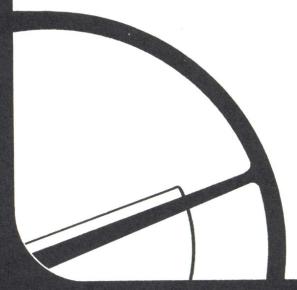
MASTER
TECHNICIANS
SERVICE
CONFERENCE

REFERENCE BOOK 69-2

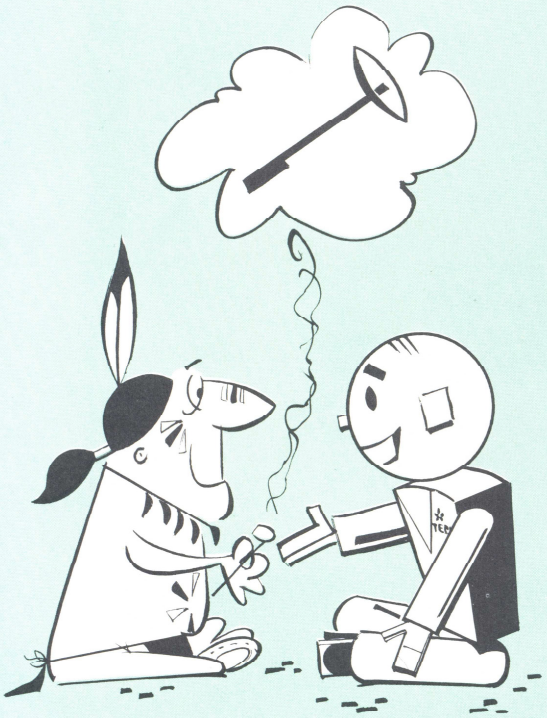


POWER STEERING

Pumps and Gears

PLYMOUTH
DODGE
CHRYSLER
IMPERIAL
DODGE TRUCK

CHRYSLER
MOTORS CORPORATION



POW-WOW ON POWER STEERING

The vast majority of power steering gears and pumps are remarkably dependable and trouble-free. That's why power steering diagnosis and repair isn't a high-volume service item in most dealerships. As a matter of fact, the only things that have to be checked periodically are pump drive belt adjustment and power steering fluid level. But nothing is absolutely foolproof and power steering troubles do crop up now and then to tax your diagnosis know-how and service skills. That's where this pow-wow on power steering comes in.

The information in this reference book will sharpen up your know-how and tip you off to the more common service pitfalls. The first section introduces you to the new roller-type power steering pump with its combination flow control and pressure relief valve. You are going to be seeing a lot more of these pumps this year so here's your chance to learn all about them *before* you have to take one apart.

The second section reviews power steering gear and steering control valve operation. This will be old stuff to many of you but, unless you do a lot of power steering gear work, it's easy to get rusty. You'll find this review is a good rust remover. The final section covers diagnosis, service highlights and precautions that will help you solve pump and gear problems that come your way. Here's where you'll find this timely information on power steering pumps and gears.

TABLE OF CONTENTS:

POWER STEERING PUMPS

Two different type power steering pumps will be used on 1969 Chrysler-built cars equipped with power steering. The .94-cubic-inch displacement pump has been used for several years. This vane-type pump is easily identified by its long, oval-shaped filler tube. The new 1.06-cubic-inch pump was introduced on late-production 1968 models and will be used on many 1969 models. It is easily identified by the threaded "puller" hole in the pulley-end of the pump shaft. Since this new pump is quite different from other pumps you have serviced, it will help to understand how it works and what precautions should be observed when servicing it.

THE ROLLERS DO THE PUMPING

The new 1.06-cubic-inch pump gets its name from twelve steel rollers which fit into twelve "V" grooves in the pump rotor. Functionally, these rollers replace the slippers or vanes used in other pumps you have serviced.

The rotor is driven by the pump pulley and the rotor and rollers rotate inside the elliptical cam ring. In operation, centrifugal force moves the rollers outward against the cam ring.

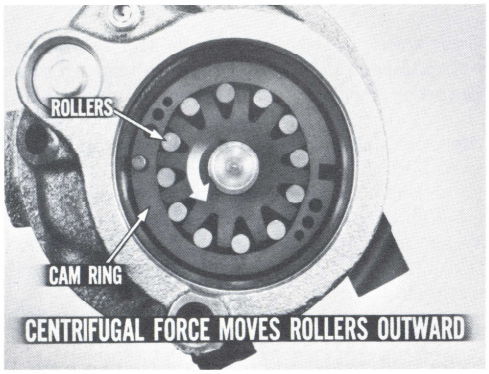


Fig. 1—The rollers follow the cam ring contour

INLETS AND OUTLETS COME IN PAIRS

This new pump has two pump inlets or low-pressure areas. The two inlets are opposite each other where there is a lot of room for the incoming fluid to fill the space between the roller, the "V" groove and the cam ring.

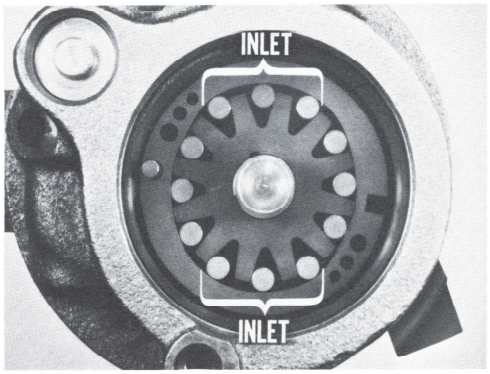


Fig. 2—The roller-type pump has two inlets

There are also two outlets or discharge ports. When the rollers reach these pressure points, the cam ring pushes the rollers into their "V" grooves. The rollers literally squeeze the pump fluid out of the "V" grooves and into the pump discharge ports.

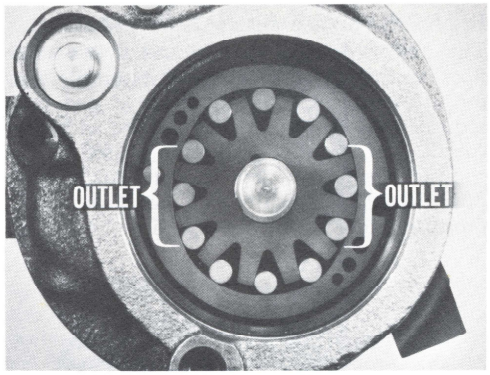


Fig. 3—Two outlets balance out radial loads

Since the two pressure areas are directly opposite each other, they balance out the radial loads on the rotor. As a result, there are no side loads on the pump shaft and bearings.

PUMP FLOW AND GEAR DEMAND

A power steering pump must deliver enough fluid under pressure at low engine speed to satisfy gear demand for parking and maneuvering at low speed. If pump output is low at

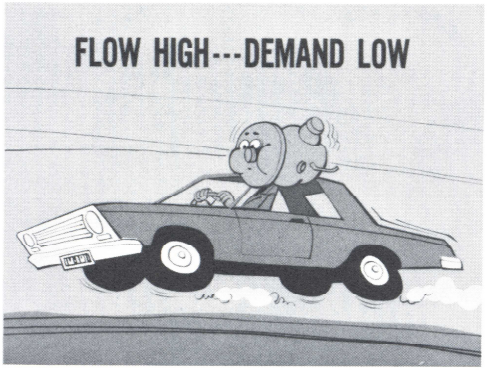


Fig. 4—Flow must be reduced at highway speeds

low engine speed the gear will "catch up" to pump output unless the steering wheel is turned quite slowly. On the other hand, a pump that has plenty of capacity for parking will have far too much flow at highway speeds. And, at highway speeds gear demand is very low. Excess flow at high speeds would waste engine power and overheat the power steering fluid and the entire power steering system.

THE FLOW VALVE IS THE MATCHMAKER

The new roller-type pump has a two-stage flow control valve which permits ample flow for full assist at low engine speed and then reduces flow to the amount needed at higher speeds. Incidentally, some pumps used by our competitors have a less efficient single-stage flow valve. This results in a significant compromise either at the low-speed end or at the high-speed end. Our new pump with its two-stage flow valve is a good feature of our power steering system. It matches pump flow to gear demand under all driving conditions.

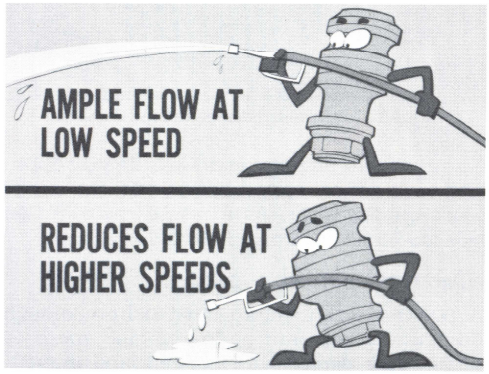


Fig. 5—Two-stage valve matches flow to demand

THE FLOW VALVE CONTROLS THE BYPASS

The flow control valve is a spring-loaded spool valve. It controls the amount of fluid which is returned to the inlet side of the pump. At low engine speed the entire pump output flows from the pressure chamber to the pump outlet and is supplied to the steering gear. Notice in the accompanying illustration (Fig. 6) that the flow control valve has closed the internal bypass completely.

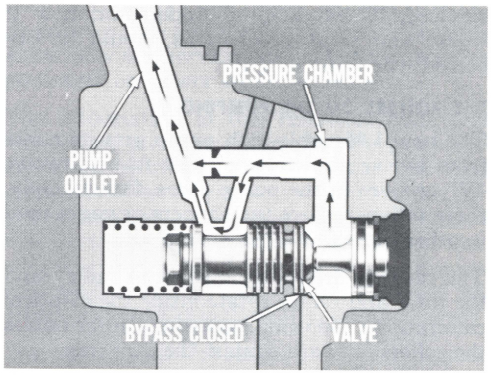


Fig. 6—Two passages from pressure chamber to outlet

This same illustration shows that there are two passages leading from the pump pressure chamber to the pump outlet. One passage, leading directly from the pressure chamber to the pump outlet has a pressure-dropping orifice. The second flow path leads into the spool valve bore and then back out to the pump outlet. This second passage also contains an orifice. When maximum flow is required, fluid flows through both of these passages on its way to the pump outlet.

PRESSURE DROP MOVES THE SPOOL VALVE

Refer to Figure 7 and note that there is a small passage through one end of the spool valve. This is a *pressure sensing port* leading to the chamber at the spring-end of the spool valve.

As pump speed and flow increases, pressure builds up at the plug end of the spool. However, there is a pressure drop across the two

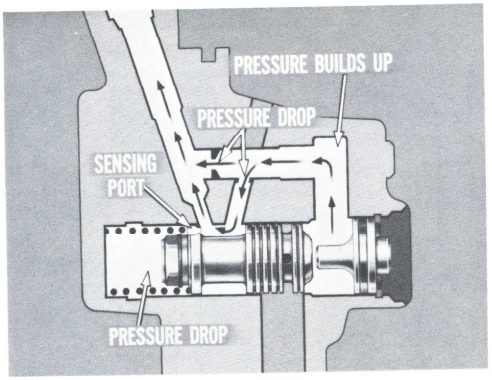


Fig. 7—Orifices cause pressure drop at end of spool

orifices in the two passages leading to the pump outlet. Because of the sensing port, this pressure drop is also reflected at the spring end of the spool valve.

When the pressure difference between the plug end and the spring end of the valve is great enough to overcome the spool valve spring, the spool moves far enough to uncover part of the bypass passage. Part of the pump output is returned to the pump inlet and flow to the gear is reduced. This is the first phase or stage of flow control.

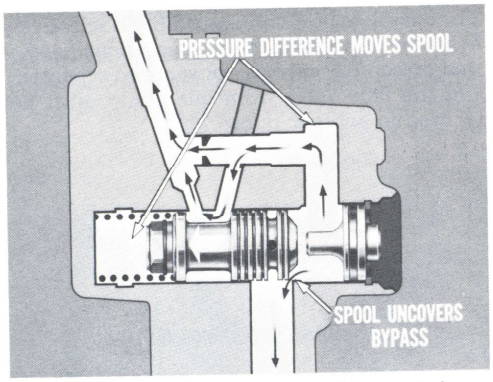


Fig. 8—Valve spool in first stage of flow control

THE SECOND STAGE KEEPS IT COOL

At still higher speeds and lower gear demand, the pressure difference at the two ends of the spool is even greater. This increased pressure difference moves the valve even more until one of the flow paths to the pump outlet is closed

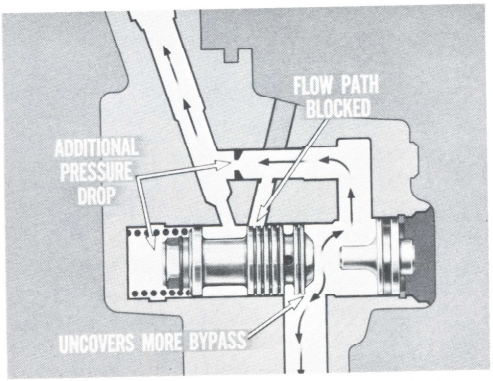


Fig. 9—Second stage position of flow control valve

off completely. The pressure drop across the orifice in the remaining flow path results in a correspondingly greater pressure drop at the spring-end of the valve. The spool moves even more, uncovering still more of the bypass. With the valve in this position, most of the pump output is returned to the pump inlet. Only the flow required for normal highway driving is supplied to the gear. As a result, there is no waste of engine power or unnecessary heating of the power steering fluid. This is the second stage of flow valve operation.

PRESSURE MUST ALSO BE CONTROLLED

A flow control valve limits the amount of flow to the gear but it doesn't control maximum pump pressure. If a pump tries to keep on pumping fluid into a closed chamber, pressure will build up unless it is relieved. For example, let's suppose the front wheels are turned as far as they will go and the power piston reaches its travel limit. If the driver keeps trying to turn the steering wheel, the steering control valve will try to send more fluid into the power steering gear. Since the piston can't move, pressure will build up in the power chamber of the gear until it reaches the opening pressure of the pump relief valve. Pump pressure must be controlled within design limits by the pressure relief valve under all operating conditions.

A NEW DOUBLE-DUTY VALVE

The new roller-type pump has a combination flow control and pressure relief valve. The pressure relief part of this valve is actually a triggering device which causes the flow control valve spool to limit pump pressure.

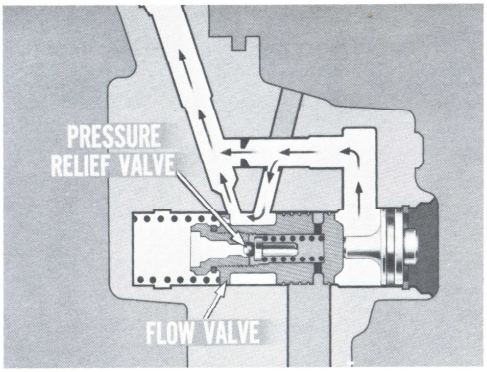


Fig. 10—Pressure relief valve inside the flow valve

The spring-loaded, ball-type pressure relief valve located inside the flow valve spool, is normally closed. As long as pump pressure doesn't exceed the pressure rating of the pump, the ball remains seated and the pressure relief valve doesn't affect flow valve operation in any way.

PRESSURE POPS THE RELIEF BALL

When pump pressure builds up to rated maximum, pressure at the spring-end of the flow control valve unseats the relief valve ball. When the ball is unseated, fluid from the spring end of the spool valve is dumped into the bypass passage.

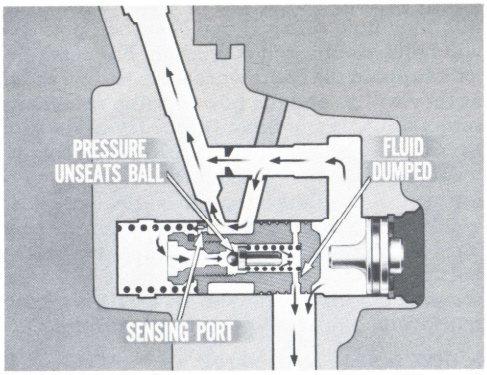


Fig. 11—Maximum rated pressure unseats relief ball

When pressure unseats the relief ball, fluid flows through the sensing port in the spool. The sensing port then becomes a pressure reducing orifice. The pressure drop across this orifice controls valve spool position to maintain rated pump pressure.

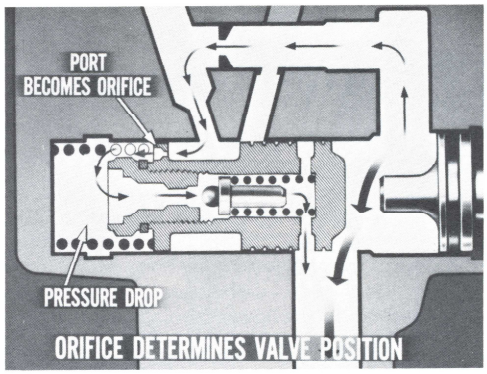


Fig. 12—Pressure drop across orifice triggers valve

This device for controlling maximum pump pressure is referred to as a trigger-type relief valve. Unseating the relief ball doesn't provide sufficient flow to relieve pressure. Instead, the pressure drop across the "trigger orifice" causes the flow valve spool to double as a pressure relief valve.

THE FLOW VALVE IS SERVICEABLE BUT NOT SERVICED

The complete flow valve assembly is selectively fit in the valve bore of the pump housing. For that reason the valve is not serviced separately and the flow valve from one pump must not be used in another pump.

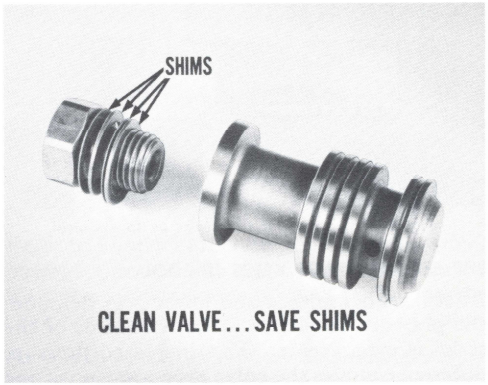


Fig. 13—Shims determine pump pressure rating

The flow control valve can be removed and completely disassembled for cleaning if necessary. However, the separate parts of the valve are not serviced. If a valve is disassembled for cleaning, the shims must be saved so they can be reassembled after the valve has been thoroughly cleaned. This is very important since the shims are used to obtain correct pressure calibration and only the original shims must be used when the valve is re-assembled.

The new pump is supplied in three different pressure ratings, depending on car model application. If you replace a pump, be sure and get the correct part number.

POWER STEERING GEARS

There isn't anything very mysterious or complicated about a power steering gear. Mechanically there is very little difference between a power steering gear and a manual steering gear. For all practical purposes, the power steering gear is a mechanical gear that has had a hydraulic power and a hydraulic control system added to it. Even if something happens to the hydraulic part of the power system, the driver still has manual control of the car.

WHEN THE WORM TURNS

Turning the steering wheel and wormshaft of a power steering gear moves the power piston up or down in exactly the same way that the wormshaft of a manual gear moves the ball nut up or down.

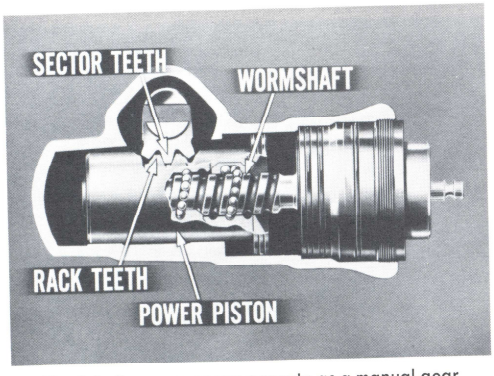


Fig. 14—Power gear can operate as a manual gear

Rack teeth machined into the power piston engage the cross shaft sector teeth. This gear arrangement changes up-and-down piston movement into cross shaft rotation. This is essentially the same as the relationship between the ball nut and the sector teeth of a manual gear.

Going one step further, cross shaft rotation moves the pitman arm in an arc and this motion is transmitted through the steering linkage to the front wheels of the car. So, mechanically, the operation of power and manual steering gears is essentially the same.

THE POWER PISTON DOES THE WORK

In a power steering gear, the steering gear housing is also the cylinder for the power piston. The power piston divides the cylinder into two separate chambers. Pressurizing one of these chambers provides the power assist. The steering valve, mounted on the gear housing, determines whether the pressure will be routed to the power chamber above the piston or to the chamber below the piston.

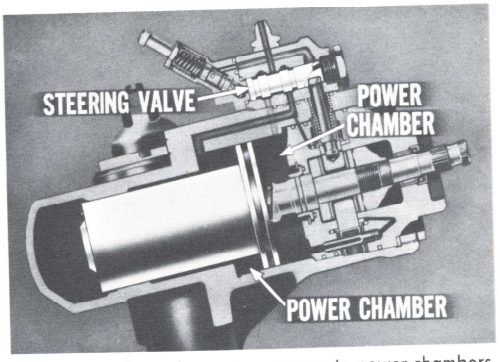


Fig. 15—Steering valve routes pressure to power chambers

ACTION AND REACTION

The pivot lever is the mechanical link between the steering valve and the wormshaft. In a right turn, for instance, a gear having a left-hand wormshaft tries to thread its way out of the power piston when the steering wheel is turned. As a matter of fact, the entire wormshaft does move upward a very small amount. This steering action and wormshaft reaction is used to control the steering valve.

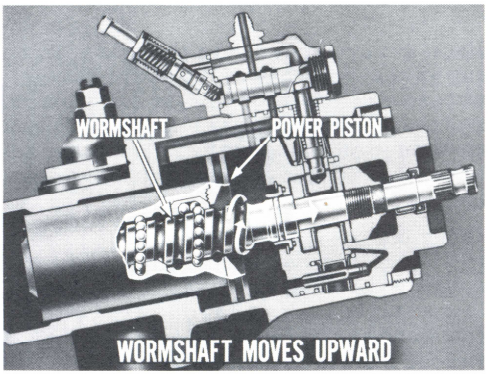


Fig. 16—Wormshaft reaction controls steering valve

With the exception of right-hand-drive cars for export, all current production cars use a power steering gear having a left-hand wormshaft. So, the wormshaft will move upward on a right turn; downward on a left turn. A closer look at the wormshaft thrust bearing and reaction area explains how this room for up or down wormshaft movement is designed into the gear.

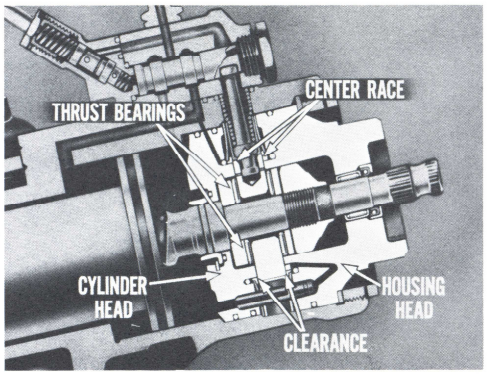


Fig. 17—Wormshaft bearing clearance allows movement

The wormshaft thrust bearings and spacer are sandwiched in between the cylinder head and the housing head. But, enough clearance is provided in this stack-up to allow the center race of the thrust bearing to move up or down a small amount.

A CLOSE LOOK AT THE PIVOT LEVER

The steering valve spool is connected by the pivot lever to the center race of the wormshaft thrust bearing. A ball-shape at the upper end of the pivot lever fits into a machined pocket in the spool valve. The lever pivots on another ball-shape and is connected to the bearing center race by a ball-shape at the lower end of the lever.

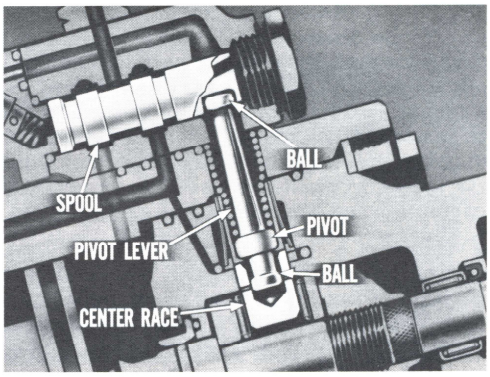


Fig. 18—Pivot lever multiplies wormshaft movement

It doesn't take much movement of the center race to move the steering valve spool quite a lot. Since the part of the lever above the pivot is about four times as long as the part below the pivot, the lever multiplies center race movement about four-to-one.

VALVE SPOOL LANDS CONTROL FLUID FLOW

Lands on the sliding spool of the steering valve open or close the ports leading to the power chambers above and below the power piston. The valve spool lands also open or close these ports to return flow to the pump reservoir.

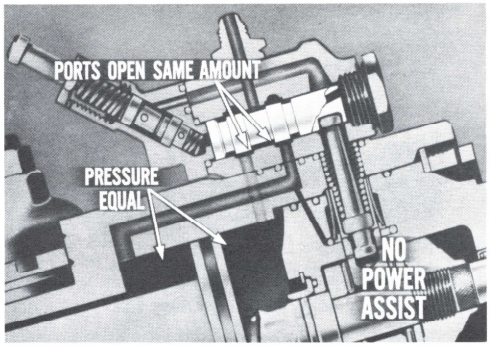


Fig. 19—Steering valve in centered position

As long as the valve spool is centered, both of the ports leading to the power chambers are open the same amount. The pressure is the same in both power chambers and there is no power assist.

THE STEERING VALVE TURNS THE POWER ON

When the steering wheel is turned in either direction the steering valve spool is moved off center and hydraulic power is applied to the piston. For example, turning the steering wheel to the left moves the worm and the center race of the thrust bearing downward. This causes the pivot lever to move the valve spool upward. The lower land closes the lower port to pump pressure and opens this same port to return flow. This reduces the pressure in the power chamber above the piston. At the same time, the upper land of the valve spool increases the port opening to pump pressure and restricts return flow through this port.

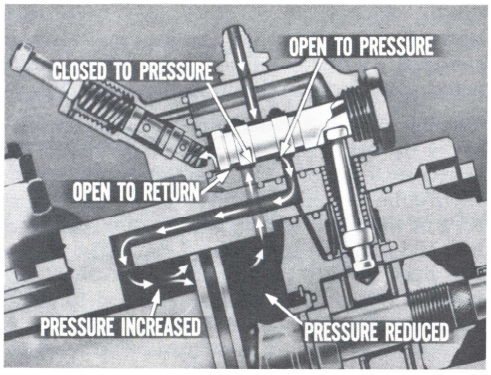


Fig. 20—Steering valve in left-turn position

Since there is great pressure below the piston and less pressure above the piston, hydraulic pressure tries to push the piston upward. This power assist continues as long as the driver turns the steering wheel and keeps the steering control valve off center.

When the steering wheel is turned to the right, the control valve moves down instead of up. Pressure is applied to the power chamber above the piston and the entire power-assist process is reversed.

MOST OF THE POWER ALL OF THE TIME

The Chrysler-built power steering system is truly full-time power steering since it provides power assist whenever the steering wheel is turned. Equally important from the standpoint of safety and driving pleasure, it is a constant-control design which provides a realistic feel of the road. The amount of power assist is always proportional to steering wheel effort required to control the turn. Heavy pressure on the steering wheel produces more power assist . . . less effort on the steering wheel results in less assist.

SPRINGS AND RINGS PROVIDE STEERING "FEEL"

It was pointed out earlier that the wormshaft and thrust bearing are free to move up or down a slight amount and this movement controls steering valve movement. In order to provide steering feel, resistance to this movement must be built into the gear. This resistance to thrust bearing movement is provided by a combination of reaction springs and reaction rings.

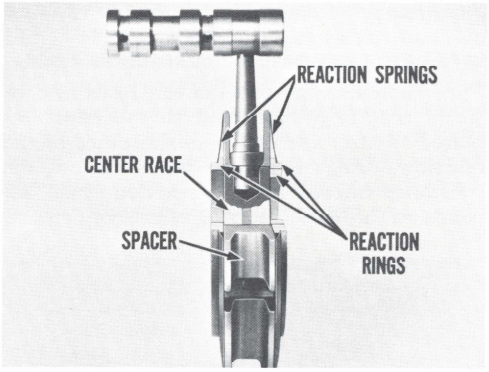


Fig. 21—Pivot lever and reaction area elements

The center race of the thrust bearing, a spacer and the pivot lever are sandwiched between the reaction springs and the reaction rings. The reaction springs provide the basic centering force acting on the center race of the thrust bearing. Figure 21 illustrates the arrangement of the principle reaction area parts.

REACTION SPRINGS PUSH ON THE RINGS

Notice in Figure 22 that the reaction springs do not bear directly against the center race. Instead, they bear against the reaction rings which in turn bear against the center race. When turning force on the steering wheel is

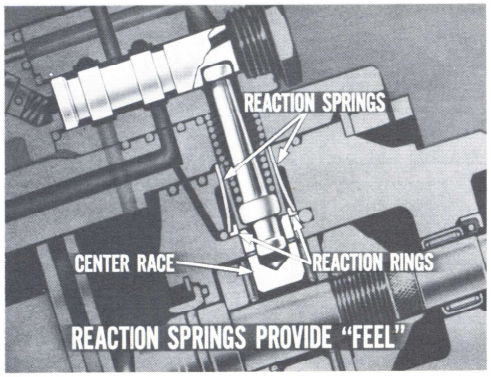


Fig. 22—Reaction springs bear on reaction rings

relaxed, the reaction springs center the bearing race and this returns the steering valve to the neutral or "no assist" position. The resistance of the reaction springs provides part of the very desirable feel built into the gear . . . but not all of it.

HYDRAULIC PRESSURE ON THE REACTION RINGS

The reaction rings provide the resistance or "feel" that is proportional to the effort required to steer the car. The resistance of the reaction springs is always the same but the resistance offered by the reaction rings depends on the actual steering effort required.

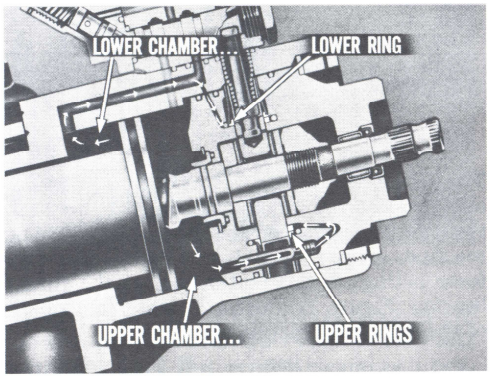


Fig. 23—Hydraulic pressure applied to reaction rings

Hydraulic pressure from the lower power chamber acts on the reaction ring below the bearing center race. Pressure from the upper chamber acts on the upper reaction rings.

When the steering wheel is turned and the steering valve is moved off center, there is more hydraulic pressure acting on one of the reaction rings. This extra pressure resists movement of the center race. This resistance is passed on to the steering wheel. Now remember, the more the road wheels resist turning, the greater the pressure developed in the power assist chamber and the greater the hydraulic pressure applied to the reaction ring opposing steering wheel movement. In this way, the reaction rings provide excellent steering feel which is always proportional to the steering effort required.

REACTION RINGS BALANCE THE SYSTEM

Pressure in the upper chamber is transmitted past the wormshaft and into the cavity inside the piston. Pressure inside this cavity pushes upward on the lower end of the wormshaft. Hydraulic pressure on the lower end of the wormshaft causes an inherent unbalanced condition which tends to move the center race upward . . . even when the steering valve is centered. If this condition were not counteracted, the gear would self-steer to the right.

The inherent unbalanced condition is compensated by using two reaction rings above the center race and only one reaction ring below it. Hydraulic pressure, acting on the additional area of the extra upper reaction ring, counteracts the inherent unbalanced condition. When the steering valve is adjusted correctly, there is no self-steering tendency, the resistance to steering wheel movement and power assist is the same on left and right turns.

THE BACK-PRESSURE VALVE

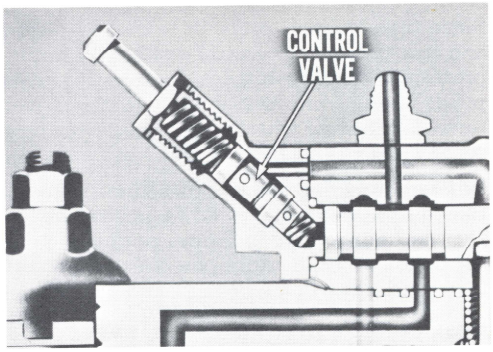


Fig. 24—The control valve is a back-pressure valve

So far we haven't mentioned the control valve. This is not the steering control valve but rather it is a pressure control valve attached to the steering valve body at its outlet. This is actually a back-pressure valve. It is designed to shut off return flow from the gear to the pump inlet until a minimum pressure of about 35 p.s.i. is reached. When this pressure is reached, the control valve opens and allows return flow from the gear to the power steering pump. This keeps the gear charged and under minimum pressure at all times.

DIAGNOSIS AND SERVICE HIGHLIGHTS

The diagnosis and repair information in your Service Manuals is very complete and easy to follow. Gear and pump disassembly and assembly is not difficult or complicated if you use the special tools available for servicing these units. There is no need to repeat the detailed service instructions contained in your Service Manuals. However, there are a few diagnosis and service highlights and sidelights that will help you avoid mistakes and costly comebacks.

COMMON-SENSE DIAGNOSIS

The power steering gear and pump are remarkably trouble-free. The power steering system seldom causes any trouble as long as correct fluid level and drive belt tension are maintained. When trouble does occur in the pump or the gear, the symptoms usually tell you whether the trouble is in the pump or in the gear itself.

FIRST THINGS FIRST

The first thing to figure out on any power steering diagnosis problem is whether the trouble is in the pump or in the gear. If there is no assist in either direction, the trouble is probably in the pump. At least, the trouble is most likely lack of pressure or flow. The obvious things to check are belt tension and fluid level. As a matter of fact, these two items should always be the first things checked on any power steering complaint.

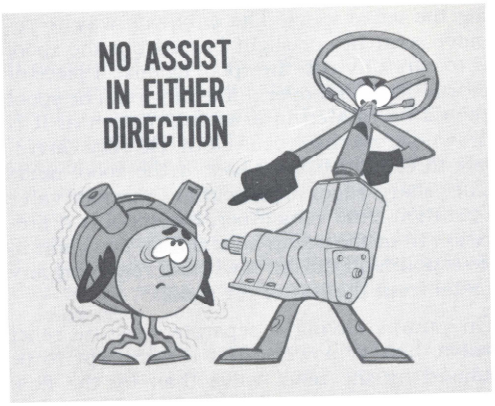


Fig. 25—When there's no assist, check the pump

IN CASE OF PUMP TROUBLE

If you are quite sure the trouble is in the pump, the first thing to suspect is the flow valve or the pressure relief valve. In the case of the new roller-type pump you'd suspect the combination flow and pressure relief valve. In other pumps these two valves are separate. If a flow or pressure relief valve sticks, it will stick in the open rather than the closed position. Pump pressure will invariably open a sticky or dirty valve but spring pressure won't be great enough to close it. The resulting complaint will be lack of assist in both directions.

SERVICING PUMP VALVES

Pump valves can be removed and cleaned. Care must be used to avoid nicking or scratch-

Fig. 26—Do not round off valve spool lands

ing the valve spool. The only safe way to remove scratches or slight burrs from the spool is to carefully rub the spool against a piece of crocus cloth laid over a flat surface. The spool should be rotated in a wiping motion as it is drawn across the crocus cloth. Be very careful not to round off the edges of the spool lands since sharp edges are essential to proper valve operation. And remember, the spool is a precision fit in the pump bore and all you want to do is polish off the burrs without removing any metal from the rest of the spool.

On pumps having a separate pressure relief valve, lack of power assist is more apt to be caused by the relief valve than by the flow valve. In the case of a sticking flow valve, speeding up the engine will usually provide normal assist if the pressure relief valve is okay. Probably the simplest and easiest way to check this out is to install a new pressure relief valve. If this solves the problem and there isn't any evidence of excessive dirt in the system, leave the new valve in and send the customer on his way. If the new pressure relief valve doesn't do the trick, you better disassemble the pump and look for the trouble elsewhere.

SELF-STEERING OR UNEQUAL ASSIST

Self-steering or unequal assist on right and left turns is most apt to be caused by a steering valve that is sticking or misadjusted. It is seldom caused by internal gear troubles and surely can't be caused by the pump.

Here is an easy way to adjust the steering valve. First, jack up the front of the car so that the front wheels are clear of the floor. Then, back off the steering valve body screws and retighten them to about 7 foot-pounds. With the engine running, tap the steering valve up or down until there is no self-steering. Don't forget to tighten the steering valve body screws to 200 inch-pounds.

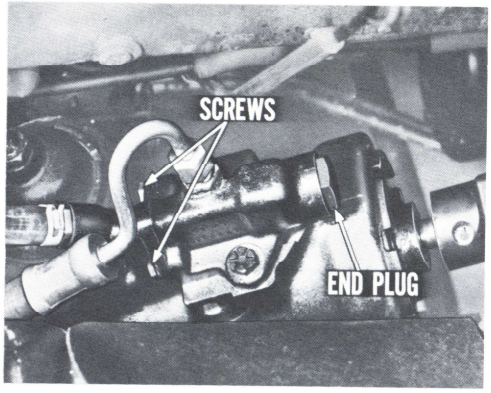


Fig. 27—Tap the body screws or the end plug

CAUTION: Do not turn the front wheels against their stops before you retighten the valve body screws or you will blow out the "O" ring seals. When adjusting the valve, tap the control valve body screws to move the valve up . . . tap the end plug to move it down. Do not tap on the control valve or steering valve body.

LUMPINESS OR BINDING

Lumpiness, tight spots or binding is usually not traceable to the gear or the pump. It is most often caused by some external binding or misalignment condition. Look for misalignment of the steering column or binding in the coupling at the lower end of the steering shaft.

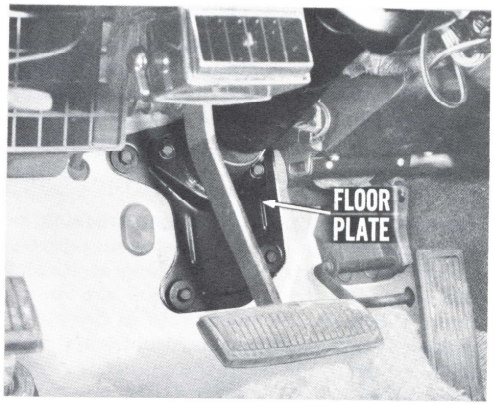


Fig. 28—Align the steering column correctly

If you follow the procedure outlined in the Service Manual for installing and correctly aligning the steering column, you won't have any trouble avoiding or correcting column alignment problems. Whatever you do, don't force or pry the floor plate at the lower end of the column in order to line up the plate with bolt holes in the toeboard. If the floor plate holes don't line up without use of force, something is out of line.

STEERING SHAFT COUPLING ALIGNMENT

The lower end of the steering shaft must be centered in the coupling so the gauge hole is 13/16" above the upper face of the coupling. An uncentered coupling can cause lumpiness, wander and returnability problems.

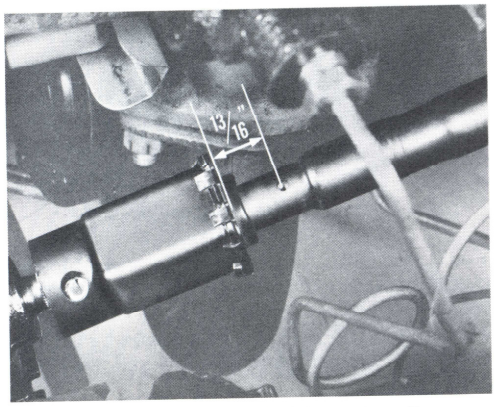


Fig. 29—Center steering shaft in gear coupling

PRESSURE-TESTING THE SYSTEM

Sometimes symptoms and common sense aren't accurate enough to pinpoint the cause of trouble. If you are not sure, follow the test procedure outlined in your Service Manuals to find out whether the trouble is in the gear or in the pump. Rather than repeat the step-by-step manual procedure, the following cautions and comments will help you make better use of these tests.

General Precautions: Test pressure specifications are based on steering fluid temperature of 150 to 170 degrees F. If fluid is cold, higher than normal pressure may be indicated and high fluid temperatures may give abnormally low pressure readings for a system that is okay. Don't guess at fluid temperature or engine speed. Use a reliable thermometer and tachometer. Do not close the test shut-off valve suddenly or leave the valve closed more than a few seconds when making pressure tests. When the shut-off valve is closed, temperatures increase very rapidly and this can cause damage.

Low-Speed Test: The purpose of this test is to make sure there are no abnormal restrictions anywhere in the hydraulic system. This checks out the possibility of internal as well as external restrictions to normal flow.

High-Speed Closed-Valve Test: The purpose of this test is to measure the pump's ability to develop specified pressure. If the pump passes this test, chances are the pump is okay and the trouble is in the gear. This can be checked out by using the "open-valve" test described below. If the pump does not develop specified pressure, the trouble is in the pump. However, it is more apt to be relief or flow valve trouble than actual pump wear . . . particularly on low-mileage cars.

High-Speed Open-Valve Test: This test is made with the shut-off valve *fully* open and the engine operating at 1,000 r.p.m. Pressure readings are taken with the steering wheel held hard over against the left-turn stop and then hard over against the right-turn stop. In effect, you are using the steering control valve and gear as a shut-off valve. Pressure readings with wheels in extreme left and right position should be equal. If these pressure readings are not equal, internal gear leakage is indicated and the gear must be removed and repaired. Also, if left-turn and right-turn readings are equal but considerably lower than pressure registered in the "Closed-Valve Test," internal gear leakage is indicated . . . probably past the piston ring, allowing flow between the two power chambers.

SERVICE SUGGESTIONS AND PRECAUTIONS

There have been very few changes this year in service procedures for power steering gears and pumps. Although the roller-type power steering pump was introduced late in the 1968 model year, only a limited number were used in last year's production. So, chances are that most of you are not familiar with this new pump. Before servicing one of these pumps, be sure and check the information in your 1969 Service Manuals. The following suggestions will help you avoid costly mistakes.

PUMP DISASSEMBLY PRECAUTIONS

Be sure and use the special puller (C-4068) to remove the pump drive pulley. This tool will make the job easier and you won't damage the pump or the pulley.

Pump disassembly is simple if you know how to go about it. Remove the reservoir and clamp the pump body in a vise with soft jaws . . .

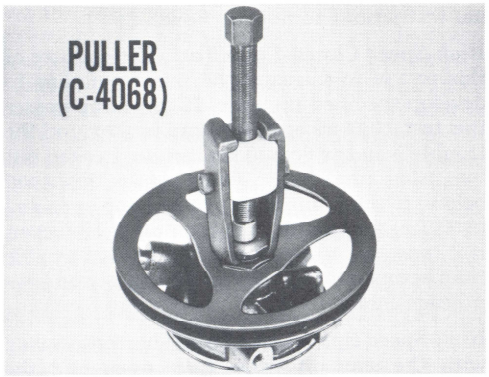


Fig. 30—Use the special puller to remove pulley

pump shaft down. This will make it easy to get at the end cover retaining ring.

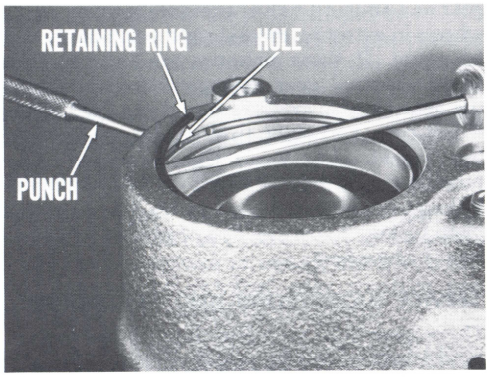


Fig. 31—Removing end-cover retaining ring

Here's the secret to removing the end cover retaining ring. Tap the ring around in its groove until one of its ends is opposite the small hole in the pump body. Use a pin punch to push the end of the ring out of its groove. After that you'll find it's easy to pry the ring out. The rest of the disassembly process is obvious and easy.

ASSEMBLING THE SEAL PLATE AND GASKET

Some very early production pumps had round seal plates and gaskets. These were replaced by "butterfly-shaped" gaskets and seal plates. When servicing a roller-type pump, only the butterfly-type gasket and the butterfly-type seal plate should be used.

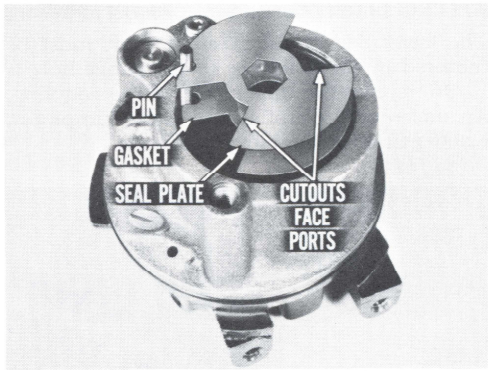


Fig. 32—Butterfly-type gasket and seal plate

You'll probably find it easier to assemble the pump if you put the dowel pin in first, followed by the seal plate gasket and the seal plate. Make sure the notch in the gasket and the notch in the seal plate are indexed with the dowel pin.

CAUTION: Make sure that the cut-out sections of the gasket and seal plate are adjacent to the intake ports of the pump body, otherwise they'll block off the intake.

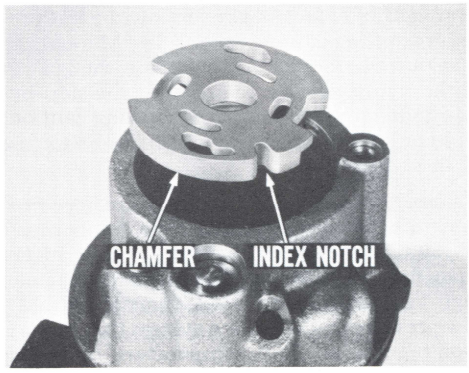


Fig. 33—Thrust plate chamfer faces downward

THRUST PLATE CHAMFER

When you assemble the thrust plate, make sure you put it into the bore chamfered edge first. And of course, the index notch in the thrust plate must line up with the dowel pin.

MACHINED NOTCH UP

Some cam rings have a formed notch in one

face and a machined notch in the opposite face. Other cam rings have only the machined notch. The machined notch in the cam ring must face upward when it is installed in the pump. On cam rings having two notches it is easy to tell which is the machined notch . . . it's the one having the sharp corners cut by a milling tool.

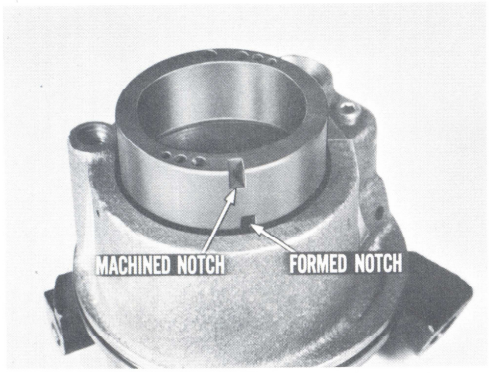


Fig. 34—Machined notch in cam ring faces upward

LUBRICATE AND SPIN THE ROTOR

After the rotor and rollers have been positioned in the cam ring, lubricate them with power steering fluid. Then spin the shaft to position the rollers properly. If this is not done, some of the rollers may not be perfectly upright in their notches. If any of the rollers are cocked even slightly, they will interfere with correct assembly of the pressure plate.

LINE UP THE PRESSURE PORTS

Before you install the pressure plate, make sure the dowel pin extends 3/16″ above the cam ring . . . it will if everything has been correctly assembled. Then, line up the index notch in the plate with the dowel pin. As a final check, look through the pressure ports in the pressure plate. If the plate is properly assembled you will be able to see all six pressure transfer holes in the cam ring . . . three through each port opening. If you can't see all six holes, you'll know you've slipped up someplace.

Before you assemble the pressure plate, lubricate the "O" ring with power steering fluid. Use a *clean* 1⅛″ socket and a plastic hammer to seat the pressure plate firmly against the cam ring. This is very important because the "O" ring on the pressure plate will offer considerable resistance to seating. If the plate is not seated, excessive clearance between the cam ring and the pressure plate will result in internal leakage and the pump won't prime.

DON'T PRESS ON THE PULLEY OR SHAFT

With this new pump you don't dare press the pulley onto the shaft. It doesn't take much of a push on the shaft to push the pressure plate away from the cam ring. If that happens, the end cover spring won't be strong enough to re-seat the pressure plate and the pump won't prime. Pressure plates have been unseated by bumping the end of the pump shaft when installing the reservoir—don't do it!

When installing a pulley, be sure and use the special tool provided for this purpose. Installer C-4063 will pull the pulley into place on the pump shaft without any danger of damaging the pump or causing excessive clearance between the cam ring and the pressure plate.

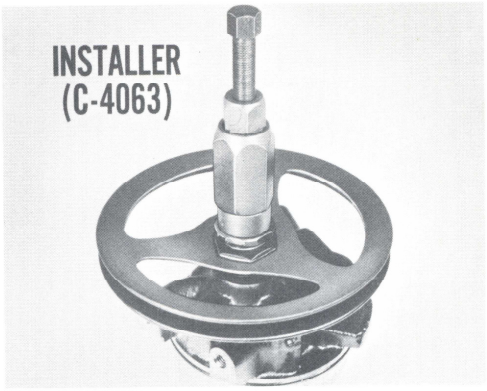


Fig. 35—Use the special pulley installing tool

LET'S KEEP IT CLEAN!

It is impossible to over-emphasize the importance of cleanliness when servicing a pump or steering gear assembly. Dirt is probably the greatest single enemy of any hydraulic system. Clean all parts carefully with solvent. When all parts are as clean as you can get them, rinse them in clean solvent. Don't use cloth or paper to dry parts. It doesn't take a very big piece of lint to stick a valve. Compressed air doesn't leave any lint! Dip each valve and small part in clean power-steering fluid just before you assemble it. This provides initial lubrication.

Master Technician

customer care

LITHO IN U.S.A.