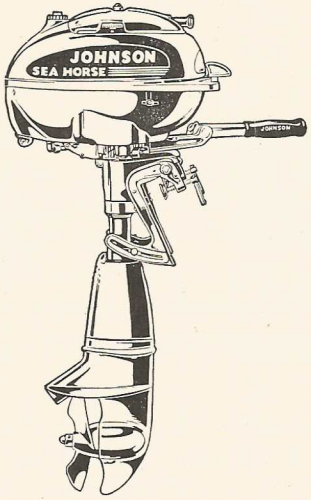
Part No. 301-678

SERVICE INSTRUCTIONS

for

Models TS-TD



Johnson Motors

WAUKEGAN, ILLINOIS

Key—10-45—4M

FORWARD

This booklet is devoted to maintenance of the motor and includes information on such repairs and assemblies as are apt to be conducted in the service shop from time to time. It is well to know, nevertheless, that three things are basically required to make any gasoline engine run, regardless of whether it be a two stroke (outboard motor) or four stroke cycle engine—they are, namely: 1. Spark, 2. A combustible ratio of air and gasoline, or in other words, "Gas" and, 3. Compression.

(1) Spark must of sufficient strength to jump the spark plug gap under compression in the cylinder and must be properly timed with relation to position of the piston. It is an easy matter to determine whether or not the magneto is functioning—(1) simply detach spark plug wires (ignition leads) from spark plugs, (2) remove spark plugs; (3) hold ends of spark plug wires approximately 1/8" from cylinder head (4) have someone spin flywheel (5) if magneto is in good order, spark will jump gap at end of wire to cylinder. In bright day-light, spark may not be seen but a distinct audible "snap" should be noted. To check spark plugs, attach spark plug wires, lay plugs on cylinders and proceed in manner like that described above. Spark plugs may be (1) fouled (filled with accumulation of unburned oil and carbon) (2) burned (points burned off) or (3) cracked (porcelain). Don't waste time with questionable spark plugs—install new ones—Champion J-8-J.

(2) Gas must be of correct air-gasoline ratio—that is, if the mixture is too rich (too much gasoline) it will not ignite; also, if too lean (too little gasoline) it will not ignite. This is largely a matter of carburetor adjustment. Mix one-half (1/2) pint oil S.A.E. 40 per each gallon of gasoline. If the gasoline and oil are properly mixed and the carburetor needles correctly adjusted, gasoline-oil vapor should enter the motor when cranking to start. (Note (1) Vent in filler cap must be open, (2) shut off valve on gas tank must be open and (3) of course, the tank must be filled with gasoline-oil mixture.

(3) Compression must be good—amount of compression depending on ability of the piston rings to prevent its escaping. Conditions of the cylinder, piston ring grooves and the rings are naturally contributing factors. Turn flywheel by hand to check compression—(spark plugs installed). If compression is present, it can be felt when attempting to complete one revoluntion of the flywheel. If little or no compression exists, no particular effort will be required to turn flywheel one complete revolution. An engine will run with some deficiency if either of the above are slightly off par, but to get the most out of it, there must be (1) spark, (2) gas and (3) compression.

TO LOWER OR REMOVE COVER

For inspection of spark plugs, carburetor, etc. — loosen screws as indicated, Fig. 17. Four screws are used to hold cover in position — namely, two at rear and two at front, arrow directed to location.

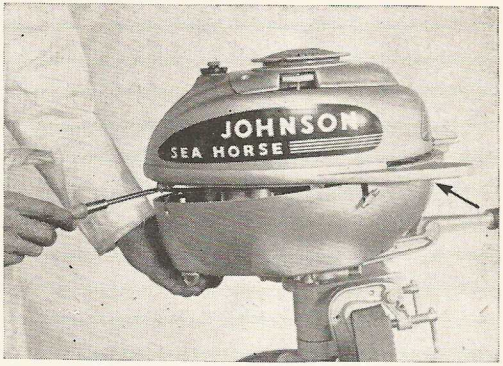


Fig. 17

TO REMOVE FLYWHEEL FOR INSPECTION OF THE MAGNETO

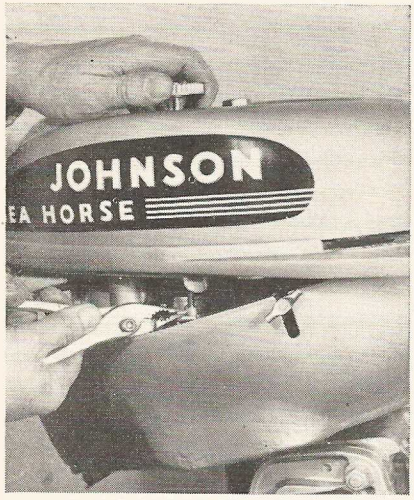


Fig. 18

Proceed as follows:

1. Remove spark plug cover as described above.
2. Remove starter pulley and spacer from flywheel. See motor illustration Fig. 1.
3. Remove high speed needle and primer, by withdrawing small tapered pin from end of shaft as shown, Fig. 18.
4. Disconnect gas line, gas tank is held in position by four 1/4-20 x 1-1/8 screws. Remove tank from bracket as illustrated, Fig. 19.
5. Remove flywheel nut, using a 3/4" socket wrench. Grasp rim of flywheel to prevent turning when unscrewing nut. If nut appears to be too tight to loosen with socket wrench only, strike handle of wrench with a hammer—resulting jar should be sufficient to loosen nut.
6. Attach wheel puller No. S-288 to flywheel as shown, Fig. 20.
7. Turn puller screw down until it rests firmly against end of crankshaft. Grasp puller with one hand, as illustrated, lift upward to absorb shock and strike puller screw head sharp blow with medium size hammer.

Fig. 19

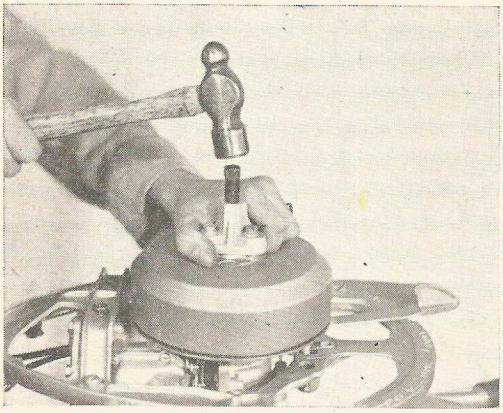


Fig. 20

If first application fails, draw up further on puller screw and repeat as above. Two or three similar attempts should be sufficient to loosen flywheel on taper of crankshaft.

8. After having loosened flywheel, simply lift off.

TO INSTALL FLYWHEEL after inspection of magneto, proceed in reverse order of that described above. Note—Be sure flywheel is securely mounted before attaching spacer and starter pulley—the nut must be tight to prevent flywheel from loosening in operation.

TO REMOVE MAGNET ROTOR (see magneto, Fig. 23), simply grasp rotor between thumb and forefinger—lift up. Rotor slips over end of crankshaft, but in event fit is found to be a bit snug, pry gently using screw driver as illustrated, Fig. 22. Excessive force not required to replace rotor—slip over end of crankshaft and press down lightly.

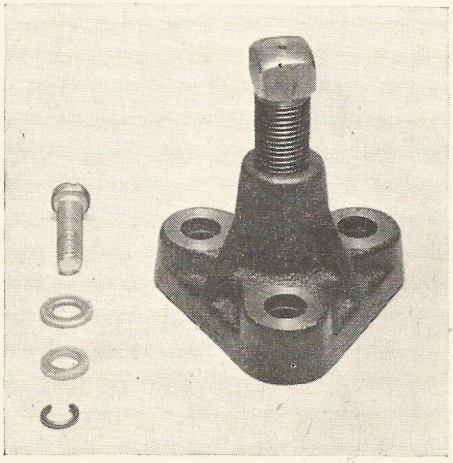


Fig. 21
S-288
PULLER

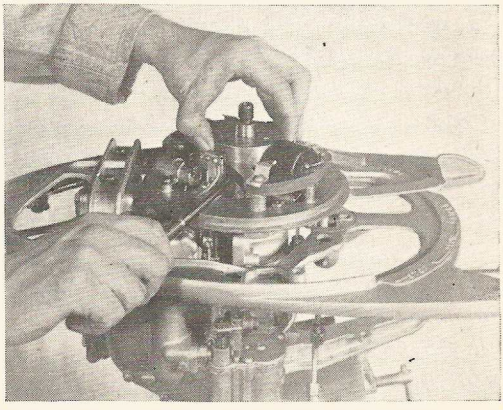


Fig. 22

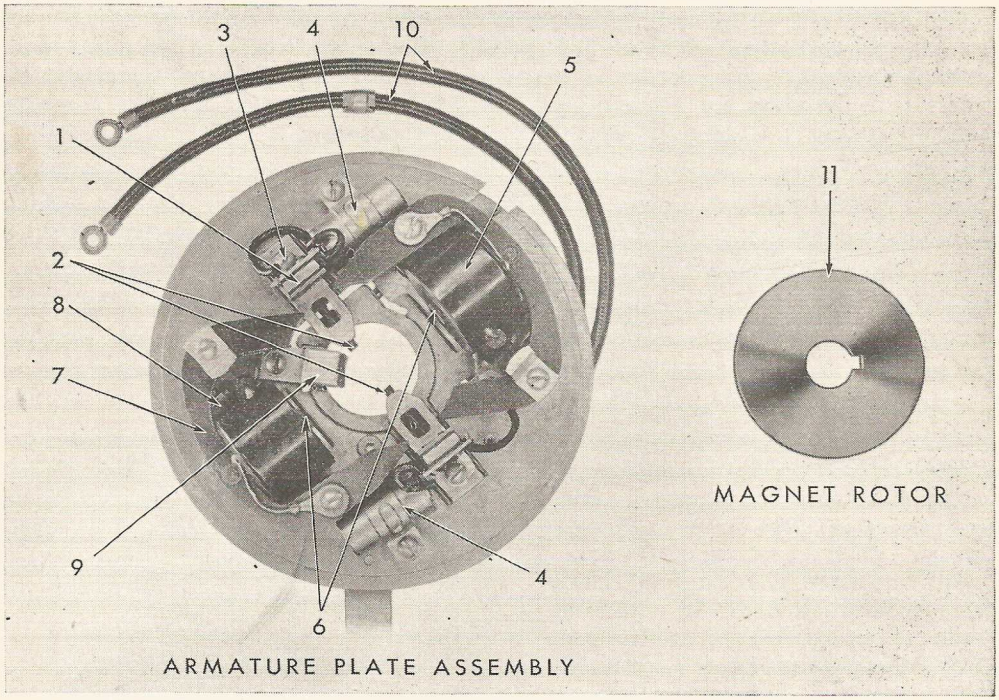


Fig. 23

1. Breaker point assembly
2. Breaker point push rods
3. Breaker point adjusting screw
4. Condensers
5. Ignition coils
6. Coil core
7. Ignition coil pole shoes
8. Maverick spark suppressors (under coil shoe)
9. Rubbing block
10. Ignition leads
11. Magnet rotor

Maverick Spark Suppressors—The word maverick means *stray* or, in terms of the cattlemen, unbranded—here it is but whose is it. The word also is associated with the characteristics of an electrical ignition system—a stray spark, unwanted but still present.

Maverick spark does not occur at slow speeds but prevails in the higher speed range, resulting in a spark jumping the spark plug gap before the breaker points actually open. This effects timing, causes pre-ignition and faulty operation of the motor at high speeds. It is not a particularly strong spark and is easily controlled, but if not suppressed is strong enough to interfere considerably. Control consists of installing a small gap in the secondary (high tension) circuit Maverick Spark Suppressor (8). It is located between the armature plate (ground) and ground lead of the secondary winding.

Operation of the Maverick Spark Suppressor is extremely simple—the gap provided merely sets up sufficient resistance to keep the secondary circuit open, thus suppressing the spark (maverick) until the breaker points open, when the controlled spark is strong enough to jump both the plug gap and the suppressor gap. Consequently, every time the plugs fire, a spark jumps the Maverick suppressor gap—this is visible when operating on a test stand with the flywheel removed.

TO INSTALL NEW COIL—Remove screws attaching coil and shoe assembly to armature plate. Detach ground wire, high tension lead and primary lead to breaker assembly. (Use only enough heat to loosen soldered connections.) Flatten out small lugs on end of coil core, using blunt punch. Remove coil by sliding off core. Install new coil. Upset lugs on core to hold coil in position. Attach ground wire, primary lead to breaker assembly and high tension lead. (Under no circumstances use acid flux —use soldering PASTE or ROSIN and just enough heat to obtain a good soldered connection.) Attach coil and shoe assembly to armature plate but do not tighten screws.

TO ADJUST CLEARANCE BETWEEN COIL SHOES AND MAGNET ROTOR — Attach armature plate assembly to motor. Adjust armature plate screw to desired tension. (This screw is located underneath armature plate and in clamp arrangement provided for attaching same to crankcase.) Install magnet rotor. Move coil and shoe assembly to a point where .008" exists between shoe and rotor (use .008" feeler guage). Fig. 24. Tighten screws holding coil assembly to armature plate.

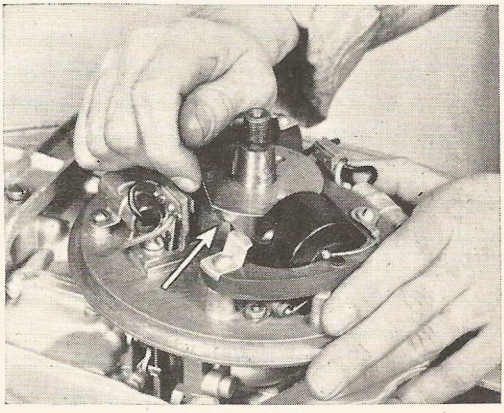


Fig. 24

TO ADJUST MAGNETO BREAKER POINTS — Since two coils are used (one for each cylinder) two condensers and two sets of breaker points are required, both of which may need occasional inspection from time to time.

Note flat machined on crankshaft and two push rods operating both sets of points are open when respective push rods ride on high side of crankshaft — closed when on flat. Correct breaker point gap setting is .020" (full open).

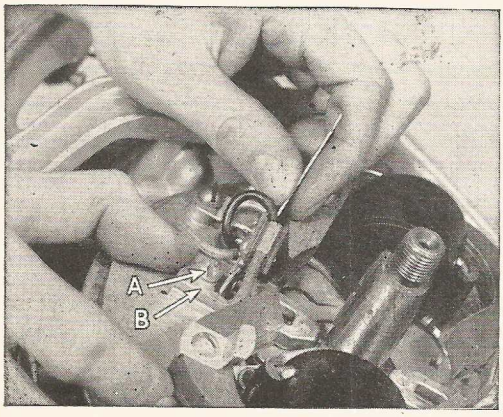


Fig. 25

To adjust gap setting Fig. 25 — loosen screw "a". Turn crankshaft to position where push rod rides on high side. Check gap between points, using .020" feeler gauge as illustrated. If gap is less than .020" push breaker point bracket "b" in (towards crankshaft), sufficiently to obtain correct gap setting. Tighten screw "a". If gap is over .020" slide bracket "b", out (away from crankshaft). Adjust both points in like manner.

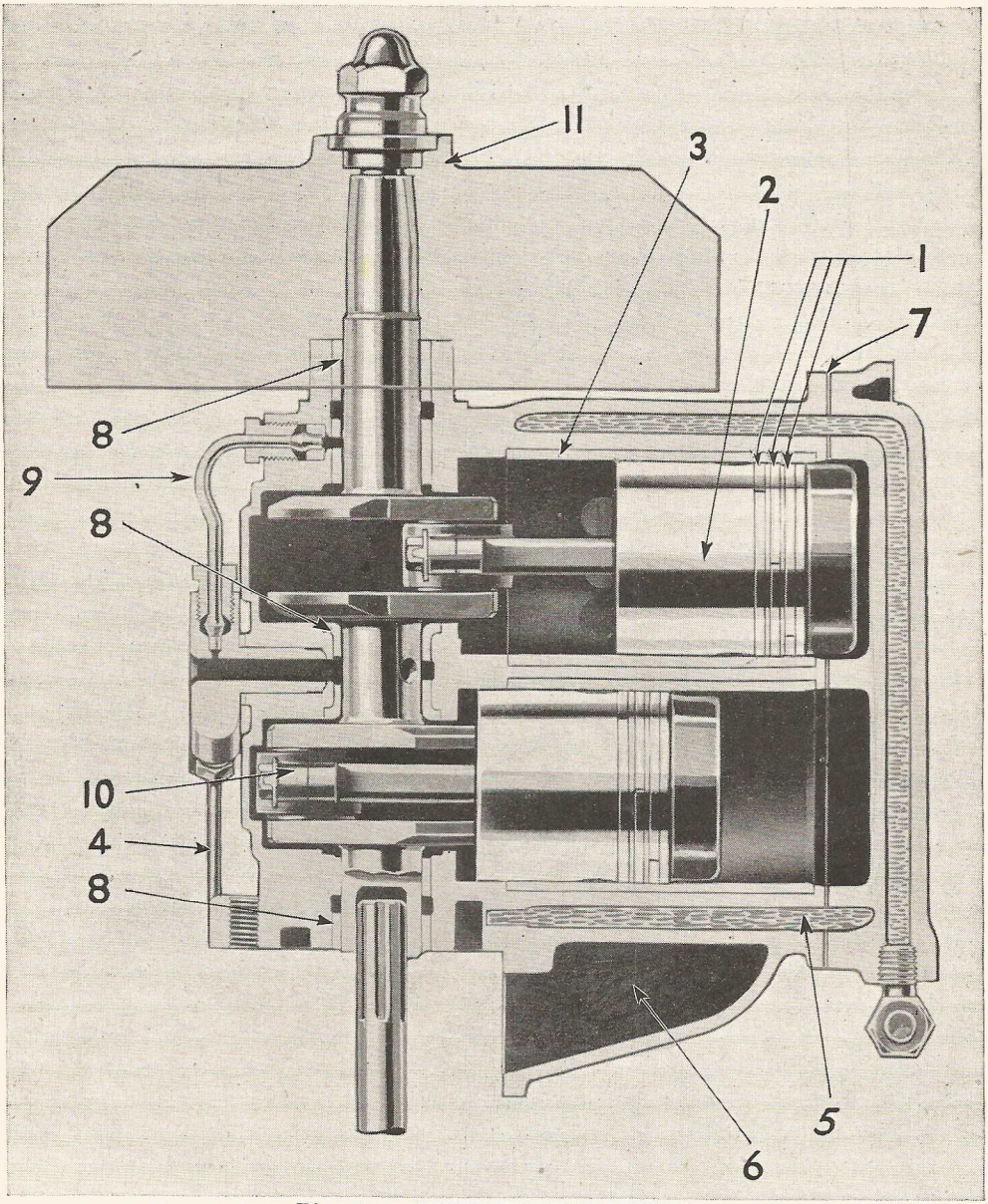


Fig. 26 POWER HEAD ASSEM.

POWER HEAD

Service Suggestions

1. Piston rings—worn or fast in ring grooves, resulting in loss of compression. (Ring groove may be clogged with carbon causing rings to stick).
2. Piston—worn or scored.
3. Cylinder—worn or scored, causing loss of compression.
4. Low speed needle—improperly adjusted, needle and seat in low speed insert may be damaged beyond point where satisfactory adjustment can be obtained. This frequently results from screwing needle down too tightly on seat.
5. Water jacket—clogged with foreign matter, causing motor to overheat.

6. Exhaust passage—clogged with carbon to restrict flow of exhaust gases—will cause loss of power and motor to overheat.
7. Cylinder head gasket—leaking or blown out—cause water to enter or motor to overheat.
8. Journal bearings—excessively worn, causing loss of crankcase compression.

NOTE: Journal bearings are cast in the cylinder-crankcase assembly and, therefore, not replaceable. If bearings are worn to point where replacement is required, it is necessary to install a new cylinder-crankcase assembly. Crankshaft journals and bearings in cylinder-crankcase assembly are machined to such sizes as to permit bearing clearance of .001" to .002". Excessive journal bearing wear results in loss of crankcase compression and is indicated by oil smearing on magneto armature plate.

9. Oil return—clogged, causing excess oil to escape from bearing.
10. Connecting rod bearing—loose, causing motor to knock.
11. Flywheel—loose, causing motor to knock. Tighten flywheel nut.

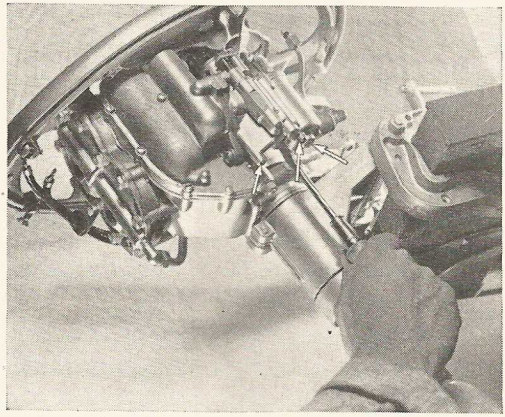


Fig. 27. Showing removal of check valve screen assembly and drain screws for cleaning purposes. (carburetor)

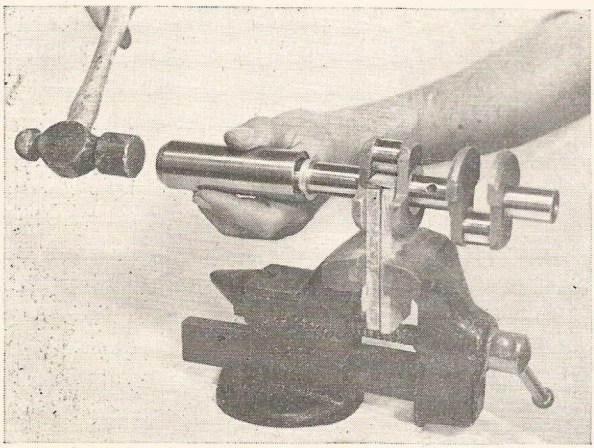


Fig. 28. Illustrating use of tool No. S-271

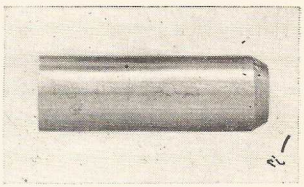


Fig. 28. Tool for installing oil slinger on crankshaft. No. S-271.

To Remove Piston Rings from Piston

Expand rings by spreading with thumbs as illustrated, Fig. 29, and slide over end of piston. There are three rings per each piston. Be careful not to spread too far, rings can be broken. Spread only far enough to permit slipping off piston.

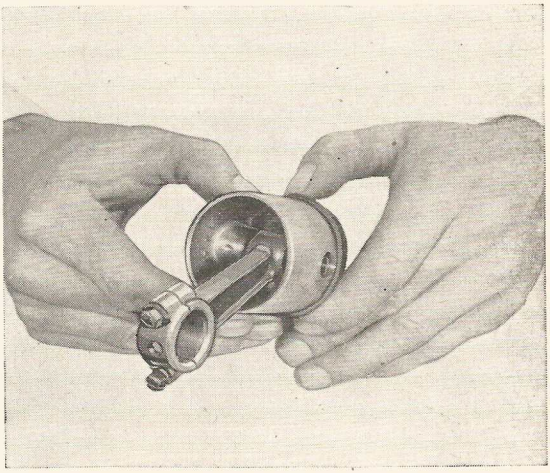


Fig. 29

Rings are replaced in reverse order of that described above—spread enough by hand to slide over piston and into position in respective ring grooves.

To Clean Piston Ring Grooves

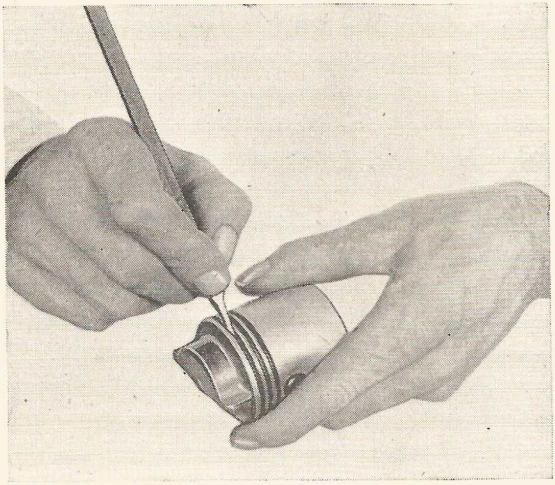


Fig. 30

The piston ring grooves frequently become clogged with carbon after long periods of operation, which requires removal to prevent rings from sticking and becoming partially inoperative. This condition results in loss of compression and noticeable deterioration in power.

It is a simple matter to remove carbon from the ring grooves by scraping as shown in illustration Fig. 30. A suitable scraper can be easily made from a discarded file or hack saw blade—make it slightly narrower than ring grooves in piston and sharp enough to scrape out accumulated carbon.

After removing carbon from ring grooves (piston) and prior to installing new rings, care should be exercised to make certain rings fit in piston grooves with no indication of tight spots or binding. This can be determined by rolling each ring, in their respective grooves, around the piston as illustrated in Fig. 31. Resistance will be encountered where tight spots exist—this may be result of particles of carbon, burrs in piston ring grooves or high spots on edge of ring. Check grooves to see that all traces of carbon has been removed. If burrs exist, they usually can be removed with a sharp edge scraper.

Handle piston carefully. Burrs are the result of rough handling or dropping.

High spots on edges of rings are not frequent occurrences, but if such is the case, they can be dressed down by rubbing edge (side) of ring lightly over a piece of fine sandpaper or emery cloth placed on a flat surface.

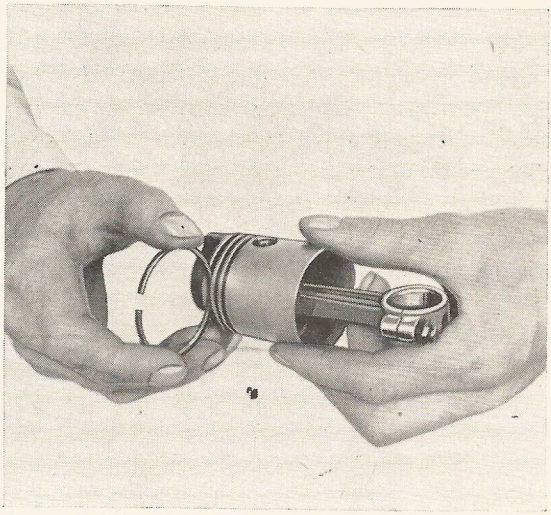


Fig. 31

NOTE: Rings must fit freely in piston ring grooves. Recommended clearance in piston grooves is .0015" to .0025". Piston rings and piston grooves are machined to correct sizes at factory and will fit properly, providing all carbon has been removed from piston grooves and no burrs are present.

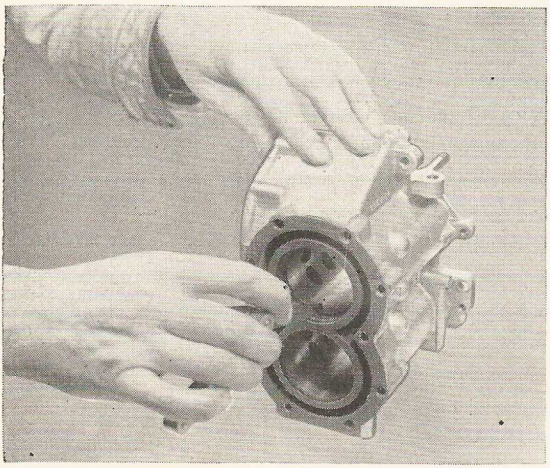


Fig. 32

Piston rings are ground to size at factory, but it is advisable to check gap clearance to make sure recommended .005" to .010" is maintained. Place each ring squarely in cylinder as illustrated Fig. 32. Insert feeler gauge between ends of ring (gap). Repeat same operation for each ring in respective cylinders. If noted clearance falls below .005", file end of ring carefully until desired gap is obtained. If clearance is considerably in excess of .010", cylinder is worn oversize and should be replaced.

To Install New Carburetor Float

In event the carburetor float becomes gasoline logged, it should be replaced to correct flooding condition produced. Remove cover from float chamber, see Fig. 33, to expose float and float valve. Float is held in correct position of float valve stem by a small cotter which fits into a groove in the valve stem. To remove float, spread ends of cotter with screw driver as illustrated in Fig. 33, then press down on end of float valve with thumb. Lift float off valve stem.

To install new float, proceed in reverse order of that above. Care should be taken to see that cotter ultimately anchors in groove on float valve stem to prevent fuel level being too high or too low.

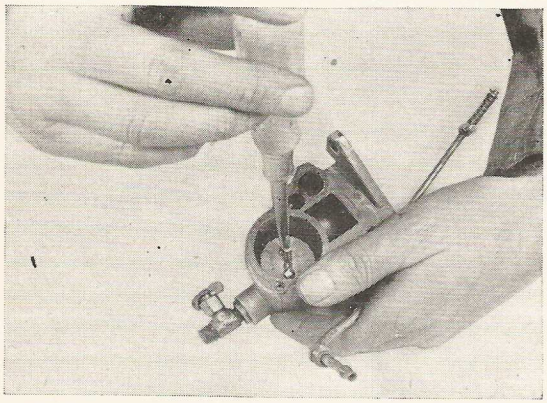


Fig. 33

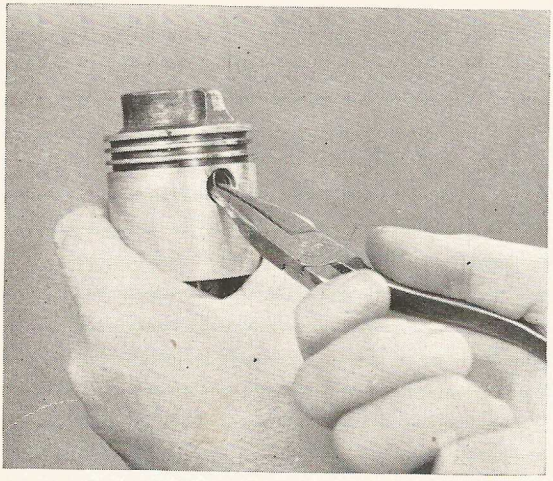


Fig. 34

If found advisable to INSTALL A NEW PISTON, it must be detached from the connecting rod. First remove both lock rings from wrist pin hole as illustrated Fig 34. Use long nose pliers, grasp protruding end of ring and pull out with twisting motion. The pin can then be driven out as shown in Fig. 35. Use small flat end punch. If the fit appears a bit snug, hold piston in hot water for a few seconds to expand. Do not drive out wrist pin by laying piston on bench or hard surface — this will result in springing it out of round.

Handle the piston assembly carefully.

Attach new piston in reverse order of that described above. Note grooves in wrist pin hole for lock rings. Reinstall lock rings — grasp end of ring with long nose pliers, insert with twisting motion at the same time making certain ring comes to rest in groove provided for this purpose.

Fig. 35

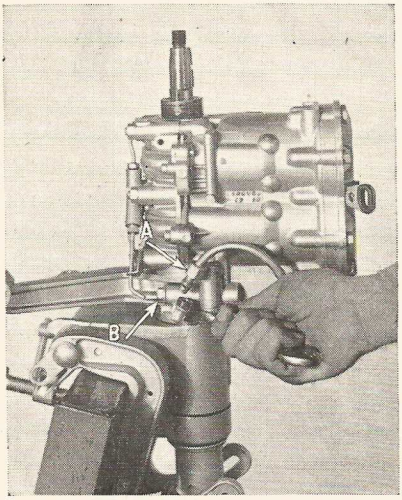
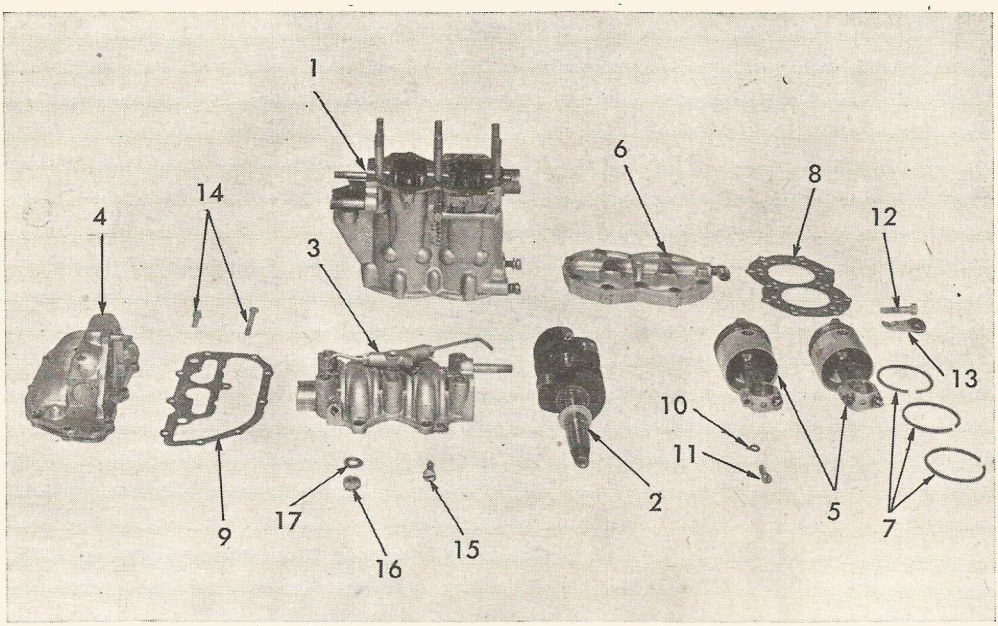


Fig. 36

Fig. 36. Illustrating removal of powerhead from lower unit. Detach water tube connection A. Remove nut as shown and screw B. (Note—a similar nut and screw are located on reverse side which must also be removed). After removing nuts and screws, simply lift power head from lower unit.

Correct Procedure for Assembling Power Head



1. Cylinder
2. Crank Shaft
3. Crank Case
4. Manifold
5. Piston & Connecting Rod
6. Cylinder Head
7. Piston Rings
8. Cylinder Head Gasket
9. Manifold Gasket
10. Lock Plate
11. Connecting Rod Screw
12. Cylinder Head Bolt (Screw)
13. Spark Plug Wire Support
14. Manifold Screws
15. Crankcase Screws
16. Crankcase Nut
17. Crankcase Washer

1. Make certain all parts have been thoroughly cleaned and that piston rings are properly fitted in piston ring grooves. Ring grooves must be free of carbon to prevent rings sticking. (Recommended gap clearance .005" to .010" — groove clearance .0015" to .0025".)

Remove all traces of gasket cement from face of both crankcase sections—this is important.

Lay all parts on a convenient assembly bench as illustrated Fig. 37.

2. Place a few drops of oil on pistons and in ring grooves. Insert piston, ring and rod assemblies as shown Fig. 38. Note deflector on piston, one side is abrupt while the other slopes gradually towards outer edge of piston. Piston should be installed with sloping side of deflector directed towards exhaust outlet as illustrated. See Fig. 38. Note: compress rings with fingers.

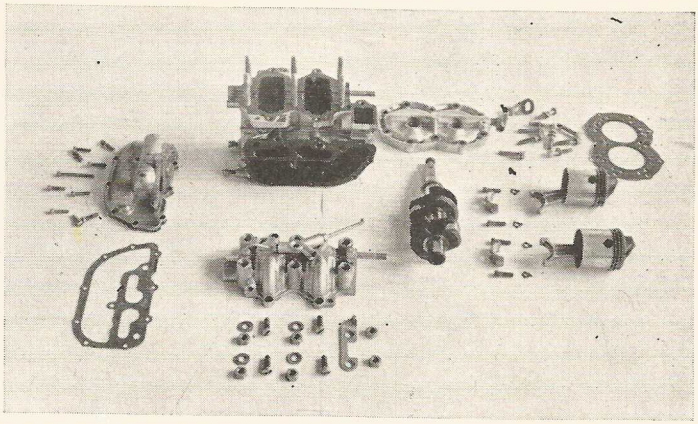


Fig. 37

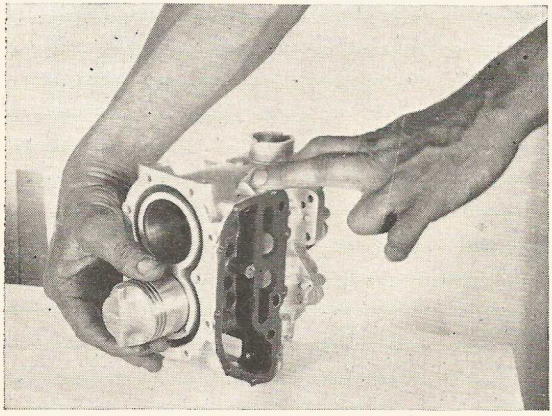


Fig. 38

3. Place a drop or two of oil on each of the three bearings in the cylinder assembly — also a drop or two on each connecting rod bearing. Install crankshaft. Attach connecting rods to crankpins as in Fig. 39. Do not neglect bending small lug on lock plate *up* to prevent connecting rod screw from turning.

4. Spread thin coat of gasket cement over surfaces of both crankcase sections—(a light coat is essential — if too much is applied or if the cement is too thick, it will be impossible to maintain proper journal bearing clearance, .002" to .0025") — see crankcase assembly.

Place a drop or two of oil on each of the three bearings in crankcase section. Attach as shown Fig. 40. Assem-

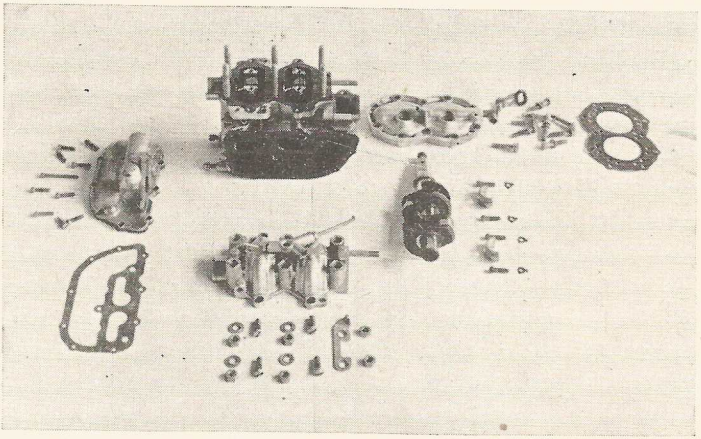


Fig. 39

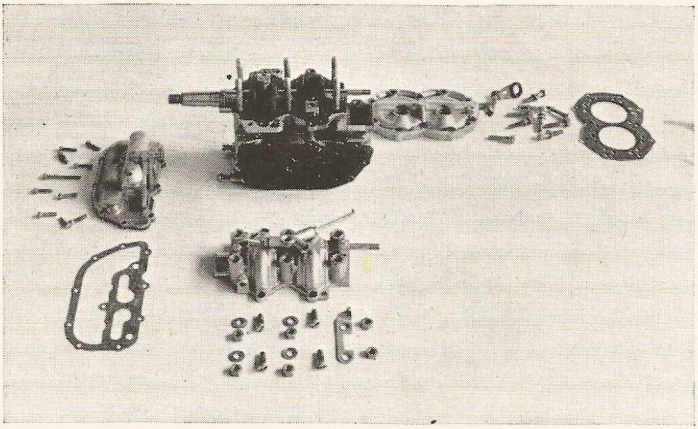


Fig. 40

ble necessary screws, nuts and washers — draw down evenly and securely.

Crankcase Assembly

Since there are no gaskets between the crankcase sections it is extremely important the surfaces of both halves are properly cemented when assembling. These surfaces are very accurately machined but must rely on a thin film of cement to guard against loss of crankcase compression. Fig. 41.

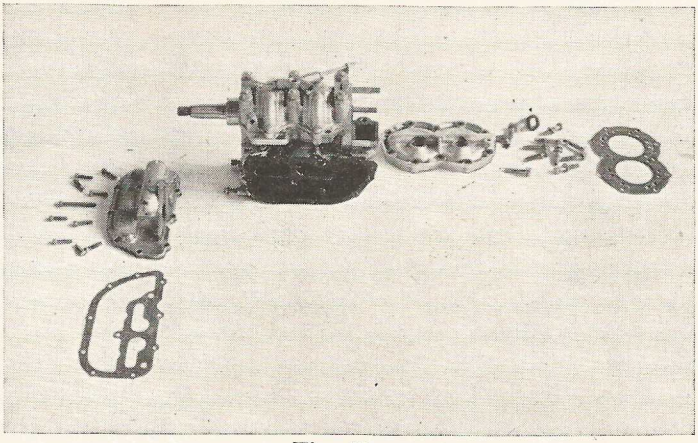


Fig. 41

When assembling, be sure both surfaces are clean and that all traces of old cement has been removed. If the crankcase is assembled with the old cement still remaining and freshly coated with additional cement, bearing clearances are likely to be excessive — this will affect performance of the motor. Correct bearing clearance can be maintained only if, when assembling, the old cement is thoroughly removed and a thin coat of fresh cement applied to the surface. DO NOT USE THICK CEMENT. Apply only enough to cover the surfaces—be sure none of the oil passages are obstructed by an over abundance of cement.

Gasket cement dries quickly — everything should be in readiness to complete assembly immediately after applying the cement. If permitted to dry before assembling, bearing clearance will be greater than it would have been had the cement been in a fluid state at the time of tightening crankcase bolts.

5. Complete assembly by installing gaskets, muffler-manifold assembly and cylinder head, — as illustrated Fig. 42.

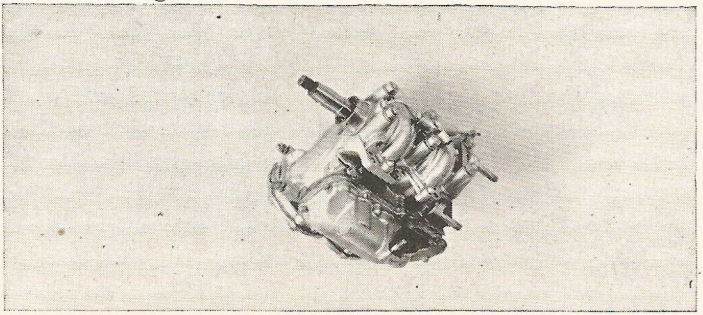


Fig. 42

To remove propeller shaft, gears and drive shaft from lower unit, proceed as follows:

1. Partially withdraw drive shaft as shown Fig. 43 A.

2. Remove pump housing and gear case head — each held in position by three screws. Fig. 43 and 44.

3. Lift out propeller shaft, gear assembly and pinion. (Gear case houses only propeller shaft, bevel gear and pinion.)

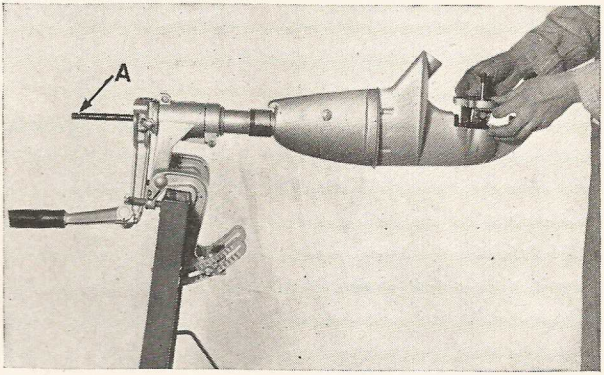


Fig. 43.—Showing removal of gear case head from lower unit.

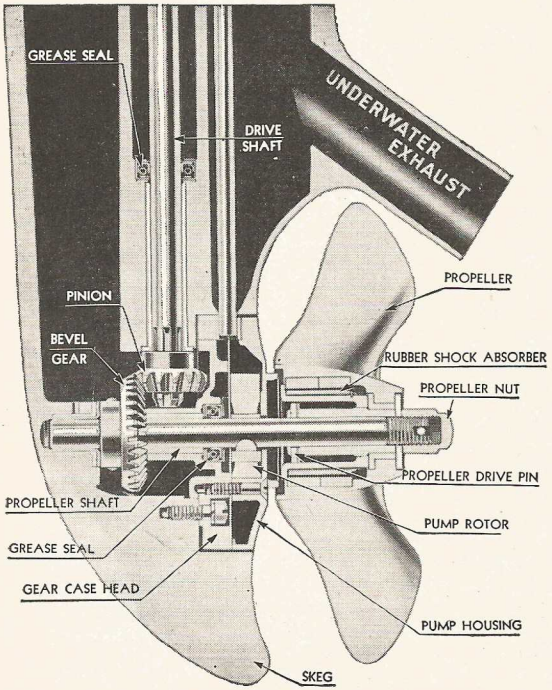


Fig. 44. Gear Case.

4. Reassemble in reverse order of that described above—installing whatever new parts may be necessary. Note: Bearings in gearcase and gearcase head are cast in, consequently when found to be excessively worn are not replaceable—a new gearcase and gearcase head are required under these circumstances. Driveshaft, propeller shaft and bearings are machined to such sizes to permit clearance of .0015" on propeller bearing and .0025" on driveshaft bearing. When necessary to install new gearcase and gearcase head, it is advisable to include new driveshaft and propeller shaft assembly. Fig. 44 and 44-A.

5. Refill with fresh gear lubricant as instructed, page 10.

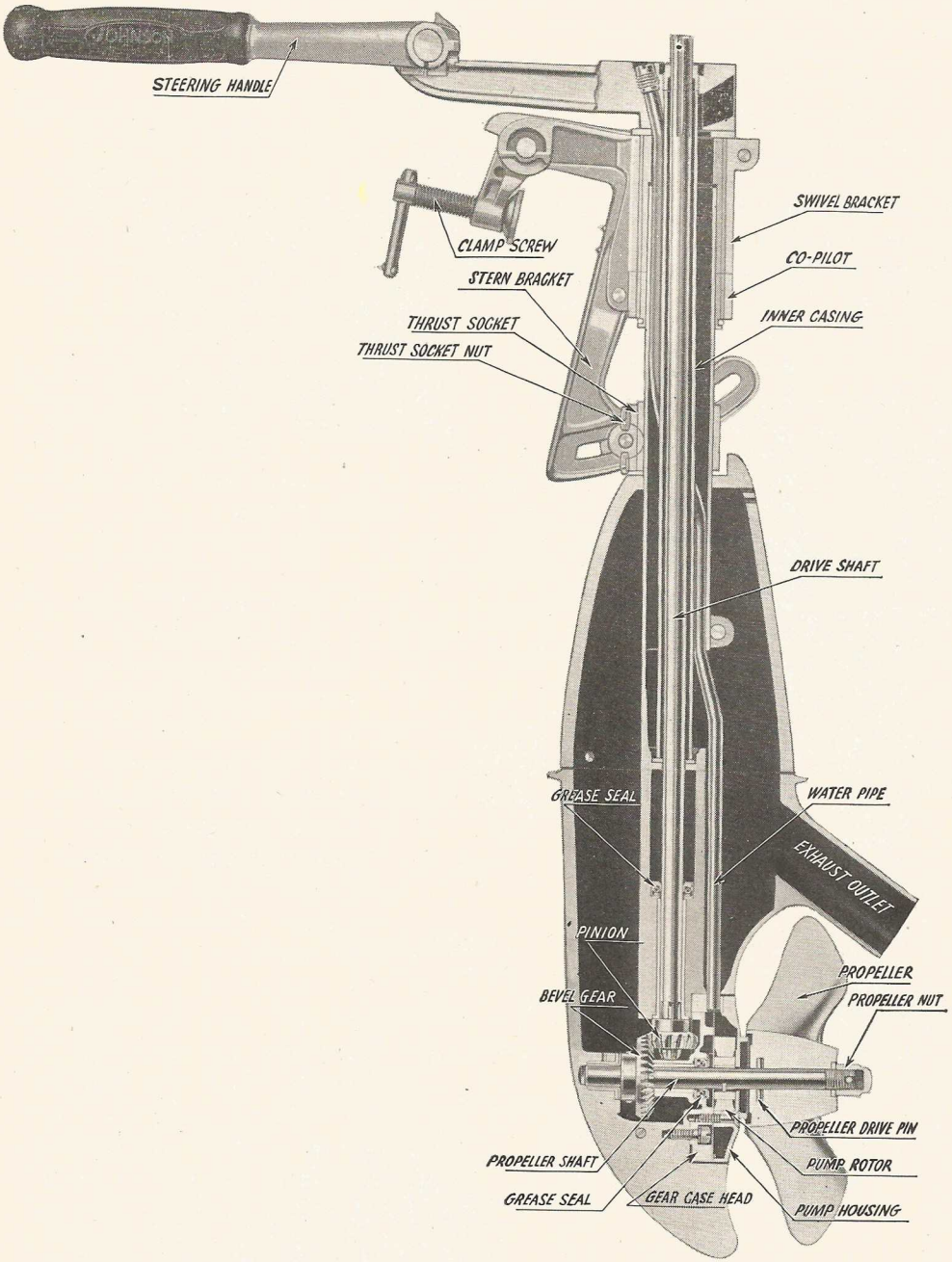


Fig. 44A—Lower Unit Assembly

In event of excessive overheating of motor, source of difficulty may lie in the pump rotor, which probaby will necessitate replacing. To install new pump rotor, proceed as follows:

1. Remove propeller nut cotter pin.
2. Remove propeller nut.
3. Remove propeller.
4. Remove water pump housing (held in position by three screws) Fig. 40 and 44.
5. Lift old rotor from eccentric. Fig. 45.
6. Install new rotor — slip over pump eccentric. Fig. 45.
7. Reassemble all parts in reverse order of above.

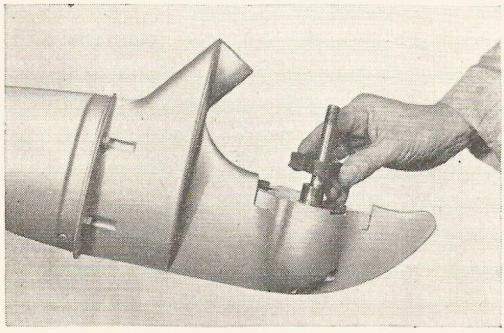


Fig. 45—Showing installation of New Pump Rotor.

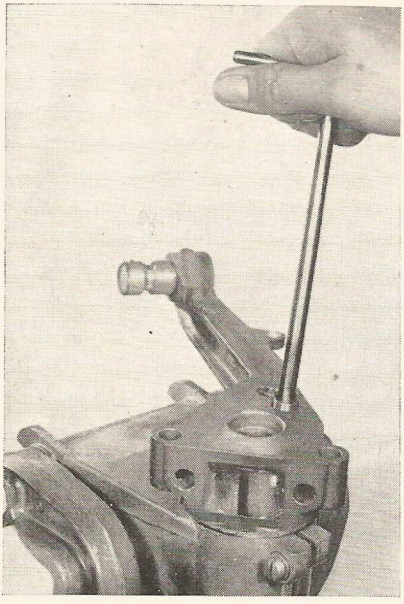


Fig. 47 — Illustrating use of tool No. S-260 for removing water tube from drive shaft casing.

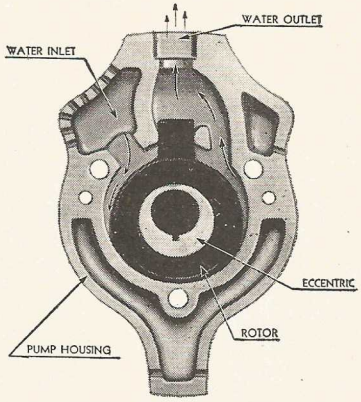


Fig. 46—Positive Rotor, Pump

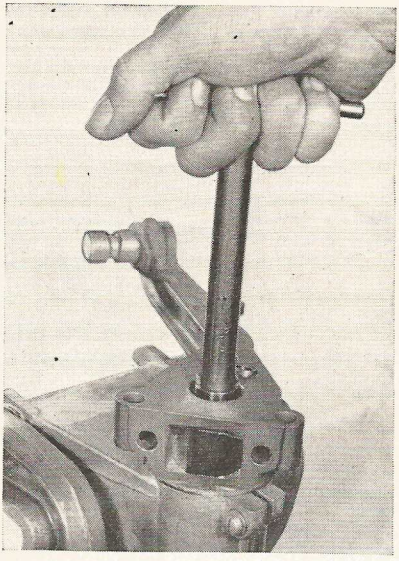


Fig. 48 — Illustrating use of tool No. S-261 for removing inner tube from drive shaft casing.

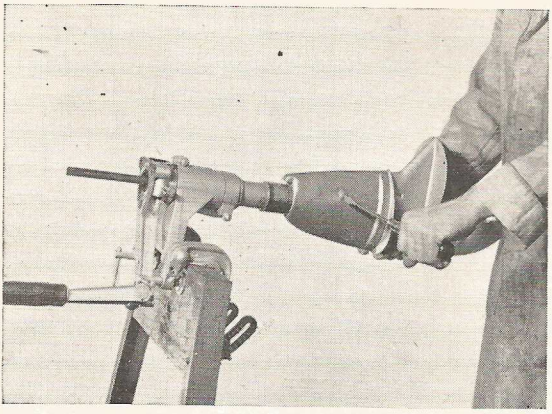


Fig. 49.

If it becomes necessary to remove the gear case housing from drive shaft casing, simply loosen large screw and pull in twisting motion as shown Fig. 49. Assemble in reverse order.

TO INSTALL NEW STARTING CORD, proceed as follows—

1. Remove "Ready Pull."

2. Remove fragments of broken starting cord.

3. Obtain new cord. Attach grip as shown Fig. 50. Use only the special cable provided by the manufacturer.

4. Cut a small piece of wood to fit in ratchet as shown in Fig. 51.

5. Turn in anti-clockkwise direction (right to left) 7 turns, using marker as indicated. Fig. 51 (Be sure to turn right to left—to do otherwise will damage the recoil spring.

6. Insert starting cord as illustrated. Fig. 51.

7. Attach grip as shown.

8. Gradually release until all of cord has been taken up.

9. Attach "Ready Pull" to motor.

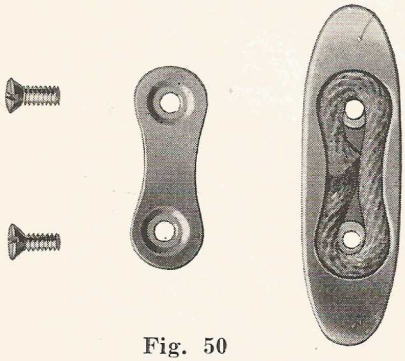


Fig. 50

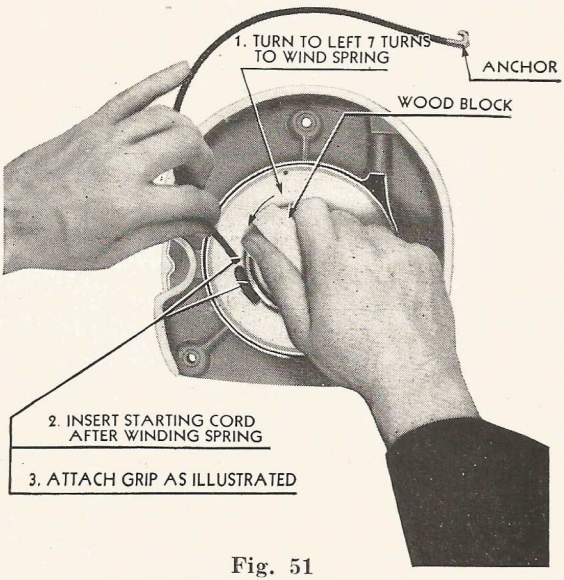


Fig. 51