MERCURY

KIEKHAEFER CORP.

(General Offices)
Fond Du Lac, Wisc.

(Parts and Service Division)
Beaver Dam, Wisc.

CONDENSED SERVICE DATA

Series Year Produced	10-15 hp	18-20 hp	20-25 hp	35 hp
1955	.....	Mark 20, 20H, 25	.....	.....
1956	.....	Mk 20H, 25	.....	.....
1957	Mk 10	Mk 25	.....	.....
1958	Mk 10	Mk 25	Mk 28	.....
1959	Mk 10A, 15A	.....	Mk 28A	.....
1960	Merc 100, 150	.....	Merc 200	.....
1961	Merc 100, 150	.....	Merc 200	.....
1962	.....	.....	Merc 250	.....
1963	.....	.....	Merc 200	Merc 350
TUNE-UP				
Rated Horsepower	10 - 15	16 - 20	20-25	35
Rated rpm	4500	5400	5400	5200
Bore—Inches	$2\frac{11}{32}$	$2\frac{7}{16}$	$2\frac{9}{16}$	$2\frac{7}{8}$
Stroke—Inches	$2\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{1}{8}$	2.3
Number of cylinders	2	2	2	2
Displacement—Cu. In.	18.5	19.8	22	30
Compression @ Cranking Speed	Not more than 15 psi variation between cylinders			
Spark Plug				
Champion	J7J, J7M, J6J or J6M	J6J or J6M	J6J or J6M	J6J
AC	M45 or M44C	M44C	M44C	M44C
Electrode gap	0.025	0.025	0.025	0.025
Magneto				
Make	Phelon	Phelon	Phelon	Phelon
Point gap	0.018	0.018	0.018	0.020
Timing	See Text	See Text	See Text	See Text
Carburetor				
Make	Tillotson	Tillotson or Carter	Tillotson	Tillotson
Model	See Text	See Text	See Text	KC-4A
Adjustment	See Text	See Text	See Text	See Text
Fuel—Oil Ratio	20:1	20:1	20:1	20:1
SIZES—CLEARANCES				
Piston Rings End gap Side clearance Piston Skirt Clearance Crankshaft Bearing Journal Diameter Upper main bearing Center main bearing Lower main bearing Crankpin	Publication Not Authorized by Manufacturer			
Crankshaft Bearing Diametral Clearance				
Upper main bearing	Roller Brng.	Roller Brng.	Roller Brng.	Roller Brng.
Center main bearing				
Lower main bearing	Roller Brng.	Roller Brng.	Roller Brng.	Roller Brng.
Crankpin	Roller Brng.	Roller Brng.	Roller Brng.	Roller Brng.
Piston Pin Diameter				
Clearance	Roller Brng.	Roller Brng.	Roller Brng.	Roller Brng.
TIGHTENING TORQUES (All Values In Inch—Pounds)				
Connecting Rod	180	180	180	180
Flywheel Nut	780	780	780	780
Reed Valve	35 - 40	35 - 40	35 - 40	35 - 40
Center Main Brng.	150	150	150	150
Cylinder Cover	60	60	60	60
Exhaust Cover	60	60	60	60
Transfer Port Cover	45 - 60	45 - 60	45 - 60	45 - 60
Spark Plug	180	180	180	180

LUBRICATION

The power head is lubricated with oil mixed with the fuel. If "Kiekhaefer Quicksilver" 2-cycle engine oil is used, one 12 ounce can should be mixed with each 2 gallons of gasoline. If "Quicksilver" oil is not available, a good grade "Type MM," SAE 30 motor oil may be substituted by mixing ½-pint of oil with each gallon of fuel. Gasoline and oil should be thoroughly mixed. Marine white, automotive white, or light-aircraft gasoline is recommended. If not available, use a suitable "Regular" gasoline.

The lower unit gears and bearings are lubricated by oil contained in the gearcase. Special "Quicksilver Outboard Gear Lubricant" or a non-channeling, waterproof, marine gear lubricant should be used. Gearcase is filled through the lower filler hole, located on starboard side of gear case, until lubricant reaches the level of the upper (vent) plug hole. Lubricant should be maintained at level of upper vent plug.

FUEL SYSTEM

CARBURETOR. Carter or Tillotson carburetors are used. Refer to the appropriate following paragraphs for overhaul and adjustment procedures.

Carter Model N-2150S carburetors are used on Mark 20H motors. Refer to Fig. M45. Initial setting is 1¼ turns open for both the idle adjustment needle (6) and high speed adjustment needle (16). Final adjustment must be made under load after operating temperature has been reached. Adjust the high speed needle to provide the leanest setting which will permit full power and acceleration. Adjust the idle needle after high speed needle has been adjusted, to provide smooth operation under load at slow speeds. Clockwise rotation of the high speed adjustment needle leans the mixture. Clockwise rotation of the idle needle provides a richer mixture.

To disassemble the carburetor, scribe a line on the body and bowl to assure proper assembly, then remove the bowl nut and fuel bowl. To check and adjust the float level, invert the carburetor body with bowl removed, and measure the clearance between nearest edge of float and gasket surface of body flange. This clearance should be $\frac{5}{32}$-inch with body inverted and float resting against the seated inlet needle. Adjust by bending lip of float.

When installing throttle valve (3), make sure the "C" trademark is toward idle port. Seat the valve by tapping lightly with a screwdriver and use new screws to secure the valve.

Carter parts numbers are as follows:

Repair kit	1772
Inlet needle and seat	25-219S
Main nozzle	12-413
Float and lever assembly	21-162S
Idle adjustment screw	30A-60
High speed adjusting needle	37-66S
Throttle valve screw	39-10

Tillotson Carburetors: All models except Mark 20H are normally equipped with Tillotson Series AJ, KA, KB or KC carburetors. Construction is similar for all carburetors. Refer to Fig. M46. Some early models are equipped with a high speed mixture adjustment needle instead of the fixed jet (17); and are not equipped with the fuel filter (3).

Initial setting for carburetors equipped with the high speed adjustment needle is one turn open from the closed position for the idle needle (16); and 1½ turns open for the high speed adjustment needle which replaces high speed jet (17). Run motor until operating temperature is reached, then shift to forward gear and open the throttle. Slowly turn the high speed adjustment needle clockwise until engine falters or slows down because of a too lean mixture; then back needle out approximately ½-turn. After high speed needle has been properly adjusted, regulate the idle adjustment needle (16) until engine runs smoothly **under load** at slow speed. Turning idle mixture needle clockwise will lean the mixture.

On carburetors employing the fixed main jet, high speed mixture adjustment may be made for special conditions by changing the size of the jet (17). The standard jet should normally be used. If motor is operated at altitudes above 2,500 feet, performance can usually be improved by installing a smaller jet. On most models, the standard jet is a part of the carburetor repair kit, and optional jets must be obtained separately. NOTE: On K and KC models, the main jet is not listed as a part of the repair kit, and the required jet should be ordered. The standard jet is indicated on the parts lists.

On carburetors employing the fixed main jet, initial setting for the idle adjustment needle (16) is one turn open from the closed

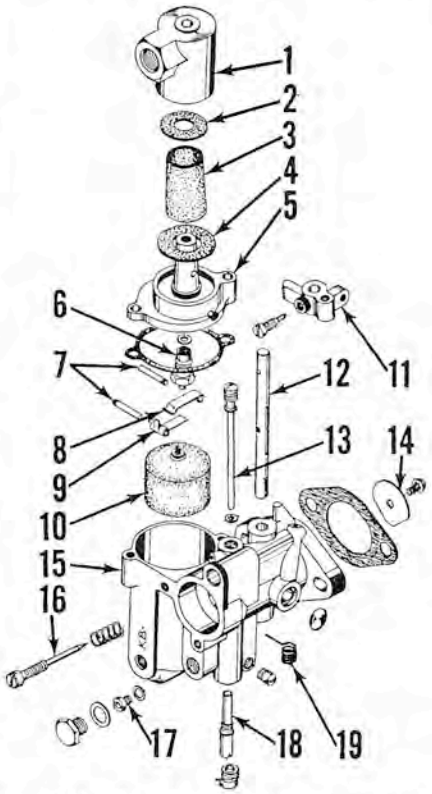


Fig. M46—Exploded view of Tillotson carburetor of the type used on most models.

1. Strainer cover
2. Gasket
3. Strainer
4. Gasket
5. Bowl cover
6. Inlet needle & seat
7. Shaft
8. Secondary lever
9. Primary lever
10. Float
11. Throttle lever
12. Throttle shaft
13. Idle tube
14. Throttle valve
15. Body
16. Idle needle
17. High speed jet
18. Main nozzle
19. Spring

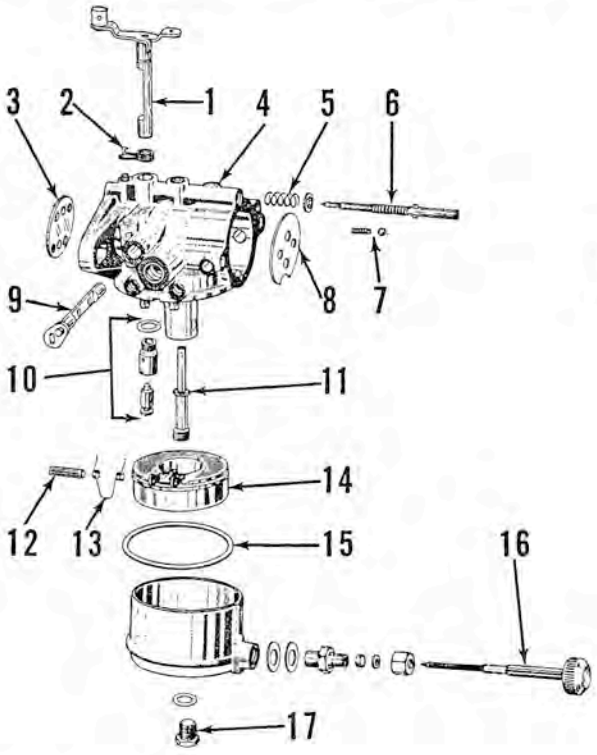


Fig. M45—Exploded view of Carter carburetor used on some early models.

1. Throttle shaft
2. Spring
3. Throttle valve
4. Body
5. Spring
6. Idle needle
7. Choke detent
8. Choke valve
9. Choke shaft
10. Inlet needle & seat
11. Main nozzle
12. Float shaft
13. Spring
14. Float
15. Gasket
16. High speed needle
17. Cap screw

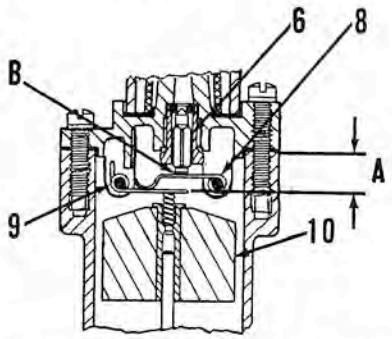


Fig. M47—Schematic view of float mechanism showing method of adjustment. Refer to text.

A. Closing adjustment
B. Open adjustment
6. Inlet needle
8. Secondary lever
9. Primary lever
10. Float

position. Idle needle must be adjusted **under load** to obtain smooth operation at slow speeds. Turning the needle clockwise will lean the mixture.

The recommended fuel level is approximately $\frac{11}{16}$-inch below gasket surface of float bowl. To adjust the float, remove bowl cover (5) and refer to Fig. M47. Invert the cover and, with inlet needle (6) closed, measure the distance between primary lever (9) and gasket surface of bowl cover as shown at (A). This distance should be $\frac{13}{32}$-inch; if it is not, bend the curved tang on secondary lever (8) until correct measurement is obtained. After adjustment is made, bend the vertical tang on primary lever (9) to allow a maximum clearance (B) between the secondary lever (8) and inlet needle (6). The contact spring located in center of float should extend 5/64-inch above top of float (10). Check to see that spring has not been stretched or damaged.

Tillotson model numbers and parts lists are as follows:

Model AJ-41A

Repair kit	RK-107
Gasket set	GS-107
Inlet needle and seat	010400
Float	09805
Idle adjustment screw	08690
Idle tube	06907
Main adjusting screw	09981

Model AJ-47A

Repair kit	RK-168
Gasket set	GS-107
Inlet needle and seat	010400
Float	09805
Idle adjustment screw	010402
Idle tube	010433
Main adjustment needle	010410

Models AJ-50A—AJ-50AT

Repair kit	RK-313
Gasket set	GS-123
Inlet needle and seat	010790
Filter element	010741
Float	09805
Idle adjustment screw	010402
Idle tube	010433
Main adjustment needle	010410

Model AJ-52A

Repair kit	RK-371
Gasket set	GS-123
Inlet needle and seat	010790
Filter element	010741
Float	09805
Idle adjustment screw	011389
Idle tube	010433
Main adjustment needle	09968

Model AJ-56A

Repair kit	RK-396
Gasket set	GS-123
Inlet needle and seat	010790
Filter element	010741
Main fuel jet (0.057) Std.	011394
Main fuel jet (0.055)	011722
Main fuel jet (0.053)	011765
Main fuel jet (0.051)	011764

Model AJ-56AB

Repair kit	RK-426
Gasket set	GS-123
Inlet needle and seat	010790
Filter element	010741
Main fuel jet (0.055) Std.	011722
Main fuel jet (0.053)	011765
Main fuel jet (0.051)	011764
Main fuel jet (0.049)	011763

Model KA-5A

Repair kit	RK-370
Gasket set	GS-142
Inlet needle and seat	011357
Filter element	010741
Float	09805
Idle adjustment screw	011748
Idle tube	011387
Main fuel jet (0.063) Std.	011385
Main fuel jet (0.061)	011396
Main fuel jet (0.059)	011395
Main fuel jet (0.057)	011394

Model KA-5B

Repair kit	RK-471
Gasket set	GS-142
Inlet needle and seat	011357
Filter element	010741
Main fuel jet (0.063) Std.	011385
Main fuel jet (0.061)	011396
Main fuel jet (0.059)	011395
Main fuel jet (0.057)	011394

Model KA-15A

Repair kit	RK-505
Gasket set	GS-142
Inlet needle & seat	011357
Filter element	012107
Main fuel jet (0.065)	011252
Main fuel jet (0.063) Std.	011385
Main fuel jet (0.061)	011396
Main fuel jet (0.059)	011395
Main fuel jet (0.057)	011394

Model KA-20A

Repair kit	RK-560
Gasket set	GS-142
Inlet needle & seat	011357
Filter element	012107
Main fuel jet (0.063)	011385
Main fuel jet (0.061) Std.	011396
Main fuel jet (0.059)	011395
Main fuel jet (0.057)	011394

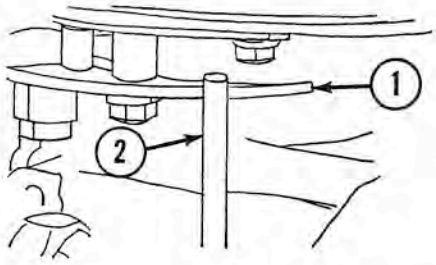


Fig. M48—Schematic view of speed control linkage. Refer to text for details of adjustment.

1. Throttle cam
2. Follower lever

Model KB-1A

Repair kit	RK-441
Gasket set	GS-149
Inlet needle and seat	010790
Filter element	010741
Float	09805
Idle adjustment screw	012074
Idle tube	012077
Main fuel jet (0.051) Std.	011764
Main fuel jet (0.049)	011763
Main fuel jet (0.047)	012027
Main fuel jet (0.045)	012101

Model KB-4A

Repair kit	RK-442
Gasket set	GS-149
Inlet needle and seat	010790
Filter element	010741
Float	09805
Idle adjustment screw	012074
Idle tube	012077
Main fuel jet (0.051) Std.	011764
Main fuel jet (0.049)	011763
Main fuel jet (0.047)	012027
Main fuel jet (0.045)	012101

Model KC-4A

Repair kit	RK-552
Gasket set	GS-157
Inlet needle & seat	011357
Filter element	012107
Main fuel jet (0.071)	012645
Main fuel jet (0.069) Std.	012515
Main fuel jet (0.067)	011397
Main fuel jet (0.065)	011252

SPEED CONTROL LINKAGE. The speed control grip or lever moves the magneto stator plate to advance or retard the ignition timing. The throttle valve is synchronized to open as timing is advanced. It is extremely important that ignition timing and throttle valve opening be correctly synchronized to obtain satisfactory operation.

All Models Except Merc 350: To synchronize the linkage, set the troll control lever in "RUN" position and turn speed control grip until forward gear is engaged and engine is operating at 1000 rpm. Refer to Fig. M48. With controls set as outlined, the control cam (1) attached to magneto stator should just contact the throttle follower lever (2). Adjust by loosening the screws attaching control cam to stator, and shifting the cam (1) slightly until contact is

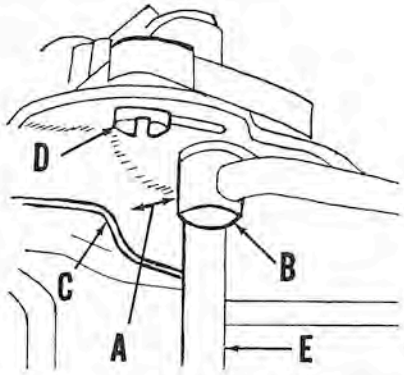


Fig. M48A — Synchronizing cam adjustment on 2 cylinder Merc 350. Distance A should measure 9/32-inch. Refer to Text.

A. Adjustment
B. Swivel link
C. Cam
D. Locking screw
E. Throttle lever

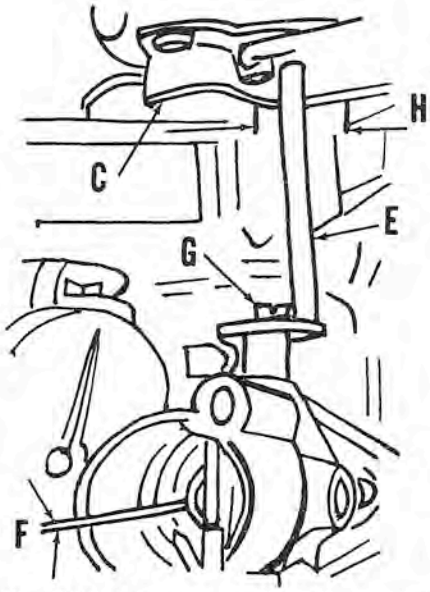


Fig. M48B—Move speed control lever until throttle shaft (E) is in economy position (H). Loosen the screw (G) and reposition throttle shaft until a clearance of 0.089 exists between edge of throttle and carburetor throat as shown at (F). Clearance can be measured using a No. 43 drill.

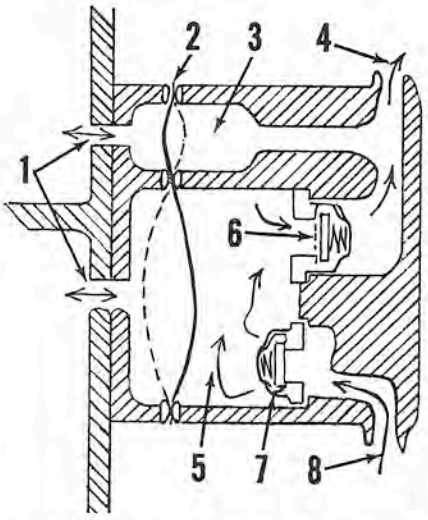


Fig. M50—Schematic view of diaphragm type fuel pump. Pump body mounts on side of cylinder block and is ported to both crankcases as shown. Refer to text for details of operation.

1. Pressure ports
2. Diaphragm
3. Booster chamber
4. To carburetor
5. Main fuel chamber
6. Outlet check valve
7. Inlet check valve
8. Fuel inlet

made. On Mark 20 and 25 motors with adjustable throttle control linkage rod, adjust the rod length to $2\frac{9}{16}$ inches center to center.

Merc 350: To synchronize the linkage, first be sure that ignition timing is properly adjusted and maximum timing advance screw properly set. Check position of synchronizing cam (C—Fig. M48A) to be sure it is correctly positioned. Clearance (A) should be $\frac{9}{32}$-inch when measured between nearest points of swivel link (B) and cam (C). To reposition the cam, loosen the two screws (D) and shift the cam in the slotted holes. NOTE: The cam is properly positioned at the factory, and no adjustment should be necessary unless throttle lever or synchronizing cam are renewed.

Carburetor throttle is correctly synchronized when throttle butterfly valve is wide open when magneto is fully advanced; and a clearance (F—Fig. M48B) of 0.089 exists between edge of throttle valve and carburetor throat when throttle shaft is in economy position (H) as shown. Make the adjustments by loosening clamp screw (G) and repositioning throttle lever (E) on throttle shaft; and/or by bending throttle lever (E). Move speed control lever to full idle position and adjust idle speed stop screw, if necessary, to provide an idle speed of 600-700 rpm. Bend idle end of speed control cam (C), if necessary so that cam contacts throttle lever $\frac{1}{4}$-$\frac{5}{8}$-inch from end of cam.

REED VALVES. The inlet reed valves are located on the crankshaft center main bearing assembly as shown in Fig. M49. Crankshaft must be removed before reed valves can be serviced.

Reed petals (RP) should be perfectly flat and have no more than 0.007 clearance between free end of reed petal and seating surface of center main bearing. The reed stop must be adjusted to $\frac{5}{32}$-inch on models before 1962; or $\frac{3}{16}$-inch on later models. This clearance is measured from end of stop to seating surface of bearing housing as shown at (A). Seating surface of bearing must be smooth and flat, and may be refinished on a lapping plate after removing reed stops, reed valves and dowels. Do not attempt to bend or straighten a reed petal to modify performance or to salvage a damaged reed. Never install a bent reed. Lubricate the reed valve units with "Quicksilver" Multipurpose lubricant or a light distributor cam grease when reassembling.

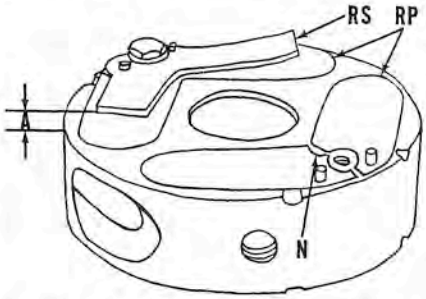


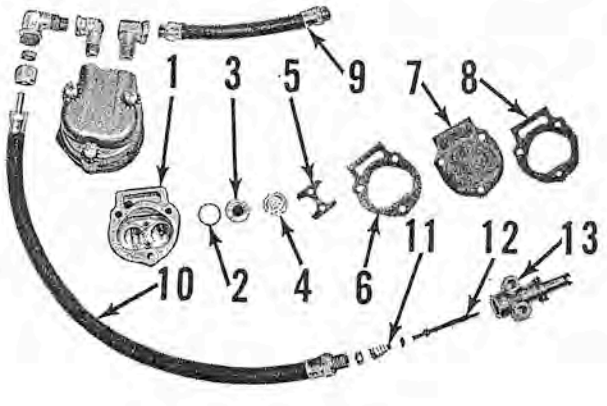
Fig. M49—Center main bearing showing inlet reed valves. Reed petals (RP) are right and left hand units. When installing reed petals, place the reed with the cut-out notch (N) on the left as shown. Adjust free height of reed stop (RS) to 5/32 inch as shown at (A).

Models 10, 10A, 15A and 100 are equipped with four reed petals which are available individually. Other models have eight reeds which are right-hand and left-hand units, and are available only in a matched set. When installing reed valves on these models, place the reed petal with the cut-out notch (N) on the left as shown in Fig. M49.

FUEL PUMP. A diaphragm type fuel pump is used. It is operated by pressure and vacuum pulsations from the crankcases which alternate to pull the fuel from the fuel tank and supply the carburetor. Most of the work is performed by the main sup-

Fig. M51—Exploded view of fuel pump and associated parts.

1. Pump body
2. Valve gasket
3. Outlet check valve
4. Inlet check valve
5. Retainer
6. Gasket
7. Diaphragm
8. Gasket
9. Outlet hose
10. Inlet hose
11. Spring
12. Adapter valve
13. Adapter



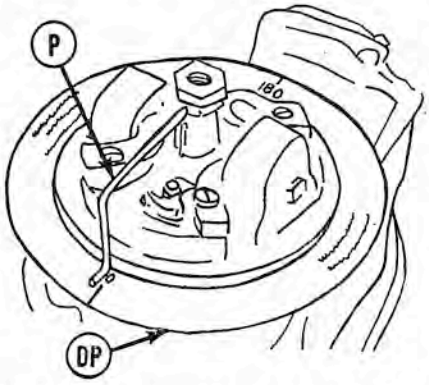


Fig. M52—Synchronizing tool installed for adjusting the magneto points. Refer to text for details.

DP. Degree plate
P. Pointer

ply chamber (5—Fig. M50). Vacuum in the crankcase pulls the diaphragm (2) in, causing fuel to be drawn through inlet line (8) past inlet check valve (7). The alternate pressure forces diaphragm down, and fuel out past the outlet check valve (6). The booster pump chamber (3) serves to dampen the action of the larger, main pump chamber (5), and increase the maximum potential fuel flow.

When overhauling the fuel pump, use Fig. M51 as a guide. All defective or questionable parts should be renewed.

IGNITION

All Models Except Merc 350: Breaker point gap should be set at approximately 0.018. The two sets of points should be set to open at exactly 180 degree intervals. The points may be synchronized by using the Mercury Synchronizing Tool Set, part number 91-28619A1 shown in Fig. M52 (or equivalent); plus a timing test light such as that shown in Fig. M53. To adjust the timing, remove the flywheel and install the degree plate (DP—Fig. M52) and pointer (P). Set the contact points for top cylinder at 0.018. Remove the spark plugs and install the test light by attaching one clip to insulated point connection and the other clip to a suitable ground. Turn the crankshaft clockwise slowly until the points just open as indicated by the test light bulb going out. Turn the degree plate until the 0° timing mark is aligned with pointer as shown. Attach the test light to the other set of points and turn the crankshaft ½-turn until the timing pointer is aligned with the 180° timing mark on degree plate; then adjust the second set of points to barely open. Recheck both sets of points with the degree plate and timing light. If the synchronizing tools are not available, renew the points or dress the contacts, then set each set of points to exactly 0.018 with a feeler gage.

On Mark 25, adjust spark advance as follows: Turn twist grip until carburetor throttle arm is approximately ¾-inch from end of magneto cam travel; then turn the adjusting screw (2—Fig. M54) to just touch control lever as shown. Adjust the stop screw (1) to limit the slow-speed travel to a point where best performance is obtained.

On Mark 28 and 28A, and on Merc 100, 150 and 200, make sure points are correctly adjusted; then turn adjusting screw (A—Fig. M55) to limit magneto advance. The advance spark should occur when No. 1 (top) piston crown reaches a point 0.275 BTDC on Mark 28 and 28A, and Merc 150 and 200; or 0.235 BTDC on Merc 100. The timing can be correctly adjusted by removing No. 1 spark plug and using the correct Mercury Timing Gage or a depth gage to measure piston position; then adjusting the link (1) until points just break. Adjust the stop screw (A) to limit magneto advance travel at this point. After maximum advance and carburetor have been adjusted, set the magneto idle stop (S—Fig. M56) to obtain the desired smooth performance with levers set for "Troll."

Merc 350: Breaker point gap should be adjusted to about 0.020. The two sets of points must be adjusted to open at exactly 180° intervals and maximum advance stop screw adjusted so that each set of points open when the affected piston is 0.222 before top dead center.

Timing and synchronizing is best accomplished using the Mercury Timing Gage (Tool No. 91-32253A1) and a timing test light such as that shown in Fig. M53. Adjust the points as follows:

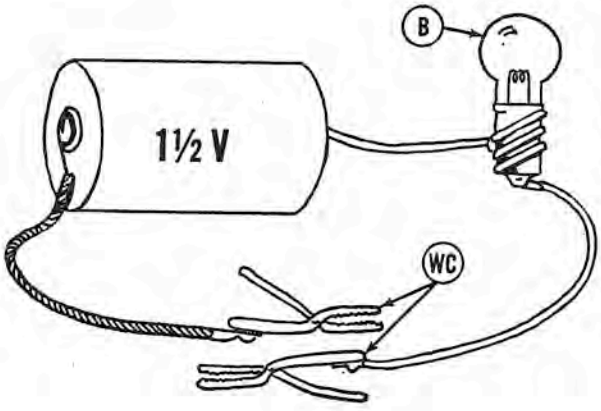


Fig. M53—A timing test light can be constructed as shown, using a flashlight battery, bulb (B), two wire clips (WC) and short pieces of wire.

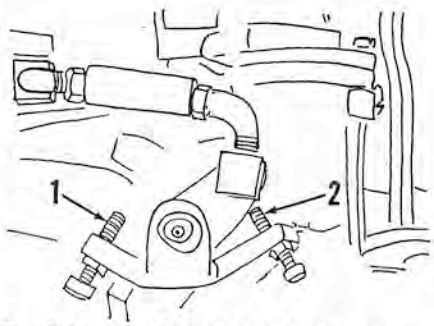


Fig. M54—On Mark 25, the timing advance stop screws must be adjusted as outlined in text.

1. Slow speed stop screw
2. Maximum advance stop screw

Remove flywheel and spark plugs, and set breaker points for top cylinder to 0.020 using a feeler gage. Thread the Timing Gage (9132253A1) into spark plug hole of top cylinder, making sure center plunger of gage fits into notches of threaded outer body. Turn crankshaft until piston strikes the gage; then thread gage out until crankpin will pass over-center while in contact with gage plunger. Turn crankshaft counterclockwise; then without moving threaded outer gage body, depress center plunger and turn plunger ¼-turn. Turn crankshaft clockwise until piston crown strikes the plunger, positioning crankshaft at correct advance timing position. Attach one lead of a timing test light to breaker point terminal and the other test lead to a good ground. Move the speed control lever toward the

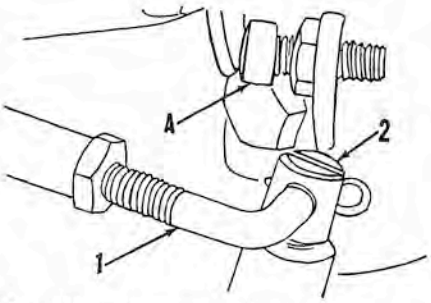


Fig. M55—Maximum advance stop screw used on some models. Refer to text.

1. Adjusting link
2. Control lever
A. Stop screw

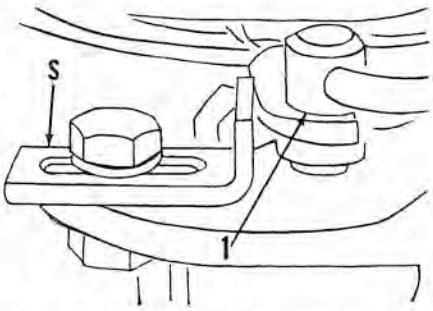


Fig. M56 — Idle stop adjustment used on some models.

1. Control cam
S. Idle stop

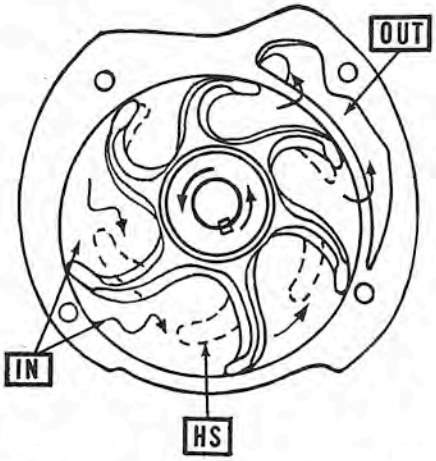
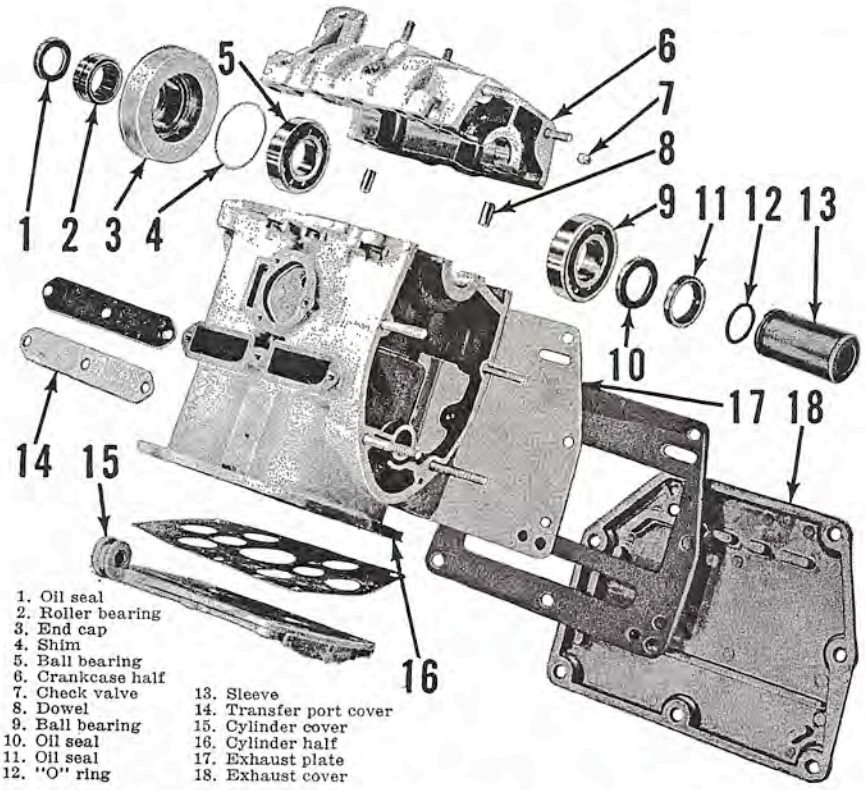


Fig. M57—Schematic view of rubber impeller type water pump. Flexing of impeller blades in offset housing causes water to be drawn into pump through inlet ports (IN) and forced into power head through outlet ports (OUT). At high speeds, blades remain partially curved as shown by broken lines (HS) and pump becomes a centrifugal pump.



1. Oil seal
2. Roller bearing
3. End cap
4. Shim
5. Ball bearing
6. Crankcase half
7. Check valve
8. Dowel
9. Ball bearing
10. Oil seal
11. Oil seal
12. "O" ring
13. Sleeve
14. Transfer port cover
15. Cylinder cover
16. Cylinder half
17. Exhaust plate
18. Exhaust cover

Fig. M59—Exploded view of crankcase and associated parts used on late models.

"FAST" position (back out stop screw, if necessary) until points break as indicated by test light going out. Turn the maximum advance stop screw in until it just contacts the stop; then adjust the other set of points to just open with lower piston against the timing gage plunger and speed control lever in maximum advance position. Recheck the adjustment of both sets of points before reinstalling flywheel and spark plugs.

COOLING SYSTEM

WATER PUMP. The rubber impeller type water pump is housed in the lower unit driveshaft housing and can be removed after removing the transmission. The pump housing is offset with relation to driveshaft as shown in Fig. M57.

When cooling problems are encountered, first check the water inlet for plugging or partial stoppage, then if not corrected, remove the water pump as outlined in TRANSMISSION paragraph and examine water pump, water tubes and seals. The water inlet is located in the anti-cavitation plate immediately above the propeller.

POWER HEAD

R&R AND DISASSEMBLE. Two types of power heads are used: On Mark 20, 20H and 25, the crankcase is a one-piece unit with a detachable cylinder; on later models, the front half of the split crankcase can be detached for removal of the crankshaft and piston units. The cylinder assembly is an integral part of the rear crankcase half.

To disassemble the power head, refer to the appropriate following paragraphs:

Detachable Cylinder Type: To remove the powerhead, first remove the cowling and detach interfering lines and linkage, then unbolt and remove power head from lower unit driveshaft housing. Place the power head on a stand and remove the flywheel, magneto, spark plugs, carburetor and fuel pump, then remove the stud nuts securing the cylinder to crankcase. Use a putty knife as an aid in separating cylinder and crankcase, using extreme care not to scratch or damage the gasket surfaces. Remove the connecting rod and piston assemblies from crankshaft, making sure the units are properly identified for correct assembly. Use care not to lose any of the 25 loose needle bearings located in the crankpin bearing. The bearing needles must all be removed from crankcase before crankshaft is pressed out.

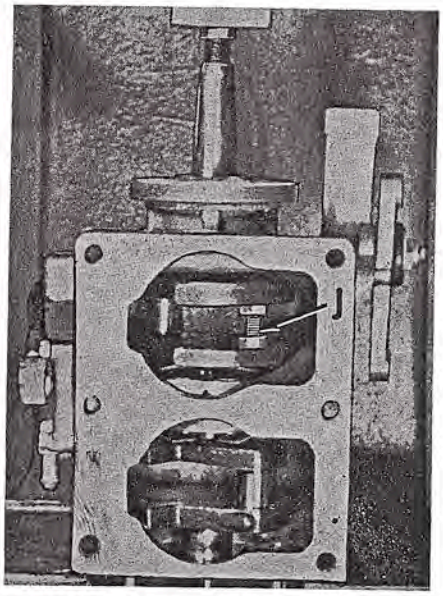


Fig. M58—When pressing out the crankshaft assembly, place a jack (J) between counterweights of upper crankpin as shown.

Remove the stud nuts retaining the crankcase lower bearing housing, then remove housing by tapping with a plastic hammer. Do not attempt to pry the assembly from crankcase.

Remove the screw retaining the center main bearing assembly to crankcase, and install a jack (J—Fig. M58) between the counterweights of upper crankpin to keep from springing the crankshaft; then press crankshaft assembly downward out of crankcase as shown. NOTE: Use flywheel nut or other means to prevent damage to threads on crankshaft.

Crankshaft, pistons, bearings and other components may be overhauled as outlined in the appropriate paragraphs. Assemble by following the procedures outlined in the ASSEMBLY paragraph.

Split Crankcase Models: To remove the power head, first remove the cowling and detach interfering lines and linkage.

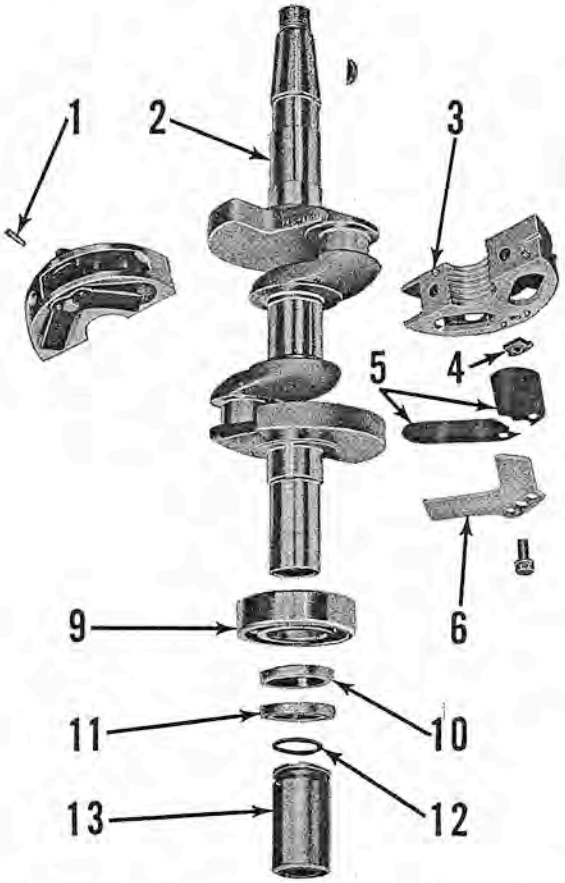


Fig. M60—Exploded view of crankshaft and associated parts.

1. Dowel
2. Crankshaft
3. Main bearing
4. Nut
5. Reed petals
6. Reed stop
9. Ball bearing
10. Oil seal
11. Oil seal
12. "O" ring
13. Sleeve

On Mark 10, 10A and 15A, remove the carburetor, detach magneto drag link at control end; then remove control handle and control bracket from motor. Remove the transmission cover plate located on leading edge of lower unit driveshaft housing just below lower stern bracket mounting; and disconnect the lower control shift rod from shift arm.

On all models, remove the nuts securing power head to lower unit; then free the power head mounting gasket by jarring power head with heel of hand on exhaust side. Remove the power head from lower unit by lifting straight up until power head is clear of motor.

Remove the flywheel, and the carburetor if not previously removed. Detach spark plug leads, disconnect high tension lead wire clip; then remove power head by turning unit clockwise until free from hold-down ring. Remove exhaust cover plates, transfer port cover plates and cylinder block cover to assist in cleaning and reassembly.

Remove the screws retaining upper crankcase end cap (3—Fig. M59), the screw retaining the center main bearing, and the screws retaining crankcase front half (6) to cylinder (16); then remove the crankcase half by prying with two screwdrivers in the recesses provided in center of each side joint. Be careful not to mar or damage the mating surfaces of the joint.

Crankshaft, pistons, bearings and connecting rods may now be removed for service as outlined in the appropriate following paragraphs. When assembling, follow the procedures outlined in the ASSEMBLY paragraph.

ASSEMBLE. Because of the two-cycle design, crankcase must be completely sealed against both vacuum and pressure. Exhaust manifold and water passages must be sealed against both vacuum and pressure. Exhaust manifold and water passages must be sealed against water leakage. Whenever power head is disassembled, it is recommended that all gasket surfaces and machined joints without gaskets be carefully checked for nicks and burrs which might interfere with a tight seal. Slight damage can sometimes be remedied by lapping the surfaces on a lapping block using No. 00 emery cloth. Remove only the high spots without lowering the surface. If parts are warped, sprung or excessively damaged, renew the parts.

All gasket and sealing surfaces should be lightly and carefully coated with an impervious liquid gasket sealer such as Mercury Gasket Sealer Compound (92-28804). Surface must be completely coated, using care that excess sealer does not squeeze out into bearings. crankcase or other passages. Lubricate all bearing and friction surfaces thoroughly with engine oil. Loose needle bearings may be held in place during assembly by using a light non-fibrous grease.

Check the assembly by turning the crankshaft after each step to check for binding or locking which might indicate improper assembly. Remove the cause before proceeding. After piston and crankshaft assembly is installed and secured, rotate the shaft until each piston ring in turn, appears in one of the exhaust ports, then check by pressing on ring with a blunt tool. Ring should spring back when released; if it does not, a broken or binding ring is indicated and the trouble should be corrected.

Refer to the CONDENSED SERVICE DATA table for tightening torques.

Detachable Cylinder Types: The recommended crankshaft end play of 0.008-0.012 is controlled by means of shims placed under each of the end, ball-type main bearings. Shims of approximately equal thickness should be used under each bearing. When assembling, use the removed shim packs. Press the assembled crankshaft and center main bearing into the crankshaft using the Mercury Center main Bearing Tool (91-23701 for Mark 20; or 91-25061 for Mark 25); making sure that locking screw hole in center main bearing is aligned with hole in crankcase. If Center main Bearing Tool is not available, use a "jack" as shown in Fig. M58, between BOTH sets of crankshaft counterweights. After center main bearing is properly aligned, install the locking screw, install and tighten the crankcase lower bearing housing; then check the crankshaft end play between end main bearing inner race and thrust face on crankshaft. Tap the crankshaft each direction with a plastic hammer when measuring. If end play is not as specified, remove the crankshaft and add or remove shims as required.

When installing the connecting rod and piston assemblies, make sure the sharp, vertical side of deflector is installed to starboard (intake) side of cylinder block. See Fig. M61.

Split Crankcase Models: Completely assemble the crankshaft, bearings, connecting rods and pistons, making sure the sharp, vertical side of deflector on piston crown is installed toward starboard (intake) side of cylinder block. Thoroughly lubricate the pistons and rings and make sure that ring end gaps are aligned with the locating pins in ring grooves. The two angle ring compressers of Mercury Ring Compressor Kit 91-28891A2 should be used to insert the pistons in lower ends of cylinders. If ring compressers are not available, work each ring individually into cylinder, taking special precautions not to distort or break the rings or score the surfaces of rings or pistons. Check the rings carefully after installation.

Make sure that center main bearing dowel (1—Fig. M60) is in place and that main bearing (3) is properly located over dowel. Assemble and install the upper main bearing cap, using the shim pack (4—Fig. M59) which was used when power

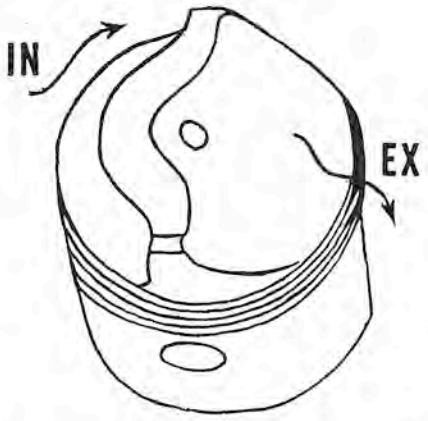


Fig. M61—Piston crown is designed to improve scavenging efficiency. Be sure piston is installed as indicated, with relation to inlet and exhaust ports.

head was disassembled. Install and tighten the cap screws retaining the main bearing cap to cylinder half of crankcase; then check the clearance between upper bearing (5) and thrust face of crankshaft. Tap crankshaft each direction with a plastic hammer to make certain bearing is fully seated. Crankshaft end clearance should be 0.008-0.012. If clearance is not correct, add or remove shims (4) as required. Shims are available in thicknesses of 0.002, 0.003, 0.005 and 0.010. NOTE: If more than one shim is required, center the crankshaft by placing half of shim pack below the lower ball bearing (9).

Tighten the crankcase and exhaust cover cap screws by working each way from the center. The coarse thread aluminum lock screw for intermediate main bearings should be tightened to a torque of 120 inch pounds. Fine thread brass screws in this location should be tightened to a torque of 150 inch pounds. Other tightening torques are given in CONDENSED SERVICE DATA table.

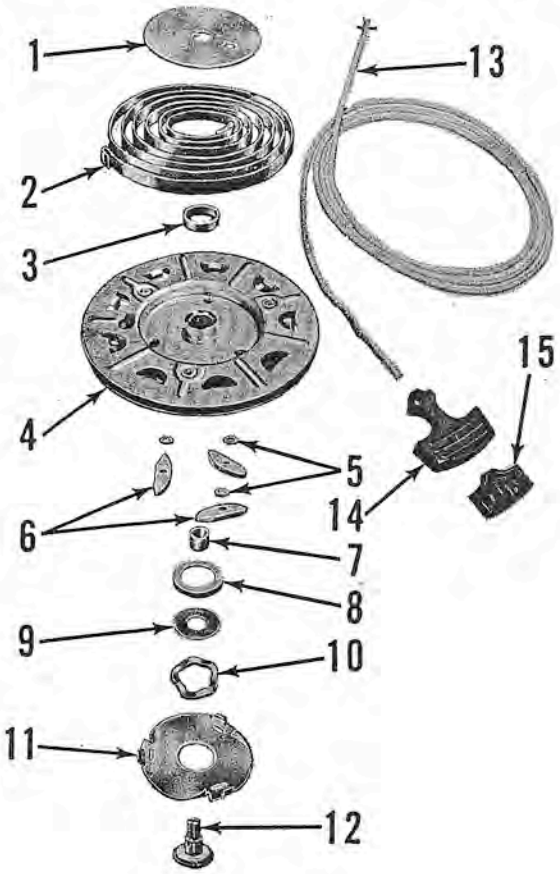
PISTONS, PINS, RINGS & CYLINDERS. Before detaching connecting rods from crankshaft, make sure that rod and cap are properly identified for correct assembly to each other and in the correct cylinder.

Each piston is fitted with three rings which are interchangeable in the ring grooves and are pinned in place in piston.

Piston pin is pressed in piston bosses and secured with retaining rings. Piston end of connecting rod is fitted with 22 loose needle bearings which use the connecting rod bore and the piston pin as bearing races. Install bearing washers and needle bearings in piston end of connecting rod using light non-fibrous grease to hold them in place, then install and center the piston pin using Mercury tool (91-24263). Piston must be installed so that sharp, vertical side of deflector will be to starboard (intake) side of cylinder block. See Fig. M61. Thoroughly lubricate all friction surfaces during assembly. Pistons and rings are available in 0.015 oversize.

Fig. M62—Exploded view of recoil starter of the general type used.

1. Retainer
2. Recoil spring
3. Bushing
4. Sheave
5. Wave washer
6. Pawl
7. Spacer
8. Retainer
9. Washer
10. Wave washer
11. Plate
12. Sheave shaft
13. Cable
14. Handle
15. Anchor



CONNECTING RODS, BEARINGS & CRANKSHAFT. Upper end of crankshaft is carried by a ball bearing plus a caged needle bearing.

In early Mark 25 motors, the center main bearing contained 22 loose needle bearings. The center main bearing on later Mark 25 motors consisted of a renewable insert which fitted in the bearing housing. On all other models the center main bearing consists of the unbushed housing. On all models, the center main bearing housing also contains the inlet reed valves.

The lower main bearing is a ball bearing which is interchangeable with the upper ball bearing.

Connecting rod rides in 22 loose needle rollers at piston end and 25 loose needle rollers at crankpin end. Check rod for alignment, using Mercury Alignment Tool (91-28441A1), or by placing rod on a surface plate and checking with a light.

If bearing surface of rod and cap is rough, scored, worn, or shows evidence of overheating, renew the connecting rod. Inspect crankpin and main bearing journals. If scored, out-of-round, or worn, renew the crankshaft. Check the crankshaft for straightness using a dial indicator and Vee-blocks.

Inspect and adjust the reed valves as outlined in REED VALVE paragraph, and reassemble as outlined in ASSEMBLY paragraph.

MANUAL STARTER

Refer to Fig. M62 for a starter of the general type used. To disassemble the manual starter, remove the top cowl; then remove the screw and trim cap from top of cowl. Insert a screwdriver in slot in top of sheave shaft (12) and loosen the shaft nut (left hand thread). Allow the screwdriver and shaft to turn clockwise until recoil spring (2) is completely unwound. Pry the anchor (15) out of starter handle (14) and remove the anchor and handle. Remove the nut from upper end of sheave shaft (12), invert the assembly and remove the parts, making sure that recoil spring (2) remains in housing recess as sheave (4) is removed. Protect hands with cotton gloves or a cloth, grasp recoil spring (2), remove spring and allow it to unwind slowly to prevent personal injury.

Lubricate the parts with Multipurpose Lubricant and assemble by reversing the disassembly procedure. Make sure that pawls (6) are all installed the same way, with flat radius to outside. Install wave washer retainer (9) with cup end up and make sure the tab in spring retainer (1) engages slot in sheave shaft (12). Loosely install the shaft nut, pull free end of cable through top cowl and install handle (14) and anchor (15). After handle is installed, turn sheave shaft (12) counter-clockwise with a screwdriver until cable handle is pulled against top cowl; then turn shaft an additional 1¼ turns and tighten the shaft retaining nut.

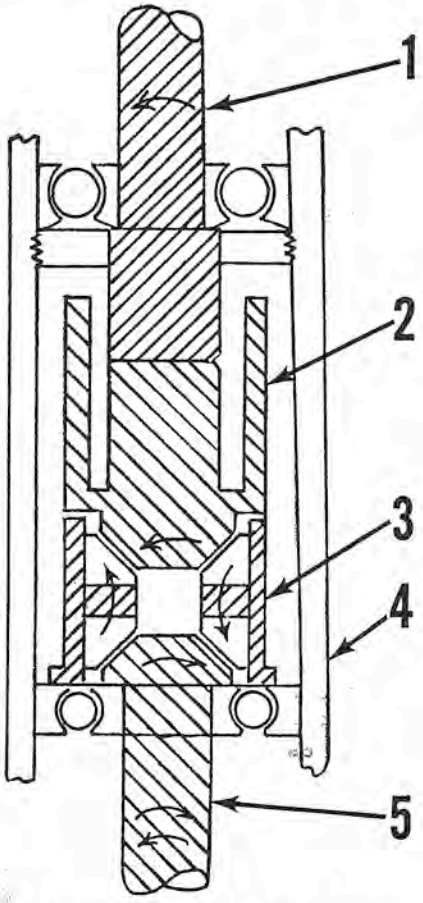


Fig. M63—Schematic view of the automatic transmission used on all models. Refer to text for complete description of method of operation.

1. Upper drive shaft
2. Input drum
3. Trunnion carrier
4. Driveshaft housings
5. Lower drive shaft

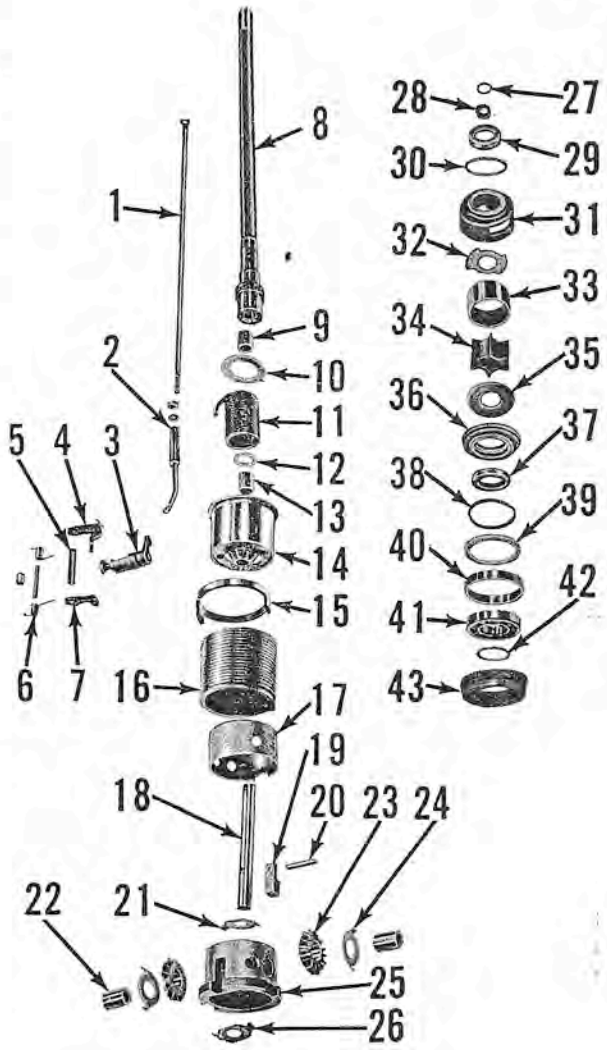


Fig. M64—Exploded view of transmission and associated parts.

1. Shift shaft
2. Adjusting coupling
3. Shift shaft
4. Neutral pawl
5. Pawl shaft
6. Pawl spring
7. Reverse pawl
8. Upper driveshaft
9. Bushing
10. Washer
11. Neutral clutch spring
12. Thrust washer
13. Bushing
14. Input drum & gear
15. Control sleeve
16. Reverse clutch spring
17. Sleeve
18. Pilot shaft
19. Catch key
20. Locking pin
21. Thrust washer
22. Idler gear shaft
23. Idler gear
24. Thrust washer
25. Trunnion carrier
26. Thrust washer
27. "O" ring
28. Slinger
29. Oil seal
30. "O" ring
31. Pump cartridge
32. Bottom plate
33. Liner
34. Impeller
35. Top plate
36. Retainer
37. Oil seal
38. Sealing ring
39. "L" washer
40. Bearing sleeve
41. Ball bearing
42. Shim
43. Lock ring

LOWER UNIT

NOTE: Models before 1957 and after 1962 are equipped with gear shift transmission similar in design and operation to that used on Four Cylinder models. For service on these models, refer to overhaul section for Four Cylinder Lower Unit.

PROPELLER AND DRIVE CLUTCH. Protection for the motor is built into a special cushioning clutch in the propeller hub. Propeller is splined to the shaft. No adjustment is possible on the propeller or clutch. Various pitch propellers are provided, and propeller should be selected for best performance under applicable conditions. Propellers other than those designed for the motor must not be used.

TRANSMISSION. Some models are equipped with an automatic transmission in which forward, reverse and neutral positions are controlled by the speed control grip. The transmission is located in lower part of driveshaft housing and consists of differential gearing and two helical-spring clutches controlled by a cam and pawls.

OPERATION. Refer to Fig. M63. In normal operating position, the upper drive shaft (1) is connected to input drum and gear assembly (2) by the neutral spring. The input drum (2) and trunnion carrier (3) are locked together by the forward and reverse spring, and the entire transmission rotates as a unit. When the control lever is moved to the neutral position, the neutral pawl (4—Fig. M64) moves in to catch the extended upper end of neutral spring (11). When the spring is stopped, the rotative force of upper driveshaft (1—Fig. M63) tends to unwind the spring, releasing the connection between driveshaft (1) and input drum (2); and the input shaft rotates within the unit without transmitting power. When the control lever is moved to the reverse position, the reverse pawl (7—Fig. M64) moves inward into a notch in control sleeve (15). The control sleeve is attached to upper end of forward and reverse spring (16). Lower end of spring rests against the key (19) which is attached to trunnion carrier (25). When upper end of forward and reverse spring is stopped by the reverse pawl, the rotative force of the transmission unit releases the connection between input drum (2—Fig. M63) and trunnion carrier (3); and the trunnion carrier tends to rotate in the same direction at a slower speed. This further rotation plus the action of the spring key causes the forward and reverse spring to further expand, locking the trunnion carrier (3) to the driveshaft housing (4). Power is then transmitted through the differential gears (23—Fig. M64) to turn the lower driveshaft in the reverse direction. Because the transmission control shaft (3) is connected to the speed control lever, the clutches are engaged and disengaged only at idle speed. The helical-spring clutches are so designed that their holding power increases as torque increases so that power is transmitted by the spring clutches, relieving the operating pawls of overload.

R&R AND OVERHAUL. To remove the transmission, first remove the transmission control cover plate at lower side of driveshaft housing; then remove the three stud nuts retaining gearcase housing to driveshaft housing. NOTE: One nut is located be-

neath the previously removed control cover plate, the other two on lower side of anti-cavitation plate on gearcase housing.

Remove the gearcase housing by pulling while tapping with a soft mallet to free the "O" ring seal.

If the power head has been removed, turn the transmission control shaft (3—Fig. M64) until lever is vertical, then remove the complete driveshaft and transmission assembly by pressing downward on upper end of driveshaft (8).

If power head is not removed, hold the trunnion carrier (25) from turning by inserting a screwdriver in notch, then remove the short screw from lower end of pilot shaft (18). Thread a long No. 10-32 screw in end of pilot shaft to serve as a puller. Hold trunnion carrier (25) from turning, pull down on the puller screw, and turn the powerhead flywheel in a reverse direction to free the grip of the neutral spring (11). Transmission may be removed in this manner, leaving upper drive shaft (8) in housing.

The spiral winding of neutral spring (11) and forward and reverse spring (16) is designed to lock the assembly together when turned in the normal direction of rotation. Transmission components can be easily disassembled or assembled by hand, by turning the top unit counter-clockwise as the units are pulled apart or assembled. NOTE: When removing the input drum (14) from trunnion carrier (25), it may be necessary to release the lower end of forward and reverse spring by prying it over the catch key (19) after securing a slight amount of slack.

To disassemble the trunnion carrier, remove the sleeve (17) by pulling upward, then withdraw the locking pin (20). Both are a slip fit. Remove the thrust washers (21 and 26), then remove pilot shaft (18), using an arbor press. Idler pinion shafts (22) can be pressed out after pilot shaft has been removed. Assemble by reversing the disassembly procedure. Idler pinion shafts (22) must be installed flush with outer edge of trunnion bushings. When installing pilot shaft (18), make sure the hole for pin (20) is aligned in shaft and trunnion carrier. Check and note thickness of thrust washers (21 and 26). On some early models, the washers are interchangeable and are 0.020 in thickness. On most motors, the upper thrust washer (21) is 0.031 in thickness, while the lower washer (26) is 0.020. Make sure the washers are installed in the proper location.

Upper drive shaft (8) on Merc models can be removed without removing the power head, by threading a long No. 10-32 screw or rod in lower end of shaft to serve as a puller. On older models, remove the power head to remove the drive shaft. Shim pack (42) controls the transmission end play and will be found on the bearing shoulder when drive shaft (8) is removed.

The upper drive shaft ball bearing (41) and the water pump assembly are retained in the driveshaft housing by the retaining ring (43) which is threaded into housing with a left-hand thread. To disassemble the bearing and water pump, remove the retaining ring with Mercury tool 91-27532A1 or equivalent; then remove the components with a suitable expanding puller. NOTE: On early models, the water pump cartridge (31) is reversed, with closed end down. Cartridge must be removed before impeller (34) can be renewed. A water pump puller (91-27780) is provided by the manufacturer. When removing the cartridge on these models, expand the puller below the upper cover plate (35) as cover plate must be tilted for removal from housing.

When reassembling, make sure that all components are properly assembled with the inner holes aligned so that the drive shaft (8) can be inserted. Lubricate all parts liberally with a good, light grease such as "Quicksilver" Multipurpose Lubricant. The Assembly Tool (91-28742A1) will facilitate installation.

The transmission must be installed with 0.006-0.010 end play. Thickness of shim pack depends on the assembled height of the gearcase drive pinion (2—Fig. M66). If service on the gearcase or components is required, complete the necesary work before measuring the transmission end play. Transmission end play is adjusted by adding or removing shims in shim pack (42—Fig. M64) which fits between bearing (41) and the shoulder of upper drive shaft (8). To determine the required shim pack thickness, completely assemble the transmission, omitting the clutch springs (11 and 16). Install the assembly in driveshaft housing; then measure and record the distance between lower face of thrust washer (26) and the mounting flange of driveshaft housing. Measure and record the height of thrust washer face of lower drive shaft pinion (2—Fig. M66) above the mounting flange of gearcase housing (29). Subtract the second measurement from the first to obtain the existing clearance. Remove the transmission assembly and upper drive shaft (8—Fig. M64) and add or remove shims (42) as required to establish the recommended end play. Shims are available in thicknesses of 0.002, 0.003, 0.010, 0.020, 0.030 and 0.040. The manufacturer has designed a transmission gage (91-28987A1) which can be used to determine the shim pack thickness. See Fig. M65. When using the gage, omit one 0.010 shim (42—Fig. M64) from the previously installed shim pack, then measure the gap between lower drive pinion and the slide as shown. The measured gap indicates the thickness of shims to be added, as end play is provided for by the length of the slide on the gage.

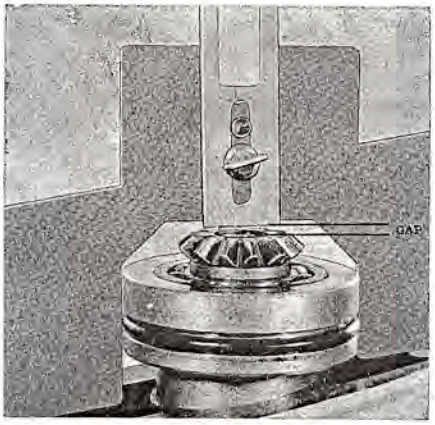


Fig. M65—Using the recommended tools to adjust transmission end play. Refer to text for details.

ADJUSTMENT. To adjust the transmission linkage, set the speed control grip or lever in the "Neutral" position, and adjust the length of shift rod (1—Fig. M64) until the lever on transmission control shaft (3) points horizontally forward.

GEARCASE HOUSING. To overhaul the lower unit gearcase, unbolt and remove the unit from driveshaft housing and clamp the assembly in a vise, using formed blocks of wood to protect the gearcase housing. Remove the propeller by removing nut (10—Fig. M66). Before disassembly, check the backlash of the gears by pushing in on propeller shaft (25) and pulling out on the lower driveshaft (2); then rotating the driveshaft slightly to determine backlash. The backlash should be 0.003-0.005.

To disassemble the gearcase, remove the threaded cover (13) using Mercury Tool 91-27534A1 or a suitable spanner wrench. Cover is retained to gearcase by a left-hand thread. Clamp the end of propeller shaft (25) in a soft-jawed vise and tap the housing (29) from shaft using a rubber mallet. Remove and save the washer (22) and shims (23) from gearcase housing shoulder, if they were not removed with shaft and bearing assembly. The shims control the backlash of the propeller drive gears. Tap the propeller shaft and bearing assembly from the bearing carrier (17). Remove snap ring (19) and shims (20); then remove the bearing (21) using bearing plates and an arbor press. The shims (20) control end play in the propeller shaft. Driven gear (24) can be pressed from propeller shaft after removing the drive pin (26). NOTE: this drive pin is retained by the bearing inner race, and should drop out after bearing is removed. On early models with closed hole, pin must be drilled out if it is tight.

To remove the drive shaft (2) clamp the upper pinion in a soft jawed vise and remove the retaining screw (9); then tap gearcase housing (29) if necessary, to free pinion (8) from lower drive shaft. Shaft and pinion can now be withdrawn from housing. Clamp upper end of pilot assembly (6) in protected vise and tap housing (29) to remove the pilot. Shims (4) control the mesh position of the propeller drive gears. Shims of same thickness should be used when reassembling; unless pilot (6), gearcase (29), or the gears (8 & 24) are renewed. If parts are renewed, make a trial assembly using bearing blue to check and adjust the mesh position. Shims are available in thicknesses of 0.002, 0.003, 0.005, 0.010 and 0.020.

Reassemble by reversing the disassembly procedure. Be sure to align drive pin hole in propeller shaft (25) and driven gear (24); and press the gear on shaft until drive pin (26) can be inserted. Install and seat the ball bearing, then install snap ring (19), using sufficient shims (20) to remove all clearance between snap ring groove and bearing. Shims are available in thicknesses of 0.003, 0.005 and 0.010. Install the propeller shaft assembly using the shim pack (23) removed on disassembly, then check the backlash between pinion (8) and gear (24). If the recommended 0.003-0.005 backlash is not obtained, disassemble and add or remove shims (23). Increasing the shim pack thickness increases the backlash. Shims are available in thicknesses of 0.002, 0.003, 0.005 and 0.010. Install the assembled gearcase as outlined in TRANSMISSION paragraph.

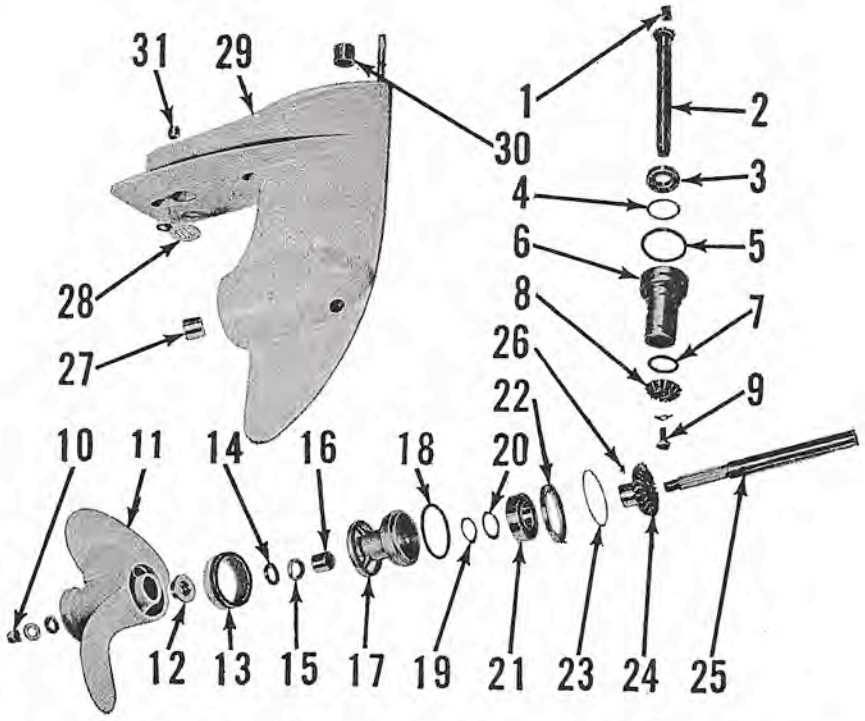


Fig. M66—Exploded view of lower unit gearcase and associated parts.

1. Bushing
2. Lower drive shaft
3. Ball bearing
4. Shim
5. "O" ring
6. Pilot assembly
7. "O" ring
8. Drive pinion
9. Cap screw
10. Nut
11. Propeller
12. Collar
13. Housing cover
14. Oil seal
15. Oil seal
16. Roller bearing
17. Bearing carrier
18. "O" ring
19. Snap ring
20. Shim
21. Ball bearing
22. "L" washer
23. Shim
24. Driven gear
25. Propeller shaft
26. Drive pin
27. Roller bearing
28. Water inlet
29. Gearcase
30. Roller bearings