosive except in the presence of moisture.
Boiling point at atmospheric pressure lower than cooling unit temperature.
Suction pressures usually above atmospheric pressure.
Low compression ratio.
Stable.
Lubricant solubility.

Temperature Pressure Relation

Any change in the temperature surrounding a vessel that confines a liquid refrigerant will change the pressure in that vessel in direct relation to the physical properties of the liquid. Increasing the temperature around the vessel will raise the pressure in the vessel and conversely lowering the temperature will lower the pressure.

Since the boiling point of any liquid is determined by the pressure under which the liquid is confined, any change in pressure on the liquid will change its boiling point. Temperature pressure relation of Freon-12 is shown in Figure 2.

The use of this graph will assist in diagnosing pressure difficulties when servicing the unit.

Refrigeration System

In any refrigeration system, a refrigerant is employed which alternately is evaporated from its liquid condition to form a vapor, and condensed so that the vapor returns to the liquid form. The refrigerant is a substance that evaporates rapidly at low temperatures. As the liquid is evaporated, it absorbs heat from everything around it and lowers the temperature. Then the absorbed heat is in the vapor. As the vapor is condensed back to a liquid, it loses the previously absorbed heat. By causing evaporation to take place where temperature is to be lowered, then causing condensation to take place where the discharged heat will not be objectionable, the refrigeration cycle is accomplished.

DESCRIPTION AND OPERATION

The "All Season Air Conditioning System" is designed to accomplish cooling, heating, and defrosting with the same unit. Basically, the function of the system as an air conditioner is to filter, cool, dehumidify, and circulate the air within the car. As a heater, the system will function in the same manner as the Weather Eye Heater and Defroster.

The design of the composite system is to include a common forced air convection system for heating, cooling, and defrosting air.

The heater core is located in the air flow path and is a component part of the composite system. The same convection system is used for heating as for cooling; the heating system also utilizes the air discharge outlets and the recirculation duct and heat distribution duct along the toe panel in heating and defrosting.

Various advantages are accomplished with the "All Season Air Conditioning" design. Quick "cool-down" is effected at average driving speeds. Stable temperature levels are maintained inside the passenger compartment by the automatic controls and the operator's use of the two speed blower system.

Approximately 30 per cent fresh air is admitted through the cowl air intake to the car in addition to the air being recirculated and retooled constantly by the blower incorporated in the system.

The air conditioning capacity is sufficient to maintain a 15 to 20 degree inside to outside temperature differential at 30 miles per hour. The controls are in keeping with the relative simplicity of previous systems and enable the cooling and heating to be carried on at a comfortable level.

The drive pulley incorporated on the compressor has a magnetically engaged clutch. When the air conditioner is not in use, the drive pulley free wheels and the compressor is not running.

The system is compact and readily accessible for service operations. The cooling unit is in the dash compartment. The cooled air is introduced by two air discharge outlets located on the instrument panel. The condenser is located ahead of the radiator and the balance of the components are located in the engine compartment.

To effectively air condition the interior of the car, the windows and ventilators should be closed during the time the air conditioner is in operation.

Open the windows to expel accumulated heat if the car has been parked for an extended period in the hot sun prior to using the air conditioner. This will lessen the initial work of the unit and

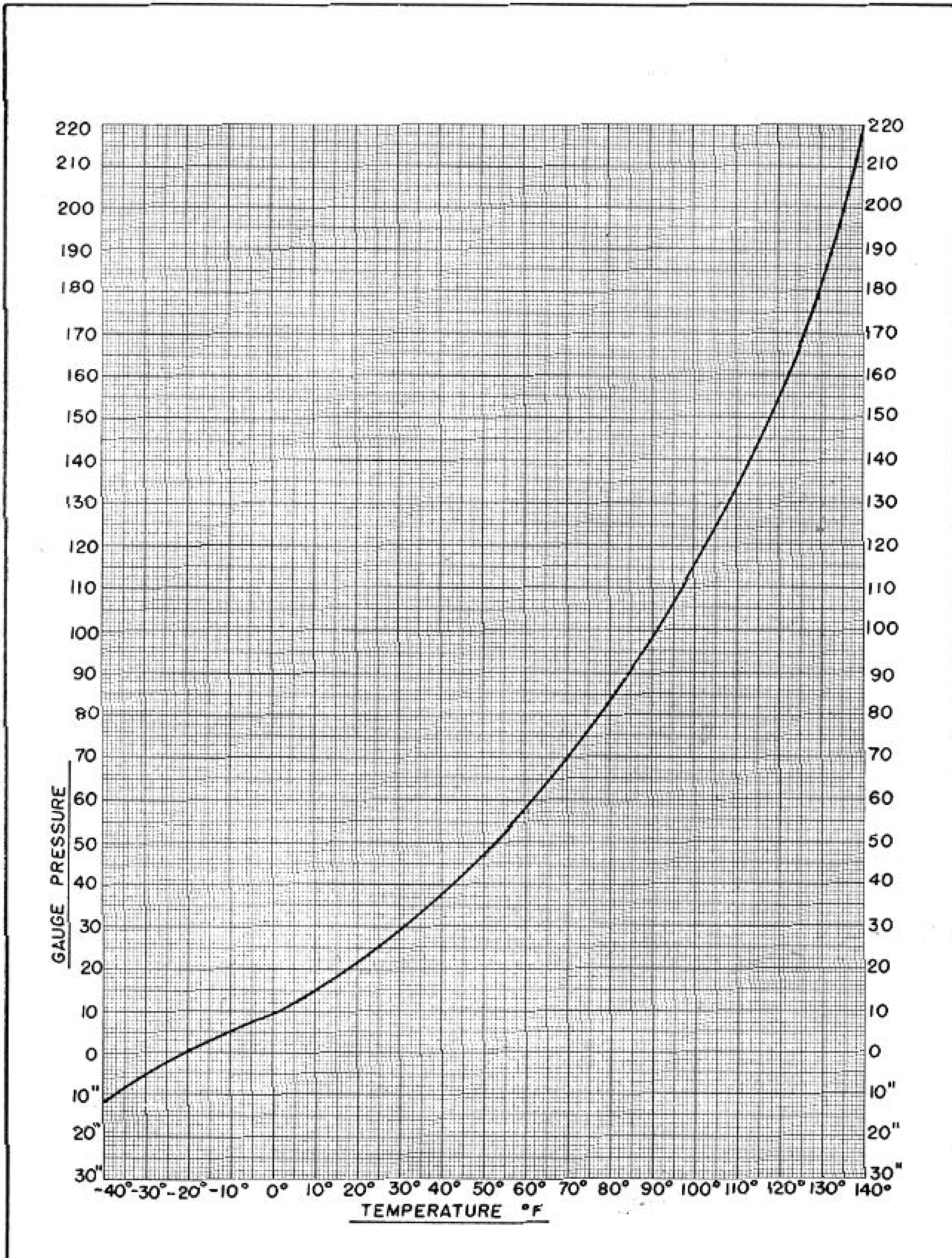


Figure 2 - *Freon-12 Temperature Pressure Relation Curve*

enable the temperature to be pulled-down more rapidly.

Start the engine before operating the Air Conditioning System to reduce the battery load and provide easier starting.

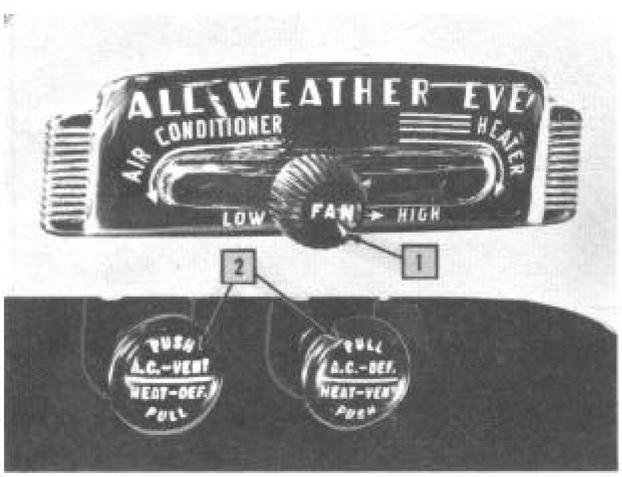
Under conditions where the system might be operated with the car standing, for more efficient cooling, run the engine well above idle speed.

MANUAL CONTROLS

Air Conditioning and Heater Switch

A single control knob operates both the heater and air conditioning systems (Figs. 3 and 4).

FIGURE 3—*Air Conditioning and Heater Control—"Hornet" and "Wasp" Series*



1. Air Conditioning and Heater Switch
2. Damper Controls

FIGURE 4—*Air Conditioning and Heater Controls "Rambler" Series*

The heating system operates in a similar manner as the Weather Eye. The water valve control knob is moved from left to right to increase and thermostatically maintain the amount of heat required.

The water valve control knob has two positions to operate the two speed high capacity blower which is utilized for circulation of heated air in slow traffic conditions and for frosted windshields. Turn clockwise to the first position for low speed blower operation; the second for high speed operation.

The cooling system is placed in operation by having the water valve control knob in the extreme "Low" position, and by rotating the knob counterclockwise to the first position for low speed blower operation; the second position for high speed operation.

Normally, to gain a quick cool-down effect, the air conditioner would be turned to the "High" blower speed position. When the air has been pulled-down to a comfortable range, the "Low" position can be used.

In the "High" or "Low" switch position, the cooling operation is in effect as the blowers are then on; the magnetic clutch is energized and engages the compressor pulley driving the compressor. The solenoid by-pass valve is energized when the air conditioning switch is on, closing the solenoid valve and the refrigerating cycle is underway. The solenoid valve function is also controlled by the automatic temperature control thermostat in the by-pass cycling operation of the system.

Damper Controls

"Hornet" and "Wasp" Series

The damper positions for each operation is controlled by the damper control located to the left of the steering column (Fig. 51.

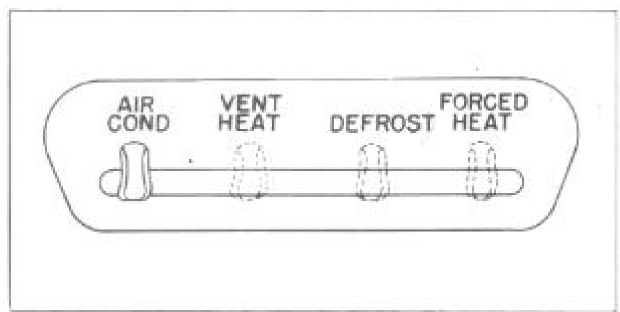


FIGURE 5—Damper Control "Hornet" and "Wasp" Series

Movement of the control knob to each position wlll place the dampers in the correct position for each operation. The three dampers, inlet, cowl vent, and defroster are attached to the cam and roller control.

"Rambler" Series

The right hand knob marked $\frac{\text{A.C. Def.}}{\text{HEAT-VENT}}$ (Fig. 4) located under the left side of the instrument panel controls the cowl vent damper. A control cable, attached to the right side of the cowl vent damper rod, is connected to the evaporator shroud air outlet door and operates the door in conjunction with the cowl vent damper. When the damper is closed (knob pulled out), the shroud air outlet door is closed.

The left hand knob marked $\frac{\text{A.C. Def.}}{\text{HEAT-VENT}}$ Fig. 4.

located under the left side of the instrument panel controls the air recirculation damper.

AIR FLOW
Air Conditioning
"Hornet" and "Wasp" Series

The air conditioning switch is placed in the extreme left or "Low" position for the water valve control, and turned counterclockwise to either the "Low" or "High" position to start normal air conditioning.

The damper control is placed in the Air Condition. ing position. This puts the dampers in their correct position to route the air flow properly.

The cowl vent damper is closed, with a modified opening to admit approximately 30 per cent fresh air by car interior volume. The defroster dampers close the openings in the sides of the evaporator side plates. The inlet damper (which is actually two dampers, one spring loaded, the other operated by the lever arm) is closed to the evaporator housing opening and open to the dash inlet opening.

The reduced amount of fresh air passes over a baffle or rain shedder to prevent moisture from entering. Then through the filter which removes dust and foreign matter. The fresh ram air passes through the heater core and into the heater hopper box. The blower motor draws the air from the heater hopper box and directs it through the blower motor opening to the evaporator core. The defroster dampers are closed to the openings in the evaporator core side plates. Thus the air has a free unobstructed course to the evaporator core. The air flows through the evaporator core, is cooled and delivered directly to the ducts, and two air discharge doors on the instrument panel which may be opened to the desired position (Fig. 6).

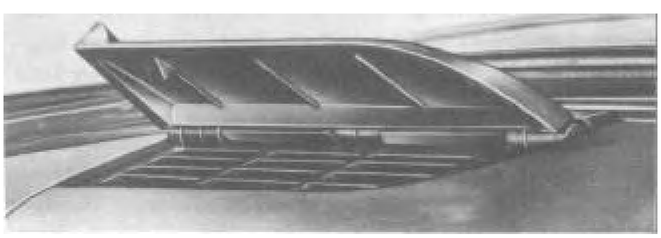


FIGURE 6—*Air Discharge Grille Door "Hornet" and "Wasp" Series*

The air discharge doors may be adjusted independently, directing air flow where desired. The partially open position provides maximum front seat cooling. The low position will direct the cool air toward the lap area of the front seat passengers. This position may be used when only these passengers are in the car or when driving into the hot sun. "Full open" position is best suited for over-all front and rear cooling.

The sun visors may also be used to control the distribution of the air. With the sun visors "up", air can be circulated more readily toward the rear. Tilting the visors down will direct the air toward the front seat area. When using the visors for control of the air flow, the large air doors must be in the "full open" position.

The "full open" position will direct the cool air upward and natural circulation takes place; the air moves along the top of the car from front to rear and returns under and around the seats. Warm air is displaced and carried around and under the seats during this time and drawn into the recirulation air duct. With the dash inlet damper open, the blower draws this air into the heater hopper box. The recirculated air is intermixed, by the blower, with fresh air from the cowl vent and directs the air through the evaporator core where it is again cooled and delivered to the car interior (Fig. 7).

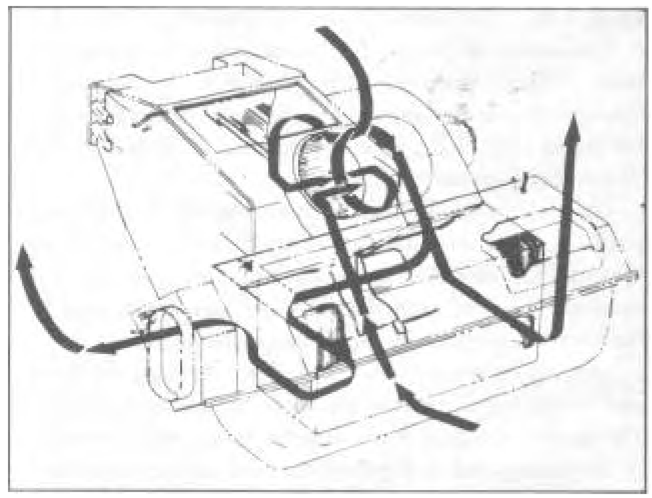


FIGURE 7—*Air Conditioning Air Flow "Rambler" Series*

The combination switch and water valve control knob is placed in the extreme left "Low" position. The knob is turned counterclockwise to start the air conditioning system.

The left damper control knob is pushed in to open the air recirculating damper.

The right damper. control knob is pulled out to close the cowl vent damper and the evaporator shroud air outlet door.

The air discharge doors are open to the desired position.

The blower fan draws air from the car interior for recirculation through the air recirculation duct located on the left side of the dash panel. The closed cowl vent damper prevents outside air from entering and passing directly through the heater and evaporator cores.

A reduced amount of fresh outside air is mixed with the air from the car interior by means of an opening cut in the left side of the cowl ventilator air intake chamber. The opening is covered by the blower to dash duct. The air passes over a baffle or rain shedder to prevent water from entering the car.

The blower fan mixes the fresh and recirculated air and directs it through the heater and evaporator cores into the evaporator shroud.

The evaporator shroud air outlet door is closed when the cowl vent damper is closed. Therefore, the cooled air is directed up through the ducts to the air discharge grilles located on the instrument panel. The air then follows the roof panel contour, down, around, and under the front seat back to the air recirculating duct where it is mixed with incoming fresh air and the cycle again takes place.

Vent—Heat
"Hornet" and "Wasp" Series

The combination fan switch and water valve control knob is moved to the right to the desired position. Intermediate positions are for thermostatically controlled heat. "High" position is for full flow of hot water through the heater core. The damper control on the left hand side of the steering column is moved to the "Vent-Heat" position.

The cowl vent damper is then placed in the open position. The inlet damper is open at the dash panel opening and closed to the evaporator retainer housing opening. The defroster dampers are open and moved to the position closing off the evaporator core.

Ram air enters the cowl vent, flows through the filter and heater core. Heat is added to the air at this time. The heated air then flows directly to the inlet opening in the dash panel and enters the heat distribution duct along the toe panel where the heated air is delivered to the car interior through the slotted openings in the duct (Fig. 8).

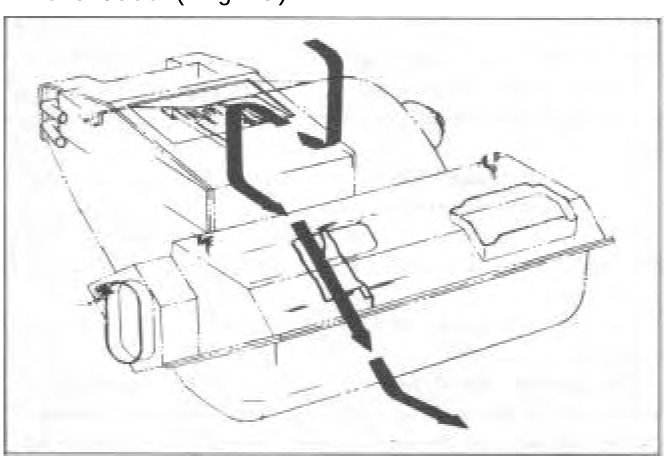


FIGURE 8—*"Vent-Heat" Air Flow*

Ventilators and windows should normally be closed in cold weather. but to increase defrosting or heating effect, the rear window or ventilator may be opened slightly.

The air discharge outlet door is closed at this time; the defroster door should be opened to allow heated air to keep the windshield defrosted.

"Rambler" Series

The combination fan and water valve control knob is moved laterally to the right to intermediate positions to thermostatically control the heat, as desired, or to "High" to the "full open" position.

The left hand damper control knob is pulled out to close the air recirculation duct.

The right hand damper knob is pushed in to open the cowl vent damper and evaporator shroud air outlet door.

Ram air enters the cowl vent and passes through the open cowl vent damper. It then passes through the filter and heater core. The heated air passes through the evaporator core to the open evaporator shroud outlet door where it is discharged out of the air outlet duct located on the lower side of the evaporator shroud.

The evaporator shroud air outlet door in its open position will partially block the air ducts going to the air discharge outlets on the instrument panel.

Defroster

"Hornet" and "Wasp" Series

The combination fan switch and water valve control knob is moved to the right and turned clockwise to either the "Low" or "High" position to start the blower fan.

The damper control knob and lever is moved to the "Defroster" position. Ram air enters the cowl vent and is directed through the open cowl vent damper. The air is directed through the filter and heater core. The blower fan draws the heated air from the heater hopper box and directs it through the blower opening into the evaporator housing.

The defroster dampers are open. This deflects the heated air to the defroster openings in the evaporator side plates to the ducts connected to the two air discharge outlets located on the instrument panel. The inlet damper is closed to the dash panel and partially open to the heat distribution duct. Thus a portion of the heated air is also delivered to the front floor area of the passenger compartment (Fig. 9).

The defroster door of the air discharge outlet is open during defroster operation to allow the heated air to be delivered to the windshield surface (Fig. 10) .

"Rambler" Series

The water valve control knob is moved to the right and the blower motor is turned on to either "Low" or "High" speed as required.

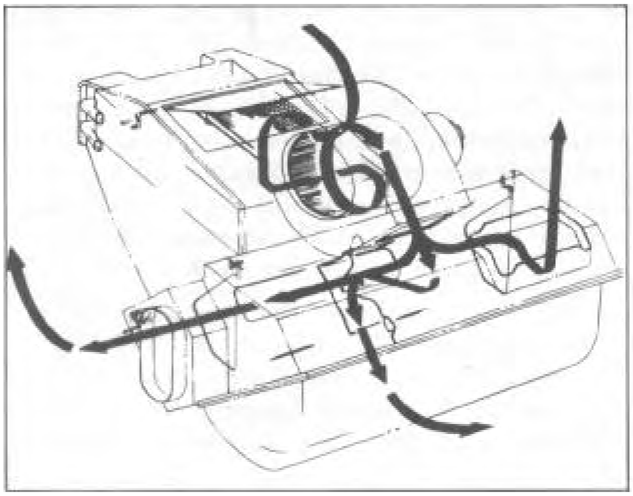


FIGURE 9—*Defroster Air Flow*

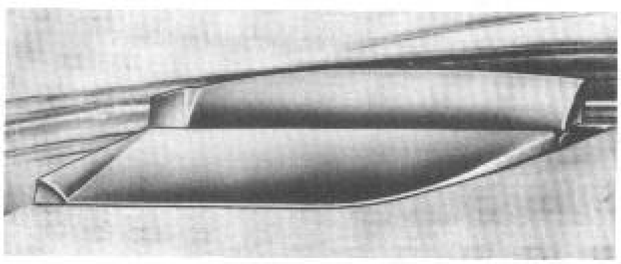


FIGURE 10—*Defroster Door Position ("Open")*

The right hand damper control knob is pulled out to open the air discharge duct opening and close the evaporator shroud air outlet damper and cowl ventilator damper.

Fresh air is taken in at the opening used in air conditioning, drawn in by the blower motor. The air flow is directed to the heater core. Heated air is then routed to evaporator shroud, to the air ducts, and in turn to the air discharge outlets. The defroster outlet doors on the instrument panel are open to direct the heat to the windshield.

Forced Heat
"Hornet" and "Wasp" Series

The blower motor is used to add force to the air flow during this operation.

The damper control knob is moved to the "Forced- Heat" position. This opens the inlet damper from the evaporator housing to the "full open" position. The air is then directed to the heat distribution duct along the toe panel (Fig. 11).

This operation is used for city traffic or driving below twenty miles per hour.

"Rambler" Series

The blower fan may be used during a heating operation to add to the velocity of the air flow and delivery of heated air to car interior.

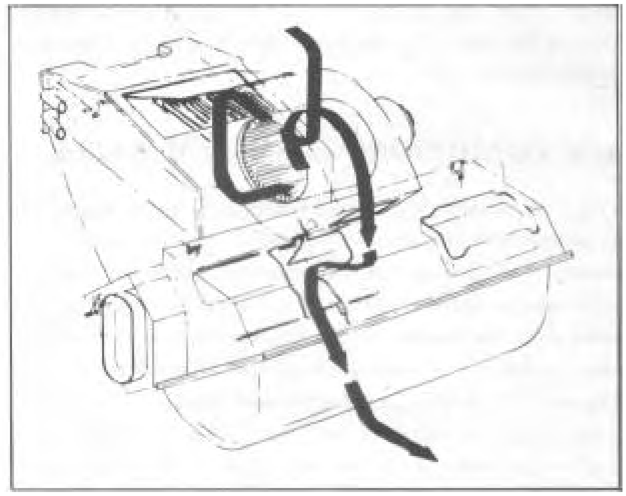


FIGURE 11—*"Forced-Heat" Air Flow*

DAMPER ADJUSTMENTS
"Hornet" and "Wasp" Series

The damper control cables and housings are routed behind the glove box mounting panel. The cowl ventilator cable and housing is routed through a hole and grommet in the dash panel.

Place the damper control knob in the "Air Condition" position. Close the cowl ventilator damper.

Move the inlet damper control arm to the upper position of travel. The defroster control arm is moved to the right.

Each cable has a specific length and the end loop diameters will only fit the damper control arm which it operates.

After the dampers are placed in the aforementioned positions, the Boden wire loops are placed on the damper control arms. The cable housings are installed in the clip brackets, allowing enough room for each control arm to complete arc of travel.

"Rambler" Series

Push the left hand control knob marked $\frac{\text{A.C.-DEF.}}{\text{HEAT-VENT}}$ in.

Place the recirculation damper in the open position. Insert and tighten the cable in the damper arm. Pull the knob and check that the damper closes completely. The knob should not be pulled out farther than the lower edge of the air condition control escutcheon on the instrument panel.

Place the cowl ventilator damper in the closed position. Also close the evaporator shroud damper. Place

the right hand control knob marked $\frac{\text{A.C.-DEF.}}{\text{HEAT-VENT}}$ even

with the left hand knob when it is pulled out. Insert the cable to the cowl ventilator damper arm and tighten. Insert and tighten the evaporator shroud damper cable to the opposite end of the cowl ventilator control arm. Place the Boden wire loop on the evaporator shroud damper. The dampers should be open when the control knob is pushed in.

AIR CONDITIONING SYSTEM CYCLE

The "All Season Air Conditioning System" consists of a compressor, condenser, solenoid by-pass valve, receiver, sight glass, filter, expansion valve, evaporator unit, temperature control thermostat, and blower. A discharge line muffler which incorporates a filter and a heat exchanger is also used on the "Rambler" Series. Figure 1 illustrates the identity and location of various components on the "Hornet" and "Wasp" Series.

The functions of the various units in the system will be pointed out in the following description of the air conditioning cycle. At times, reference will be made to "high side" and "low side" so named because the refrigerant dealt with is at high or low pressure at the time it is referred to as such. The "high side" consists of the compressor, (line discharge muffler in "Rambler" Series) condenser, receiver, sight glass, filter, (heat exchanger in "Rambler" Series) and expansion valve. The "low side" will consist of the expansion valve, evaporator, (heat exchanger in "Rambler" Series) temperature control thermostat, and compressor, also the connecting lines between the units. The high pressure lines may be readily recognized as they are smaller in diameter than the low pressure lines.

NOTE: *The compressor and expansion valve are mentioned in both sides. Actually they are the dividing points between the high and low pressures. The heat exchanger is also mentioned in both sides as it functions in both.*

CONTINUOUS CYCLE OF AIR CONDITIONING

The following charts outline the continuous refrigeration cycle (Figs. 12 and 13)

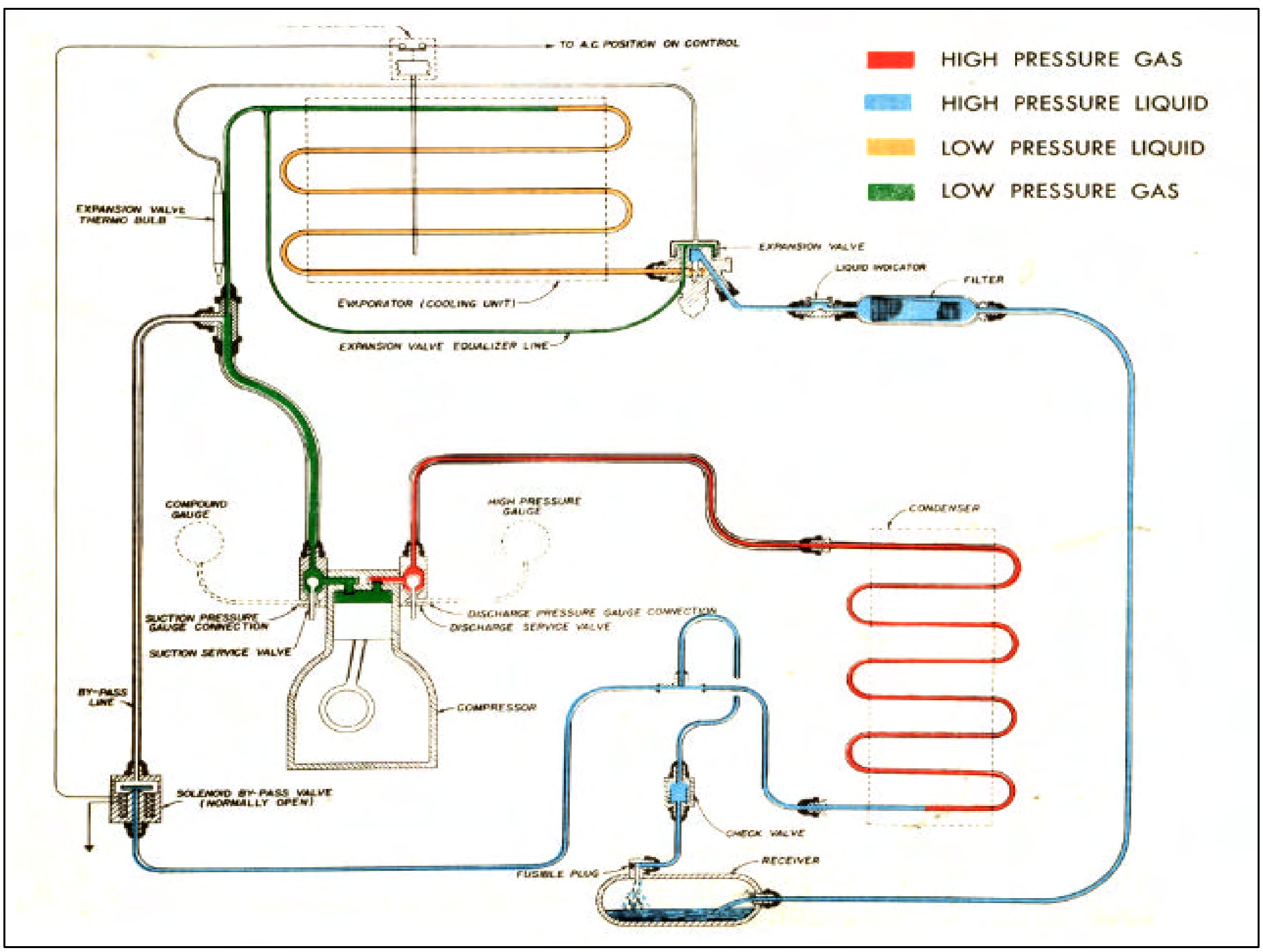


FIGURE 12—*Continuous Air Conditioning Cycle "Hornet" and "Wasp" Series*

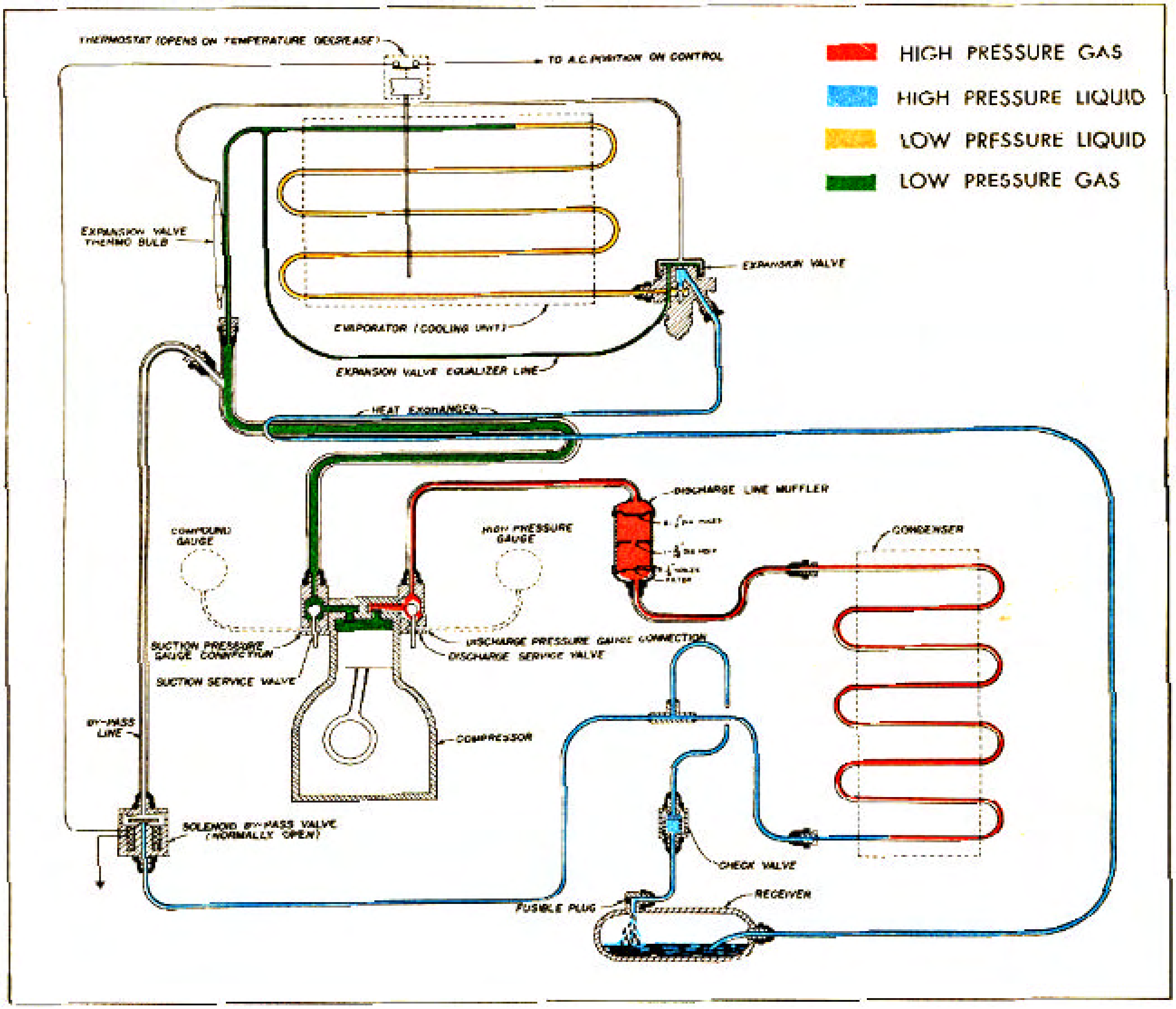


FIGURE 13—*Continuous Air Conditioning Cycle "Rambler" Series*

Compressor

The compressor is designed to be capable of having sufficient capacity at variable speeds. A two cylinder reciprocating type compressor is used. It is mounted on the engine driven by a "V" type belt from the engine crankshaft dynamic balancer pulley. An idler shaft is used to adjust belt tension. The idler shaft is used to drive the power steering pump when equipped with power steering.

The idler shaft or power steering pump, whichever the case may be, is adjustable by a slotted link. Some applications call for adjusting the compressor mounting bracket in addition to the idler shaft. The belts require a tight adjustment. Reduce the "flex" to a minimum.

The capacity of a compressor is generally stated in terms of "tons of refrigeration" or B.T.U. per hour. A ton of refrigeration is the cooling effect resulting from the melting of 2,000 pounds of ice in 24 hours or one ton equivalent to a cooling rate of 12,000 B.T.U. per hour.

The "All Season Air Conditioning System" has a capacity of 1-/2 tons at 30 M.P.H. Thus it is capable of removing heat from the interior of the car (including the fresh air admitted) at the rate of 18,000 B.T.U. per hour.

The primary purpose of the compressor is to increase the relatively low pressure of the gas returning from the evaporator to a high pressure.

The vapor temperature is increased by compression to get the boiling point of the Freon-12 higher than the temperature of the condensing medium. Therefore, the cooler temperature of the air flowing across the condenser core will cool and condense the Freon vapor to liquid.

Discharge and Suction Service Valves

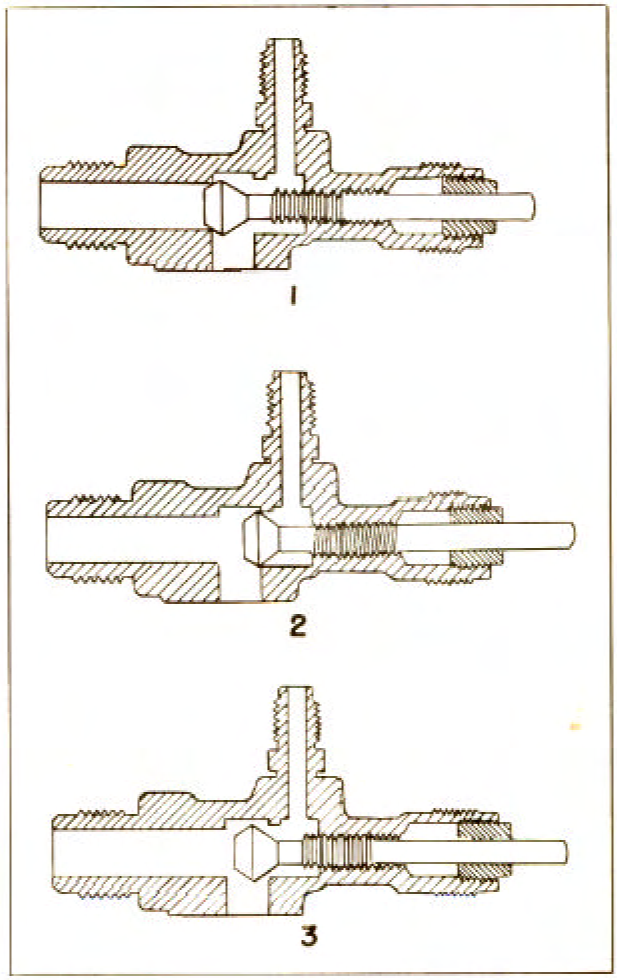
The discharge and suction service valves are three position valves and are mounted on each side of the compressor. The discharge service valve is located on the left hand side of the compressor. The suction service valve is located on the right hand side of the compressor. The suction side of the compressor is further identified by the word "Suction" cast in the cylinder head.
The purpose of a three position valve is to allow a gauge connection to be made and used while the system is in operation. This can be used for service checks, bleeding, evacuating, and charging. Also, the compressor may be removed from its bracket by closing the service valves and removing them intact with the lines from the compressor to enable engine work to be performed on the car.

The stem turned all the way in "back seats" the valve, closing the line. The compressor and service ports are open. This serves to isolate the compressor from the rest of the system. The charge is held in the rest of the system.

The valve is "front seated" when the stem is backed all the way out; then it is in the operating position.
Placing the stem in the half way position "cracked" is used as a service connection for bleeding, evacuating, charging, and using a gauge manifold set to service check the system. The valve positions are illustrated in Figure 14.

The Freon-12 refrigerant gas enters the compressor through the suction service valve at the same pressure as the gas in the evaporator. It goes through a close mesh strainer upward through inlets in the valve plate into the low pressure side of the cylinder head which is divided into two compartments by ribs cast into the cylinder head. Both suction and discharge valves are the inertia type with both suction and discharge ports in the one valve plate. The valves flex to open and the lift is limited. On the downward stroke of the piston, the suction valve is opened due to differential pressure filling the cylinder with low pressure Freon-12 vapor. When the piston starts on the up stroke, pressure immediately closes the suction valve. The piston forces the vapor into the discharge side of the cylinder head through the discharge valve. From there it goes out of the compressor through the discharge service valve (Fig. 15).

The discharge pressure is governed by the suction pressure, the temperature, and the amount of air passing over the condenser. A decrease in the flow of air or an increase in the suction pressure will increase the discharge pressure. An increase in the air flow over the condenser or a decrease in suction pressure will lower the discharge pressure. Normally the discharge side of the compressor is referred to as the "high side."



1. **Position for Servicing Compressor**
2. **Operating Position**
3. **Position for Evacuating, Charging, and Operating with Gauge Set**

FIGURE 14—*Service Valve Positions*

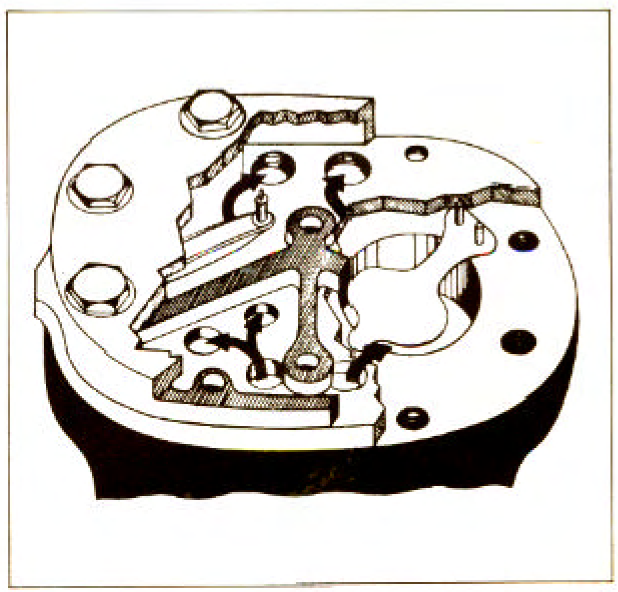


FIGURE 15—*Compressor Valves and Path of Refrigerant Vapors*

Discharge Line Muffler "Rambler" Series

The discharge line muffler is used in the "Rambler" Series to dampen high pressure pulsations. A fine mesh wire screen is also incorporated to filter any dirt that may be present. The muffler is connected to the discharge service valve (Fig. 13).

Condenser

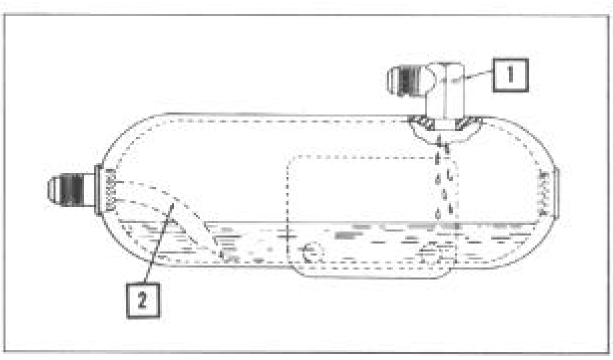
The high pressure, high temperature vapor produced by the compressor is directed through a high pressure line to the condenser. The condenser is located ahead of the radiator, mounted on the radiator air baffles.

The heat of compression and the latent heat of vaporization absorbed by the refrigerant in the cooling coil is rejected to the air flowing over the finned condenser tubes, liquefying or condensing the refrigerant.

The temperature of the air used to cool the condenser is lower than the saturated temperature for the compressor discharge pressure. Freon-12 gives up its latent heat of evaporation during this process to the coolant air and in this way the heat removed from the car is given up to the atmosphere. The condenser temperature is dependent upon two factors, the temperature and amount of the air flow across the condenser core.

Receiver

The receiver, located on the right hand side of the front crossmember, is a reservoir which stores the liquid refrigerant which is still under high pressure. Under normal operating conditions, the receiver should be about one-half filled. As the liquid condenses, it drops into the receiver ; the pick-up tube delivers the liquid refrigerant to the expansion valve. The pick-up tube or quill should normally be below the liquid level; the upper half of the receiver is normally in a high pressure vapor state. To determine the level, place your hand on the receiver; the part containing the liquid will be colder than the vapor half while the system is in operation (Fig. 16).



1. Fusible Plug
2. Pick-up Tube

FIGURE ***16—Receiver***

The receiver is equipped with a fusible plug, set to discharge at extremely high temperatures and pressures. In the event of a fire or development of excess refrigerant pressure, the fusible plug will melt releasing the entire refrigerant charge harmlessly to the air outside the car.

Filter

The liquid refrigerant flows under high pressure through the filter. This unit has a fine mesh wire screen that removes any dirt that may be present in the system (Fig. 17).

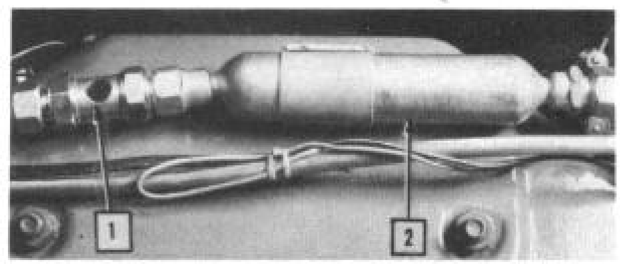


FIGURE 17—*Sight Glass and Filter Location "Hornet" and "Wasp" Series*

Sight Glass

The high pressure liquid flows from the filter through the sight glass.

The sight glass and the filter are mounted on the right hand wheelhouse panel (Fig. 17). Some "Rambler" models do not incorporate a sight glass as illustrated in Figure 13.

The sight glass provides a quick way of checking the refrigerant charge in the system. Presence of bubbles or foam would indicate a shortage of refrigerant.

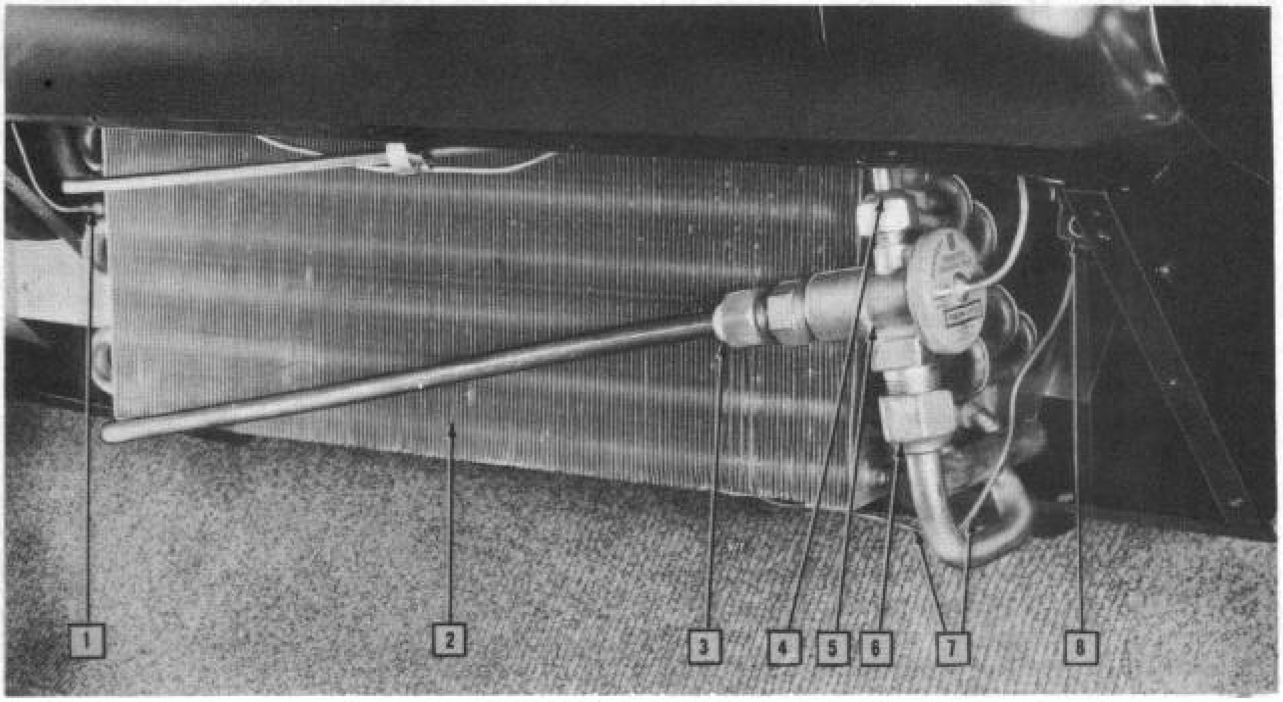
Heat Exchanger "Rambler" Series

The heat exchanger is used on the "Rambler" Series (Fig. 13). The function of the heat exchanger is to transfer heat. This transfer of heat gives two results; one, it cools the warm liquid in the coil before it enters the expansion valve, and two, it further superheats the suction gas, thereby adding to the efficiency of the evaporator.

Expansion Valve

The expansion valve (Fig. 18), a metering and pressure reducing control, regulates the flow of refrigerant to the evaporator. It is located in the evaporator housing on all series.

It is the dividing point between the high and low pressure sides of the liquid side of the system. Refrigeration begins at this point, it



1. Thermo Bulb
2. Evaporator
3. Expansion Valve Inlet (High Pressure Line)
4. Equalizer Connection and Line
5. Expansion Valve
6. Expansion Valve Outlet (Low Pressure Line to Evaporator)
7. Temperature Thermostat Control Capillary Tube
8. Temperature Thermostat Control

FIGURE 18—*Expansion Valve Location "Hornet" and "Wasp" Series*

is the coldest point in the system. High pressure liquid enters the expansion valve through the high pressure line and screen. The fine mesh screen in the high pressure inlet prevents dirt and foreign matter from entering the valve orifice (Fig. 19).

To utilize the latent heat of vaporization and absorb the heat from the air flow and boil the liquid, it is neccessary that the high pressure be reduced to a low pressure at this point. Thermostatically, the expansion valve controls the amount of liquid refrigerant admitted to the evaporator core. It must keep the evaporator core wet at all times during air conditioning.

The expansion valve reduces the pressure of the liquid from high to low pressure by its orifice opening. By reducing the pressure of the liquid before it enters the evaporator core, the temperature of the boiling point is reduced. It is desirable that the temperature of the boiling point be lower than that of the air that flows through the evaporator.

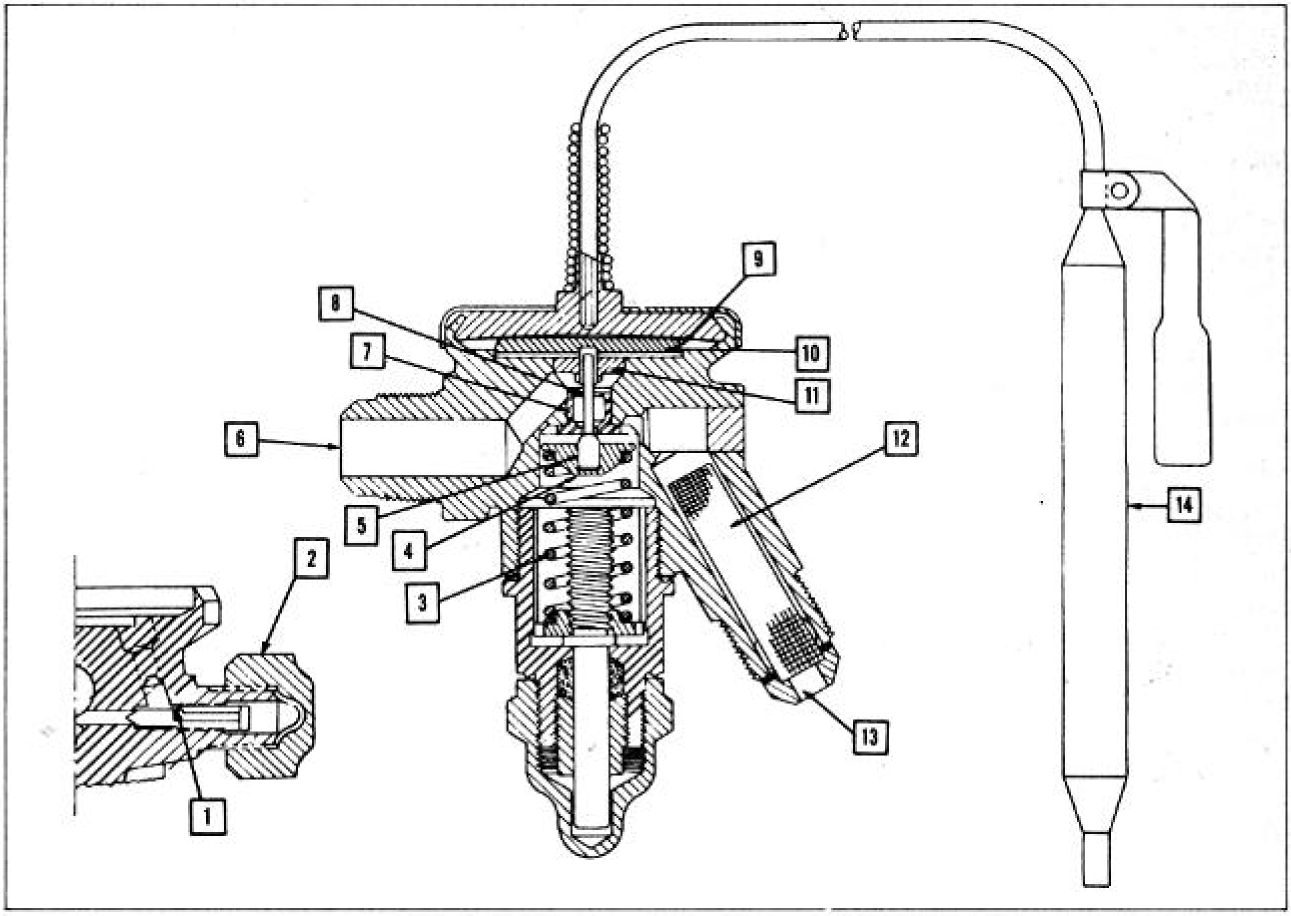
Three forces operate the valve; spring force, pressure above the diaphragm (from power element), and pressure below the diaphragm (equalizing or back pressure 1.

The valve normally operates only during compressor "ON" cycles. During "OFF" cycles, the evaporator temperature, as sensed by the power element (which contains Freon-12 in a liquid gas state) attached to the suction line equalizes the thermal charge pressure (above the diaphragm) and the evaporator pressure allowing the full force of the valve spring to hold the valve closed.

During the "ON" cycle, the valve maintains a constant pressure difference across the diaphragm between the bulb thermal charge pressure and the evaporator pressure. This pressure difference is determined by the super heat setting and controls the flow of refrigerant to the evaporator. When the temperature at the bulb contact on the suction line rises sufficiently, the thermal charge (expanding) creates enough pressure to overcome the combined evaporator pressure and pressure of the valve spring. The diaphragm then moves against the valve pusher pin and induces the valve ball to open the valve and pass refrigerant to the evaporator.

As the temperature at the bulb contact drops, the bulb thermal charge contracts relieving its pressure on the valve diaphragm. At a point determined by the super heat setting, thermal charge pressure on the diaphragm will be overcome by the opposing evaporator pressure and valve spring pressure. The diaphragm will then be forced to move against the thermal charge and the valve ball will move to the closed position.

When the thermal charge pressure increases (due to an increase in temperature at the bulb) and/or opposing evaporator pressure drops sufficiently to allow thermal charge pressure on the



1. **Equalizer Screw**
2. **Equalizer Connection**
3. **Valve Spring**
4. **Ball Carrier**
5. **Valve Ball**
6. **Outlet Connection to Evaporator**
7. **Valve Seat**
8. **Pusher Pin**
9. **Diaphragm**
10. **Pusher Plate**
11. **Pin Guide**
12. **Strainer**
13. **Inlet Connection**
14. **Power Element or Thermo Bulb**

FIGURE 19—*Section of Expansion Valve*

diaphragm to overcome evaporator pressure and valve spring pressure, the valve will again open.

When the compressor stops, the evaporator and bulb temperature equalize causing the pressures above and below the diaphragm to equalize and the spring closes the valve.

During the "ON" cycle, the valve will not actually close completely. A throttling action takes place. Under normal operating conditions, the power element provides accurate control of the quantity of refrigerant to the cooling coil.

The equalizer connection is used in all high capacity systems. It maintains a balance of pressure at the expansion valve evaporator outlet and the evaporator outlet manifold. Any loss of pressure in the evaporator would be corrected by the equalizer connection, as it by-passes from the outlet manifold back to the evaporator intake. It assures operation of the cooling unit at maximum capacity at all times.

The liquid control valve must keep the entire interior surface of the evaporator wet with liquid refrigerant al all times, and yet not permit the raw liquid to pass into the suction line.

The expansion valve super heat of 8 degrees on the "Hornet" and "Wasp" Series and 13 degrees on the "Rambler" Series in the power element is factory set. No attempt to change this setting should be made. The charge in the power element is in the liquid gas state. This is to prevent the frost line from creeping out of the evaporator to the suction line. It also prevents liquid refrigerant from reaching the compressor. Due to the super heat, the power element will react in advance of a temperature and pressure change.

Evaporator

The evaporator is located in the evaporator housing. The housing is located on the right hand dash panel, at the heater opening, in the "Hornet" and "Wasp" Series and in the center of the dash panel on the "Rambler" Series.

The low pressure liquid admitted to the evaporator by the expansion valve vaporizes due to the heat which it absorbs from the air passing over the evaporator surface. This is the principle of "Latent Heat of Vaporization" that is utilized to vaporize the liquid Freon in the evaporator core. The B.T.U.s or a certain quantity of the heat in the air is used to vaporize the liquid. As it boils it to a vapor, the heat is retained in the vapor— and is carried along to the compressor. In turn, to the condenser where the heat is given up to the atmosphere as the vapor is condensed. This absorption of heat from the air results in a reduction in the air temperature. It is where the refrigerant is changed from a liquid to a vapor.

Blower Unit

The blower fan is a high capacity squirrel cage type.

The air is drawn into the evaporator unit housing from the passenger compartment through the heat distribution duct and the return air duct by the blowers. The blower is located directly over the evaporator core and beneath the heater core. The fresh ram air admitted to the evaporator from the cowl vent is combined with this air passing over the evaporator core.

The air conditioning cycle is completed at this point. The evaporated refrigerant, in a vapor state, carrying the heat removed from the passenger compartment continues back to the compressor through the low pressure suction line. The cycle is again started and repeated.

BY-PASS CYCLE

The continuous cycle of air conditioning has been outlined. If this operation were carried on continuously, the temperature would be drawn down to a very uncomfortable level. A control must be introduced into the system to prevent this condition. Also, if the cycle were allowed to run continuously, the evaporator core would frost and eventually block the flow of air over the evaporator and thus cooling would be stopped.

One method to control the amount of air conditioning desired is by the operator's use of the air conditioning switch. To pull the temperature down initially, "High" blower is used. When the temperature is lowered to a comfortable level, "Low" blower is used to maintain a comfortable level in the car.

Another method of control is the automatic by-pass cycle built into the system. The components of this part of the system are the solenoid by-pass valve, temperature control thermostat, and check valve and manifold line (Fig. 20).

The solenoid by-pass valve is wired in series to the temperature control thermostat and air conditioning switch. When the switch is turned on, the blowers and the solenoid by-pass valve are energized, the valve is closed, and normal air conditioning cycle takes place.

When the temperature of the evaporator reaches the frost point, the solenoid by-pass valve is de-energized by the temperture control thermostat and the by-pass line will open. With the by-pass line open, the pressure on the inlet side of the check valve is less than the pressure on the outlet side. The pressure present in the receiver then closes the check valve. The refrigerant vapor is then by-passed back to the compressor. The pressures of the high and low side are partially equalized. A modified amount of refrigerant is directed to the evaporator. Therefore, air cooling is reduced at this time.

Check Valve

The check valve prevents liquid refrigerant from entering the by-pass and low pressure lines when the solenoid valve is open. In turn, this will prevent liquid refrigerant from entering the compressor during a by-pass cycle I Fig. 22).

The valve has a spring loaded seat and operates by differences in pressure at each end of the valve. During refrigeration, the check valve is open as the pressure in the condenser is slightly higher than that in the receiver. During the time the system is not refrigerating, the pressure in the receiver becomes higher and the check valve closes.

Temperature Control Thermostat

The solenoid by-pass valve is controlled during the refrigeration cycle by the temperature control thermostat located on the top of the evaporator housing.

The capillary sensing tube is located in the coldest section of the evaporator core. The temperature control thermostat is wired in series from the air conditioning switch to the solenoid by-pass valve. This unit is pre-set at the factory and no attempt to adjust it should be made by service personnel.

Temperature Control Thermostat Operation

The temperature control thermostat controls the cycling operation of the system. It also prevents the evaporator core from becoming frosted. By cycling the refrigeration, the evaporator core is allowed to warm up during "OFF" cycles. The temperature control thermostat cuts out at 32°F., "Hornet" and "Wasp" Series, and 34°F. on the "Rambler" Series as sensed by the capillary tube. The thermostat points are opened and current to the solenoid by-pass valve is closed off. This de-energizes the solenoid by-pass valve and the by-pass circuit is open.

High pressure refrigerant vapor from the compressor passes through the discharge service valve through the line to the condenser. From the condenser it is directed from the by-pass line to the solenoid by-pass valve. From the solenoid by-pass line, it passes through a line that is connected by a "T" connection to the suction line in the "Hornet" and "Wasp" Series and the suction

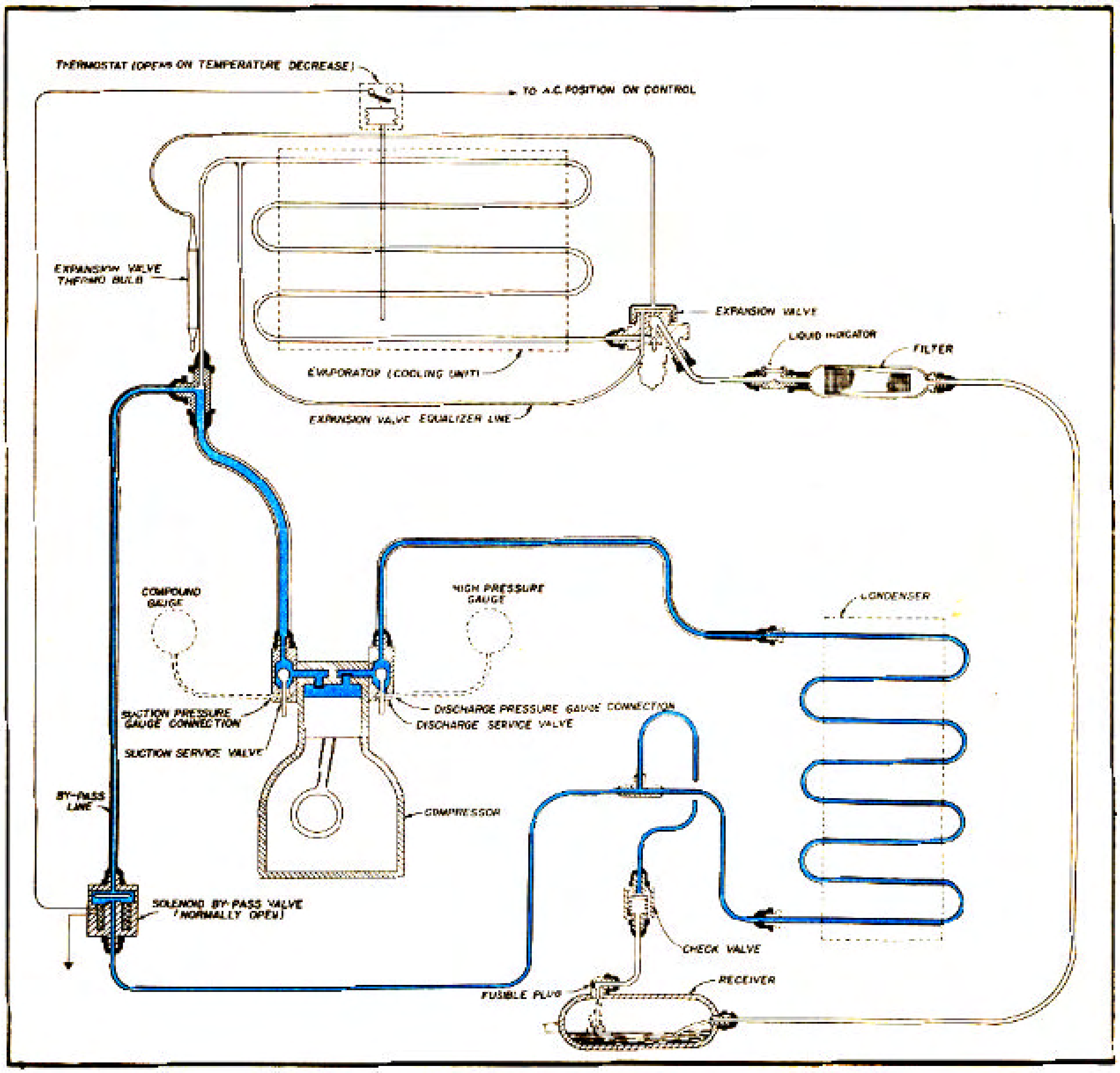


FIGURE 20—*Freon By-Pass Cycle—"Hornet" and "Wasp" Series Shown*

line portion of the heat exchanger in the "Rambler" Series. It then goes back to the compressor in the suction line. As this continues, the pressure partially equalizes on both the high and low side. The thermostat cuts back in at 37°F. in the "Hornet" and "Wasp" Series and 39°F. in the "Rambler" Series. The thermostat points are closed, and the solenoid by-pass valve is energized and closed and the normal cycle is again in operation. The normal cycle will continue until the temperature in the evaporator core reaches 32°F. or 34°F. as sensed by the capillary tube and the by-pass circuit is again used. This method of control will serve to cycle the air conditioning system and prevent the evaporator core from frosting.

Indirectly, it will tend to control the temperature, as the demand for air conditioning is fulfilled, refrigeration is modified until such time that the mean temperature in the car calls for complete refrigeration again.

The by-pass cycle takes place momentarily as the warm air flow through the evaporator core warms it up quickly.

Magnetic Clutch

The magnetic clutch is one of the unique features of this system. It is employed to allow the compressor pulley to free wheel when the air conditioner is not being used. Therefore, the compressor is not operating needlessly. During the winter and off season for air conditioning, it is not necessary to remove the belt from the compressor pulley.

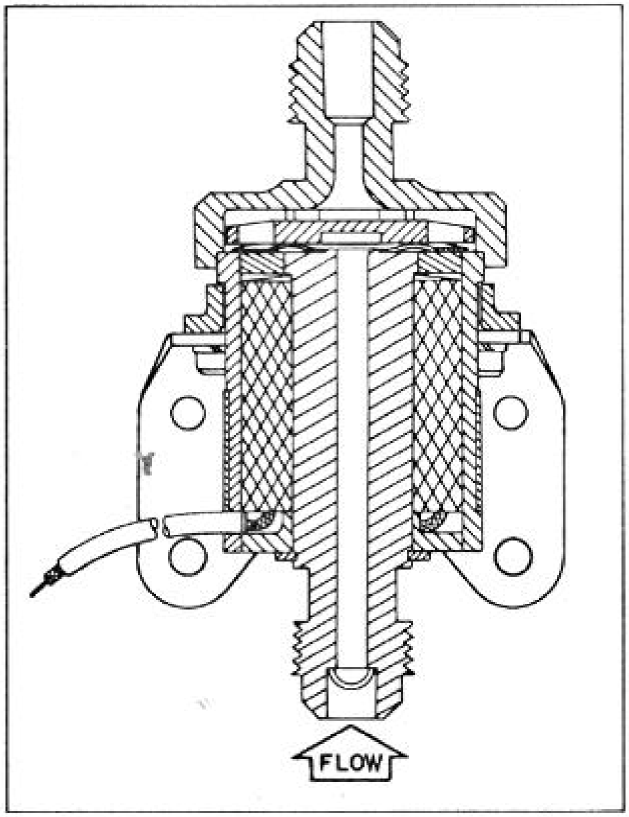


FIGURE 21—*Solenoid By-Pass Valve*

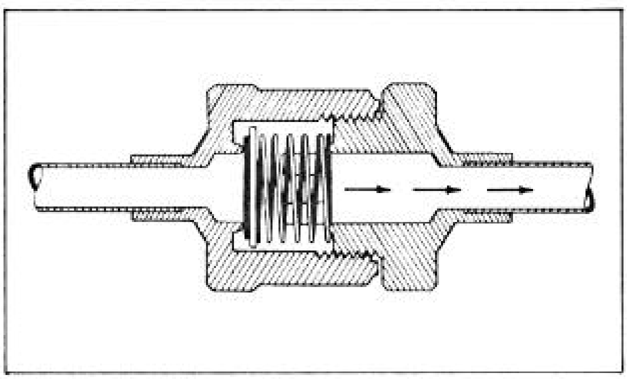


FIGURE ***22—Check Valve, Arrows Show Direction of Normal Flow***

The compressor pulley has a center bearing held in place by snap rings. The pulley and center bearing is mounted on the crankshaft of the compressor. The bearing inner race is a tight fit to the crankshaft. The pulley has a circular electromagnet mounted omits forward face. Two circular brass contact rings are on the rear face of the pulley. A brush holder bracket is mounted on the compressor body. One brush is grounded, the other is connected to the live circuit.

A clutch plate with a splined hub is mounted on the front end of the splined crankshaft. The hub is mounted to the clutch plate by torsional springs. The asbestos clutch place facing is impregnated with iron filings.

When the air conditioning switch is turned on, current is directed to the contact brush, the electromagnet is energized, and the clutch plate is held in contact with the compressor pulley. Thus, the compressor is being driven by the clutch plate.

The electromagnet is not energized in the "OFF" position of the air conditioning switch and the clutch plate does not contact the pulley. Therefore, the compressor is not being driven as the pulley is free wheeling.

WIRING CIRCUIT

The system is wired so that as the air conditioning switch is turned on counterclockwise, either to the "Low" or "High" position, the units in the system are energized.

The temperature control thermostat and solenoid bypass valve are energized simultaneously. The magnetic clutch plate on the compressor drive pulley is also energized and the clutch engages the drive pulley and the compressor starts pumping. Until this was done, the drive pulley has been free wheeling and the compressor has not been operating. The only time then that the compressor is operating is when the air conditioning switch is turned on.

The air conditioning switch also controls the blowers for heater use. The two clockwise positions, "Low" and "High" operate the blower motor and fan.

Refer to the Electrical Section for the wiring diagrams.

SERVICE INFORMATION

The following will outline various service operations and procedures in servicing the system. Upon diagnosis of the system, any unit or part found faulty in operation will be replaced as a unit. No attempt to adjust any of the units is recommended. Units such as the expansion valve and the temperature control thermostat have been pre-set to operate satisfactorily at the factory. Should these units show malfunction, they should be replaced.

Compressor service will be outlined in the compressor section.

The following operations will be referred to with each service operation in which units or parts are to be removed from the system. In such operations, each will be required to be performed: testing system with gauge set, discharging, evacuating, purging, and charging the system. These will be referred to in each service procedure only as a part of the operation. The operations are outlined as a complete operation in the following sections.

CORRECT HANDLING OF FREON

Use safety glasses to protect eyes as –21.7°F., the boiling point of Freon-12, is a temperature the eyes cannot normally stand. Treat for frostbite if either the eyes or portions of the body are affected. Splash with cold water to raise temperature of affected portion.

Always cap Freon-12 drum when not in use to protect the valve and safety plug from damage.

The drum should never be carried in the passenger compartment. Never leave the drum exposed to sun light or high temperatures. The drums are normally filled from 75 to 80 percent of their capacity to allow for expansion. If the occasion ever arises to fill small drums from a large drum never fill completely. A full drum will develop hydraulic pressure with a rise in temperature.

Always weigh the cylinder before and after charging to determine the amount of refrigerant in the cylinder.

The drum should never be subjected to high temperature when adding refrigerant to the system. In most cases, heating the drum is required to raise the drum pressure higher than the pressure in the system during the operation. A container of hot water (125°F.) is all the heat that is required. Hot rags also will suffice. Never use a blow torch or heat the drum on a stove or radiator.

Never discharge the system in an area where an open flame is present. Freon-12 will not produce toxic effects except when combined with a flame, then poisonous gas will result. Freon vapor will also damage the bright metal surfaces of the car. Never inhale large quantities of Freon vapor as it will act as an anesthetic.

Never permit a cylinder to be dropped or strike another cylinder violently.

Handling of Lines

It is extremely important that the refrigerant lines be kept dry and clean. Whenever a connection is to be broken, clean all dirt and grease from the connection.

Parts from stock are capped and dehydrated; the caps should be removed only prior to installation. Lines removed from the system to be used again should be capped immediately to prevent dirt and moisture from entering the line. If caps are not available, copper lines can be placed in an oven for a period of two or three hours before again installing in the system. Bake at 275° to 300°F.

The same is possible with units in the system, such as the evaporator core, condenser, compressor, filter, receiver, and sight glass. The expansion valve can be baked at 100° to 125°F. for two to three hours. This process will insure against moisture in these items. The rubber lines should be baked at 200° F. for two hours.

The lines should be free of kinks that will cause restrictions to the flow of refrigerant. The lines should be carefully stored to avoid crushing or bending.

The proper size wrenches should be used in tightening fittings. Always use two wrenches when tightening fittings to prevent twisting the soft copper tubing. Tubing that is left free to vibrate will harden and crystallize the area of the tube at the flare section so that it may become brittle and break (Fig. 23).

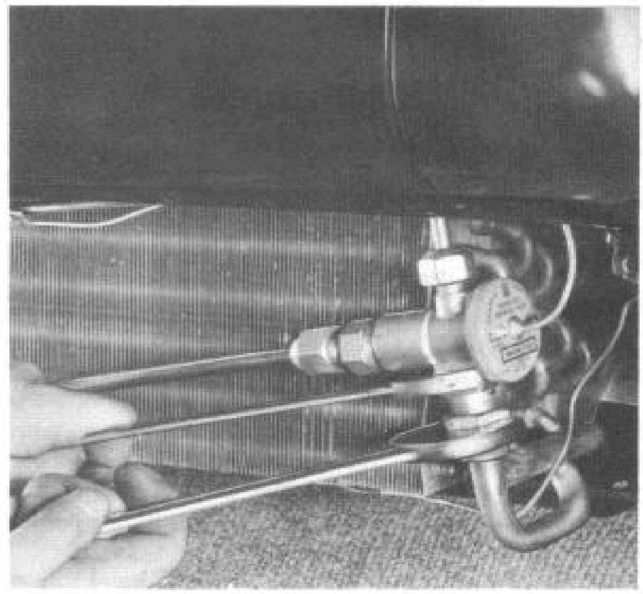


FIGURE 23—*Proper Method of Breaking a Connection*

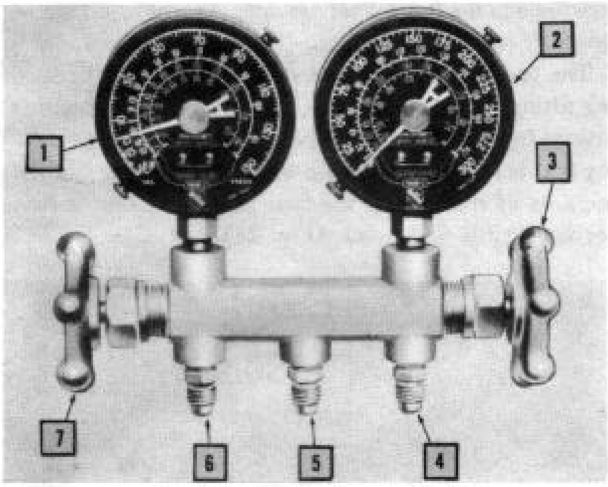
Gauge set and lines should be kept clean and free of moisture. Always plug when not in use.

The compressor lubricant container must not be left open longer than necessary as the special oil is moisture free and will absorb moisture from the air if left uncapped.

PRESSURE GAUGE SET

The Gauge Manifold Set, Tool J-5725, is a multipurpose tool and can be used to advantage in servicing the system. In addition to being used in charging a system, it can be helpful in diagnosis of the system (Fig. 24).

A compound gauge that reads from 0 to 150 pounds pressure and 0 to 30 inches vacuum is on the left hand side of the manifold. This gauge is used to read pressures for the low pressure side of the system and vacuum when used for evacuation. The compound gauge will have its gauge pointer at 0 when at atmospheric pressure or room temperature; the pointer can move in either direction along the scale from 0 depending on which use it is put to. The low pressure side should never drop below approximately 10 pounds pressure when the system is functioning properly. However, ab-



1. **Compound Pressure Gauge**
2. **High Pressure Gauge**
3. **High Pressure Hand Valve**
4. **High Pressure Connection**
5. **Service Connection**
6. **Low Pressure Connection**
7. **Low Pressure Hand Valve**

FIGURE 24-*Gauge Manifold Set Tool J-5725*

normal conditions could occur that the low pressure side may go into a partial vacuum so the use of a compound gauge is necessary. The compound pressure gauge should never be connected to the high pressure side (discharge) service valve.

The high pressure gauge is on the right hand side of the manifold. It is graduated from 0 to 300 pounds pressure and is used to check pressure on the high pressure side of the system only.

For convenience of field use, atmospheric pressure at sea level is called 0 gauge. In other words, gauges read 0 at an actual pressure of about 14.7 pounds per square inch absolute. This enables one to tell by a glance, at the gauge, whether the pressure in a system is above or below that of atmosphere and also just how much above or below without having to refer to the figure 14.7.

The gauges have four scales on their face. The outside scale is the pressure scale. The other three are marked Freon, Methyl Chloride, and Sulphur Dioxide and are graduated in degrees Fahrenheit. For any given pressure in the system shown on the outside scale, the refrigerant saturated temperature for any of the three named gases can be found by reading where the pointer crosses the scale marked for that refrigerant. This saves the operation of looking it up in the table (Fig. 2) if that information is desired.

The connection on the left is for attaching the low pressure gauge line which in turn is attached to the gauge port on the suction service valve. The one on the right is for the high pressure gauge line which is attached to the discharge service valve gauge port. The center connection is for the purpose of attaching a line for evacuating, adding refrigerant, and discharging.

This connection is common to the other two connections. If the gauge set is used to diagnose pressures while the system is in operation, it should be capped.

The hand shut-off valves do not close off pressure to the gauges. They close each opening to the center connection and to each other.

Use of Gauge Manifold Set

The gauge set as used in evacuating and charging procedures is outlined in the following sections. To use the gauge in diagnosis of pressure in the system or any further problems, hook up in the following manner:

The position of the service valves in the normal operating position is that the valve is "front-seated", stem all the way out, and the service valve gauge ports are closed off. Therefore, it is not necessary to change the position of the valve stem to attach the gauge set. All that is necessary is to remove the gauge port caps and attach gauge lines.

Close both hand valves on gauge manifold set.

Attach a gauge line to the high pressure connection on the manifold.

Remove the cap from the gauge port and attach gauge line.

Cap the center connection.

Attach a gauge line to the low pressure connection on the manifold set.

Remove the cap from the gauge port and attach gauge line.

"Crack" the service valves.

Without the system operating, both the gauges should read the same. The system is in the by-pass cycle and the pressures on the high and low side are equalized. For example: if the ambient temperature is 70°, the pressure readings on both gauges should read 70 pounds gauge pressure. Reference to the temperature pressure relation curve will give readings for other temperatures. You will note that by reading the Fahrenheit scale on the gauge for Freon-12 and the pressure scale, the readings will correspond to the temperature-pressure relation curve.

To further use the gauge set while road testing the system, long copper tubes to replace the lines can be fabricated to enable the operator to have the gauge set in the car. This way he can observe the gauges to check the system at various speeds. Experience with the system and gauge set will eventually enable service personnel to recognize malfunction of parts in the system.

DISCHARGING THE SYSTEM

Remove the cap from the gauge connection. Open the system to the atmosphere by turning the valve stem in one to three turns. Rapid release will cause the oil to foam up out of the compressor. This should be avoided.

The compressor lubricant is soluble in Freon-12. To prevent pulling too much oil out of the system, release the charge slowly so that the oil remains as the Freon vaporizes into atmosphere.

If there is no oil foaming out with the Freon, the valve may be opened wider to allow the gas to escape more rapidly. It would be advisable to release the charge in an open area other than the one wherein subsequent service operations such as checking for leaks would take place. This would prevent contaminating the area with Freon gas and cause erroneous and false leak detection.

The same operation may be performed on the suction service valve to assure complete release of the charge in the system.

This procedure should be followed in service operations where components are removed.

EVACUATING THE SYSTEM

The system should be evacuated every time it has been opened for a service operation such as a replacement of a part or line. Air and moisture may have entered the system when it was opened. It is advisable to evacuate the system every time a part has been removed from the system or whenever a charge has been lost through a leak or loose connection. The system should be evacuated prior to charging if it has been standing for a period of time without a charge. In discussing service operations requiring evacuation, only reference to evacuation will be made. The following procedure should be followed every time evacuation is necessary.

The compressor is used to evacuate the system.

The following procedure must be followed very carefully to prevent any damage to the compressor and its parts. Make certain the system is completely discharged. No Freon gas should be present during this operation.

Remove the protective caps from both service valve stems.

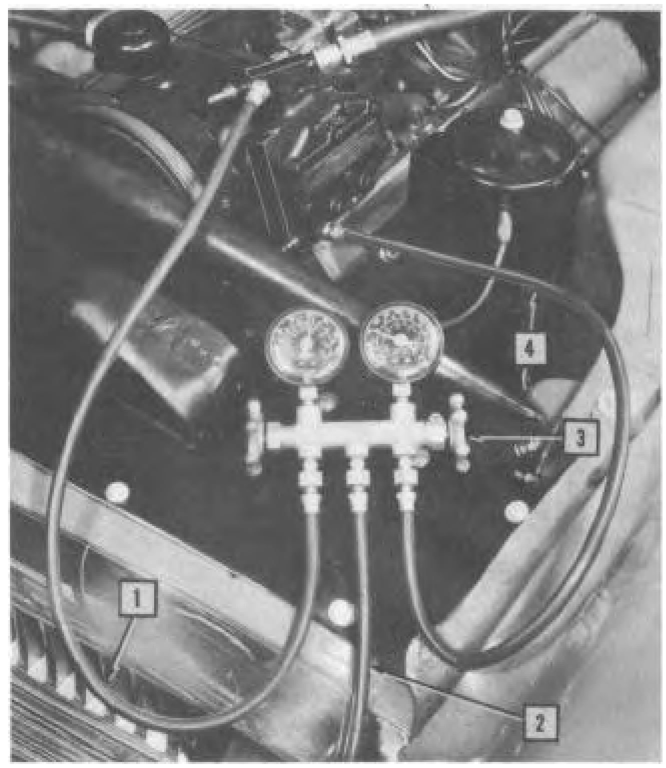
Install Gauge Line, Tool J-5418, from suction service valve port to compound gauge fitting on the gauge manifold set (Fig. 25).

Install the gauge line from discharge service valve port fitting to the high pressure gauge fitting on the gauge manifold set.

Install gauge line to the center connection on the gauge manifold set.

The hand valve on the compound gauge is closed to the center connection of the gauge manifold set. The compound gauge will still register low side pressure. The hand valve on the pressure gauge is open to the center connection.

The suction service valve is moved to the "cracked" position by turning the valve stem in two to three turns. The discharge service valve is "closed" by turning the valve stem in all the way. The discharge service valve gauge port is open to the atmosphere through the open hand valve on the gauge manifold set and the open gauge line (Fig. 26) .



1. Gauge Line, Compound Gauge to Suction Service Valve
2. Gauge Line, to Atmosphere or Freon Drum for Charging
3. Gauge Manifold Set
4. Gauge Line, Discharge Service Valve to Pressure Gauge

FIGURE 25—*Installation of Gauge Set, Tool J-5725*

The gauges both should register "0" at this time as there is no pressure present in the system.

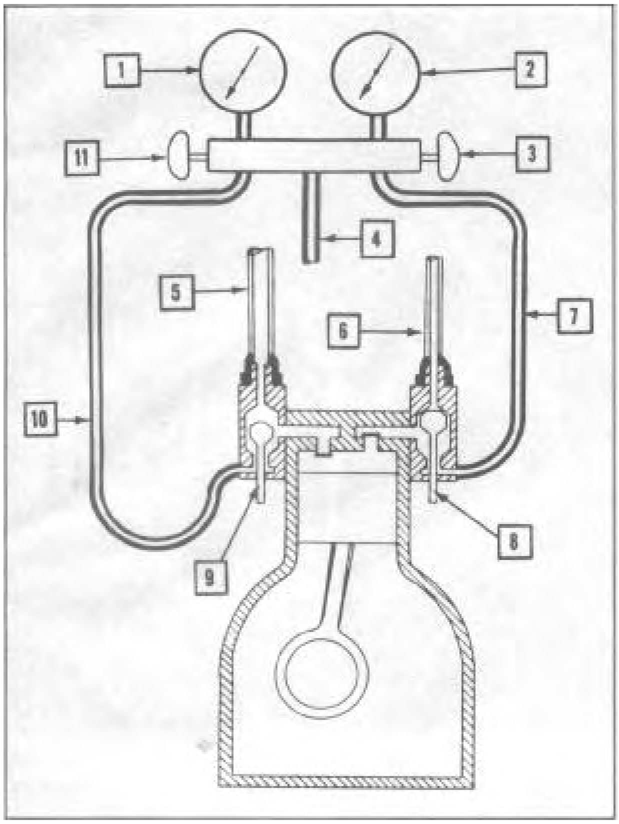
The discharge service valve being closed and with the gauge port open, air pumped out by the compressor is exhausted through the open gauge line attached to the center connection. With the discharge service valve closed, the system is closed off so that as the compressor pumps, the system is evacuated back to the closed valve.

Check the oil level in the compressor.

Start the engine and operate the compressor for a second or two at a time for three or four times to slowly reduce the internal pressure. Then run continuously observing the compound gauge. If the compressor is efficient, it should pump down from 12" to 18" vacuum quickly.

IMPORTANT: *DO NOT RUN MORE THAN 10 TO 15 MINUTES AS IT IS POSSIBLE TO DAMAGE THE COMPRESSOR.*

If a 12" to 18" vacuum cannot be reached, the compressor is evidently defective or a leak is present in the system.



1. **Compound Gauge**
2. **High Pressure Gauge**
3. **High Pressure Gauge Hand Valve, Open Position**
4. **Gauge Line, Center Connection, Open to Atmosphere**
5. **Suction Line, Evaporator to Compressor**
6. **Discharge Line, Compressor to Condenser**
7. **Gauge Line, High Pressure Gauge to Discharge Service Valve**
8. **Discharge Service Valve, Closed Position**
9. **Suction Service Valve, "Cracked" Position**
10. **Gauge Line, Suction Service Valve to Compound Pressure Gauge**
11. **Compound Pressure Gauge Hand Valve, Closed Position**

FIGURE 26—*Evacuation of Air Conditioning System*

Evacuation also dehydrates since it removes most of the moisture bearing air.

After pumping a good vacuum for 10 to 15 minutes, close the hand valve on the high pressure gauge on the gauge manifold set and immediately shut the system off and stop the engine. There should only be a brief interval between these two operations.

Return the discharge service valve to the "cracked" position by turning the valve out two to three turns. Both the hand valves on the gauge manifold set remain turned off.

At this time, the vacuum reading on the compound gauge should remain constant; it should read from 12" to 18" or better vacuum. Let the system stand for about 10 to 15 minutes and if the vacuum remains constant, the system is sealed from the atmosphere. If the vacuum drops off, there is probably a loose connection or leak in the system. Correct by tightening or replacing the leaking part and repeat the procedure.

Heat a Freon drum in a container of hot water (125°) or with rags soaked in hot water. Then attach the drum to the center connection gauge line.

Loosen the gauge line fitting to the center connection slightly. "Crack" the drum valve, purging air from the gauge line with Freon vapor. Tighten the gauge fitting and close the drum valve.

Open the hand valve on the pressure gauge side of the gauge manifold. With the drum in the upright position, "crack" the drum valve slightly to admit the vaporized Freon gas from the top of the drum into the system.

Close the drum valve.

The internal pressure will record on both gauges; this pressure should be approximately room temperature of 70° which gives the equivalent pressure of 70 pounds.

The system should now be completely tested for leaks (follow "Leak Test Procedure") with a Halide Leak Detector, Tool 6084. Eliminate any leaks present by tightening connections and replacing leaky part and repeat entire procedure up to this point.

The system may now be charged with refrigerant following the procedure outlined in "Adding Refrigerant—Complete Charge".

CHARGING THE SYSTEM

The normal charge of refrigerant for the system is 4 pounds of Freon-12 in the "Hornet" and "Wasp" Series, and 31/2 pounds in the "Rambler" Series.

For every pound of Freon-12 in the system, 2 c.c. of Anhydrous Methanol is added to the Freon-12. Moisture is not soluble with Freon-12, but with the addition of Methanol to lower the freezing point, the moisture will pass through the system. Without Methanol, moisture would freeze and block the system particularly at the expansion valve orifice where the high pressure liquid is metered into a low pressure liquid.

This is the coldest point in the system. Although the system is controlled to 32°F., it is entirely possible to go a few degrees below before the temperature control thermostat would cycle the system into the by-pass circuit.

NOTE: ***Refer to "Moisture and Air" in the system for additional information.***

The Methanol is added to the compressor crankcase at the oil filler plug prior to evacuation in cases where it is not already added to the Freon in the drum.

The check valve in the compressor crankcase will prevent the Methanol and oil from leaving the system. The Methanol will enter the system in the same manner as the oil when the system is in normal operation.

The sight glass provided in the liquid line is used to check the system for a normal check the system for a normal charge. Bubbles of vapor passing through the sight glass would indicate a low or short charge of refrigerant.

Allow the system to run for a period of 5 to 10 minutes to normalize before checking the sight glass for vapor bubbles. Initially, some vapor will be present, especially on an extremely hot humid day.

In a correctly charged system, the liquid level in the receiver covers the liquid outlet tube to prevent hot gas from going to the evaporator. The receiver is normally 50 to 60 per cent filled with liquid.

There is no actual way of determining how much refrigerant is required if the sight glass is checked and vapor bubbles are present.

Adding Refrigerant—Partial Charge

This operation is only performed when part of the charge is lost through a leak.

Leak test (Refer to "Leak Test Procedure"). Correct conditions as required. If leak exists at connection, tighten. If a part is at fault and leaks, discharge, replace part, and complete charge; follow "Complete Charge" procedure.

Remove the cap from the discharge service valve port fitting and install a gauge line, tool J-5418, to the fitting and to the high presure gauge fitting on the gauge manifold set, tool J-5725. Remove the cap from the suction service valve port fitting and install a gauge line to the fitting and to the compound gauge fitting on the gauge set.

Close the gauge hand valves to the center gauge fitting. Install a gauge line to center fitting on the gauge set.

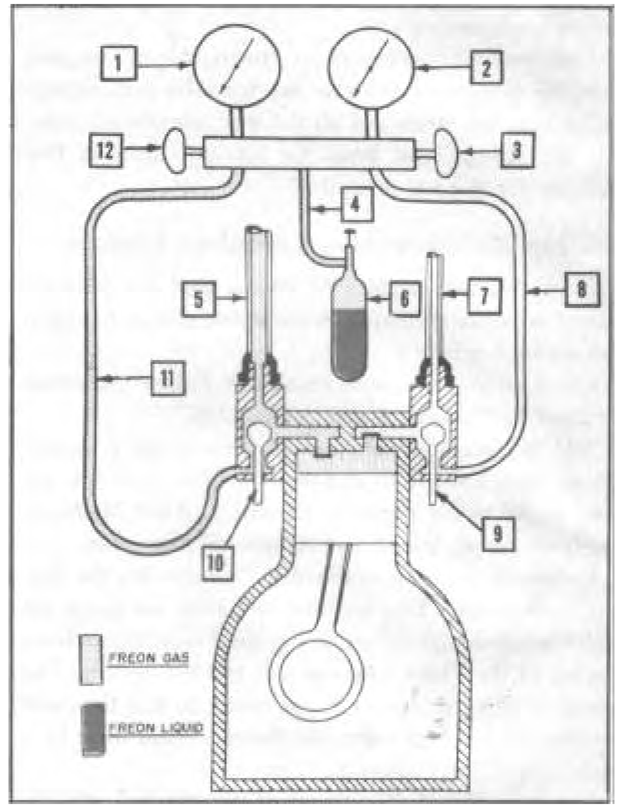
Install gauge line to Freon drum. Check all connections to see that they are tight (Fig. 27).

> NOTE: *An important rule to follow in charging is that the refrigerant should always be in a vapor state when added to the "low" side. The Freon drum will require the use of heat in order to charge the refrigerant into the system in a vaporous state. A bucket of hot water, 125°F., is adequate. This will cause the liquid to vaporize as it leaves the drum. Hot rags wrapped around the drum will also serve to vaporize the refrigerant.*

With the drum in the upright position, open the drum valve slightly.

Open the gauge hand valves on the gauge set. This will open the center charging line to each charging line to the compressor.

Both service valves are to remain closed to the gauge fittings. Loosen the flare nut connections of the charging lines at the service valves to purge air from the lines and gauge set. These should only be cracked open momentarily. Air will be purged or driven out by the Freon vapor. Retighten the connections.



1. **Compound Gauge**
2. **Pressure Gauge**
3. **Pressure Gauge Hand Valve, Closed Position**
4. **Gauge Line, Center Connection to Freon Drum**
5. **Suction Line, Evaporator to Compressor**
6. **Freon Drum, Upright Position**
7. **Discharge Line, Compressor to Condenser**
8. **Gauge Line, High Pressure Gauge to Discharge Service Valve**
9. **Discharge Service Valve, "Cracked" Position**
10. **Suction Service Valve, "Cracked" Position**
11. **Gauge Line, Suction Service Valve to Compound Gauge**
12. **Compound Gauge Hand Valve,Open Position**

FIGURE 27—*Adding Partial Charge of Refrigerant*

Close the hand valve on the high pressure gauge on the gauge set. This will close the gauge to the center fitting. The gauge will still record pressure on the high side when the compressor is running with the charge installed.

"Crack" both service valves.

The Freon drum valve has been "cracked" slightly until this time. With the drum in the upright position, open the valve completely.

Operate the engine and compressor at a slow idle speed.

Observe the sight glass until a solid liquid column appears. Then add approximately 1/2 pound additional refrigerant.

Close the drum valve.

Operate the engine for five minutes at approximately 1500 to 1800 R.P.M.

Observe gauges, sight glass and entire

system for proper performance.

After the unit operates satisfactorily, stop engine, close the service valves to the service valve port fittings by backing the stems out all the way, disconnect lines, cap the fittings, and leave the service valves in this position for normal operation.

Adding Refrigerant—Complete Charge

This operation is performed after a part has been removed from the system or the complete charge has been lost through a leak.

Check oil in compressor crankcase. Follow procedure outlined in "Checking and Adding Oil."

Add Methanol required at this time at the compressor oil filler hole. This is done if the Methanol has not been added to the Freon in the drum. After Methanol has been added, install and tighten oil filler plug.

Follow instructions outlined in "Evacuating the System" procedure. This includes attaching the gauge set and lines, evacuation, and using the Freon vapor from the top of the Freon drum to leak test the system. The use of a slight charge of Freon vapor at this time will prevent the loss of a complete charge should there be a leak.

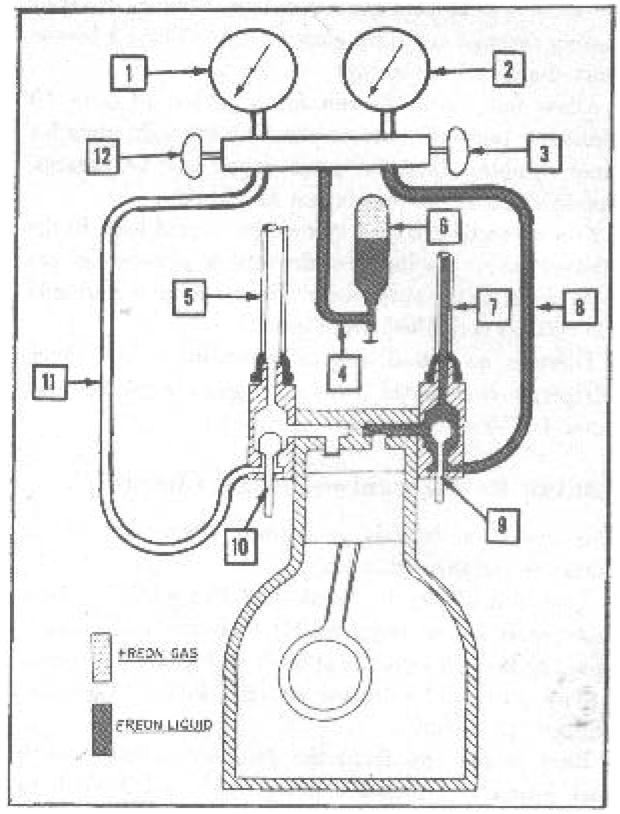
Common size of refrigerant drums are 3, 5, 10, 25, 50, and 145 pounds. The drums are ordinarily marked with their tare weight, which is the weight of the cylinder when empty. Weighing a cylinder containing refrigerant, then subtracting the tare weight, gives the weight of the contained refrigerant. The specified complete charge for the system is 4 pounds of Freon-12, for "Hornet" and "Wasp" Series, and 31/2 pounds for the "Rambler" Series. To determine the amount of refrigerant used, weighing the cylinder before and after charging will enable you to determine the amount used.

Close the hand valve on the compound gauge of the gauge set. This will close the gauge to the center fitting and to the high pressure gauge.

The discharge service valve is in the "cracked" position. The suction service valve is "front seated" or the stem backed all the way out. Heat may be applied to the drum as outlined in the procedure of Partially Charging the System.

Open the Freon drum valve. Charging with liquid refrigerant is done at the high side of the compressor at the discharge service valve. The compressor should not be running. The drum is held in an inverted position so the vapor goes to the top of the drum and exerts pressure on the liquid and forces it into the system. The liquid refrigerant goes through the condenser and into the receiver (Fig. 28).

Close the drum valve after the complete charge is in the system. This can be readily determined by the stopping of the hissing noise as refrigerant is fed into the system or weighing the drum. Close the hand valve on the high pressure gauge on the gauge set.



1. Compound Gauge
2. High Pressure Gauge
3. High Pressure Gauge Hand Valve, Open Position
4. Gauge Line, Center Connection to Freon Drum
5. Suction Line, Evaporator to Compressor
6. Freon Drum (4 Pound Charge), Inverted Position
7. Discharge Line, Compressor to Condenser
8. Gauge Line, High Pressure Gauge to Discharge Service Valve
9. Discharge Service Valve, "Cracked" Position
10. Suction Service Valve, Operating Position
11. Gauge Line, Suction Service Valve to Compound Gauge
12. Compound Gauge Hand Valve, Closed Position

FIGURE 28—*Installing Complete Charge of Refrigerant*

Move the suction valve to the "cracked" position.

Turn air conditioner in "High" blower. Run the engine at 1500 to 1800 R.P.M. a few minutes to check by-pass cycle. Observe the sight glass and the high and low pressure gauges. The engine should run from 10 to 15 minutes at idle to normalize the system.

If no bubbles appear at the sight glass and the pressures are normal, shut off the engine.

NOTE: Head pressure (high side) should not exceed 275 pounds at normal room temperatures.

Excessive head pressure would indicate air or excessive charge in the system. Purge the air from the system or release excessive charge. This method is outlined in the section on "Air and Moisture in the System"

Again leak test the system. Correct as required (refer to Leak Test procedure).

If the system operates normally, move the service valves to the operating position. Remove the gauge lines and cap the gauge port fittings.

CHECKING AND ADDING OIL

In normal operation, a small amount of oil is always circulating throughout the refrigerating system. An oil sight glass is provided in the compressor so that you can see if the oil is splashing when the compressor is running. It does not indicate the oil level when the compressor is stopped. The oil level is determined by stopping the compressor and closing the suction and discharge service valves to the lines. This isolates the compressor from the rest of the system and leaves the system sealed from the atmosphere.

Loosen the gauge port cap on the discharge service valve slightly and let the gas in the compressor purge to the air slowly until the charge in the compressor is released. Relieve the crankcase pressure by loosening the oil filler plug slowly and remove it when oil has stopped foaming.

The usual charge of oil in the compressor is 10 ounces. Should it be necessary to add oil, use a refrigerant type oil of 280 to 300 Seybolt. Use a straight piece of wire as a dipstick. Check at the oil filler hole. Use the wire dipstick as near vertical as possible. To avoid adding too much oil, add slowly and check with dip stick; take two or three readings, each time wiping the dipstick dry.

The following should be used to determine the correct oil level with the compressor warm and stopped.

Vertical Mounted Type ("Rambler", "Wasp", and "Hornet" 6)

Minimum	9 Oz. Avdp.	1-1/8" on Stick
Maximum	10 Oz. Avdp.	1-1/2" on Stick

Horizontal Mounted Type ("Hornet" V-8)

Minimum	9 Oz. Avdp.	1-1/4" on Stick
Maximum	10 Oz. Avdp.	1-9/16" on Stick

Replace oil filler plug.

"Crack" the suction service valve slightly for approximately a few seconds until a hissing sound is heard from the valve to allow the system to purge air from the compressor through the discharge service port.

Tighten the discharge service valve port cap.

After the air has been purged from the system, return the service valves to the operating position.

Install valve stem caps; operate system and allow to run a few minutes. Observe the oil splash in the sight glass of the compressor. There should be oil splash if there is sufficient oil in the system.

NOTE: The refrigerant charge should be checked whenever oil is added to the compressor.

CAUTION: *The oil in the container originally is packed moisture free and every effort should be made to maintain its status. The oil will quickly absorb any moisture with which it comes in contact. The container should not be opened until ready for use, and be recapped immediately after use. Tools, tubes, gauge sets, and replacement parts should be kept clean. The system should not be open any longer than absolutely necessary.*

Oil Level When Replacing Compressor

Precautions should be taken to prevent an over or under charge of oil whenever the compressor is replaced. The oil charge in a new compressor is sufficient for an entire system. In a system that has been running, there is always some oil circulating through it.

Purge the gas pressure in the crankcase of the original compressor to 0 pounds pressure slowly after the line valves are closed.

Check the oil level without running the compressor. Running the compressor will cause a sudden drop in pressure in the crankcase and may cause oil pumping. The oil level in the crankcase would then be temporarily lowered, putting an over-charge of oil in the evaporator, so a false reading is obtained when checking the oil level.

Check the oil level in the new compressor and add or remove oil from it until the oil level is the same as it is in the compressor to be replaced.

After the new compressor has been run for 10 or 15 minutes, recheck the oil level.

MOISTURE AND AIR IN THE SYSTEM

Presence of air and moisture in the system is harmful. Precautions should be exercised to prevent both from entering the system. Moisture and air often enter together because in all air there is more or less water vapor along with the oxygen, nitrogen, and other gases of which air is composed. Moisture and air may enter through leaky shaft seals, faulty tubing connections, defective gasket joints, and other leaks. It can get in during service operations which are incorrectly performed and during installation of equipment. Water or moisture may enter with refrigerants or oil which has been allowed to gain water through contact with air. As a precaution, the compressor oil container should only be opened when in use.

Water causes the most serious troubles. Water does not dissolve in Freon-12 but separates and remains apart from the refrigerant. Consequently, the separated water is likely to freeze into ice and clog the small openings in the expansion valve. Ice in the expansion valve orifice stops flow of refrigerant. Then the evaporator and valve warm up, the ice melts, and refrigeration once more takes place, only to be stopped again as more ice forms. Such intermittent refrigeration is an indication of excessive water in the system. Clogging due to particles of dirt reduces or stops refrigeration completely until the dirt is removed. Clogging due to water is intermittent while that due to dirt is permanent.

Freon-12 will slowly hydrolyze; that is, react with water to form Hydrochloric acid or Hydrofluoric acid. This quickly and seriously corrodes the metals used in the system. Freon itself has no corrosive action upon the metals used in the system, but the aforementioned reaction with water will corrode the metals. Corrosive particles in turn break loose and damage the system.

Water emulsifies with lubricating oil, meaning the two form an intimate mixture of exceedingly fine globules of the liquids. This effect is called "sludging" of the oil and greatly reduces the lubricating ability of the oil. Water in a refrigeration system tends also to make diaphragms and bellows lose their elasticity and become harder and more brittle.

The best insurance against moisture is to prevent it from entering the system.

This can be done by keeping all components sealed prior to installation and during repair procedures. Should the system be opened for a service operation, seal the openings and lines with plastic caps. Follow the procedure outlined in "Handling of Lines" to rid any of the parts of suspected moisture.

This system employs the use of Methanol to prevent water in the system from freezing. Each pound of Freon-12 requires 2 c.c of Methanol. This would lower the freezing point of the water that may be in the system. An excessive amount of water may upset the balance, and if the symptoms of water are present, corrections are necessary. Release the charge, evacuate the system, and recharge. Water will be evaporated during the evacuation process. Also, any air that may be pocketed in the system will be evacuated at the same time.

Air which consists of gases that cannot be condensed in the refrigeration system causes excessively high pressures in the high side of the system and reduces the operating efficiency.

Install gauge set and operate to determine pressures.

The presence of air is always indicated by high operating head pressure. (The pressure should normally not exceed 275 P.S.I. at normal room temperature.)

This could be confused with an excessive amount of refrigerant which would also indicate high head pressure; although an excessive amount of refrigerant would still give adequate cooling effect.

No matter where or how air enters, it will always end up in the condenser. Air remains in the condenser and takes up valuable condensing space.

If the system is known to have the correct amount of refrigerant, but during operation and using the gauge set the head or high pressure builds up, air is certain to be in the system.

PURGING AIR FROM THE SYSTEM

Allow the system to remain idle several minutes after the compressor has been operating.

The air then may be released through the discharge service valve on the compressor. This is done by first making sure that the valve is shut off to the gauge port. Then remove the gauge connections. Turn the valve stem in toward the "cracked" position for a few moments, thus allowing air to escape through the gauge port. This should be done slowly.

Cover the port opening with a cloth when purging the system of air to prevent refrigerant and oil from contacting persons or car.

This procedure should be repeated if it is apparent that air is still in the system. Care should be exercised. The system should be purged slowly to prevent drawing oil out of the system. Check compressor oil level after bleeding.

The air may also be bled from the system at the receiver. "Crack" the top connection flare nut slightly for a few moments. After you feel that the air has bled off into the atmosphere, close the connection and operate the engine and compressor. Observe the sight glass; observe the gauges; check the system to see if it is performing satisfactorily.

If it performs satisfactorily, you have bled off the air. If not, repeat until the operation is satisfactory.

PURGING EXCESSIVE REFRIGERANT FROM SYSTEM

Install the gauge set and operate to determine pressures.

Excessive amount of refrigerant will be indicated by high head pressure although the cooling effect is adequate. Place your hand on the receiver while the system is running. If the entire receiver is cold, the indication would be that the receiver is filled with liquid refrigerant.

It is possible to bleed the excessive amount of refrigerant off through the center line of the gauge manifold set to allow the refrigerant to bleed into the atmosphere. Open the hand "valve to the pressure gauge. This will open the discharge valve to the center gauge line. The Freon-12 will vaporize upon entering the atmosphere. Care should be exercised in allowing the Freon to bleed off. Bleed slowly to prevent the oil in the system from foaming and being pulled out of the system.

After you feel you have bled off the amount of refrigerant necessary to bring it to the normal charge, close hand valve on pressure gauge.

Operate the system again and observe the sight glass and gauges. If the system operates normally, you have bled off the excessive amount of refrigerant. If not, the process must be repeated. When bleeding off the excessive amount of refrigerant, a cloth placed over the gauge line opening will prevent the refrigerant or any oil from contacting on the car or persons.

LEAK TEST PROCEDURE

Outward leaks of Freon-12 are detected and located with the help of a device called a Halide Torch, Tool J-6048. It is a torch to which has been added an "Exploring Tube" through which air is drawn by injector action from points at which leakage is suspected. The torch uses Propane gas. The cylinder is not refillable. Obtain cylinder from supplier. When cylinder is exhausted, discard in safe place. Do not throw in incinerator or other fire. When torch is not in use, do not store near fire, or in room used for habitation.

A copper reaction ring, heated red hot by the flame, is located where the air is drawn into the flame. If the slightest trace of Freon comes through the exploring tube, the normally blue flame changes to green, thus indicating the free end of the exploring tube is being held near a point of leakage (Fig. 29).

Operation of Halide Leak Detector

To operate the Halide Leak Detector, open valve and light.

When the copper reaction ring becomes hot, adjust the valve to produce a flame $^3/_8$" above reaction ring. The smaller the flame, the more sensitive the burner is to leaks.

Action of the torch may be checked by holding the end of the exploring tube where there is known to be Freon gas and noting whether the flame turns green. A flame that is yellow or white indicates that the exploring tube is clogged.

Hold the free end of the exploring tube close to every joint and pass it slowly all around the joint. It takes some time for any escaping refrigerant gas to be drawn through the exploring tube into the torch flame, so this part of the work must not be hurried. The worse the leak, the greater the concentration of refrigerant carried into the torch, the darker will be the green of the torch flame. Large leaks may turn the flame to a bright purple or may extinguish it by keeping air and oxygen from the flame.

> CAUTION: *Avoid breathing the poisonous fumes and black smoke produced from the burner of the torch if Freon gas is added to flame.*

With very large leaks, the surrounding air may be saturated with so much Freon that the torch flame remains green all the time. This could happen where there is poor ventilation. Several commercial type leak detection solutions are available that may also be used.

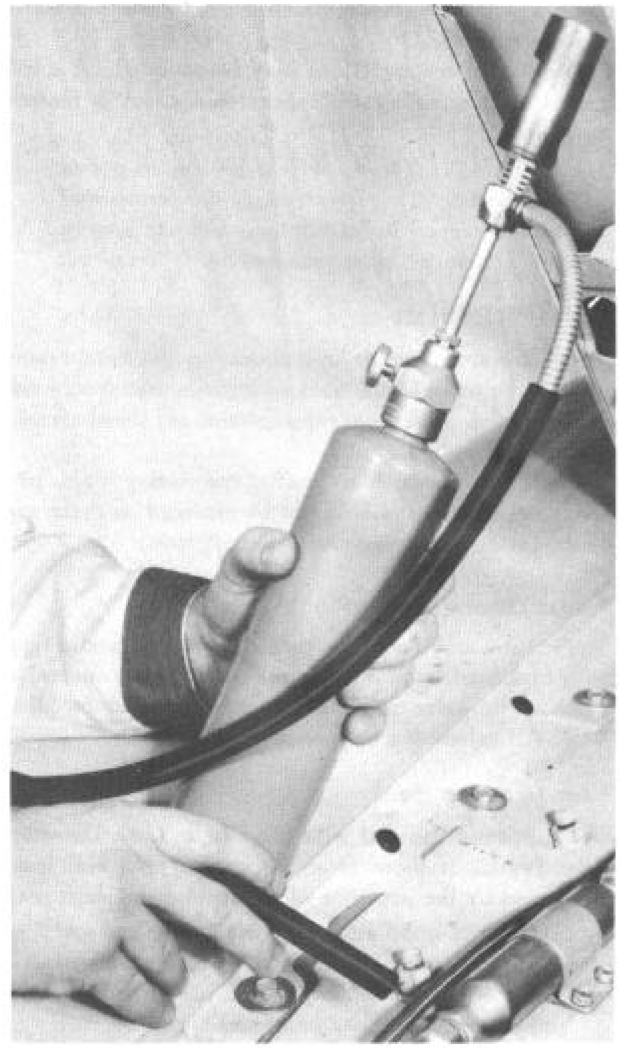


FIGURE 29—*Testing for Freon Leaks with Halide Leak Detector, Tool 1-6048*

If a leak is detected by either method, do not run the system as the entire charge may be lost. Dirt and moisture may be drawn into the system.

If the system has lost its charge, it must be completely leak tested, leaks repaired, recharged, and checked again to make sure that there are no other leaks in the system.

If a leak is detected at a flare connection, retighten with suitable wrenches. Care must be exercised in tightening flared connections; copper is soft and the flare can be damaged.

If, after tightening, the leak is still apparent, the system must be discharged, the damaged connection or line replaced, and system recharged.

New gaskets may be required, packings in service valves, or whatever other corrective measures are required for the part at fault.

Threaded joints may be made tight by applying a paste made from litharge, also called yellow lead, or lead monoxide, and glycerine mixed to the consistency of library paste to male threads. This paste sets hard in a short time.

Leaky solder connections may be soldered. A good grade of silver solder with silver solder flux is recommended.

CAUTION: Never solder a joint with gas in the system. This is extremely dangerous and should never be attempted. Release charge and recharge after connection is repaired.

COMPRESSOR

There are some repalr operations on the compressor that can be made in the field and others that should not be attempted. The usual replacements are the shaft seal and the valve plate.

Internal parts such as shafts, connecting rods, pistons, and bearings should not be replaced as there are select fits requiring several different sizes.

Compressor Valves

The suction and discharge valves are of the inertia type with both suction and discharge ports in the one valve plate.. The valve reeds are highly polished Swedish steel. All valves flex to open and lift is limited.

Compressor Seal

Check around the seal with the Halide Leak Detector, Tool J-6048, if there is an indication of a seal leak, evidenced by the presence of oil around the shaft seal.

NOTE: *A small amount of oil around the seal bearing is normal and does not indicate a seal leak. When the seal was originally assembled, all parts were dipped in oil and operation may only be forcing out the surplus oil.*

All seal parts must be replaced if the Halide Leak Detector indicates a refrigerant leak. The seal assembly is shown in Figure 30 and the components are shown in. Figure 31. A complete seal kit is available for service replacements.

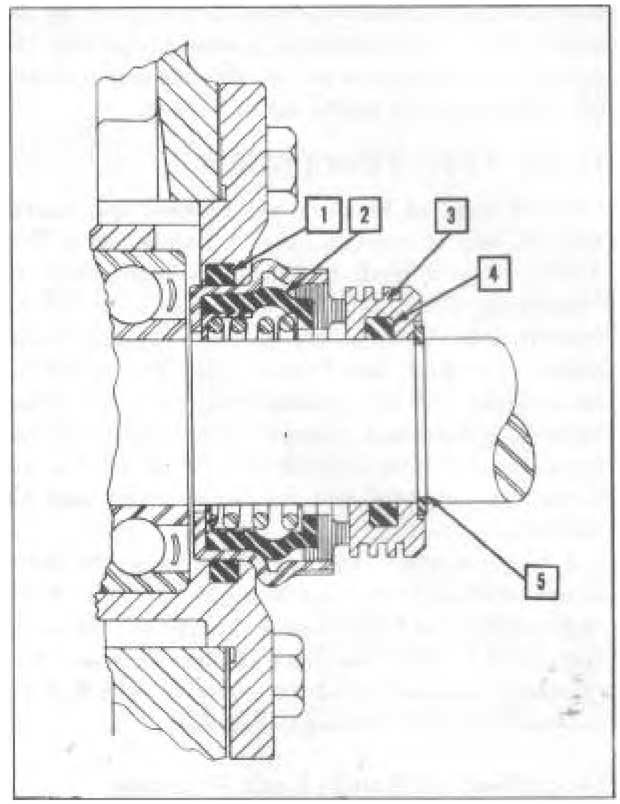
To replace the seal parts, use the following procedure:

Run the compressor for a short period. This will warm up the compressor and the crankcase oil will contain a minimum amount of refrigerant. Shut off system and engine. Close or "Seat" the service valves to the lines, stems all the way in. This isolates the compressor from the system and the charge is held in the system and is not lost. A minimum amount of refrigerant will be present in the compressor.

Loosen the gauge port cap on the discharge service valve and bleed the refrigerant vapor from the compressor. Tighten port cap after pressure is relieved.

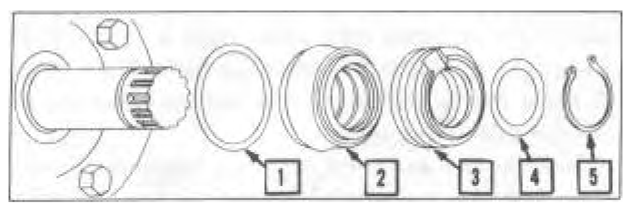
Remove the suction and discharge service valves from the compressor, leaving the line valves on their respective lines. Move the lines aside.

Remove the compressor and place on bench.



1. **Bearing End Plate "0" Ring**
2. **Seal Bellows Assembly**
3. **Seal Seat**
4. **Seal Seat and Shaft "0" Ring**
5. **Snap Ring**

FIGURE 30—*Compressor Shaft Seal Assembly*



1. **Bearing End Plate "0" Ring**
2. **Seal Bellows Assembly**
3. **Seal Seat**
4. **Seal Seat and Shaft "0" Ring**
5. **Snap Ring**

FIGURE 31—*Components of Seal Replacement Kit*

Install plastic plugs in the inlet and outlet holes in the compressor, or cover with masking tape to exclude air.

Remove the clutch and pulley from the compressor shaft.

Tilt compressor backwards to prevent loss of oil while performing the following operations:

A pair of reverse "Truarc" pliers are necessary to remove the shaft snap ring. The seal ring seat can be removed either by hand or if tight on shaft, pry off with a screw driver

The seal bellows can be removed by forcing a screw driver behind the brass stamped flange at various points and prying it out of the seal plate. Remove the neoprene "0" ring from the seal plate. Discard seal bellows and "0" ring.

Wash the seal plate and shaft with a clean cloth and solvent, and coat both with clean refrigerant oil.

Dip the new "0" ring in clean refrigerant oil and install in seal plate.

Press the seal bellows assembly into place. It is not a metal to metal press fit, but rests only on the neoprene "0" ring in the seal plate and must go in perfectly square and the flange must bottom all the way around against the seal plate.

Wash the seal seat in clean solvent and dry with a clean cloth. Dip in clean refrigerant oil with the neoprene "0" ring in place. Press onto shaft evenly with the lapped surface toward the compressor body. After the seal face is over the spline of the shaft, install the snap ring over the spline using reverse "Truarc" pliers. Do not spread the snap ring more than necessary. Slide the seal ring and snap ring together onto the shaft until the snap ring snaps into its groove in the shaft.

Install the flywheel and clutch plate. The cap screw lock plate is installed behind the flat washer in the clutch hub. Torque tighten the cap screw to 18-22 foot pounds torque and lock in place with lock plate.

Install the compressor on the mounting bracket; connect the magnetic clutch wire lead. Install belts and adjust brackets and/or idler shaft or power steering pump to tighten belt tension.

Install the suction and discharge service valves with the flexible lines intact to the compressor using new gaskets. Torque the valve body cap screws to 12 to 15 foot pounds torque.

The suction and discharge service valves remain closed. Remove gauge port caps and attach gauge manifold set and lines. The hand valve on the compound gauge is closed and the hand valve on the pressure gauge is open.

Start the engine and run the compressor for a minute or two to pump the air out of the compressor through the open hand valve and the center gauge line. After the compressor and engine are stopped, "crack" the suction service valve slightly to force what air is in the cylinder head out of the compressor with Freon gas.

Close the hand valve on the pressure gauge. "Crack" both service valves; operate and check system for pressures and normal operation.

After running the compressor for 10 or 15 minutes, shut off system and check for leaks with Halide Leak Detector. Oil around the seal at this time does not indicate a seal leak as there is a considerable amount on the new parts when installed.

CAUTION: *Do not put pressure on the crankcase unless the pulley and clutch is held firmly in place by the spacer, cap screw, and lock plate. Excessive crankcase pressure and a defective snap ring will allow the seal to be blown out of the compressor.*

NOTE: *Cleanliness, careful handling, and clean refrigeration oil on all parts are important for successful seal replacement.*

Crankcase Oil Check Valve

There is a small self-operating check valve between the passage where the refrigerant gas enters the compressor and the crankcase. Some oil circulates through the entire system when the compressor is running. Oil returning with the suction gas from the evaporator opens the check valve and flows directly into the crankcase and the refrigerant gas flows upward to reduce the amount of oil pumped out of the compressor after a prolonged idle period. Oil and Freon-12 are miscible, each in the other and during such periods, the oil in the crankcase absorbs some refrigerant. When the compressor is started under such conditions, the check valve is closed to a small orifice by the crankcase pressure so that the pressure reduces slowly, minimizing foaming of the oil and the consequent oil pumping.

Service Diagnosis of Compressor

An inefficient compressor is one in which either or both the suction valve or discharge valves leak. Both suction and discharge valves must seat properly to insure efficient operation to have a compressor that is functioning up to its capacity. The symptoms of inefficiency vary with the extent of trouble.

A compressor should be warm when testing as a cold compressor is not operating at its greatest efflciency. Turn the compressor over by hand. A definite compression should be noted. However, upon turning over at the top of the compression stroke, there should be no tendency of the flywheel to follow around. If it does follow around, a discharge valve leak is indicated. As a further test, with no refrigerant in the system, attach compound gauge to gauge port and close the compressor suction service valve. Run the compressor for intermittent intervals of a few seconds duration and allow to rest for a minute or so in between. This will allow the Freon to separate from the oil in the crankcase. This also will reduce the crankcase pressure. After this has been done, run a vacuum check. If this procedure is not followed, false reading may indicate valve weakness and crankcase oil may be pulled out. The rapidity with which the compressor can pump a vacuum determines its efficiency. In general, a good compressor will pump down to a 12" or 18" vacuum or better.

A further test is to start the system with a pressure gauge in place on the discharge service valve. Close the valve; pump a pressure of 150 to 200 pounds into the gauge. This pressure will be pumped rapidly.

Shut off as soon as 200 pounds is reached. If the pressures hold, the discharge valve is good.

Inability of the compressor to build up to or hold normal pressures, while the system is operating, would also indicate inefficiency. This is, of course, if the charge is known to be correct and no air, moisture, or dirt is in the system.

Compressor Valve Plate and Valve Replacement

A check should be made of the compressor valves to determine whether or not to replace them. The compressor should be run so that the crankcase is warm and comparatively free of refrigerant. Run the engine at slow idle speed; close the suction service valve by turning the valve stem in until it seats. The suction pressure should show 12" to 18" vacuum in a short time. Shut off the compressor and engine. The suction vacuum will rise a few inches quickly if the discharge valves are not holding. The above vacuum cannot be reached if the suction valves are not holding.

A valve replacement kit available for service replacement is illustrated in Figure 32.

To replace a defective valve plate assembly, close the discharge line valve and suction line valve, isolating the compressor from the rest of the system.

Loosen the gauge port cap on the discharge service valve and slowly release the gas in the compressor to the atmosphere until there is no pressure present.

Remove the cylinder head bolts and tap the cylinder head and valve plate to loosen and remove.

Remove and discard all gaskets and clean gasket surfaces.

Examine the cylinder walls and top of pistons if there has been any valve breakage. The compressor should be replaced if there are any scores or marks.

Always use new gaskets. Before assembling, dip in clean refrigerant oil.

Replace the suction valve leaves with the leaves included in the replacement kit. Dip the valve leaves in clean refrigerant oil.

Install the suction valve leaves on pins on bottom side of new valve plate.

The discharge valves are furnished installed on the valve plate.

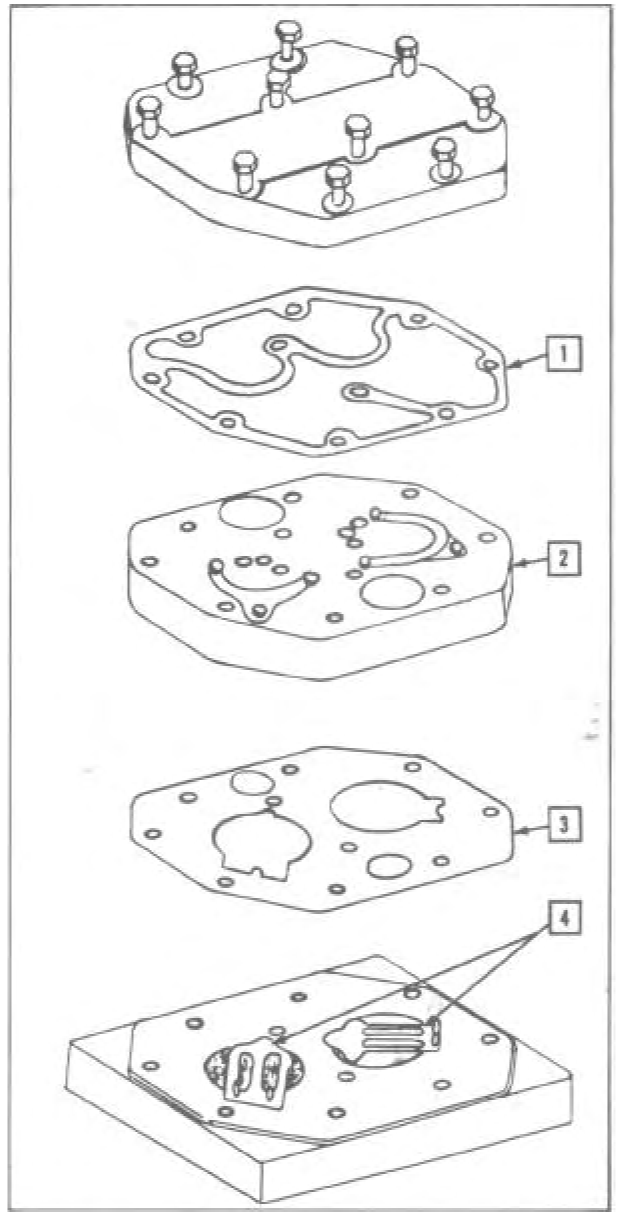
NOTE: Due to the position of the compressor in the V-8 Series, it is necessary to assemble the parts on a bench and install to the compressor as a unit. Be certain the suction valves are in place on the pins of the valve plate when installed.

Install the valve plate gasket.

Install the valve plate with suction valves in place on compressor.

Install cylinder head gasket, cylinder head, and cylinder head bolts. Torque tighten the cylinder head bolts to 15-20 foot pounds torque.

The suction and discharge service valves remain closed. Remove gauge port caps and attach gauge manifold set and lines



1. **Valve Plate Gasket**
2. **Valve Plate Assembly Includes Discharge Valve Already Installed and Suction Valve Guide Pins in Place on Bottom of Plate**
3. **Cylinder Head Gasket**
4. **Suction Valve Leaf (2)**

FIGURE 32—*Valve Plate Kit and Assembly Sequence*

The hand valve on the compound gauge is closed and the hand valve on the pressure gauge is open. Start the engine and run the compressor for 2 to 5 minutes to pump the air out of the compressor, through the open hand valve and center gauge line. After the compressor and engine are stopped, "crack" the suction service valve slightly to force what air is in the cylinder head out of the compressor with Freon gas.

Close the hand valve on the pressure gauge. "Crack" both service valves, operate and check system for pressures and normal operation. Remove gauges, replace port caps and check entire compressor for leaks.

NOTE: *If during evacuation, the compressor is discharging after two minutes, it indicates considerable refrigerant absorbed in the oil or there is a leak. Test for leaks and again evacuate. Do not continue to evacuate if a leak is present as moist air may be brought in to the compressor. Repair leak and test again.*

Although a test indicates a leaky valve plate, unless the valve plate has been damaged or has been in service a long time, dirt or foreign particles in the system will cause valve plates to appear faulty. Check the oil to see if the system is clean. Dirt small enough to go through the suction screens can cause valve trouble. Valve plates that appear good may be made to function properly by washing in clean solvent and drying with dry air or clean cloth.

Compressor Removal to Perform Engine Repairs

Clean dirt, oil, or any foreign matter from around the service valves.

Close both service valves; this isolates the compressor from the system and leaves the system sealed from the atmosphere. Loosen gauge port cap on discharge service valve and allow gas to escape from compressor slowly.

Remove service valve assemblies from compressor. The lines, both low and high pressure, are still attached to the service valves.

The service valves with the lines attached are shifted carefully to one side.

Loosen compressor belt adjusting lever screw and/or idler shaft adjusting link screw. (If equipped with power steering, the adjusting link is the same as for the idler shaft.)

Remove compressor belt from the compressor pulley and/or idler shaft or power steering pulley.

Remove the compressor from the compressor mounting bracket.

The compressor and idler shaft or power steering bracket can be removed from the engine.

Upon installation, new gaskets are necessary between the service valve assembly bodies and compressor.

After the compressor is reinstalled, purge air from the compressor and operate system.

Check oil level and the charge. Add charge if necessary although if the operation is performed properly, the amount of gas bled from the compressor is small.

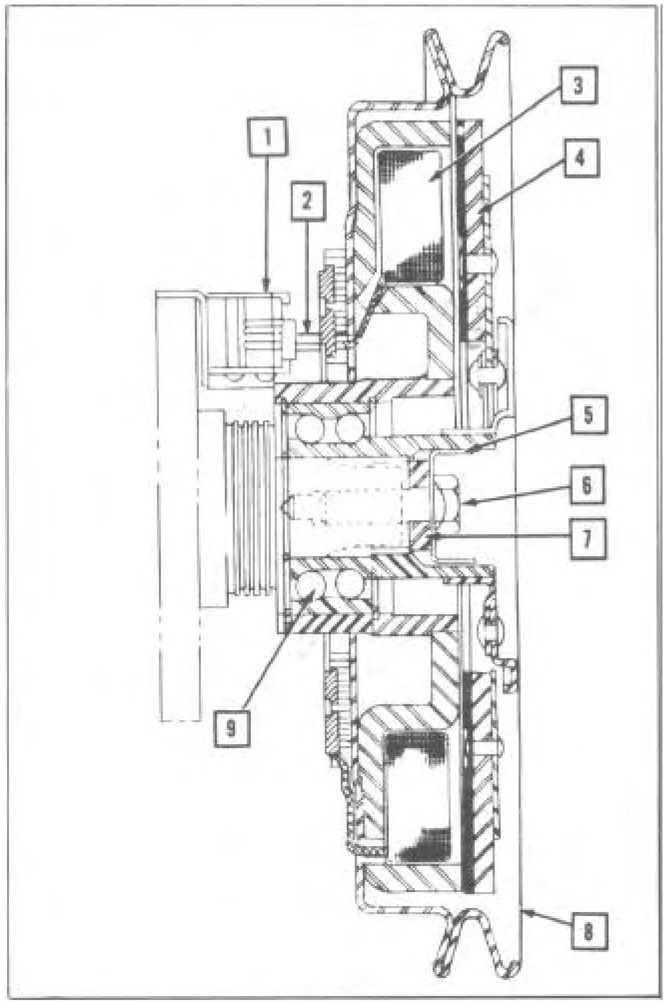
NOTE: *Be sure to close service valve openings on compressor while it is off the car. Plastic plugs or tape will serve to cover the openings.*

The above procedure would also apply in event the compressor is to be replaced by a new unit. Purge air from compressor. Check oil level and charge. Proper oil level may be determined by referring to "Checking and Adding Oil" section.

Magnetic Clutch and Flywheel Removal

Loosen the compressor adjusting lever screw and/or idler shaft and remove compressor belt.

The compressor mounting bolts are removed to allow the unit to be moved without shutting off lines, bleeding, or removing valves. The movement required should be enough to allow removing the magnetic clutch assembly 1 Fig. 33.



1. **Bracket and Brush Holder**
2. **Contact Brush, Live Lead**
3. **Electromagnet**
4. **Clutch Plate and Facing**
5. **Retaining Screw Lock Plate**
6. **Clutch Plate Retaining Screw**
7. **Washer**
8. **Compressor Pulley**
9. **Double Row Ball Bearing, Center Bearing**

FIGURE 33—*Magnetic Clutch and Compressor Pulley*

The pulley and center bearing are a tight fit on the crankshaft of the compressor.

The brush holder bracket of the magnetic clutch is mounted on the front bearing and seal plate of the compressor.

The clutch plate is adjusted to prevent contact with the magnetic pulley while the compressor is not running. Shims .010" thickness are available to make this adjustment. The air gap between the clutch plate and pulley should be .010" to .040". The liter type clutch plates have three adjusting screws and lock nuts to accomplish this adjustment.
The clutch plate cap screw is torque tightened 18 to 20 foot pounds torque and locked in place with the lock plate.

Discharge Line Muffler Removal "Rambler" Series

Clean all connections of dirt and oil. Discharge system.

Disconnect discharge line muffler from discharge service valve and cap valve.

Remove discharge line muffler support bracket from compressor mounting bracket.

Disconnect discharge line muffler from flexible high pressure line, plug line, and remove.

After installing a new discharge line muffler, install the gauge manifold set, evacuate and leak test the system. Charge the system. Start engine and operate system for 10 to 15 minutes to normalize the system.

Observe gauges and check pressures.

Condenser Removal and Replacement

The condenser is mounted on the radiator air baffles ahead of the radiator.

Clean all connections of dirt and oil. Then discharge the system.

Drain cooling system and remove the radiator from the car.

Disconnect the high pressure line from compressor to inlet connection of condenser. Use two wrenches of the proper size on these connections to prevent twisting the copper lines.

Remove the lower splash pan assembly.

Disconnect the outlet connection from condenser outlet to check valve manifold line.

Remove the condenser from its mounting on the radiator air baffles. For ease of removal, the condenser may be removed from below the car.

Upon replacement, install the gauge manifold set, evacuate, leak test, and charge the system. Run the engine at idle for 10 to 15 minutes to normalize the system. Observe gauges and check pressures for normal operation. Purge any air from the system by "cracking" or slightly opening the high pressure gauge to the center connection of the gauge manifold set and bleed the air to the atmosphere. This, of course, is done with the system shut down and not operating.

Receiver Removal and Replacement

The receiver is mounted on the right hand side of the front engine crossmember.

Clean all connections of dirt and oil and discharge the system.

Disconnect the connection from the check valve manifold line to receiver inlet.

Disconnect the connection from the receiver outlet.

Remove the receiver from the front engine cross-member.

Upon replacement, install gauge manifold set, evacuate, leak test, and charge the system.

Start the engine; operate the engine at idle for 10 to 15 minutes to normalize the system. Purge any air that may be present.

Observe the gauges and check system for normal operation.

Check Valve and Manifold Line

Removal and Replacement

Clean all connections of dirt and oil and discharge the system.

Disconnect the check valve manifold line connection from the receiver inlet.

Disconnect the connection at the condenser outlet.

Disconnect the connection at the solenoid by-pass line. The check valve and manifold is held in place by the above mentioned connections.

This unit will be serviced as an assembly. If the check valve proves to be faulty, replace the entire valve and manifold line. There will be no need to break the solder connections and replace the check valve only.

Install the valve with arrow on check valve in the direction of flow of refrigerant during normal refrigeration cycle.

Install gauge manifold set, evacuate, leak test, and charge the system.

Start the engine; operate at idle speed for 10 to 15 minutes to normalize the system. Observe the gauge to check the pressures. If the unit operates satisfactorily and the pressures are normal, the system is ready for use. If not, correct as necessary.

Solenoid By-Pass Valve Removal and Replacement

Clean the connections of any dirt and oil. Discharge system.

Disconnect wiring lead and flare nuts at the valve. Remove the valve from the panel.

Install new valve; make sure the arrow is in the direction of refrigerant flow.

Install connector to wire on valve. Check the valve by connecting jumper wire to battery and listen to see if valve clicks "On" and "Off".

Install gauge manifold set, evacuate, and leak test system. Install charge, start engine, and operate for 10 to 15 minutes to check operation and pressures.

Filter and Sight Glass Removal and Replacement "Hornet" and "Wasp" Series

The filter and sight glass are located on the right wheelhouse panel.

The filter provides protection against dirt in the system. A fine mesh screen catches dirt that might be circulating in the system. It may be necessary to remove it to clean the screen.

The sight glass provides a quick way of determining whether or not the refrigerant charge in the system is sufficient. A shortage of refrigerant will be indicated by the appearance of bubbles under the sight glass. A brass cap protects the glass.

Whenever replacement of sight glass or cleaning of the filter is necessary, proceed as follows:

Clean the connections of dirt and oil.

Discharge the system.

Disconnect the flare nut connections of the inlet side of the filter and on the outlet connections of the sight glass.

The filter is held in place on the wheelhouse panel by a metal clip. Remove the screws and remove the filter and sight glass.

After cleaning the filter or replacing the sight glass, install gauge manifold set, evacuate, and leak test the system. Install a new charge. Start engine and operate the system to observe operation and check pressures. Make whatever corrections are necessary.

"Rambler" Series

The "Rambler" Series sight glass (where provided) is located in the high pressure line on the left wheelhouse panel. Follow the procedure outlined in the previous section. The filter is located in the discharge line muffler. The fine mesh wire is a component part of the muffler. To clean the filter, the discharge line muffler must be removed.

Heat Exchanger "Rambler" Series

The heat exchanger is made up of portions of the high pressure line and suction line. To remove, the system must be discharged.

Clean all connections of dirt and oil.

Disconnect the four connections, two high pressure and two suction or low pressure, and cap lines

After installing new heat exchanger, install gauge manifold set. Evacuate the system and leak test. Install charge. Start engine and operate system and observe pressures and check operation of system.

Expansion Valve Removal and Replacement

No attempt should be made to adjust the expanison valve. Should the valve show malfunction upon diagnosis, replace the valve.

Discharge the system.

Remove the front cover from the housing on the "Hornet" and "Wasp" Series. Remove the two air ducts, evaporator damper cable and evaporator shroud on the "Rambler" Series.

The expansion valve is then accessible for service. Disconnect the high pressure inlet line connection from the expansion valve.

Disconnect the equalizer and outlet connection.

Note and mark the position of the power element or thermo-bulb on the suction line. When installing the replacement expansion valve, the thermo-bulb of the replacement valve must be attached in exactly the same location on the suction line.

The expansion valve is provided with flats upon which a wrench can be placed to help break a connection. Always use two wrenches of the correct size whenever breaking or tightening a connection.

After installing the replacement expansion valve, install the gauge manifold set; evacuate the system and leak test. Install new charge, start engine, and operate system for 10 to 15 minutes to normalize the system.

Observe the gauge, check the pressures, and the operation of the system.

Removal of the Evaporator (Cooling Unit) "Hornet" and "Wasp" Series

The evaporator is located in a retainer housing under the right hand side of the instrument panel. The retainer housing attaches to the dash panel directly behind the heater inlet and blower opening. To remove, proceed as follows:

Discharge the system.

Remove the front cover from the retainer housing.

Remove the glove box and the glove mounting panel. Remove the left hand air duct from its opening on the evaporator retainer housing.

Disconnect the high pressure inlet line at the expansion valve and also at the dash panel inside the engine compartment. Disconnect the suction line inside the engine compartment. Plug and cap all lines and expansion valve openings.

Remove the temperature control thermostat capillary tube from the bottom of the evaporator core.

Remove the screws on top outside of housing that hold the evaporator core in place in the retainer housing.

Remove the evaporator core from its housing.

The expansion valve can be removed after core has been removed from housing.

After installing the evaporator core, install gauge manifold set, evacuate, and leak test the system. Charge the system. Start the engine and operate the system for 10 to 15 minutes to normalize the system.

Observe the gauges and check the pressures.

"Rambler" Series

Remove evaporator damper control cable, two air ducts and evaporator shroud.

Remove water control valve cable from water control valve operating cam.

Disconnect high pressure inlet line at expansion valve.

Disconnect suction line from heat exchanger inside engine compartment at dash panel. Plug and cap all lines and expansion valve.

Disconnect temperature control thermostat wires.

Remove evaporator core from dash panel. The expansion valve can be removed on the bench.

After replacement of core, install the gauge manifold set, evacuate, and leak test the system.

Charge the system. Start the engine and operate system for 10 to 15 minutes to normalize system.

Observe gauges and check pressures.

Temperature Control Thermostat "Hornet" and "Wasp" Series

The temperature control thermostat is located on the top right hand side of the evaporator retainer housing; the capillary sensing tube is inserted through an opening in the bottom of the evaporator core into the coldest portion of the evaporator.

Approximately 5" of the sensing tube must be in between the fins of the evaporator core.

To remove the control thermostat, remove the evaporator cover.

"Rambler" Series

The temperature control thermostat is located on the right hand evaporator core side plate. The capillary sensing tube is inserted through an opening in the top of the evaporator core.

Approximately 5" of the sensing tube must be in between the fins of the evaporator core.

To remove the control thermostat, remove the right hand air duct. The thermostat is now accessible for removal.

Removal of Blower Fan and Motor "Hornet" and "Wasp" Series

Remove the heater hopper box cover. Remove air filter.

Drain a quart and a half of coolant from the radiator to flow the heater core to he drained.

Remove heater core.

Disconnect the wire leads to the blower motor on the outside of the blower housing at the resistor.

Remove the inlet ring on the right hand side of the heater hopper box.

Remove blower fan from the blower motor shaft. Remove fan through heater hopper box cover opening.

Remove the blower motor from the blower housing and remove through the heater hopper box cover opening.

"Rambler" Series

Disconnect wire lead to motor.

Remove blower motor housing support brackets from wheelhouse panel and dash panel.

Remove screws from blower motor mounting plate.

The blower motor and fan may be removed as an assembly from the blower motor housing. Any further service may be performed on the bench.

SERVICE DIAGNOSIS

To obtain full capacity performance of the air conditioning system, it is necessary that all components function properly.

Diagnosis of some of the components that may show malfunction are somewhat difficult to detect. The following describes the sequence and methods that might be used to determine whether the unit or part is functioning properly. Also outlined are some of the symptoms that will indicate malfunction of the system. Use the gauge set in diagnosis of the system.

The following chart may be used during a road test in diagnosing the system. The ambient temperatures and road speed given should be used when road testing the system. Should the temperature vary between those given in the chart, a mean average should be worked out.

Long copper tubes to replace the gauge lines should be fabricated to enable the operator to have the gauge set in the car. This way he can observe the gauges to check the pressures. The thermometers should be placed at the air discharge outlets.

"Hornet"

Speed	Ambient Temperatures	Average Discharge Air Temperatures	Head Pressure	Suction Pressure
30 M.P.H.	80°	47°	148	22
30 M.P.H.	85°	48°	150	22
30 M.P.H.	90°	50°	155	22
		"Wasp"		
30 M.P.H.	80°	52°	160	22
30 M.P.H.	85°	53°	180	22
30 M.P.H.	90°	54°	200	22
		"Rambler"		
30 M.P.H.	80°	45°	148	20
30 M.P.H.	85°	48°	160	20
30 M.P.H.	90°	53°	175	20

Expansion Valve

CHARGE LOST FROM THERMO-BULB: Should this occur, the valve will close tight and with the compressor operating, the suction pressure will pull down to a vacuum. Remove the thermo-bulb from the suction line and hold in hand; if no change in suction pressure is noted, the charge is lost.

FAULTY SUPER-HEAT SETTING: Cooling is adequate but frost-line moves past thermo-bulb. This could cause considerable damage due to the possibility of liquid reaching the compressor.

Moisture in system would be detected at the expansion valve by frost and suction pressure raising and dropping. When checking for moisture, energize solenoid by-pass valve so system will not by-pass.

Compressor

See Compressor section for checking the compressor.

Condenser

A condenser plugged with leaves, bugs, and dirt will not reject heat resulting in high head pressures. The owner must be informed to keep it clean.

Filter

A clogged filter will result in low suction pressure. The temperature of the refrigerant leaving the filter will be cooler than that entering. Expansion valve will hiss depending upon the degree of plugging.

Solenoid By-pass Valve

A faulty by-pass valve will not close or hold closed under pressure. This will be noted by lack of cooling. The refrigerant is being by-passed.

Temperature Control Thermostat

A faulty thermostat will not cycle the system. Install the gauge manifold set, place a thermometer at the discharge air outlet, and operate the system. Note the temperature. If the temperature drops well below 32°F. and remains there constantly, the thermostat is not cycling the system. At the same time, observe the gauges; if the system indicates cycling, the setting of the thermostat evidently is too low.

Upon cycling, the suction pressure rises and the discharge pressure drops. It is possible that they will partially equalize.

SERVICE DIAGNOSIS

DEFECT	CAUSE	CORRECTION
Low Suction Pressure	Low Charge	Add Charge
	Filter Plugged	Clean or Replace
	Liquid Line Plugged	Replace
	Expansion Valve Super-Heat Setting too High	Replace Valve
	Expansion Valve Thermo-bulb Charge Lost	Replace Valve
	Expansion Valve Port Plugged with Dirt or Moisture	Clean, Eliminate Moisture, or Replace Valve

SERVICE DIAGNOSIS (Continued)

DEFECT	CAUSE	CORRECTION
Low Suction Pressure (Continued)	Blower Fan Inoperative	Check Motors and Wiring
	Temperature Control Thermostat Does Not Cut-out	Replace Thermostat
	Moisture or Freeze-up	Open, Evacuate, and Recharge
	Expansion Valve	Replace
High Suction Pressure	Leaky or Broken Compressor Valves	Replace Valves
	Low Charge	Add Charge
	Clutch Slipping	Check Clutch and Wiring
	Loose Belts	Tighten
	Expansion Valve	Replace
Low Head Pressure	Low Charge	Add Charge
	Leaky or Broken Compressor Valves	Replace Valves
High Head Pressure	Condenser Air Passages Clogged	Clean
	Air in System	Purge
	Radiator Fan Belt Slipping	Replace or Tighten Fan Belt
	Excessive Charge	Bleed Excess
	Engine Over-Heating	Check Cooling System
	Restriction in Discharge Line	Replace Line
	Restrictions on Outlet Lines of Condenser	Clean or Replace Condenser
	Restriction in Check Valve	Clean or Replace
	Restriction in Receiver	Clean or Replace
	Expansion Valve Super-Heat Setting too Low,	Replace Valve
Compressor Noisy with Low Suction Pressure	Too Much Oil	Check Compressor Oil Level

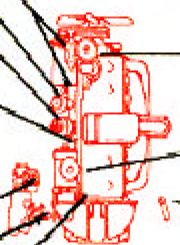
TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.

1955 "HORNET" 6 and V-8 Lubrication Service Chart

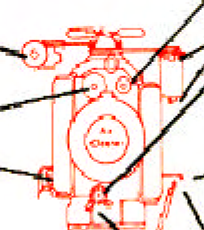
Lubricate at each arrow point every 1,000 miles except as noted

ENGINE COMPARTMENT



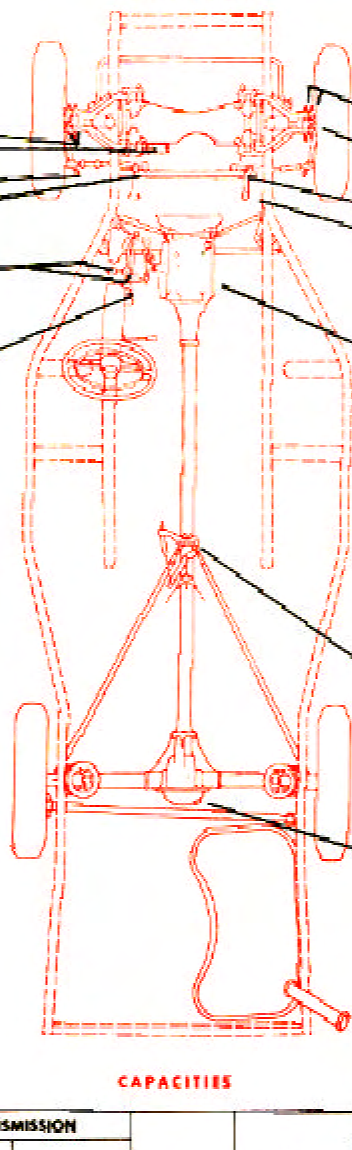
Generator (2 oilers)—every 2,000 miles **EO**
Oil Cap Filter—every 2,000 miles . . . . . **EO**
(Clean and re-oil)
Distributor—Every 2,000 miles . . . . **EO**
Cam, Wick Under Rotor, Breaker Pivot, and Shaft Oil Cup
CRANKCASE (check level) . . . . **EO**
Above +90° F. . . . . SAE 30
Not lower than +32° F. . . . . . . SAE 20
Not lower than +10° F. . . . . SAE 20W
Not lower than −10° F. . . . . SAE 10W
Below −10° F. . . . . SAE 5W
Drain and refill every 2,000 miles
Steering Gear (plug)—SAE 90 . . . . **EPL**
Every 3,000 miles
Gear Shift Control Lever (fitting) . . . . **CL**
Every 5,000 miles. Automatic transmission models, no lubrication
Throttle linkage . . . . **EO**

Air Cleaner
(Hornet 6) Replaceable element type. Follow label for service instructions
(Hornet V8) . . . . **EO**
Clean and re-oil at crankcase drain intervals or follow instructions on label
Summer—SAE 50 Winter—SAE 20
Power Steering Reservoir (check level) . **ATF**
Fill to indicated level on ½" from top
Oil Filter—Where so equipped, replace element every 5,000 miles, 6-cylinder, 4,000 miles on V-8
Steering Gear (plug) . . . . **EPL**
Every 3,000 miles, SAE 90
Automatic Transmission (dip stick check level)



Oil Cap Filter—every 2,000 miles . . . . . **EO**
(Clean and re-oil)
Generator (2 oilers) . . . . **EO**
Distributor
Cam (coat surface lightly) . . . . **PJ**
Wick under rotor—initial lubrication at 2,500 and 5,000 miles. Every 10,000 miles thereafter . . . . **EO**
Breaker Pivot—every 10,000 miles. . **EO**
CRANKCASE (check level) . . . . **EO**
Above +90° F. . . . . SAE 30
Above +32° F. . . . . SAE 20, 20W
Above +10° F. . . . . SAE 20W
Above −10° F. . . . . SAE 10W
Below −10° F. . . . . SAE 5W
Drain and refill every 2,000 miles
Automatic Transmission (dip stick check level)
Throttle Linkage . . . . **EO**

UNDER CHASSIS



Control Arms (2 fittings on each side) . . . . **CL**
Clutch Beam Lever (fitting) . . . . **CL**
Not on automatic transmission models
Tie Rod (fitting on each side) . . . . **CL**
Pitman Arm (fitting) . . . . **CL**
Power steering models only
Clutch and Brake Pedal Shaft (2 fittings) . . . . **CL**
Automatic transmission (1 fitting)

Brake Master Cylinder (check level) . . . . **HBF**
Accessible through hole in floor

Power Brake Air Cleaner
Clean every 10,000 miles

Control Arms (2 fittings on each side) . . . . **CL**
King Pin (fitting on each side) . . . . **CL**
Drag Link (fitting on each side) . . . . **CL**
Steering Idler Arm (fitting) . . . . **CL**
Not on power steering models

TRANSMISSION (check level)
Synchromesh and Overdrive . . . . **MGL**
Above +32° F. . . . . SAE 90
Below +32° F. . . . . SAE 80
Drain and refill every 10,000 miles
Overdrive drained and refilled through separate plugs
Automatic . . . . **ATF**
Drain and refill every 25,000 miles

Hand Brake Bell Crank . . . . **EO**
Wheel Bearings (repack) . . . . **WBL**
Front, every 10,000 miles
Rear, when dismantled for other service reasons
DIFFERENTIAL (check level) SAE 90 . . . . **HGL**
Drain and refill every 10,000 miles

TIRE PRESSURE (COLD)
Front and Rear . . . . **24 Lbs.**

LUBRICANT SYMBOLS

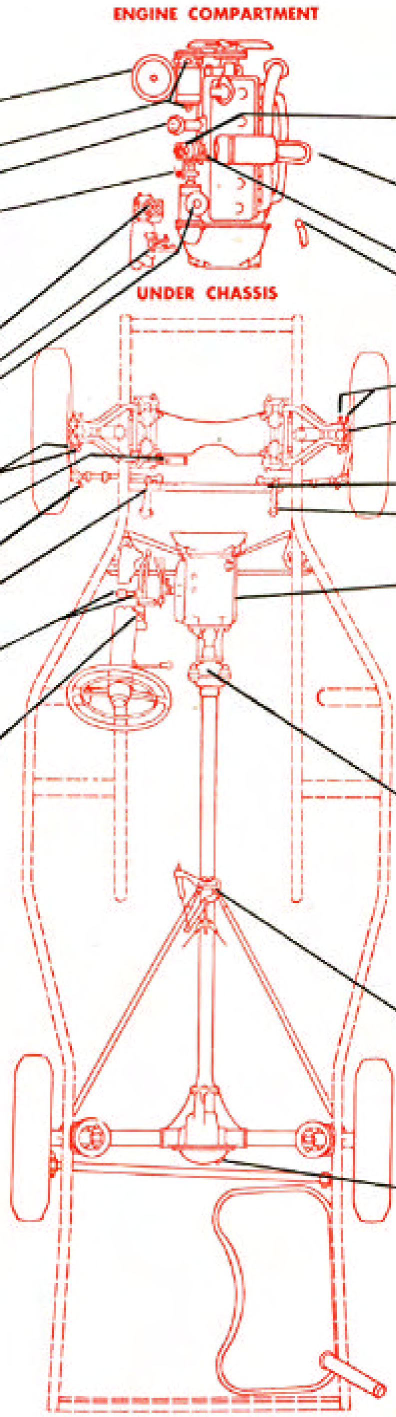
- **ATF** Automatic Transmission Fluid, Type A, AQ, ATF
- **CL** Chassis Lubricant
- **EPL** Extreme Pressure Gear Lubricant
- **MGL** Mineral Gear Lubricant
- **HBF** Hydraulic Brake Fluid, Lockheed 21B
- **HGL** Hypoid Gear Lubricant—Suitable Type
- **EO** Engine Oil
- **WBL** Wheel Bearing Lubricant
- **PJ** Petroleum Jelly

CAPACITIES

MEASURE SYSTEM	CRANKCASE		TRANSMISSION			DIFFERENTIAL	COOLING SYSTEM				GAS TANK
	"Hornet" 6	"Hornet" V-8	Automatic	Synchromesh	With Overdrive		"Hornet" 6 With Heater	"Hornet" 6 Without Heater	"Hornet" V-8 With Heater	"Hornet" V-8 Without Heater	
	Quarts	Quarts	Quarts	Pints	Pints	Pints	Quarts	Quarts	Quarts	Quarts	Gallons
U.S.A.	7	5	11	2.25	3.50	4	19.5	18.5	28	27	20
British Imperial	5.8	4.2	9.2	1.9	2.9	3.3	16.2	15.4	23.3	22.5	16.7

1955 "WASP" Lubrication Service Chart

Lubricate at each arrow point every 1,000 miles except as noted



Power Steering Reservoir (check level) . . . . **ATF**
Fill to indicated level or ½" from top

Generator (2 oilers)—every 2,000 miles . . . . **EO**

Oil Cap Filter (clean and re-oil)—every 2,000 miles . . **EO**

CRANKCASE (check level) . . . . **EO**
- Above +90° F. . . . . SAE 30
- Not lower than +32° F. . . . . SAE 20
- Not lower than +10° F. . . . . SAE 20W
- Not lower than —10° F. . . . . SAE 10W
- Below —10° F. . . . . SAE 5W
- Drain and refill every 2,000 miles

Steering Gear (plug)—every 3,000 miles. SAE 90 . . . **EPL**

Gear Shift Control Lever (fitting)—every 5,000 miles . . **CL**
Hydra-Matic models, no lubrication

Oil Filter—Where so equipped, replace element every 5,000 miles

Control Arms (2 fittings on each side) . . . . **CL**

Clutch Beam Lever (fitting) . . . . **CL**
Not on Hydra-Matic models

Tie Rod (fitting on each side) . . . . **CL**

Pitman Arm (fitting) . . . . **CL**
Power steering models only

Clutch and Brake Pedal Shaft (2 fittings) . . . . **CL**
Hydra-Matic models (1 fitting)

Brake Master Cylinder (check level) . . . . **HBF**
Accessible through hole in floor

Power Brake Air Cleaner
Clean every 10,000 miles

Distributor—every 2,000 miles . . . . **EO**
Cam, wick under rotor, breaker pivot, and shaft oil cup

Air Cleaner—Replaceable element type.
Follow label for service instructions

Throttle Linkage . . . . **EO**

Hydra-Matic Transmission (dip stick check level)

Control Arms (2 fittings on each side) . . . . **CL**

King Pin (fitting on each side) . . . . **CL**

Tie Rod (fitting on each side) . . . . **CL**

Drag Link (fitting on each side) . . . . **CL**

Steering Idler Arm (fitting) . . . . **CL**
Not on power steering models

TRANSMISSION (check level)
- Synchromesh and Overdrive . . . . **MGL**
  - Above +32° F. . . . . SAE 90
  - Below +32° F. . . . . SAE 80
  - Drain and refill every 10,000 miles
  - Overdrive drained and refilled through separate plugs
- Hydra-Matic—Drain and refill every 25,000 miles . . **ATF**

Torque Tube Trunnion (fitting) . . . . **CL**
Every 5,000 miles

Hand Brake Bell Crank . . . . **EO**

Wheel Bearings (repack) . . . . **WBL**
Front, every 10,000 miles
Rear, when dismantled for other service reasons

DIFFERENTIAL (check level) SAE 90 . . . . **HGL**
Drain and refill every 10,000 miles

LUBRICANT SYMBOLS

- **ATF** Automatic Transmission Fluid, Type A, AQ, ATF
- **CL** Chassis Lubricant
- **EPL** Extreme Pressure Gear Lubricant
- **MGL** Mineral Gear Lubricant
- **HBF** Hydraulic Brake Fluid, Lockheed 21B
- **HGL** Hypoid Gear Lubricant—Suitable Type
- **EO** Engine Oil
- **WBL** Wheel Bearing Lubricant

TIRE PRESSURE (COLD)

Front and Rear . . . . **24 Lbs.**

CAPACITIES

MEASURE SYSTEM	CRANKCASE	TRANSMISSION			DIFFERENTIAL	COOLING SYSTEM		GAS TANK
		Hydra-Matic	Synchromesh	With Overdrive		With Heater	Without Heater	
	Quarts	Quarts	Pints	Pints	Pints	Quarts	Quarts	Gallons
U.S.A.	5	8.5	2.25	3.5	3	14	13	20
British Imperial	4.2	7.1	2.9	2.5	2.5	11.7	10.8	16.6

1955 *Rambler* Lubrication Service Chart

LUBRICATE AT EACH ARROW POINT EVERY 1,000 MILES EXCEPT AS NOTED

ENGINE COMPARTMENT

Distributor
Cam (coat surface lightly). . . . . **PJ**
Wick under rotor—every 5,000 miles . . . . . **EO**
Reservoir (plug). . . . . SAE 10W **EO**
Lubricate at time of overhaul

Steering Gear (plug)—
every 3,000 miles . . . . SAE 90 **EPL**

Throttle Bell Crank (fitting). . . . . **CL**
Hydra-Matic models only—every 5,000 miles

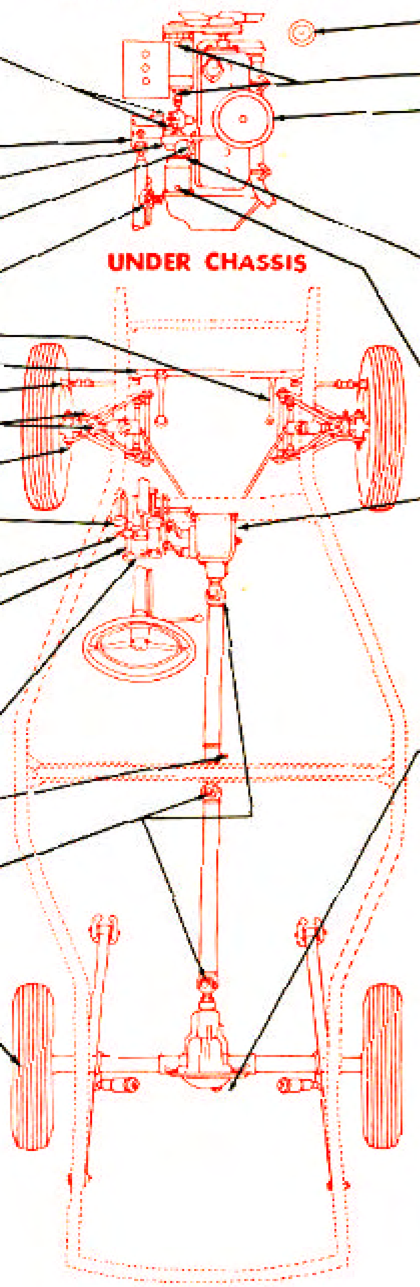
Throttle Linkage . . . . **EO**

Gearshift Control Lever (fitting)—
every 5,000 miles . . . . **CL**
Hydra-Matic models, no lubrication.

Oil Filter—Where so equipped,
replace element every 5,000 miles.

Generator (2 oilers)—every 5,000 miles . . . . . **EO**

Air Cleaner (clean and re-oil). . . . . **EO**
Oil Bath Type—every 5,000 miles. More frequently under severe conditions.
Summer—SAE 50
Winter—SAE 20
Wire Gauze Type—every 2,000 miles
Crankcase grade oil



UNDER CHASSIS

Steering Idler Arm (fitting) . . . . **CL**

Drag Link (fitting on each side). . . . . **CL**

Tie Rod (fitting on each side) . . . . **CL**

Control Arm, Upper (2 fittings on each side) . . **CL**

Control Arm, Lower (fitting on each side). . . . . **CL**

Brake Master Cylinder (check level). . . . . . . **HBF**
Accessible through hole in floor

Pedal Shaft (fitting). **CL**

Hand Brake Bell Crank. . . . . **EO**

Clutch Beam Lever (fitting). . . . . **CL**
Not on Hydra-Matic models

Universal Joint Spline (fitting) . . . . **CL**
On 4-door models without Hydra-Matic

Universal Joints (some models with fittings)
Use hand gun only . . . . SAE 140 **MGL**

Models without fittings require no repacking unless dismantled for other service reasons.

Wheel Bearings (Repack) . . . . **WBL**
Front, every 10,000 miles
Rear, when dismantled for other service reasons.

CRANKCASE (check level) . . . . **EO**
Above +32° F. . . . . SAE 20, 20W
Below +32° F . . . . SAE 10W
Sub Zero. . . . . SAE 5W
Drain and refill every 2,000 miles

Oil Cap Filter (clean and re-oil) . . . . **EO**

Starter (oiler)—every 5,000 miles . . . . **EO**

TRANSMISSION (check level)

Synchromesh and Overdrive . . . . **MGL**
Above +32° F. . . . . SAE 90
Below +32° F . . . . SAE 80
Drain and refill every 10,000 miles
Overdrive drained and refilled through separate plugs
Hydra-Matic. . . . . **ATF**
Drain and refill every 25,000 miles

DIFFERENTIAL (check level). . . . SAE 90 **HGL**
Drain and refill every 10,000 miles

TIRE PRESSURE (COLD)

Front and Rear. . . . . 24 lbs.

LUBRICANT SYMBOLS

ATF	Automatic Trans. Fluid, Type A, AQ-ATF
CL	Chassis Lubricant
EPL	Extreme Pressure Gear Lubricant
MGL	Mineral Gear Lubricant
HBF	Hydraulic Brake Fluid, Lockheed 21B
HGL	Hypoid Gear Lubricant—Suitable Type
EO	Engine Oil
WBL	Wheel Bearing Lubricant
PJ	Petroleum Jelly

DO NOT LUBRICATE

Rear Springs, Rear Spring Bolts and Shackles, Shock Absorbers

CAPACITIES

MEASURE SYSTEM	CRANKCASE	TRANSMISSION			DIFFERENTIAL	COOLING SYSTEM		GAS TANK
	Quarts	Hydra-Matic Quarts	Synchromesh Pints	With Overdrive Pints	Pints	With Heater Quarts	Without Heater Quarts	Gallons
U.S.A.	4	8.5	1.5	2.75	3	12	11	20
British Imperial	3.3	7.1	1.25	2.3	2.5	10	9.2	16.6

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes Information on Page No.