

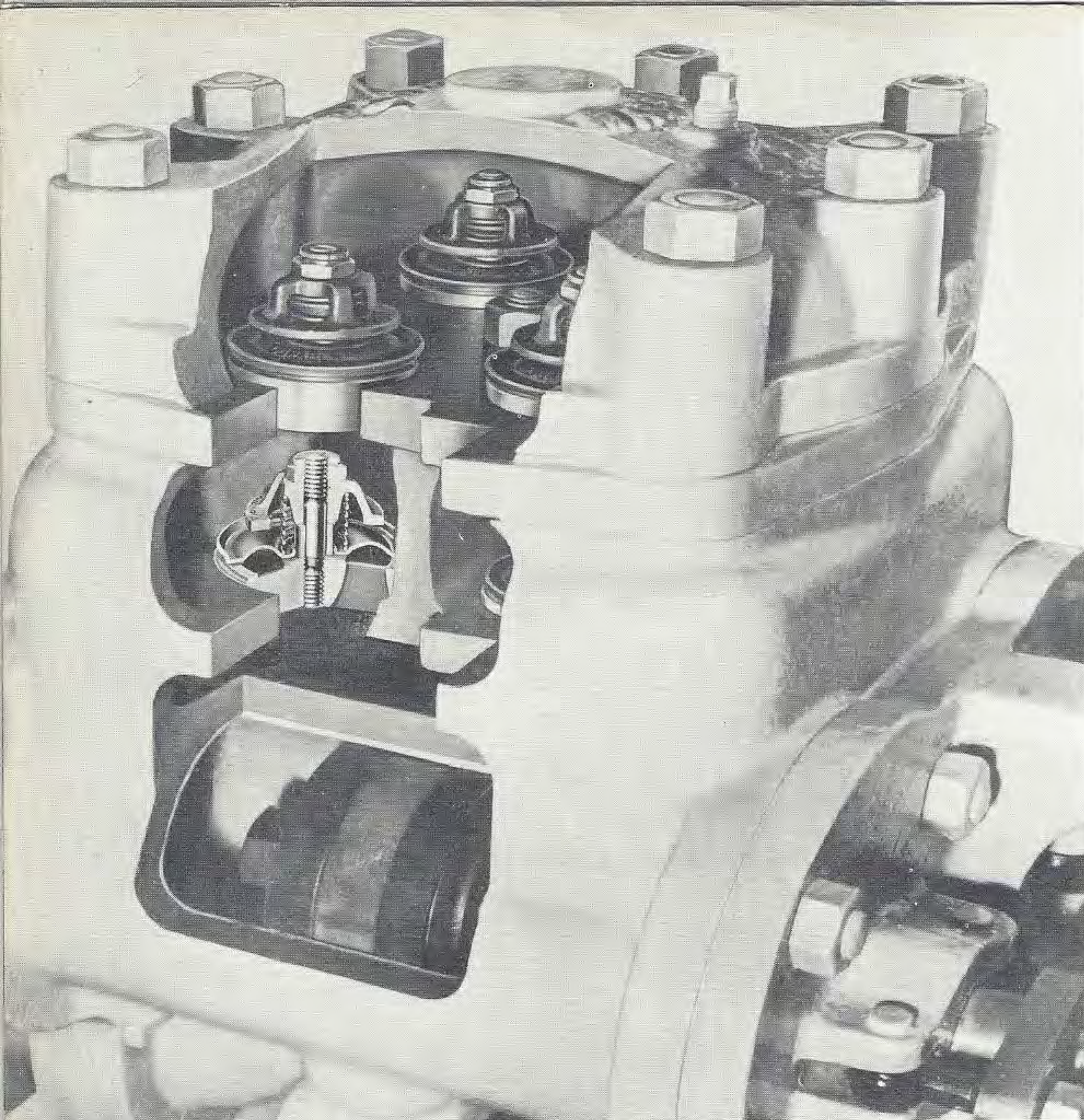
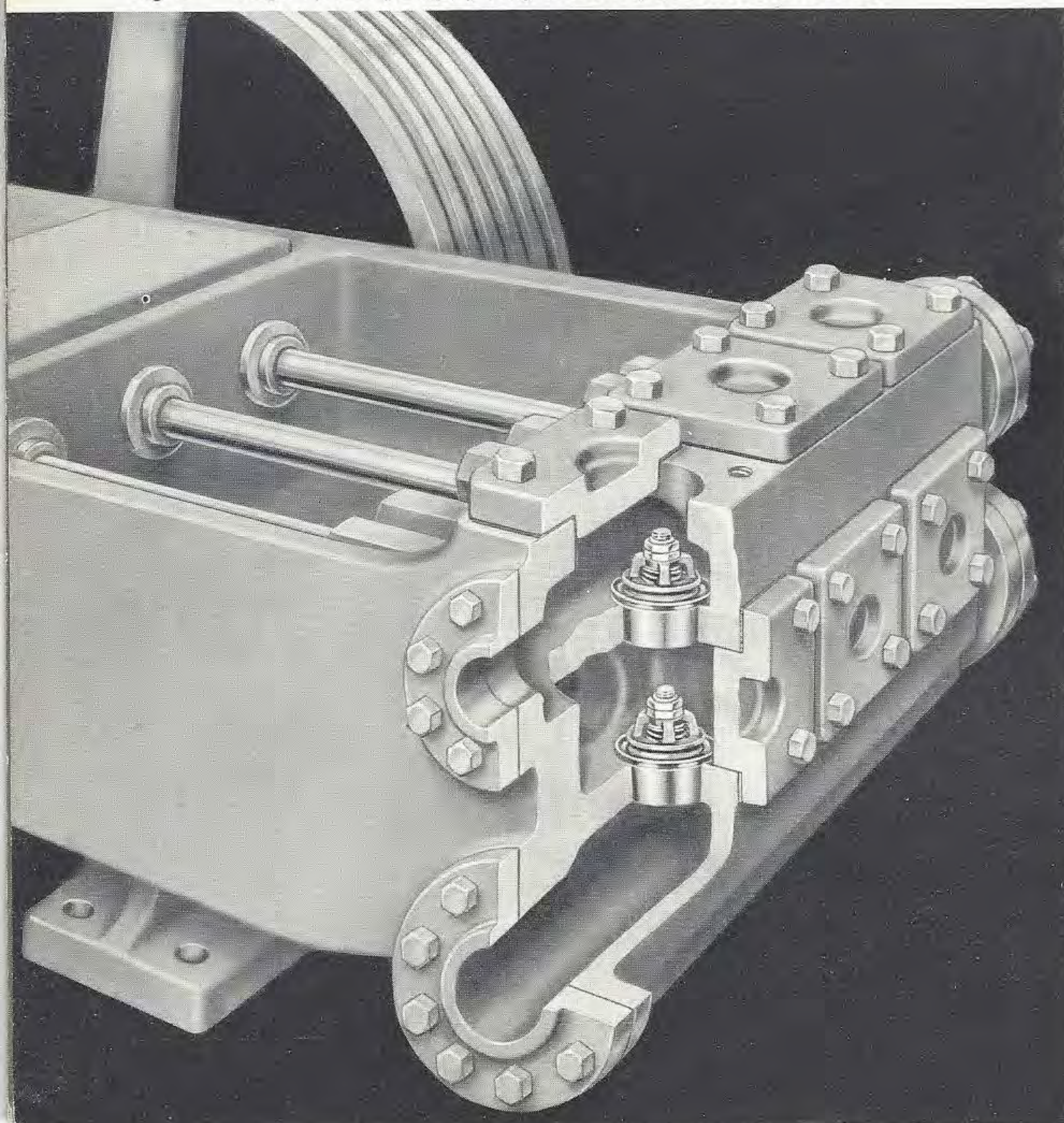


Fig. 1 — Cut-away view of a pump showing the valves in operating position.

DURABLA[®]

Fig 2 — High-speed pump, partly cut away to show the valves.



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PUMP VALVES

are complete units, built for use in any type or make of reciprocating pump. Their function is to open freely during the time the piston is pumping liquid into the discharge line, and to close quickly and tightly while the piston returns for the next filling of liquid.

DURABLA Valve Units are simple in construction, as can be seen in figure 3. Each part has been carefully designed, and is precisely made and accurately fitted. As a result, when properly installed and given reasonable care, they will provide many years of efficient service under a wide variety of operating conditions.

The following pages describe the component parts of the unit, and outline a few simple procedures for proper installation and maintenance. If these instructions are followed, you will receive the long, satisfactory performance, which you have a right to expect from DURABLA Pump Valves.

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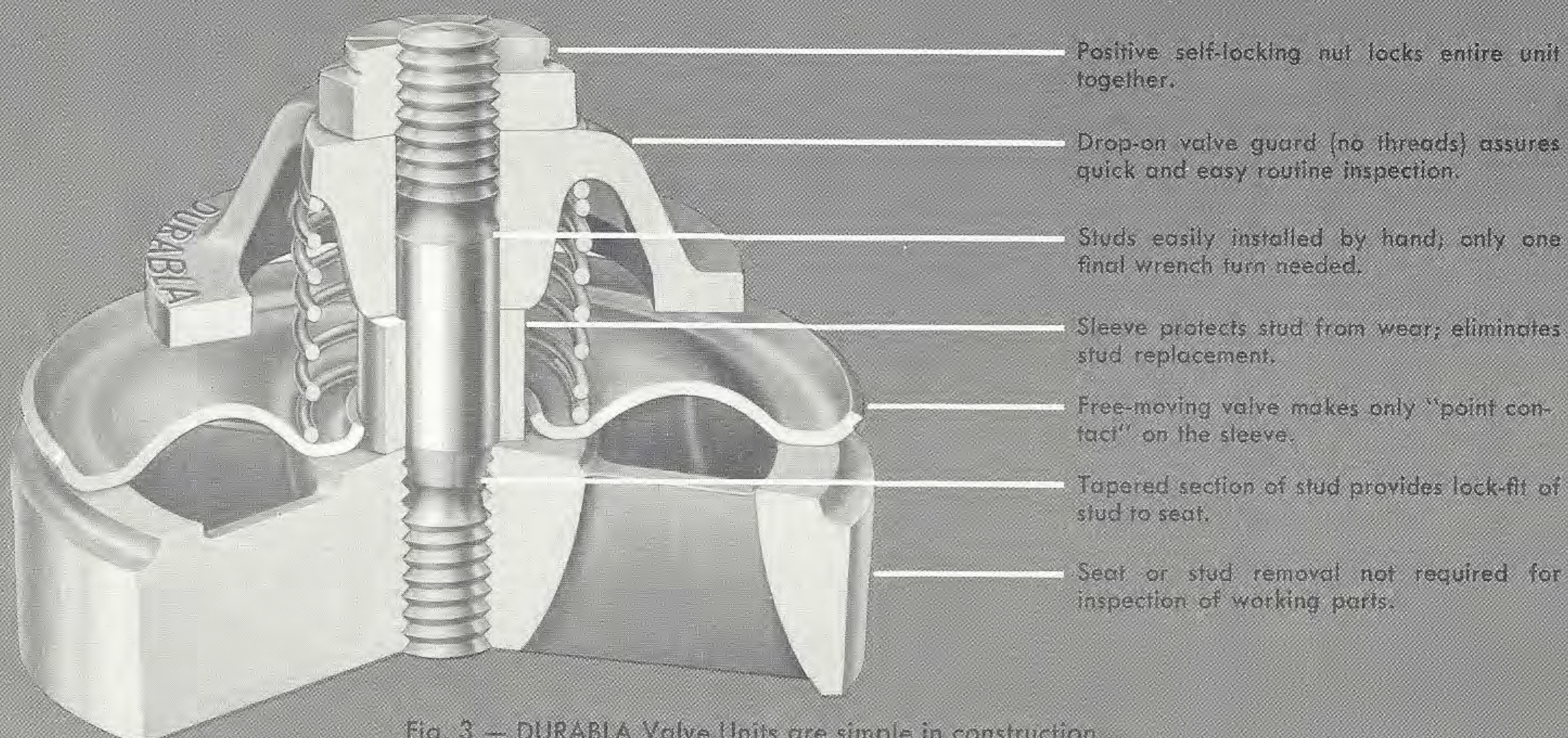


Fig. 3 — DURABLA Valve Units are simple in construction

INSTALLATION

First in importance is FIT. For correct fit of DURABLA Pump Valves into the pump valve ports, the following precautions *must* be observed:

1. The diameter and taper of the valve seat and the pump port must be matched *accurately*.
2. If the valve seat is threaded, it should *exactly* match the requirement of the pump port.
3. The seat should project out of the port far enough to allow complete valve freedom, and to provide metal stock for subsequent refacing to compensate for normal service wear.
4. There must be ample clearance between the periphery of the valve and the chamber walls to prevent physical contact, and also to assure sufficient area for flow of liquid.
5. The pump ports must be clean and free from foreign matter, threads must be clean down to the *root*, and there must be no deep scratches or stripped threads.

Unless the valve units are firmly and properly installed in clean ports, they can leak, become dis-

torted and eventually work out of the ports. Rust and corrosion are the most common causes of valves working loose. They appear firm in the port during installation, and then, when the foreign material washes out, they work free and come "adrift."

See figure 4 and note that care has been taken to wire-brush all particles and deposits away from corroded areas to expose a clean, shiny, metal wall. Should ports be so corroded that wire brushing is not sufficient for removal of all deposit, it will be necessary to use a tap of the proper specification as shown in figure 5. The tap will remove all rust and scale and, with care, no metal will be taken from the threads. If shouldered seats are involved, it is important to clean the shoulder landing levels. With straight threaded seats, a clean joint between pump body and underside of shoulder is necessary to provide locking action.

Occasionally a seat shoulder may be used solely to support the valve face. In this case (usually taper threaded seats), the underside of the shoulder may not necessarily contact the pump body, and care should be taken *not* to force the seat after the

Fig. 4 — Wire brushing to remove corrosion.



Fig. 5 — Using tap to insure clean threads.





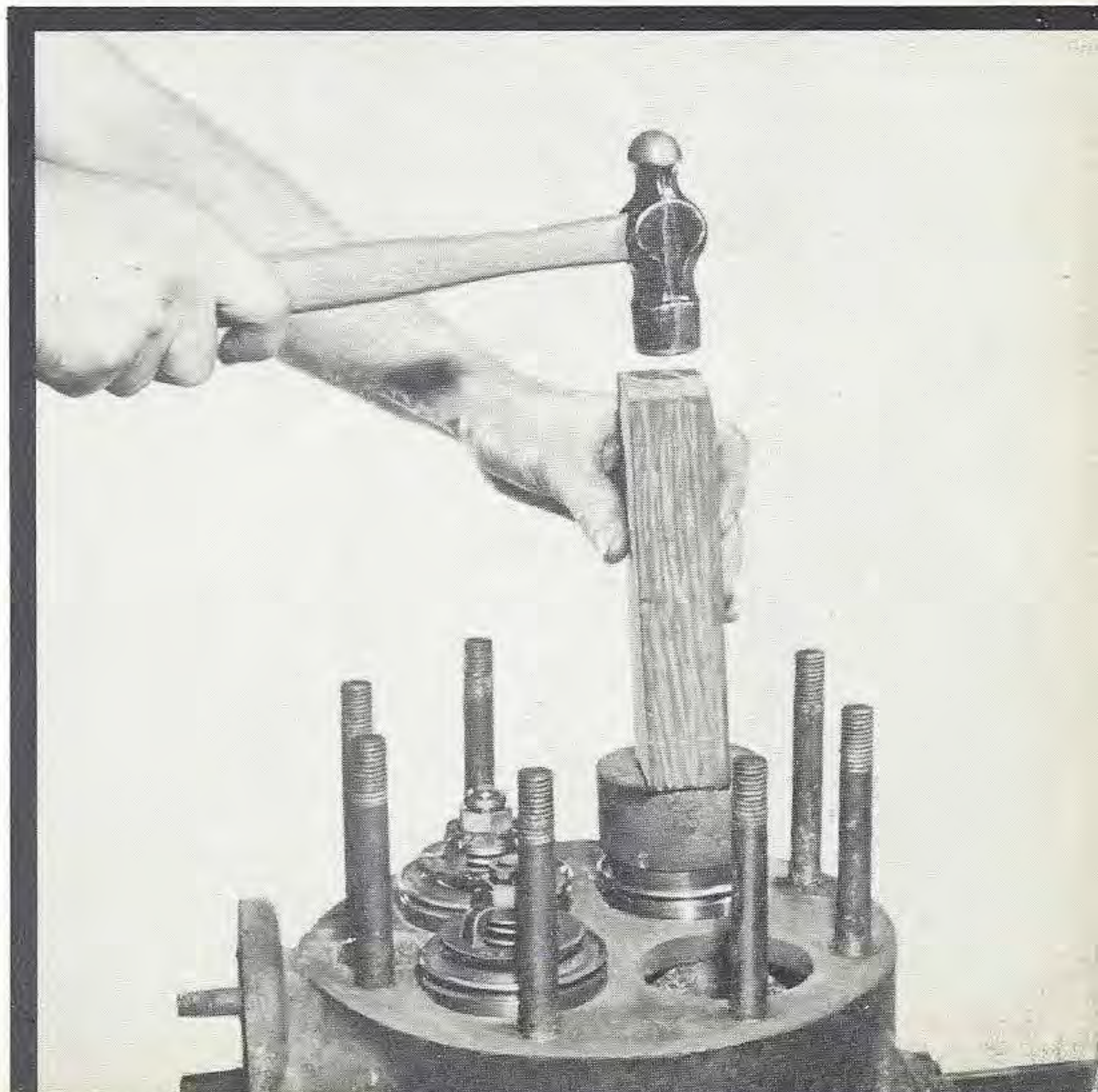
Fig. 6 — Accuracy of fit of pressing block should be checked.

normal fit of the taper has been established.

Avoiding the use of force is the single most important thing to remember in installing valve units in pump ports. The words "force" and "drive" and "sledge" should be completely forgotten. Instead, the ability of the hand to "sense" a firm, accurate fit should be the guide to the correctness of the installation.

FOR TAPER PRESS-FIT SEATS, the valve unit is first placed in the pump port and then pressed down with simple pressure of the palm of the hand. This will show if the tapers are matched, without the possibility of "binding" which can occur if the unit is slightly off level. Next, place the *pressing block* over the entire valve unit, as illustrated in figure 6, making sure that it rests on the flat upper surface of the valve member, and that it is free and clear of the guard member. All that is needed now is *very light tapping* (see figure 7), using a short block of wood between hammer and pressing block; or a rubber or composition mallet. Under no circumstances is it necessary to use a "sledge" or heavy blow of any kind directly on the block. A properly fitting valve seat will be "home" with *light tapping*. The pump action, later on, will suffice to seat the unit precisely and firmly into the port by correct and perfectly equalized liquid pressure. Actually,

Fig. 7 — Just a light tap is enough.



the tapping at the time of installation is only to hold the unit in the port during the first few pump strokes.

Note: There is no need to disassemble the unit — the installation tool furnished is made to fit over the complete unit. Figures 6 and 7 show the way the pressing block is placed over the unit, and also the *light* tools used in the actual installation work. Figure 8 shows how the valve must be “tried” to make sure it is free and clear of all obstructions.

Before giving the job a final OK, take a minute more to place the fingers around the upper outer edge of the valve and, while bearing down lightly, rotate the valve back and forth on its seat (see figure 9). As this is done, you should be able to feel the valve “biting” into the seat all around the outer diameter. This is your assurance that the center seat has not been forced up due to excessive “force” or “drive” during installation of the seat itself. If the center seat has been distorted, the valve will slide freely around the center seat, failing to contact the outer seat. When this condition is severe, the valve can actually be “rocked.” In such a case, it will be necessary to remove and reface the seat or seats.

FOR SCREWED-FIT SEATS, it is necessary to remove the working parts (except the stud) in order to install the valve units properly. Only then can the

seat wrench be applied against the seat webs (see figure 10).

Caution: Under no circumstances should the guard member be used as a means of gripping the unit for screwing it into the port. Should this be done, in an attempt to avoid the short time required for removal of valve parts, the stud may be overstressed, causing breakage to occur either at that time or after a short period of pump operation.

Sufficient stress must be exerted with the wrench on screwed-fit seats to assure a tight joint, but care must be used to avoid distortion of the center seat. A guide to the amount of force required is to apply no more pull than would normally be used during the installation of regular clean-threaded pipe of similar diameter.

After the seat is firmly “home” be sure to replace *first* the sleeve, then the valve, and then the spring, guard and lock nut. At this point, “try” the valve (see figure 8) to be sure it is free and not touching any obstruction. If the sleeve is always replaced before the valve, it is reasonably certain that the lip of the valve will never be caught under its edge. If this should happen, the valve may be damaged beyond repair. As a final precaution, the center seat should be checked to make sure that it has not been forced out of proper alignment (see figure 9). This is important with either screw or press-fit seats.

Fig. 8 — Don't fail to “try” the valves before closing the pump.

Fig. 9 — The final check of rotating the valve.



MACHINING SEATS

DURABLE Valve Units are furnished, when so desired by the user, with the outside diameter of the seats rough as cast. The user then has the seats machined locally to fit the pump ports.

In a case such as this, it is vital that the required machine work be done without straining or injuring the valve unit. A holding tool should be used to mount the seat in the lathe for the machining operation. The valve stud must *never* be used for this purpose as it will become over-stressed and may break either at once or later in service.

A holding tool can be made by using a 3" piece of 1 $\frac{1}{4}$ " hex bar, threaded to required diameter at one end. A convenient means of providing the threading is by the use of a set-screw inserted into the end of the hex bar (and locked in place by a small additional set-screw). The set-screw should be heat-treated for necessary strength, and should be threaded to match the threading in the seat. To avoid damaging the inner seating surface of the seat, care must be taken to provide a smooth and level surface on the seat end of the hex-bar tool. Figure 11 shows such a tool and the manner of mounting.

Fig. 10 — The seat wrench securely grips the webs.

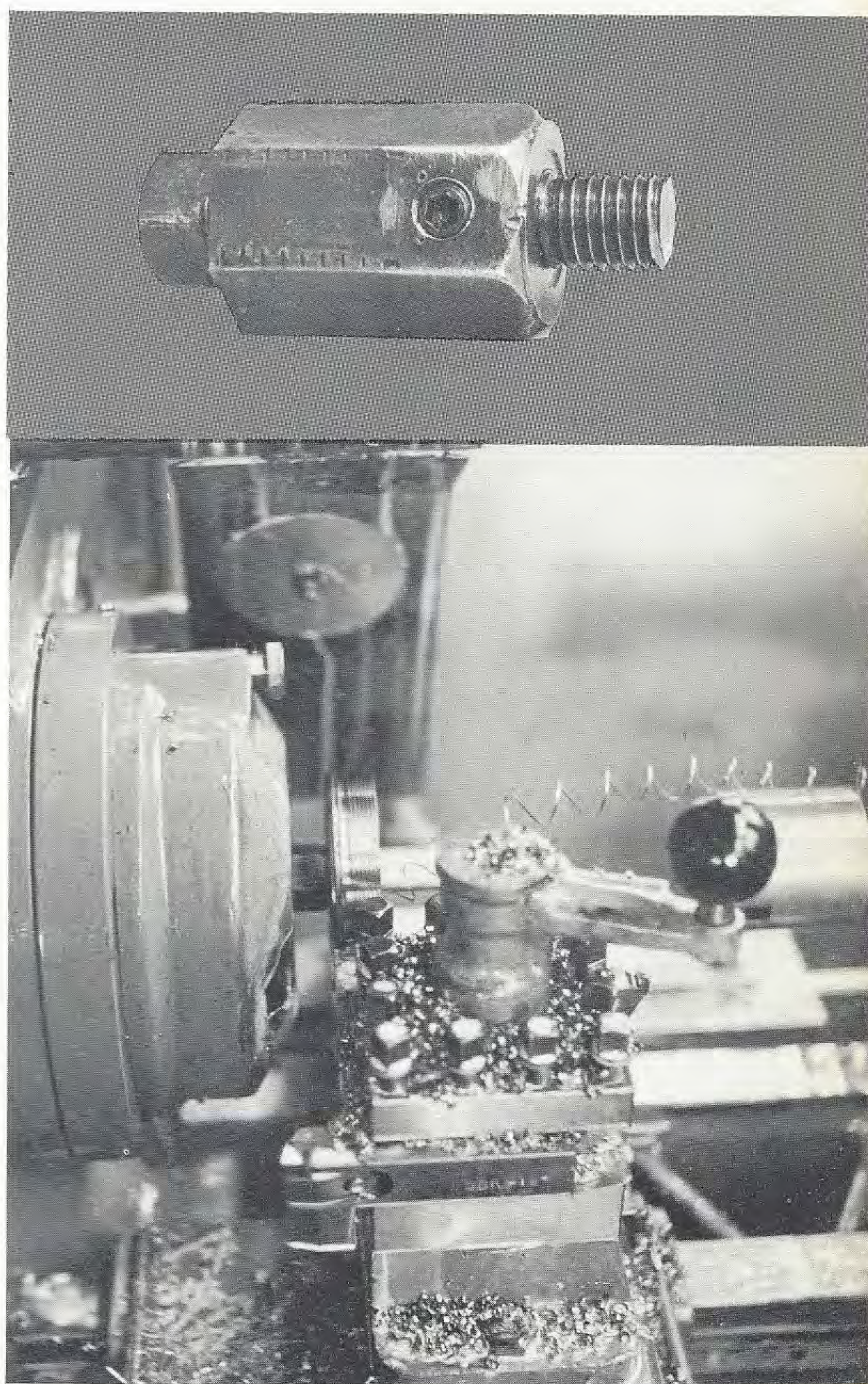


Fig. 11 — Machining is easy and safe, when the holding tool is used.

A socket-head set-screw of appropriate size can be used for the heat-treated stud for the holding tool. These set-screws serve the purpose well and are readily available from mill suppliers' stocks. Do not use ordinary steel stock as early failure will occur and there is apt to be difficulty in removing the broken portion of the set-screw from the seat.

MAINTENANCE

Long service life is built into DURABLA Pump Valves. However, actual operating life does depend on the severity of the service *and the care given to the valves*.

DURABLA Valve Units should have the same periodic inspection given other parts of the pump. When inspection discloses the need for attention, it will pay to take immediate action.

These units are designed so that normal wear is concentrated on the least expensive parts. The replacement of these low-cost parts, when necessary, will prevent relatively more expensive part renewal at a later date.

The sleeve, for example, is designed for permanently protecting the stud from wear caused by movement of the valve. When the unit has been in service long enough to show sleeve wear of about $\frac{1}{64}$ " (see figure 12), the sleeve should be replaced.

Doing this, when necessary, will make the stud a permanent non-wearing part, and will also prevent excessive wear at the center hole of the valve. The valve, as it moves normally up and down on the sleeve, wears very little. There is no "binding" as there is with other makes of valves, but when the sleeve does become worn, the valve no longer has a natural upward flow motion. Instead, it may curve upward, following the worn sleeve, and the rate of wear on both parts will be accelerated.

When the valve member has worn sufficiently to remove the protecting lip of its center hole at any one point (see figure 12), it is time to replace it with a new valve and sleeve. The tight seal between the seating surfaces (inner and outer) of the valve and seat must be maintained in order to provide two important results: (1) that all of the liquid passed through the valve at each piston stroke remains sealed off when the piston returns, and (2) that accelerated wear of the seating surfaces due to the back flow of liquid through the closed valve (a condition referred to as "wire drawing") be prevented.

When renewing a valve, it is a paying practice to reface the seat so that no ridges exist at either the inner or outer edges of the valve seat. *Important:* When seats are removed from pump ports for lathe work, reinstallation should be made with all the care previously outlined. This will prevent seat distortion and the danger of raising or lowering the center seating surface.

Fig. 12 — Replacing worn parts is an important part of regular maintenance.



There are a number of refacing tools on the market which can be used without removing the seat from the pump port. Names of suppliers will be furnished on request.

SEAT REMOVAL: Threaded seats can be quickly and easily removed with the seat wrench furnished with each installation. The lock nut, guard, spring and valve must first be removed to allow engagement of the wrench in the web of the seat.

Taper press-fit seats can be removed with a strong-back and a jack-screw which has a female threaded lower end to engage the stud (see figure 13). However, the *best* practice is to remove the stud and use a jack-screw with a male threaded lower end to engage directly into the seat (see figure 14). This will prevent the stud from being overstressed. These tools, accurately threaded and carefully engaged, will not harm the seat.

Caution: Whenever the strong-back method is used, be sure that the pull exerted by the jack-screw is *directly upward* so that the stress does not pull the unit to either side. Pulling to the side may damage the removal tool and the seat, and may also result in wedging the seat in the pump port so tightly that no reasonable pull could remove it.

After the strong-back is correctly set up, and a pull is exerted upward, it is usually helpful to direct a few sharp hammer blows on the strong-back. This adds sufficient shock-load to dislodge even a tightly-wedged seat, but avoids excessive total loading on either the seat or removal tool.



Fig. 13 — Using the strong-back to grip the stud.

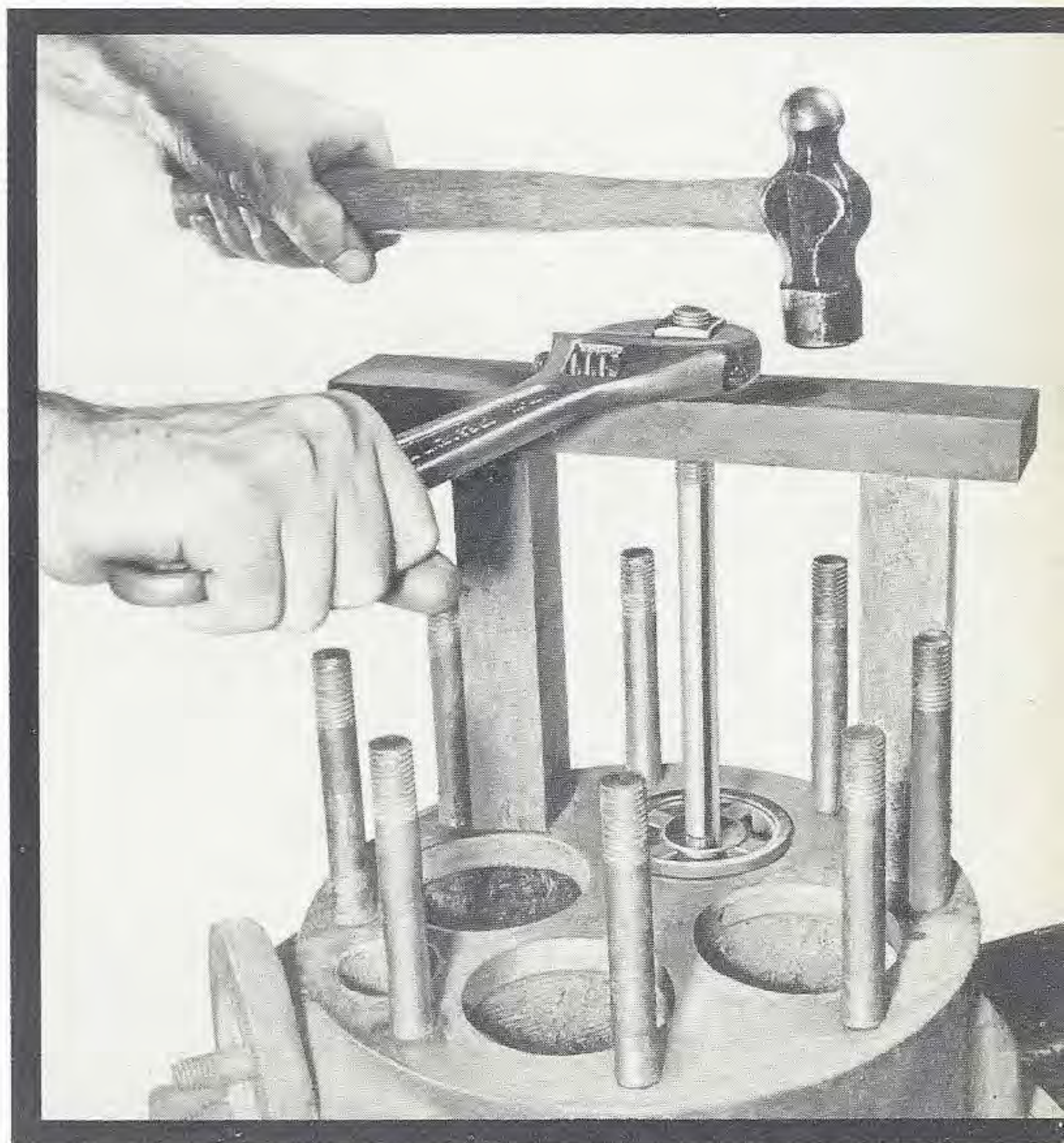


Fig. 14 — Using the strong-back to grip the seat directly. This is a better method than the one shown in figure 13.





Fig. 15 — Self-locking nut.

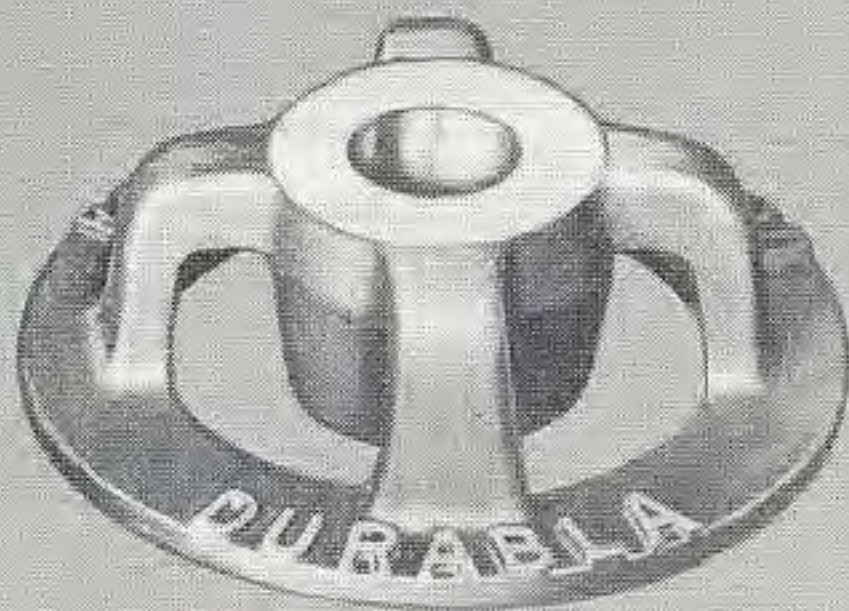


Fig. 16 — Guard.



Fig. 17 — Stud.



Fig. 18 — Sleeve.



Fig. 19 — Spring.



Fig. 20 — Valve.

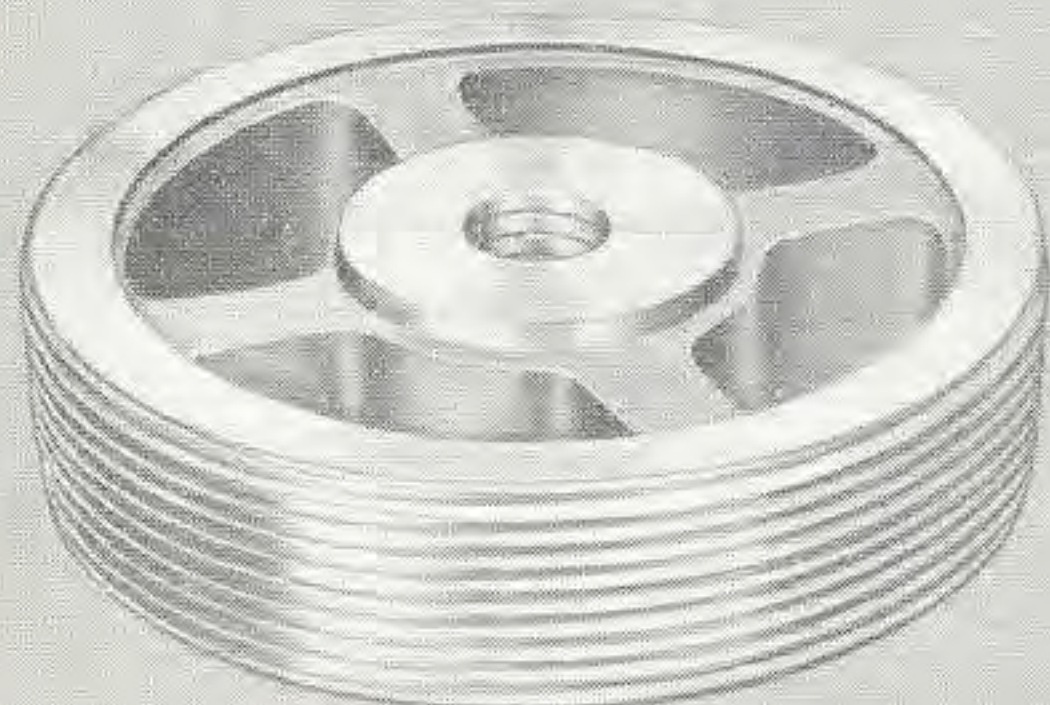


Fig. 21 — Seat.

COMPONENT PARTS

DURABLA Style V-7* embodies two design features that are most important in a valve unit: Positive assurance of tight, trouble-free operation and easy, rapid removal if necessary for maintenance purposes.

DURABLA Guards are designed to provide safe enclosure for the spring, preventing coil-to-coil contact while serving to limit accurately the upward motion of the valve member to the predetermined lift.

DURABLA V-7 Studs are taper-locked into the seat, providing assurance against the danger of the stud coming adrift in service. The taper-lock also simplifies removal for maintenance. When it is necessary to take the stud out of the seat, a single turn will unlock the stud, allowing easy removal.

When replacing, be sure that all dirt is removed from the threaded hole and the threads on the stud, and that the tapered surfaces are clean and free of dirt or rough areas that might interfere with good contact at the taper. Screw the stud into the seat until it is hand-firm against the taper. Then take up with the stud driver, exercising care to *use only enough torque* to provide firm locking action. The taper-lock design assures satisfactory application without undue stressing at time of installation. Use a stud driver which grips the stud at the unthreaded portion. Never drive the stud by using the threading provided for the self-locking nut, as this may stress the threaded portion and cause early failure. Care during installation will prolong the life of the stud through many removals and reinstallations.

There are other DURABLA stud styles, both for special equipment and of older designs. When studs other than the V-7 style are encountered, it will be found that the accurate thread fit will provide satisfactory service with normal care and maintenance.

DURABLA Lock Nuts hold the entire unit together, and should always be firmly replaced after removal. These are self-locking nuts and are to be installed with just sufficient torque to establish firm contact. It is helpful to use some lubrication on the threads to avoid any possibility of galling, allowing for easier removal of the nut when necessary.

*Patent pending

DURABLE Springs are designed to close the valve at the correct rate to hold "slip" to a minimum and, at the same time, allow the valve to open easily. "Slip" is here used to describe the flow of liquid back through the valve while it is in the act of closing. When the spring is compressed in the open valve position, the guard prevents the coils from touching or wearing against each other. With present-day higher pump speeds, it is important that springs be designed to prevent "spring surge," which is the closing together of the coils due to inertia. At inspection time, unless springs are in much the same condition as when new, they should be replaced.

DURABLE Seats are made with seating surfaces raised above the webs to provide the metal needed for normal wear as well as the number of refacings called for over the long life of the DURABLE valve itself.

Note: Whenever valve units are removed from the pump, they should be marked so that they will be returned to their original ports. Also, individual parts of each unit should be kept together so that mating equipment will be replaced in the original manner. Mark new parts, when added, so they will be identified for the next maintenance cycle.

TROUBLE SHOOTING

The problems which are likely to beset the liquid end of the reciprocating pump are relatively few. Today's pump design is such that long service life can be expected from all working parts. Normal replacement of valves, packing, etc., leaves little else to interrupt the service of the pump.

Occasionally, an operator will be confronted with "flashing" or "cavitation." This results from a liquid becoming a gas, and is caused by the exertion of too strong a "pull" on the liquid.

If the temperature is high enough, or critical, a volatile liquid may be nearly at the "flash point" (the point at which it changes to a gas) under normal operation, and then the added suction created by the pump, will cause the changeover. This condition will be recognized by a pounding at the valve chamber and lowered output through the dis-

charge line. It could be expected, for instance, when the pump is handling water at or near the 212° F boiling point; or a light hydrocarbon, say, gasoline, on an outdoor installation unprotected from the rays of the sun and at high temperatures. This condition is more likely to exist when there is a suction "lift" instead of a suction "head."

To remedy, it is necessary to reduce the temperature (if possible), or reduce the pump speed, or decrease the suction lift, or some combination of the three.

The DURABLE Valve Unit, by design, is better adapted to provide satisfactory operation under these adverse conditions than any other valve on the market. Further, by virtue of its lightness and free-moving characteristics, DURABLE Units will perform successfully without expensive changes in piping and temperature control being made.

CHANGE OF SERVICE OR OPERATION

Since DURABLE Valve Units are carefully designed for correct valve lift and spring tension, no attempt should be made to change these parts. When the service on which a pump has been operating is radically changed, involving different pressure, temperature or viscosity, DURABLE MANUFACTURING COMPANY should be consulted as to the suitability of the valve specification for the new service.

Specifications covering the pump usually identify the pressure and temperature limitations satisfactorily. It is unwise to operate a pump over the manufacturer's rated conditions or speed. Excessive speeds, even for short periods of time, are apt to damage valve parts permanently, regardless of the make or type of valve.

On all installations, provision should be made to limit speeds and also to prevent operation when the pump is "dry." Such operation may damage any and all parts. On unattended pumps, the use of a governor will prevent excessive pump speed should anything go wrong, or should there be interference in the suction line.