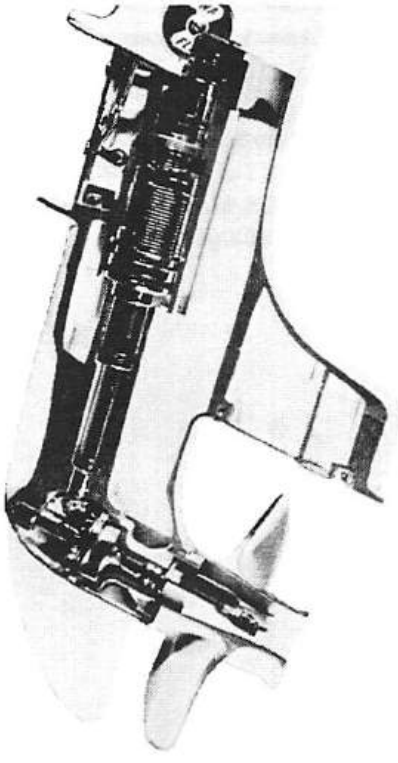
section III

lower unit



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LOWER UNITS DIVIDED INTO 6 MAIN TYPES

Type I - Neutral Clutch

Models: Mark 6-6A-5

Type II - Full Gear Shift

Models: Merc 1100-1100SS-1000-950-950SS-900-850-800-700-650-500-450-400-350-300-200-110-60-39, Mark 58-58A-55-55A-50-35A-30-25-20-15 & KH7

Type III - Automatic Transmission

Models: Merc 250-200-150-100 & Mark 28-28A-15A-10-10A

Type IV - Standard Non-Shift

(Unicast Unit)

Models: Mark 40-7, KG9, KF9, KG7, KF7, KE7, KF5, KG4, KE4, KF3 and Quicksilver Lower Units

(Two-Piece Unit, Old Models)

Models: KD4, KE3 and Models Prior to 1947

Type V - Direct Reversing

Models: Merc 800-700-600 & Mark 78-78A-75-75A

Type VI - Quicksilver

Models: Mark 55H-40H-30H-20H & KG9H, KG7H, KF7HD, KG4H

DRIVE SHAFT HOUSINGS DIVIDED INTO 4 MAIN TYPES

Type I - Spring Loaded

Models: K to KD4 & KE3

Type II - Spring Loaded and Rubber Mounted

Models: Mark 40-20-15-7, KH7, KG7, KF7, KE7, KG4 & KE4

Type III - Rubber Mounted

Models: Mark 6-6A-5, KF5 & KF3

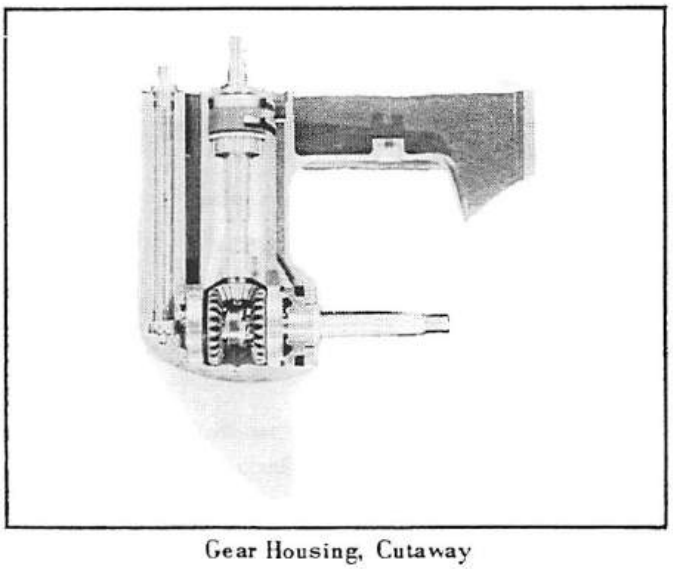
Type IV - Dyna-Float Shear Mounted

Models: Merc 1100-1100SS-1000-950-950SS-900-850-800-700-650-600-500-450-400-350-300-250-200-150-110-100-60-39, Mark 78-78A-75-75A-58-58A-55-55A-50-35A-30-28-28A-25-15A-10-10A

General Description

The lower unit is composed of 3 main sections:

1. Gear housing assembly (including propeller).
2. Drive shaft housing assembly.
3. Clamp and swivel bracket assembly.



Gear Housing, Cutaway

PART'S INSPECTION - HOW TO CHECK

Before reassembling, check all parts thoroughly. Check that the housing and all internal parts are perfectly clean.

Bearings

Cartridge needle bearings should always be replaced at overhaul and when rust conditions are present. Bearings are relatively inexpensive.

Ball bearings should be cleaned first and dried in the following manner:

a. With one hand, grasp the outer race firmly, and with the other attempt to work inner race in and out. There should not be excess play.

b. Spin outer race. If bearing sounds rough or has catches in it, discard it. Bearings should have smooth action, no rust stains. Compare with new bearing.

Note: Always press cartridge type needle bearings into part with the "lettered" side up. Opposite side has a greater radius for better installation. Check bearings after installation to see that they are free and not frozen or stuck due to improper installation or tight fit.

Inspect roller bearings, in particular, and check that they are not worn. It is recommended when repairing motors that they be replaced, as they are relatively inexpensive.

Seals

Always replace oil seals when repairing, as they are relatively inexpensive and can save trouble at a later date.

Drive Shaft and Propeller Shaft

Check for worn, twisted or bent shafts.

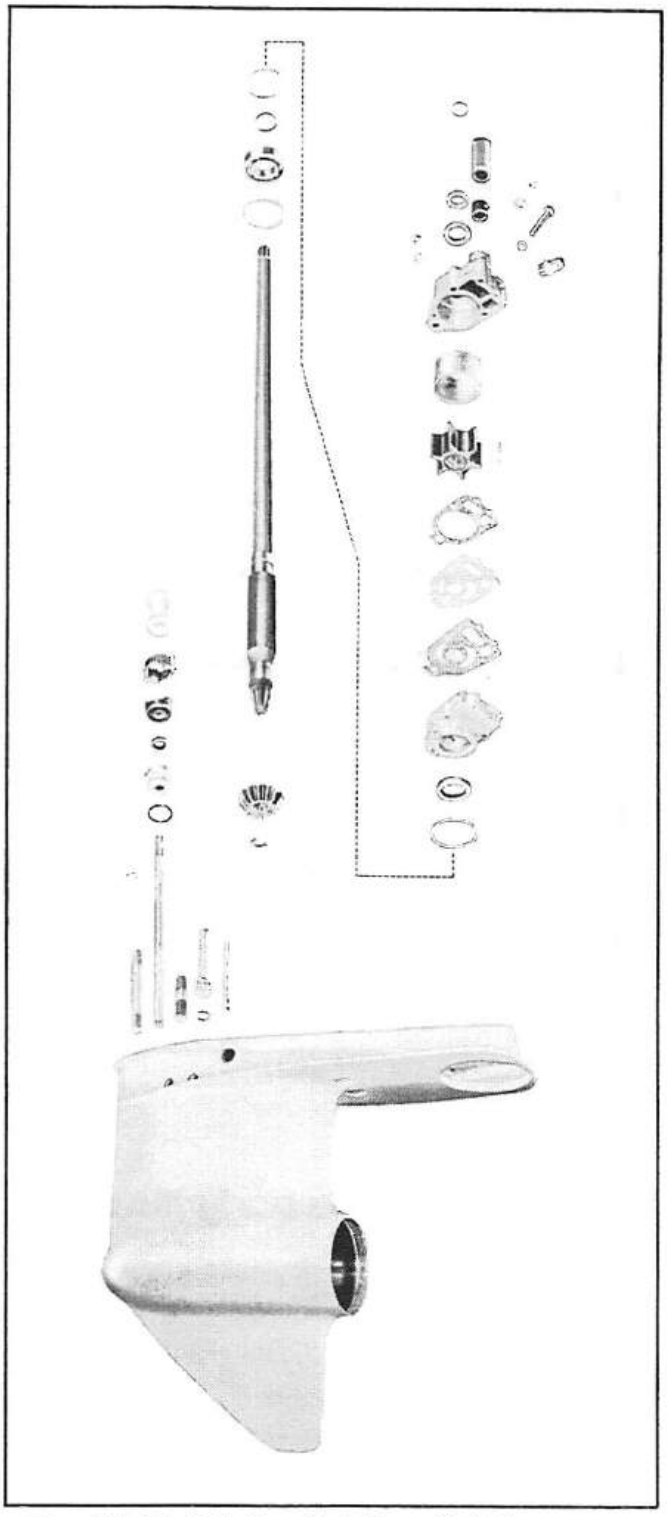
Gears

If teeth are worn, pitted, chipped or broken, or if corners are rounded, chipped or otherwise damaged, replace gear.

Check for wear, improper fit (too tight or too loose), wrong conical angle or too much back lash.

Water Pump Assembly

Check for worn, broken or corroded water pump housing. Check impeller for wear or broken vanes.



Merc 800-700 Full Gear Shift Drive Shaft Components

MARK 6 TYPE LOWER UNIT

(Neutral Clutch with Rubber Mounted Drive Shaft Housing)

Disassembly

A. MODELS

Mark 6-6A and Mark 5

B. LOWER DRIVE SHAFT ASSEMBLY

1. Loosen 2 small round head screws in holding clamp for shift cable at right side of powerhead.
2. Remove large slotted special screw in front top of drive shaft housing which holds drive shaft housing in inner pivot tube.
3. Loosen stress bolt and nut on top side of drive shaft housing and pull down to disengage, then remove entire lower unit from powerhead.
4. Remove shift cable tube by removing brass nut connection and compression fitting at side of block. (Figure 1)
5. Pull out entire tube.

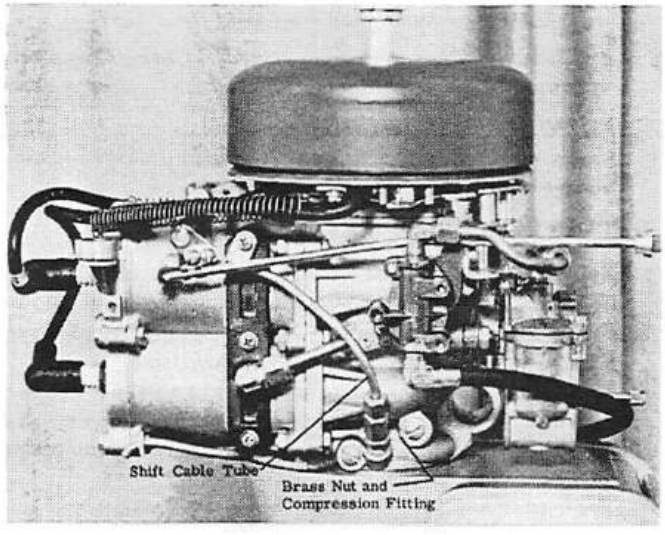


Figure 1. Removing Shift Cable Tube

6. Remove copper water tube from inside of inner pivot tube by pulling down.
7. Loosen screw in co-pilot locking ring to release powerhead and inner pivot tube assembly from clamp and swivel bracket assemblies.
8. Remove co-pilot clamp ring by pulling out. *(Note: Ring has a 5/8" spindle extension extending into bushing inside of swivel bracket.)*

C. DRIVE SHAFT HOUSING

1. Place unit in vise with 2 blocks of soft wood to protect against marring by vise jaws.
2. Remove hexagon nut and tab lockwasher, which holds 3 sections together, from stud on leading edge of housing.
3. Remove Phillips head screw from inside exhaust outlet which holds gear and clutch housing assembly together.
4. Remove hexagon nut and lockwasher from trailing edge stud, below anti-cavitation plate, which holds 3-piece assembly together.

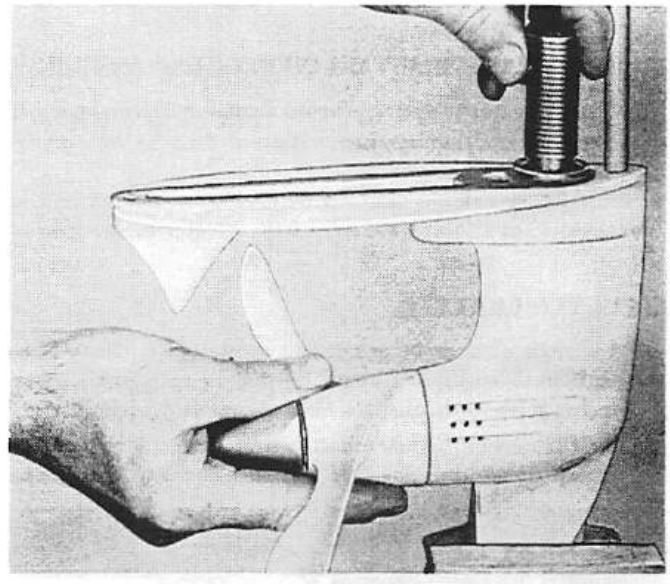
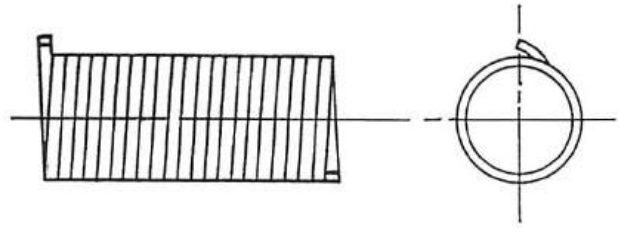


Figure 2. Turning Clutch Spring

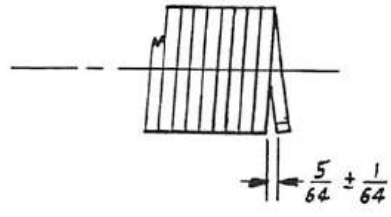
5. Separate top of drive shaft housing from bottom part of assembly.
6. Turn propeller slowly counterclockwise, at same time pulling lower drive shaft housing assembly away from gear housing. *(Note: By turning propeller slowly counterclockwise, the engaging spring from drive shaft unwinds, thus allowing separation of lower drive shaft from gear housing.)*

D. WATER PUMP

1. Remove rubber seal ring from drive shaft spline top end.
2. Remove water pump cover assembly, stainless steel washer, impeller, impeller key and stainless steel



Before Spreading



Spread Bottom 1/2 Coil As Shown

Figure 3. Spreading Coil

water pump housing from middle section of 3-piece assembly in this order.

NOTE: If required, remove water line rubber seal in pilot cap by pressing in 2 side knobs which hold it in cover.

3. To remove drive shaft seal in pilot cap, pry out with screwdriver.

E. LOWER DRIVE SHAFT & PINION GEAR ASSEMBLY

1. Remove clutch spring from knurled clutch drum by turning propeller counterclockwise to unwrap spring from drum. (Figure 2)
2. Pull upper drive shaft out of middle section and remove brass thrust washer at top of upper clutch drum.

F. CLUTCH CHATTER

1. A clutch chatter or grinding noise, which may occur on Mark 5 when in neutral gear, is caused by clutch spring without initial tension wound into spring.

   IMPORTANT: Clutch chatter will have no effect on engine operation, nor will it result in harm to engine.

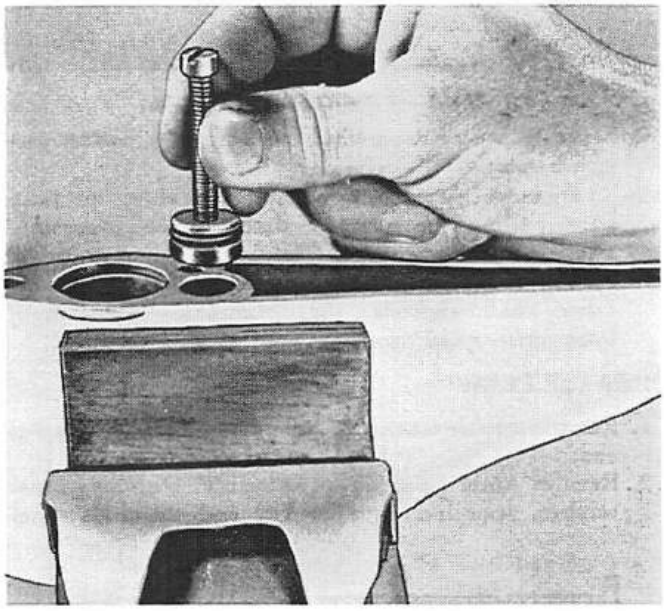


Figure 4. Removing Plug on Shift Linkage Cartridge

2. To eliminate clutch chatter in Mark 5, remove clutch spring and clamp bottom half coil of spring in vise. (Figure 3)
3. With screwdriver, bend bottom half coil 5/64" away from spring (plus-or-minus 1/64"). This will pretension clutch spring when reinstalled.

G. CABLE LINKAGE ON NEUTRAL SHIFT

1. Entire cable shift mechanism is contained in a separate cavity of middle assembly.
2. Remove seal in bottom of housing (middle assembly) by using ¼"-20 screw, turned into seal plug to withdraw assembly. (Figure 4)

   NOTE: This assembly should not be separated from its original sequence on cable when disassembling. Try to keep assembly strung on cable for easy replacement. Anchor on end of cable is soldered to cable, followed by brass trip finger, slotted bushing, spring and double tapered rubber seal. Check for proper reassembly of seal. Long, tapered end faces down.

   IMPORTANT: If excessive grease is found in cable tube, inside diameter of seal leaks. If water is found in gear case, outside diameter leaks.

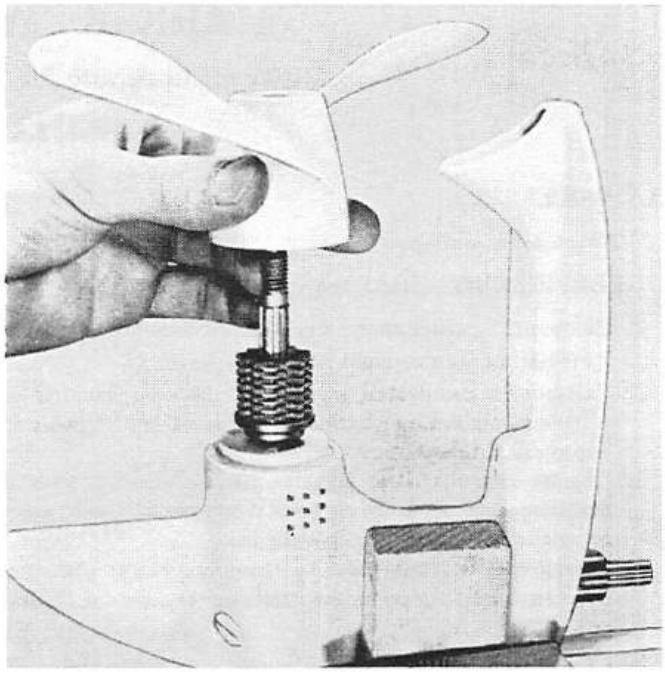


Figure 5. Removing Propeller from Shaft.

H. PROPELLER AND DRIVE SHAFT

1. Remove propeller nut by straightening tabs of lockwasher which are bent over flats of propeller nut.
2. Remove propeller clutch spring, steel washer and fibre which fit into back hub of propeller.
3. Remove propeller, being careful not to lose 14 discs (7 fibre and 7 metal) lined up on propeller shaft. (Figure 5) These are followed by clutch thrust plate and gear case cover.

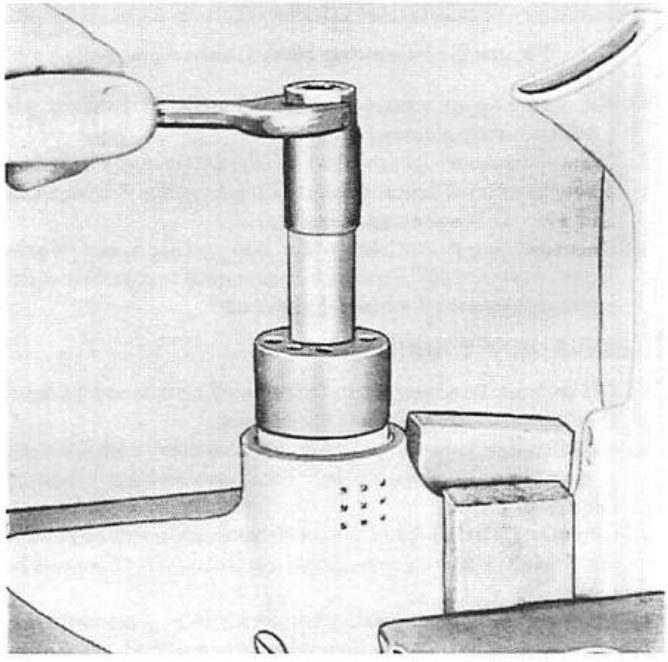


Figure 6. Removing Gear Case Cover

4. Remove gear case cover (left hand thread) with Water Pump Tool (91-24267). Set dowels in cover holes, apply wrench to flats of tool and turn. (Figure 6)
5. Pull propeller shaft drive assembly, including water intake housing, rubber sealing ring, metal retainer and propeller shaft assembly which includes snap ring, shim, ball bearing, bevel drive gear, key and metal bearing ring. (Figure 7)
6. Remove shims, if any, from shoulder in housing beneath propeller shaft ball bearing.
7. To remove propeller shaft ball bearing and gear with Propeller Shaft Gear Tool (91-26376A1), use open end of cup to remove ball bearing and other end to remove gear on shaft (Figure 8).

I. LOWER DRIVE SHAFT ASSEMBLY & GEAR HOUSING

1. Bend down tab washer on pinion gear and remove hex head bolt which holds pinion gear to shaft.
2. Remove pinion gear.

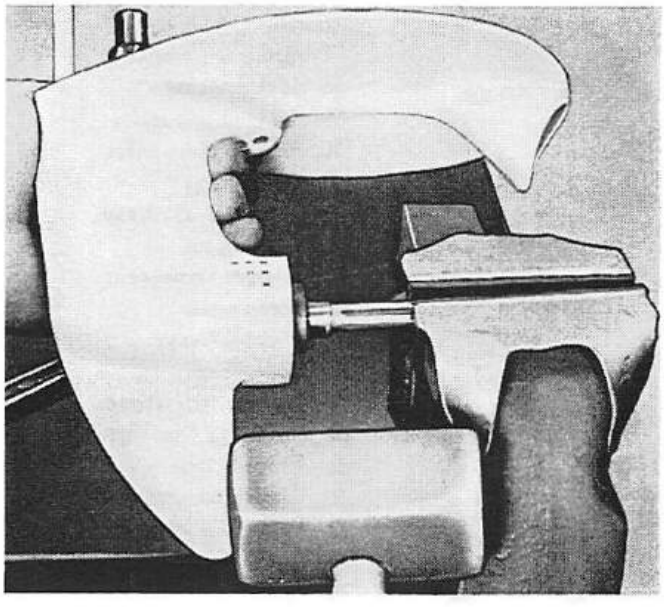


Figure 7. Pulling Propeller Shaft Assembly

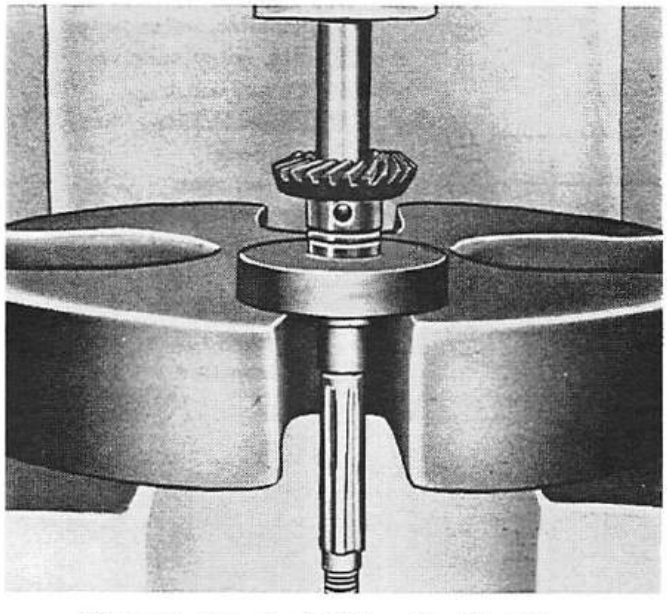


Figure 8. Pressing Off Propeller Shaft Gear

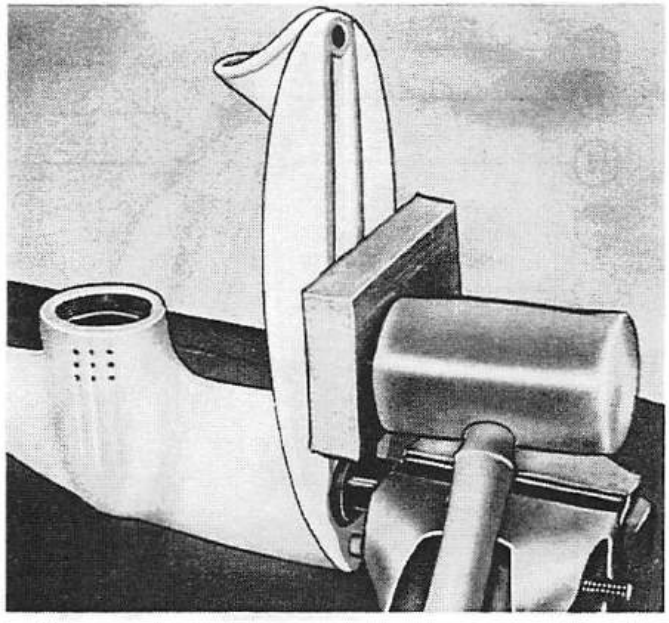


Figure 9. Removing Lower Drive Shaft

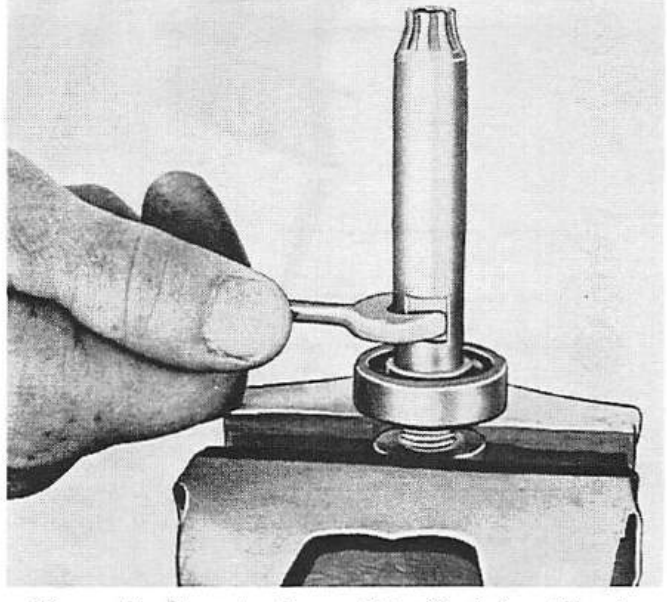


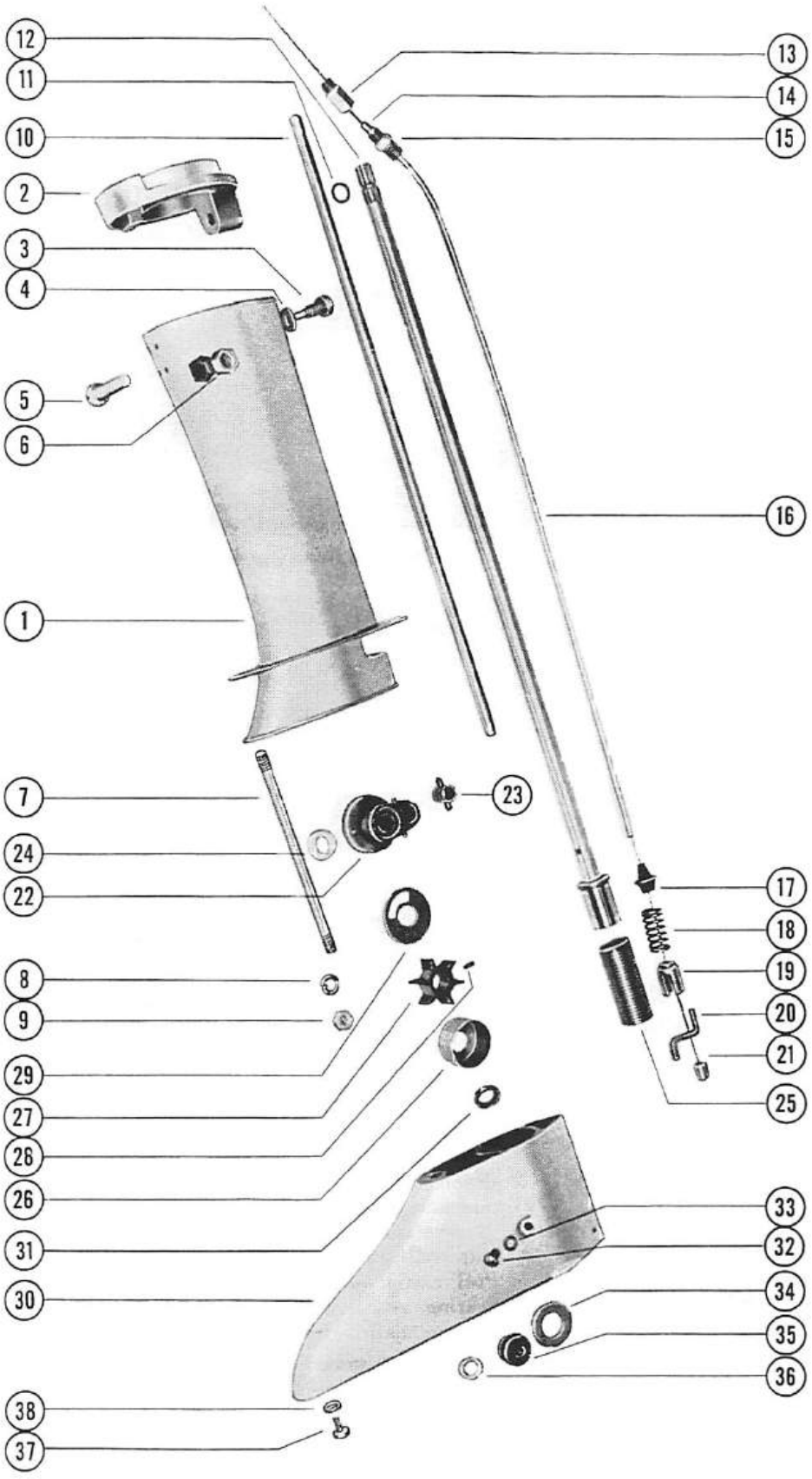
Figure 10. Removing Lower Drive Shaft from Clutch Drum & Bearing

3. Place short lower drive shaft in vise between 2 pieces of wood or soft metal protectors.
4. Remove short lower drive shaft by tapping on casing with mallet. (Figure 9)
5. Pull entire assembly -- including grease seal and bearing spacer, lower knurled clutch drum, ball bearing and shaft – free from lower gear housing.

NOTE: For proper placement when reassembling, watch position of bearing spacer when removing. Wide part is placed UP in lower gear housing.

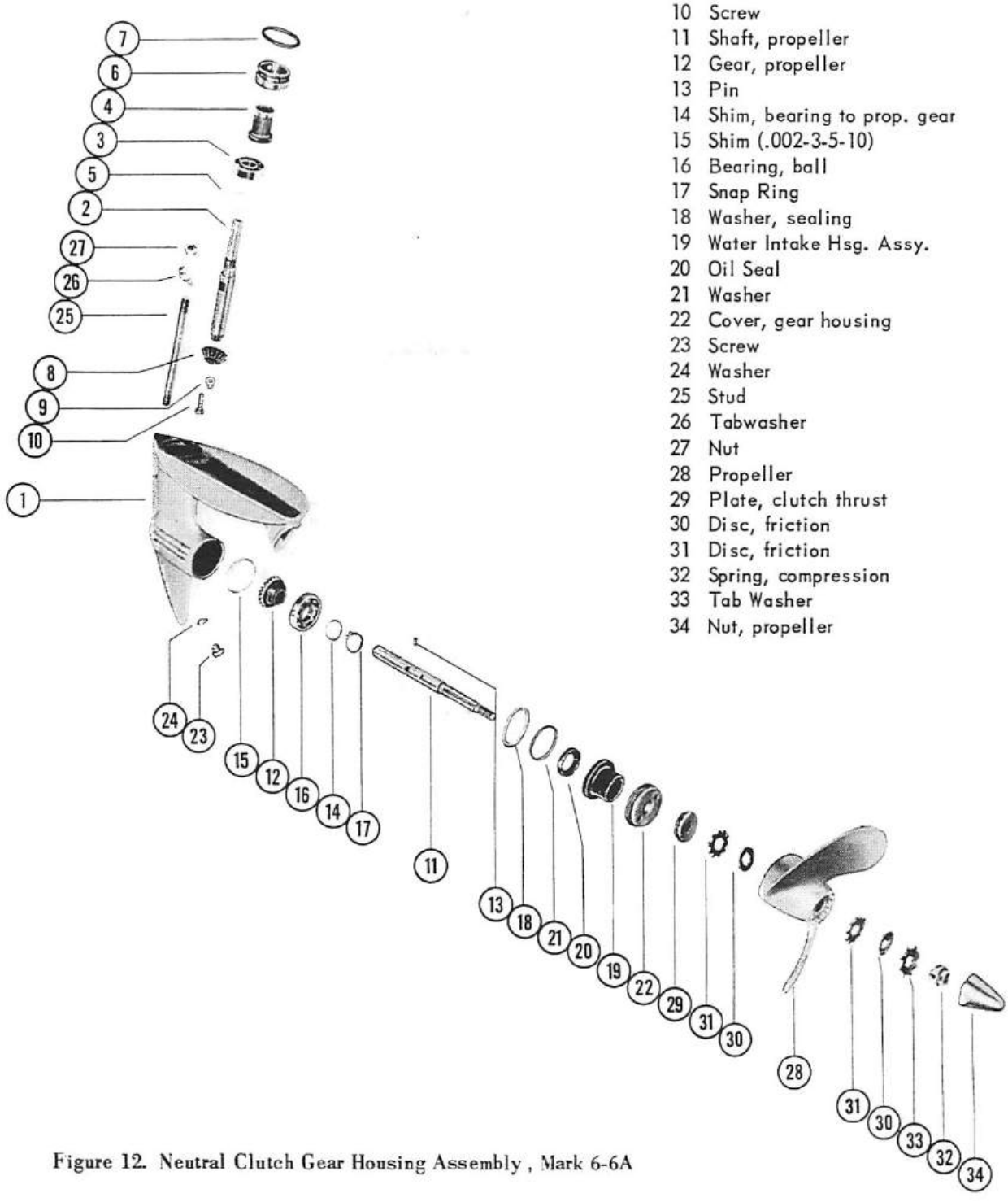
J. DRIVE SHAFT BEARING & LOWER DRIVE SHAFT

1. Place clutch drum in protected vise jaws. Note that there are two flat sides on drum.
2. Unscrew drive shaft from clutch drum with wrench and slide bearing off shaft. (Figure 10)
3. Remove drive shaft and propeller shaft needle bearings from gear housing with Gear Housing Needle Bearing Tool (91-24273).



1 Drive Shaft Hsg., up.
2 Top, d. s. hsg.
3 Screw
4 Lockwasher
5 Screw, clamping
6 Nut
7 Stud
8 Lockwasher
9 Nut
10 Pipe, water inlet
11 "O" Ring
12 Upper D. S. Assy.
13 Connector
14 Sleeve, compress.
15 Connector
16 Tubing Assy.
17 Cone Seal
18 Spring, trip finger
19 Housing, trip fing.
20 Finger, trip
21 Cable, control
22 Pilot Cap Assy.
23 Bushing, pilot cap
24 Oil Seal, pilot cap
25 Spring, clutch
26 Housing, water pump
27 Impeller, water pump
28 Pin, impeller drive
29 Cover, w.p. hsg.
30 Lower D.S.Hsg. Assy.
31 Oil Seal
32 Screw, vent
33 Washer
34 Washer, thrust
35 Plug
36 "O" Ring
37 Screw
38 Lockwasher

Figure 11. Neutral Clutch Lower Unit, Mark 6-6A



1 Gear Housing Assy.
2 Drive Shaft
3 Bearing, ball
4 Drum, clutch
5 Shim,(.002-3-5)
6 Spacer
7 "O" Ring
8 Gear, pinion
9 Lockwasher
10 Screw
11 Shaft, propeller
12 Gear, propeller
13 Pin
14 Shim, bearing to prop. gear
15 Shim (.002-3-5-10)
16 Bearing, ball
17 Snap Ring
18 Washer, sealing
19 Water Intake Hsg. Assy.
20 Oil Seal
21 Washer
22 Cover, gear housing
23 Screw
24 Washer
25 Stud
26 Tabwasher
27 Nut
28 Propeller
29 Plate, clutch thrust
30 Disc, friction
31 Disc, friction
32 Spring, compression
33 Tab Washer
34 Nut, propeller

Figure 12. Neutral Clutch Gear Housing Assembly , Mark 6-6A

Reassembly

NOTE: Refer to Page 2, this section, prior to reassembly.

A. LOWER GEAR CASE HOUSING

1. Install needle bearings in gear housing for drive shaft and propeller shaft with Gear Housing Needle Bearing Tool (91-24273).
2. Fit ball bearing race to lower drive shaft extension by pressing down to offset shoulder on shaft.
3. Screw lower half knurled clutch drum on shaft and tighten with wrench.
4. Place brass shims, as necessary, in cavity of gear housing for drive shaft bearing seat.
5. Insert assembly into drive shaft chamber in gear housing.
6. Place bearing spacer ring in journal with wider collar end up and seat grease retainer seal on collar.
7. Insert pinion gear into bottom gear housing and attach to splined end of drive shaft extension. Use new lock tab washer and hexagon head cap screw to hold. Place shaft in vise to tighten. Be sure to use jaw protectors in vise to prevent damage to knurled clutch drum. Tighten screw with a box wrench and bend tab on washer.
8. Ready the propeller shaft and gear by placing gear on closed end of Propeller Shaft Gear Tool Cup (91-26376A1). Place blank end of shaft into gear shoulder and line up drilled key hole in shaft with one in shoulder of gear.
9. Spread lubricant on shaft and press in with arbor press.
10. Insert drive pin to lock in place on shaft. (Refer to Figure 8.)
11. Install propeller shaft ball bearing on shoulder of gear -- shimming if necessary -- with same tool (91-26276A1). (Refer to Figure 8.) Place collar of tool on top of cup to replace ball bearing when pressing on with arbor press.
12. Place brass shim and snap ring to hold ball bearing on shoulder of gear.
13. Place large steel ring on shoulder within housing. (See "NOTE", following) Replace any brass shims which were removed in disassembly.
14. Drive gear and shaft assembly into housing with mallet, with care that entire assembly is entered straight into housing and that 2 gears are meshed properly.

NOTE: When damaged lower gear housing is replaced with A-1607-400A2 gear housing assembly, it can be used on all Mark 5 and Mark 6 engines. When using this gear housing with propeller ball bearing A-30-21776 (5/16" wide), use spacer A-23-23756 furnished. Place spacer on seat in gear housing before installing propeller shaft assembly. When using propeller shaft ball bearing A-30-22351 (3/8" wide), the spacer is not required. Normal gear back lash should be between .003"-to-.005". Shims of various thicknesses (.003",.005",.007") may be required to attain a correct tolerance for proper gear lash. Only difference between Mark 5 and Mark 6 lower units is the gears, and Mark 5 has smaller propeller.

Metric Conversion: 1" = 25.4mm

Mark 5 - Straight Cut Bevel Gear 16:21
Propeller 6-¾" dia. by 6-¼" pitch

Mark 6-6A - Spiral Bevel Gears 14:23
Propeller 7-¼" dia. by 7" pitch

IMPORTANT: Check play of entire assembly after gears are meshed by working drive shaft and propeller shaft back and forth to find amount of backlash -- not less than .003" nor more than .005". If too much backlash, remove shims; if too tight and no backlash, add shims for correct play and conical angle of gears. Shims must be removed or added only between ball bearing and steel washer on shoulder of gear housing.

15. Insert steel "L" washer with shoulder up, rubber washer of same dimension and housing water intake spacer which contains oil seal.
16. Position water intake housing properly to seal gear.
17. Turn gear case cover in and tighten with Water Pump Cartridge and Cover Puller (C-91-24267) by placing dowels of tool in cover holes (left hand thread).
18. Lubricate threads with MULTIPURPOSE Lubricant (C-92-35226) before installing. (Figure 6 in Disassembly)
19. After installing gear case cover, set clutch thrust plate on splined shaft with small side down. Follow alternately with 7 fibre and 7 steel friction discs, starting with a steel disc. DO NOT lubricate these clutch discs.

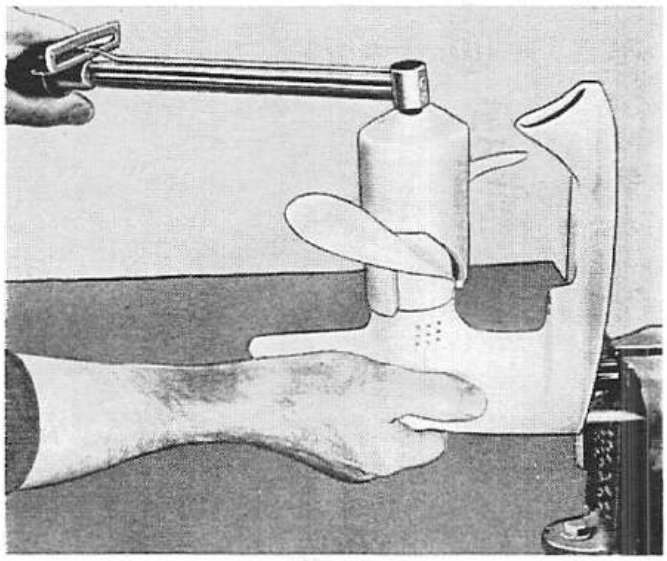


Figure 13. Torquing Propeller and Nut

20. Place propeller over friction discs on shaft, rotate lightly and propeller will drop in place. (Figure 5 in Disassembly)
21. Set one fibre disc to fit in recess of propeller hub and one steel disc, tab washer, compression spring and propeller nut.
22. Tighten nut securely with wrench and torque with Torque Tool (C-91-25666) to 170-to-240 in. lbs. (31.2-to-42.6kg/cm). *(Refer to Torque Specification Chart in Miscellaneous Section VIII.)* When checking propeller torque, hold clutch drum tight in vise. Use jaw shields or blocks of soft wood in vise so that shaft is not scored. (Figure 13)
23. Adjust clutch beneath propeller. If too tight, loosen nut. If too loose, add .010" shim beneath clutch spring.
24. Bend tabs on lock washer to flats on propeller nut.
25. Thread holding stud into top leading edge of gear housing.

B. LOWER DRIVE SHAFT ASSEMBLY (CENTER SECTION)

1. Replace water pump housing. Tab in bottom of housing should fit slot in chamber.
2. Set brass thrust washer in bottom of drive shaft chamber.
3. Slip upper drive shaft assembly thru brass thrust washer in chamber and water pump housing so that collar on upper clutch drum seats on thrust washer.
4. Insert impeller drive pin into drive shaft and slip pump impeller with keyway over pin.
5. Rotate so that impeller is locked on shaft.
6. Replace water pump cover with tab on slot to lock in place.
7. If oil seal in pilot cap assembly is to be removed, place with lip up.
8. If rubber bushing is renewed, squeeze in so that knobs seat in side holes.
9. Set pilot cap assembly on drive shaft and replace "O" ring in groove on upper drive shaft.

C. SHIFT LINKAGE CABLE CONTROL

1. String the following parts on control cable in order: Trip finger *(check that wide offset of finger is up to fit in slot in housing)*, brass slotted trip finger housing, spring and rubber cone seal. Be sure that cone seal is placed on cable with longer counter end in spring. (Figure 14)

   IMPORTANT: Do not invert, or grease leak will result.
2. Thread free end of control cable up thru housing and pull assembly into chamber. Be careful to slip trip finger into slot so that it may properly engage clutch spring.
3. Close up chamber by inserting brass plug with "O" ring to seal. Check that tapped hole is out for easy removal. (Refer to Figure 5 in Disassembly.)
4. Reassembly of lower drive shaft housing assembly now is completed.

D. UPPER DRIVE SHAFT HOUSING, LOWER DRIVE SHAFT HOUSING AND GEAR CASE HOUSING

1. Place clamp and swivel bracket assembly on motor stand to receive powerhead and pivot tube.
2. Check that co-pilot ring is inserted into swivel bracket before installing pivot tube of powerhead into swivel bracket.
3. Also make certain that upper and lower rubber and brass co-pilot bushings are in their proper place in swivel bracket and that they are lubricated properly with MULTIPURPOSE Lubricant (92-30239).

   NOTE: On Mark 6-6A, be sure to install bottom cowl on powerhead BEFORE placing powerhead into swivel bracket.
4. Grease top of pivot tube and slip drive shaft housing top onto pivot tube with drilled lug to front to receive upper drive shaft housing.
5. Use drift pin to line up hole in housing and housing top and secure with snub-nosed screw and washer.
6. Replace clamping screw and nut and tighten.
7. Replace stud in trailing edge of upper drive shaft housing to hold upper housing to gear case.
8. Insert cable control guide tubing down into left side of powerhead and tighten with compression nut and connector for extension.
9. Straighten guide tube, placing it against left inside of upper drive shaft housing. *If not straight, drive shaft splines will not mesh with splines of crankshaft and tubing will push it to the side.*
10. Insert copper water tube up into pivot tube to seat inside water inlet cap. Check that drilled bleeder hole in tube is at bottom.
11. Attach center assembly (lower drive shaft housing) to upper drive shaft housing as follows: (Refer to Figures 11 and 12.)
    a. Insert short piece of tubing (control cable guide tube extension) into bottom of pilot cap to guide end of water tube into top seal of cap.
    b. Push up on pilot cap to seat in chamber of upper drive shaft housing and move entire center assembly towards upper housing, at the same time watching that end of cable guide tube seats into top of shift assembly chamber.

    NOTE: Be sure that water pump cover plate does not move out-of-place. It can be held by thin piece of metal or screwdriver.
12. Place clutch spring on lower drive shaft clutch drum by turning spring onto drum in counterclockwise rotation so that spring opens and inserts freely. End for trip lever is up.
13. Place lower gear assembly with clutch spring into center assembly by engaging spring onto upper half of clutch drum.
14. Turn propeller slowly counterclockwise to wind spring onto upper drum, at same time pushing up on entire assembly to fit all 3 assemblies together securely.

    NOTE: Rotation must be kept up until the 2 housings are together tightly, or it will result in damaged clutch spring. Place tab washer and hexagon head nut on stud and tighten with open end wrench at leading edge. Place nut and washer on bottom stud which holds gear case. Screw in and tighten bolt and washer at exhaust outlet below anti-cavitation plate to hold entire assembly together.
15. Insert control cable into guide tube extension and replace extension by fastening with clamp on side and connecting compression nut on adaptor fitting.
16. Replace all allied components.

    NOTE: For Neutral Clutch Adjustment of Mark 6-6A-5 Models, Turn to Miscellaneous Section VIII.

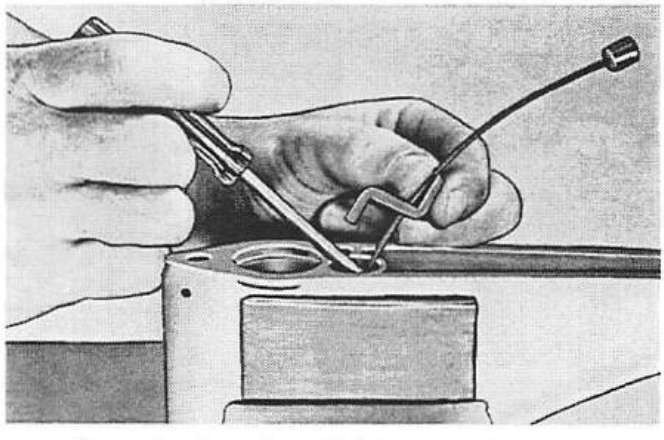


Figure 14. Installing Shift Linkage Assembly in Trip Finger Chamber