TECUMSEH

Model	No. Cyls.	Bore	Stroke	Displacement	Horsepower
MEDIUM FRAME MODELS					
VM70	1	2-15/16 in. (74.6 mm)	2-17/32 in. (64.3 mm)	17.16 cu. in. (281 cc)	7 (5.2 kW)
VM80	1	3-1/16 in. (77.8 mm)	2-17/32 in. (64.3 mm)	18.65 cu. in. (305 cc)	8 (5.9 kW)
VM100	1	3-3/16 in. (80.9 mm)	2-17/32 in. (64.3 mm)	20.2 cu. in. (331 cc)	10 (7.5 kW)
HM70	1	2-15/16 in. (74.6 mm)	2-17/32 in. (64.3 mm)	17.16 cu. in. (281 cc)	7 (5.2 kW)
HM80	1	3-1/16 in. (77.8 mm)	2-17/32 in. (64.3 mm)	18.65 cu. in. (305 cc)	8 (5.9 kW)
HM100	1	3-3/16 in. (80.9 mm)	2-17/32 in. (64.3 mm)	20.2 cu. in. (331 cc)	10 (7.5 kW)
HEAVY FRAME MODELS					
VH70	1	2-¾ in. (69.8 mm)	2-17/32 in. (64.3 mm)	15.0 cu. in. (246 cc)	7 (5.2 kW)
VH80	1	3-5/16 in. (84.1 mm)	2-¾ in. (69.8 mm)	23.75 cu. in. (389 cc)	8 (5.9 kW)
VH100	1	3-5/16 in. (84.1 mm)	2-¾ in. (69.8 mm)	23.75 cu. in. (389 cc)	10 (7.5 kW)
HH70	1	2-¾ in. (69.8 mm)	2-17/32 in. (64.3 mm)	15.0 cu. in. (246 cc)	7 (5.2 kW)
HH80	1	3-5/16 in. (84.1 mm)	2-¾ in. (69.8 mm)	23.75 cu. in. (389 cc)	8 (5.9 kW)
HH100	1	3-5/16 in. (84.1 mm)	2-¾ in. (69.8 mm)	23.75 cu. in. (389 cc)	10 (7.5 kW)
HH120	1	3-½ in. (88.9 mm)	2-⅞ in. (73 mm)	27.66 cu. in. (453 cc)	12 (8.9 kW)

Engines must be identified by complete model number, including specification number in order to obtain correct repair parts. Numbers on early models are located on a name plate or tag. Numbers on later models are stamped in blower housing. It is important to transfer ID tags from original engine to replacement short block so unit can be identified later.

Medium frame engines have aluminum blocks with cast iron sleeves. Heavy frame engines have cast iron cylinder and block assemblies. Early VH70 and HH70 engines were identified as V70 and H70. Models VH and VM are vertical crankshaft engines and HM and HH models have horizontal crankshafts.

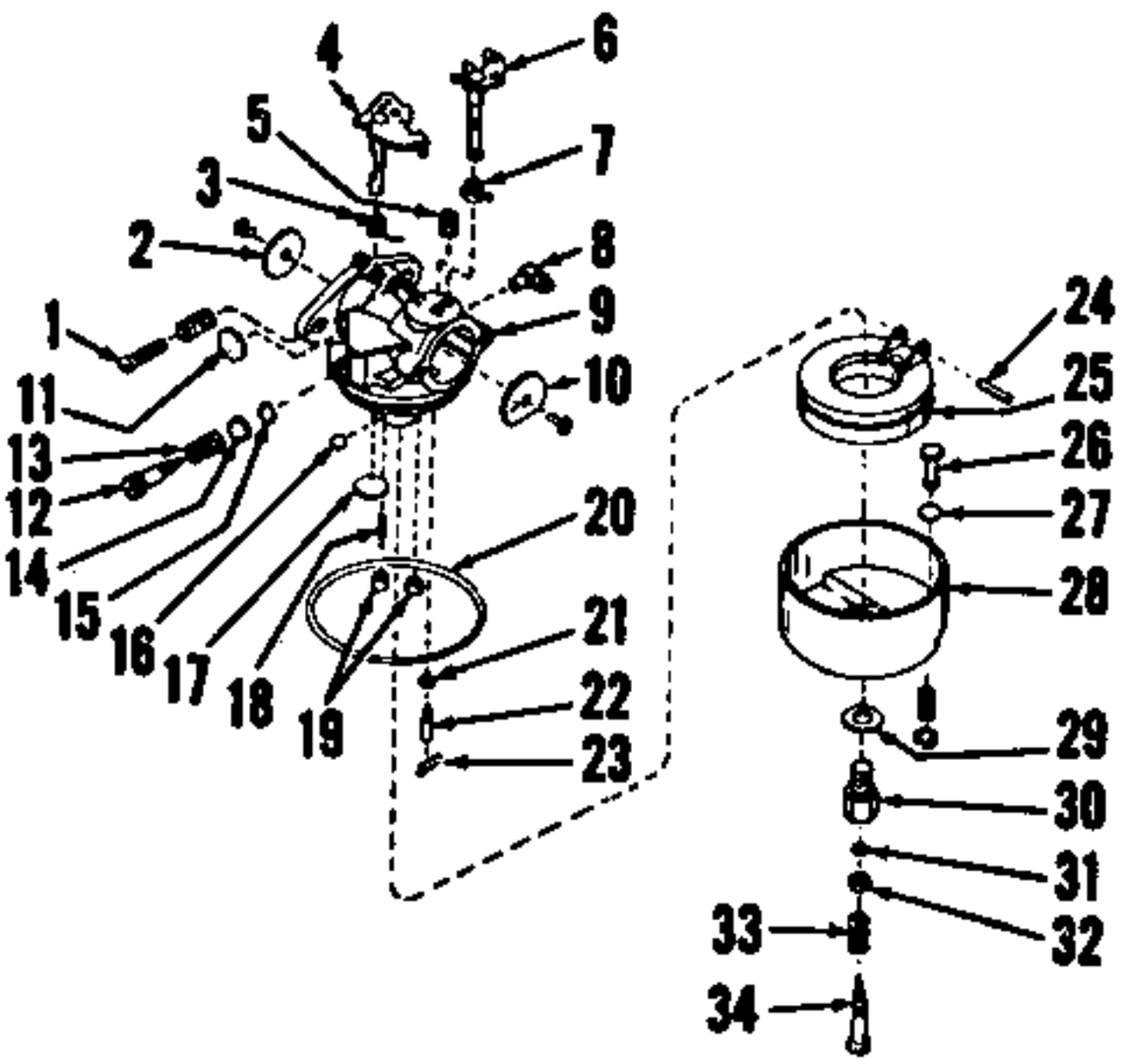


Fig. T1—Exploded view of Tecumseh carburetor.

1. Idle speed screw
2. Throttle plate
3. Return spring
4. Throttle shaft
5. Choke stop spring
6. Choke shaft
7. Return spring
8. Fuel inlet fitting
9. Carburetor body
10. Choke plate
11. Welch plug
12. Idle mixture needle
13. Spring
14. Washer
15. "O" ring
16. Ball plug
17. Welch plug
18. Pin
19. Cup plugs
20. Bowl gasket
21. Inlet needle seat
22. Inlet needle
23. Clip
24. Float shaft
25. Float
26. Drain stem
27. Gasket
28. Bowl
29. Gasket
30. Bowl retainer
31. "O" ring
32. Washer
33. Spring
34. Main fuel needle

MAINTENANCE

SPARK PLUG. Recommended spark plug is Champion J-8 or equivalent. Set electrode gap to 0.030 inch (0.762 mm). Spark plug should be removed, cleaned and adjusted periodically. Renew plug if electrodes are burned and pitted or if porcelain is cracked. If frequent plug fouling is experienced, check for following conditions:

a. Carburetor setting too rich
b. Partially closed choke
c. Clogged air filter
d. Incorrect spark plug
e. Poor grade of gasoline
f. Too much oil or crankcase breather clogged

CARBURETOR. Tecumseh or Walbro float type carburetors may be used. Adjustment and service procedures for each type carburetor is outlined in the following paragraphs.

TECUMSEH CARBURETOR. Clockwise rotation of idle mixture needle (12–Fig. T1) and main fuel adjusting needle (34) leans the mixture. Initial adjustment of both needles is 1 turn open. Final adjustment is made with engine running at normal operating temperature. Adjust main fuel needle for smoothest operation at high speed. Then, adjust idle mixture needle for smoothest engine idle. Adjust idle speed stop screw (1) for engine idle speed of 1800 rpm.

When overhauling, check adjusting needles for excessive wear or other damage. Inlet fuel needle (22) seats against a Viton rubber seat (21) which is pressed into carburetor body. Remove rubber seat before cleaning carburetor in a commercial cleaning solvent. The seat should be installed grooved side first. See Fig. T2.

NOTE: Some later models have a Viton tipped inlet needle (Fig. T3) and a brass seat.

Install throttle plate (2–Fig. T1) with the two stamped lines facing out and at 12 and 3 o'clock position. The 12 o'clock line should be parallel to throttle shaft and to top of carburetor. Install choke plate (10) with flat side towards bottom of carburetor. Float setting should be 7/32-inch (5.5 mm), measured with body and float assembly in inverted position, between free end of float and rim on carburetor body. Fuel fitting (8) is pressed into body. When installing fuel inlet fitting, start fitting into bore; then, apply a light coat of Loctite 271 to shank and press fitting into position.

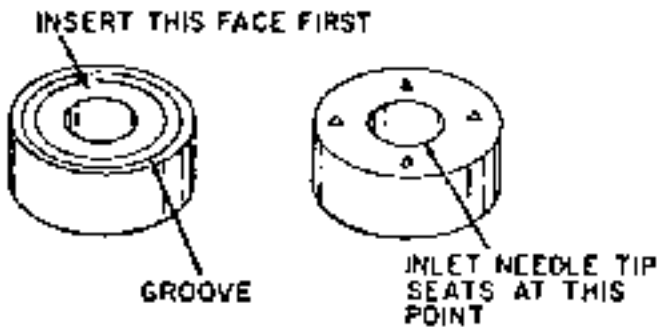


Fig. T2–The Viton seat used on some Tecumseh carburetors must be installed correctly to operate properly. All metal needle is used with seat shown.

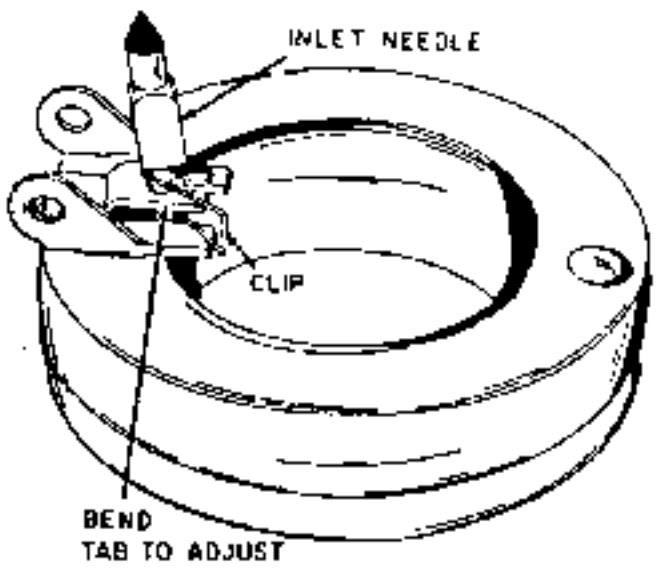


Fig. T3–View of float and fuel inlet valve needle. The valve needle shown is equipped with resilient tip and a clip. Bend tab shown to adjust float height.

WALBRO CARBURETOR. To adjust, refer to Fig. T4 and proceed as follows: Turn both fuel adjusting needles (9 and 33) in finger tight, then back idle mixture needle (9) out 1¾ turns and main fuel needle (33) out 2 turns. Make final adjustment with engine warm and running. Adjust main fuel needle until engine runs smoothly at normal operating speed. Back out idle speed stop screw (7), hold throttle to slowest idle speed possible without stalling and adjust idle mixture needle for smoothest idle performance. Readjust idle speed screw so engine idle speed is 1800 rpm.

Float setting for Walbro carburetors is ⅛-inch (3 mm) on horizontal crankshaft engines and 3/32-inch (2.4 mm) on vertical crankshaft engines when measured with carburetor in inverted position, between free side of float and body casting rim. See H–Fig. T5. Float travel should be 9/16-inch (14 mm) as measured at free end of float. Bend lip of float tang to adjust float level.

NOTE: If carburetor has been disassembled and main nozzle (19–Fig. T4) removed, do not reinstall nozzle; obtain and install a new service nozzle. Refer to Fig. T6.

GOVERNOR. A mechanical flyweight type governor is used on all models. Governor weight and gear assembly is

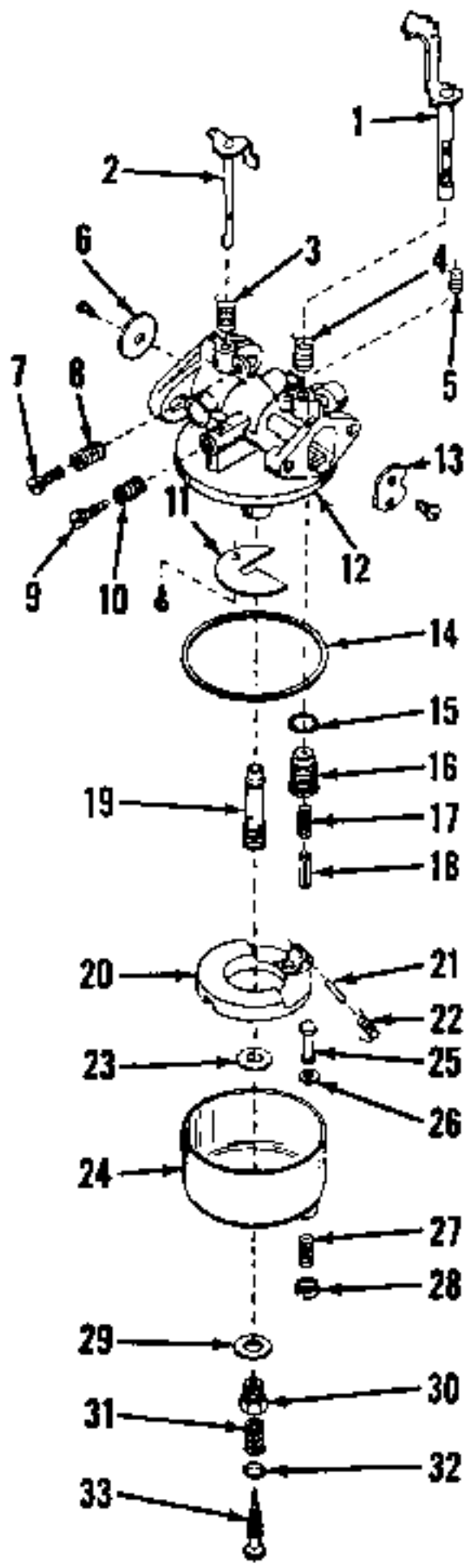


Fig. T4–Exploded view of Walbro carburetor.

1. Choke shaft
2. Throttle shaft
3. Throttle return spring
4. Choke return spring
5. Choke stop spring
6. Throttle plate
7. Idle speed stop screw
8. Spring
9. Idle mixture needle
10. Spring
11. Baffle
12. Carburetor body
13. Choke plate
14. Bowl gasket
15. Gasket
16. Inlet valve seat
17. Spring
18. Inlet valve
19. Main nozzle
20. Float
21. Float shaft
22. Spring
23. Gasket
24. Bowl
25. Drain stem
26. Gasket
27. Spring
28. Retainer
29. Gasket
30. Bowl retainer
31. Spring
32. "O" ring
33. Main fuel adjusting needle

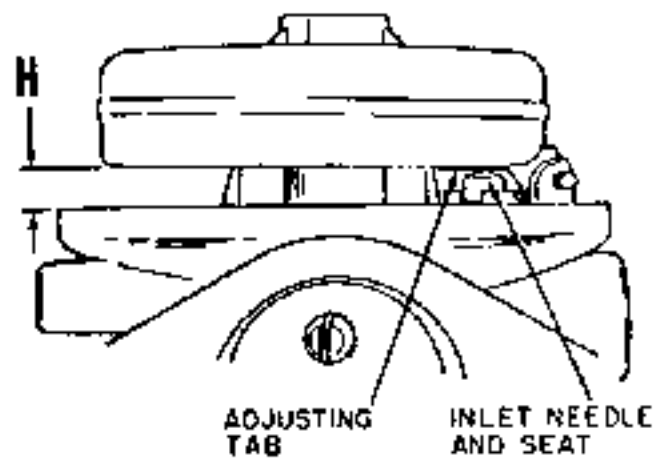


Fig. T5–Float height (H) should be measured as shown on Walbro float carburetors. Bend adjusting tab to adjust height.

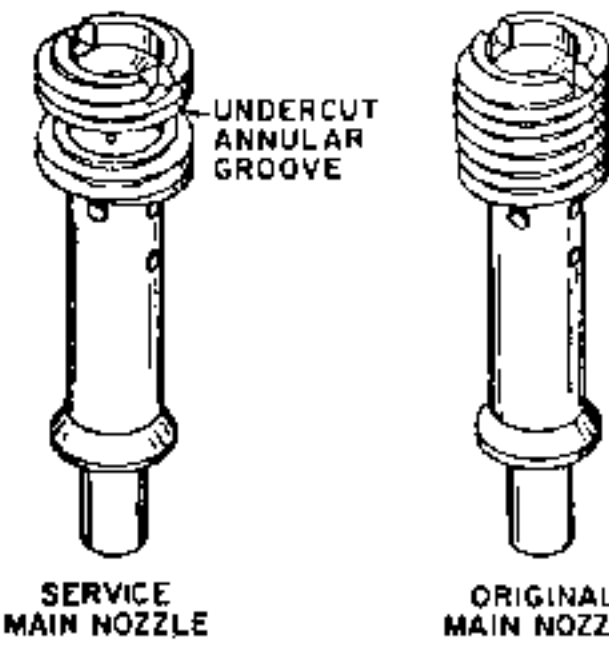


Fig. T6–The main nozzle originally installed is drilled after installation through hole in body. Service main nozzles are grooved so alignment is not necessary.

driven by camshaft gear and rides on a renewable shaft which is pressed into engine crankcase or crankcase cover. Press governor shaft in until shaft end is located as shown in Fig. T7, T8, T9 or T10.

To adjust governor lever position on vertical crankshaft models, refer to Fig. T11. Loosen clamp screw on governor lever. Rotate governor lever shaft counter-clockwise as far as possible. Move governor lever to the left until throttle is fully open, then tighten clamp screw.

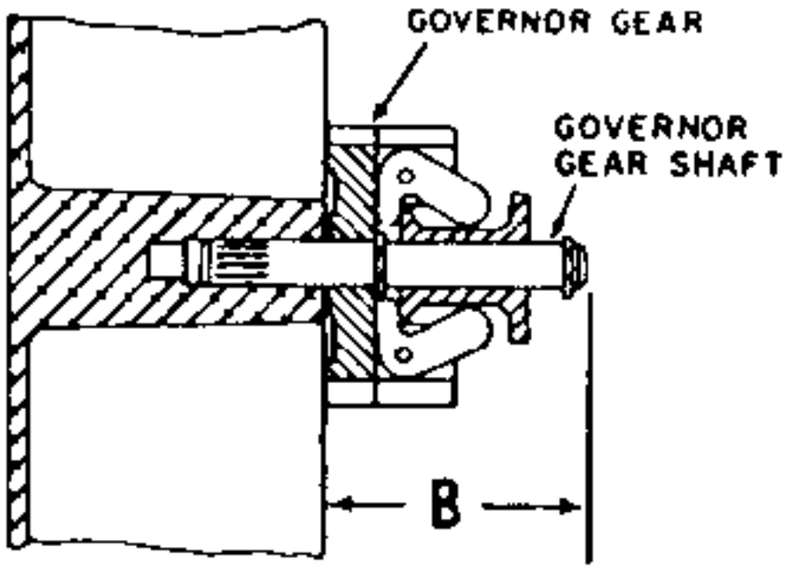


Fig. T7—View showing installation of governor shaft and governor gear and weight assembly on Models HH60, HH100 and HH120. Dimension (B) is 1 inch (25.4 mm).

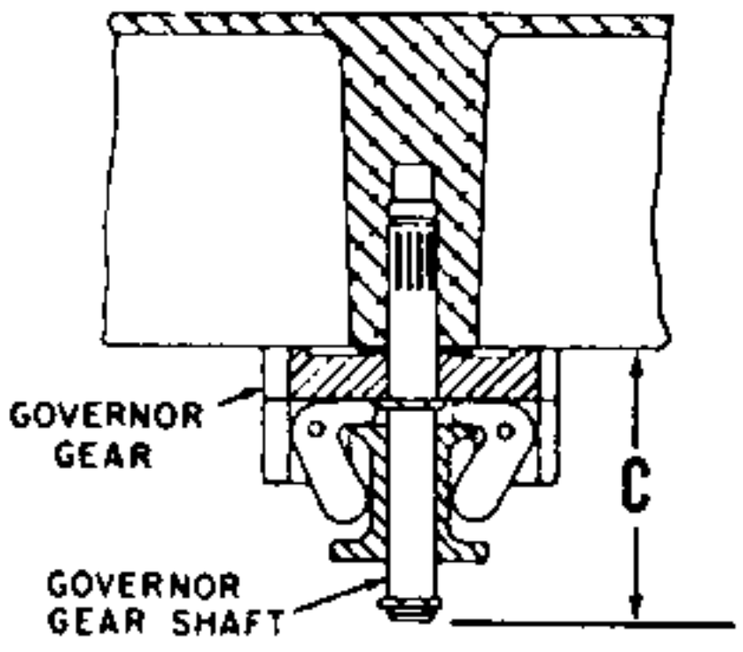


Fig. T8—Governor gear and shaft installation on Models VH80 and VH100. Dimension (C) is 1 inch (25.4 mm).

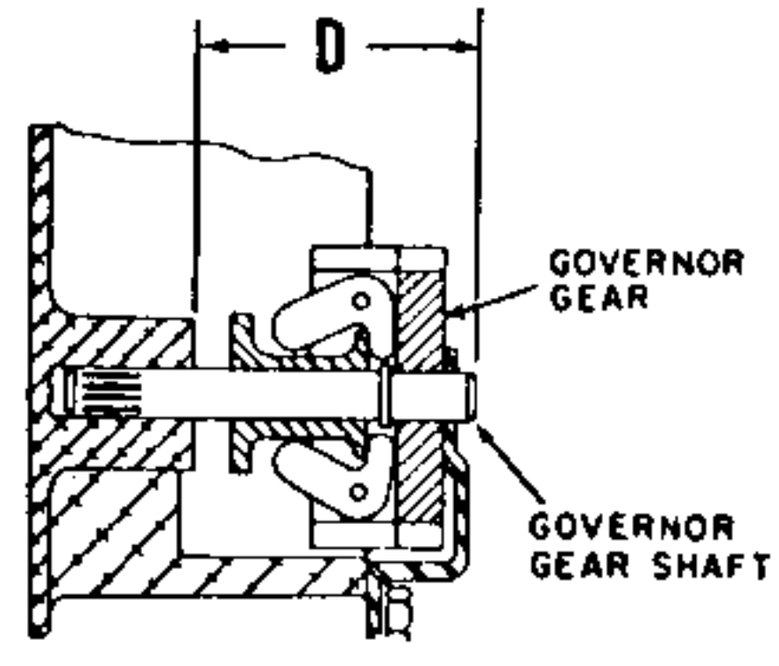


Fig. T9—Correct installation of governor shaft and gear and weight assembly on Models HH70, HM70, HM80 and HM100. Dimension (D) is 1-⅝ inches (34.9 mm) on Models HM70, HM80 and HM100 or 1-17/64 inches (32.1 mm) on Models HH70.

On horizontal crankshaft models, loosen clamp screw on lever, rotate governor lever shaft clockwise as far as possible. See Fig. T12. Move governor lever clockwise until throttle is wide open, tighten clamp screw.

For external linkage adjustments, refer to Figs. T13 and T14. Loosen screw (A), turn plate (B) counter-clockwise as far as possible and move lever (C) to the left until throttle is fully open. Tighten screw (A). Governor spring must be hooked in hole (D) as shown. Adjusting screws on bracket shown in Figs. T13 and T14 are used to adjust fixed or variable speed settings.

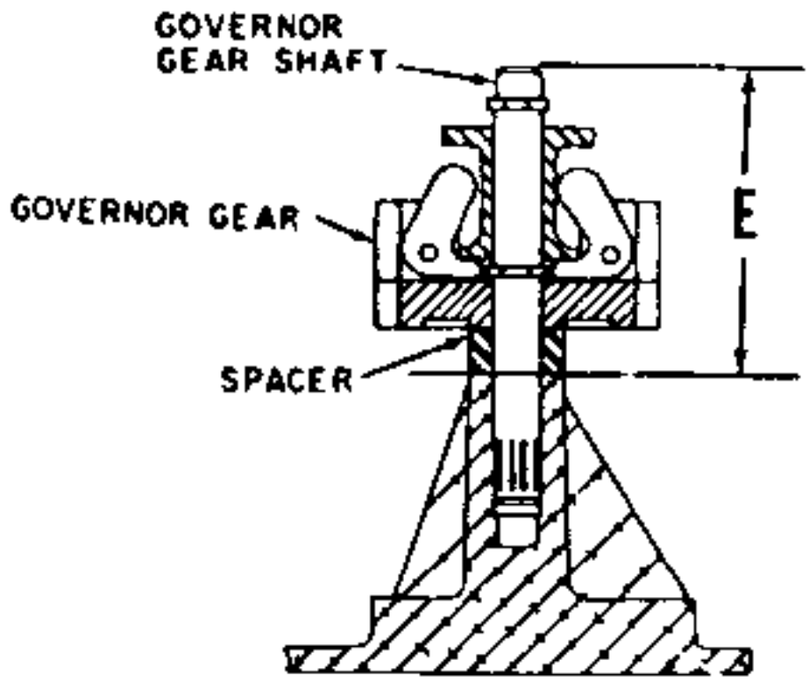


Fig. T10—Governor gear and shaft installation on Models VH70, VM70, VM80 and VM100. Dimension (E) is 1-19/32 inches (40.5 mm).

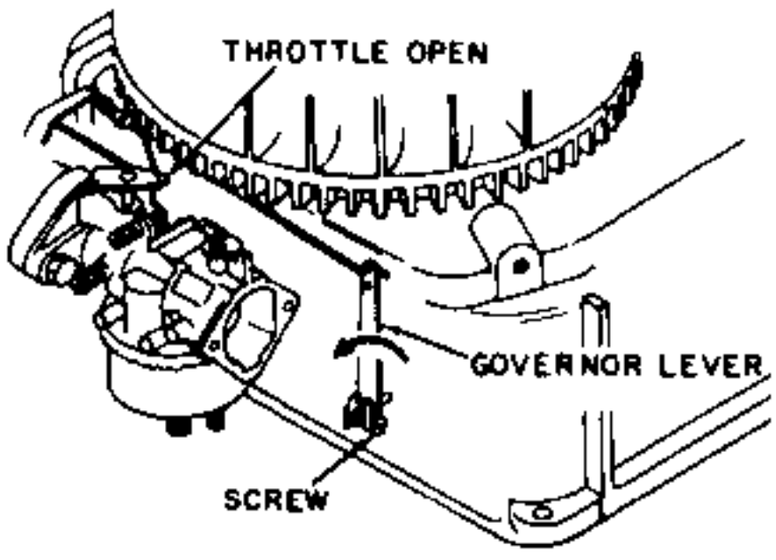


Fig. T11—When adjusting governor linkage on Models VH70, VM70, VM80 or VM100, loosen clamp screw and rotate governor lever shaft and lever counter-clockwise as far as possible.

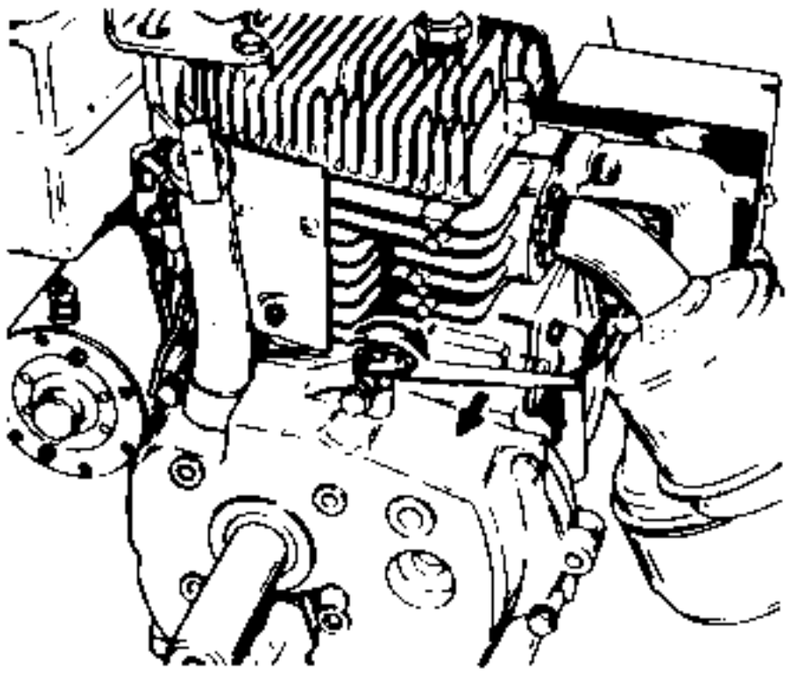


Fig. T12—On Models HH70, HM70, HM80 and HM100, rotate governor lever shaft and lever clockwise when adjusting linkage.

MAGNETO IGNITION. Tecumseh flywheel type magnetos are used on some models. On Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and VH70, breaker points are enclosed

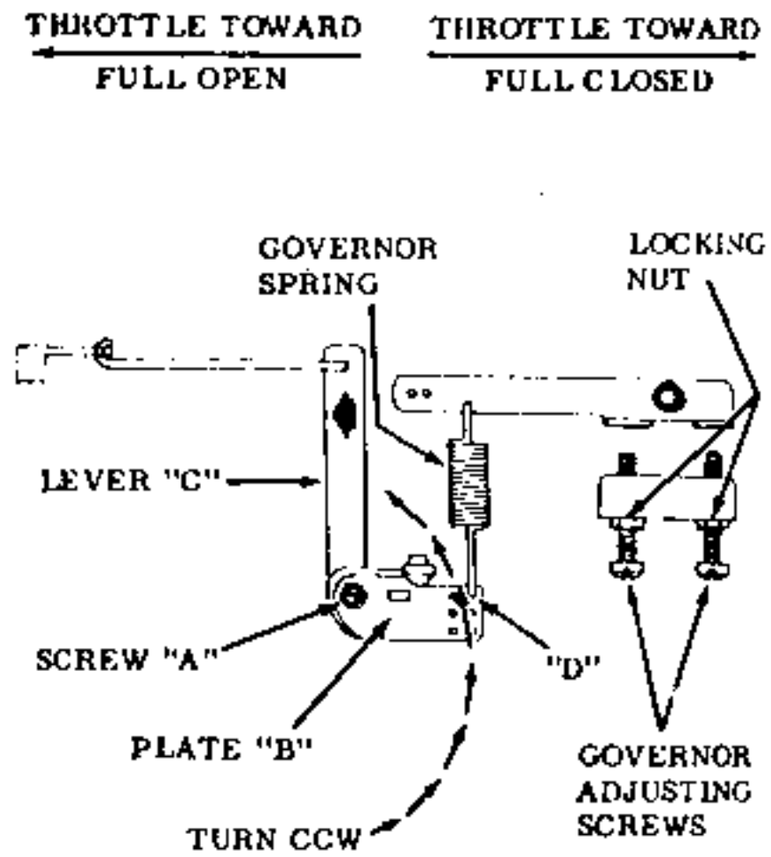


Fig. T13—External governor linkage on Models VH80 and VH100. Refer to text for adjustment procedure.

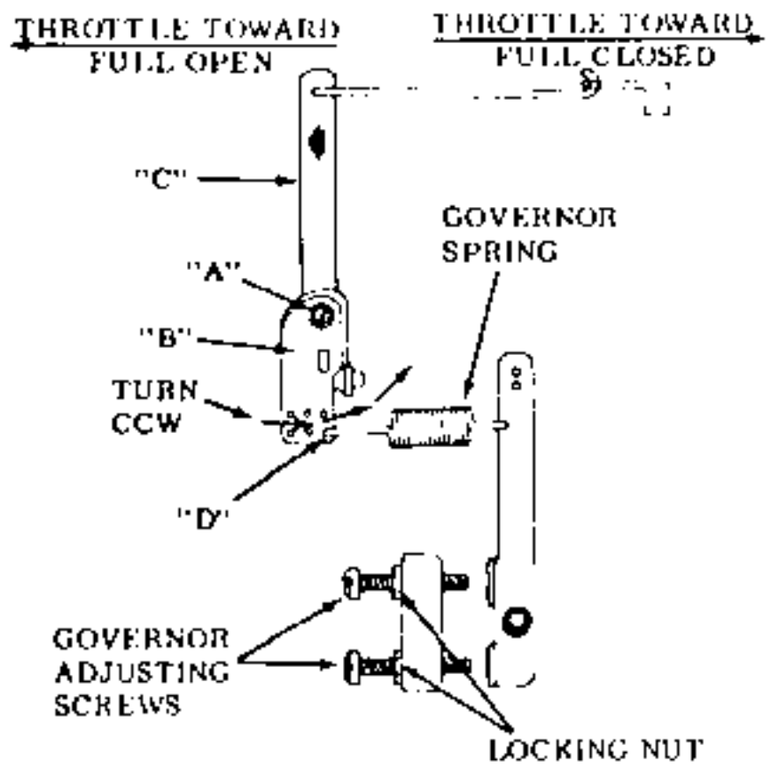


Fig. T14—External governor linkage on Models HH80, HH100 and HH120. Refer to text for adjustment procedure.

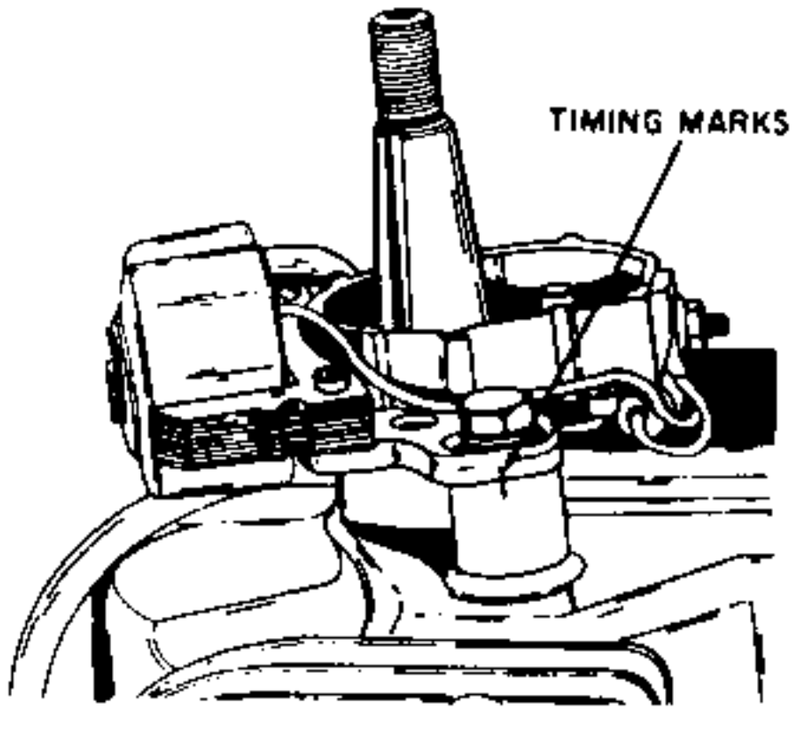


Fig. T15—On Models VM70, VH70, HM70, HH70, VM80, HM80, VM100 and HM100 equipped with magneto ignition, adjust breaker point gap to 0.020 inch (0.508 mm) and align timing marks as shown.

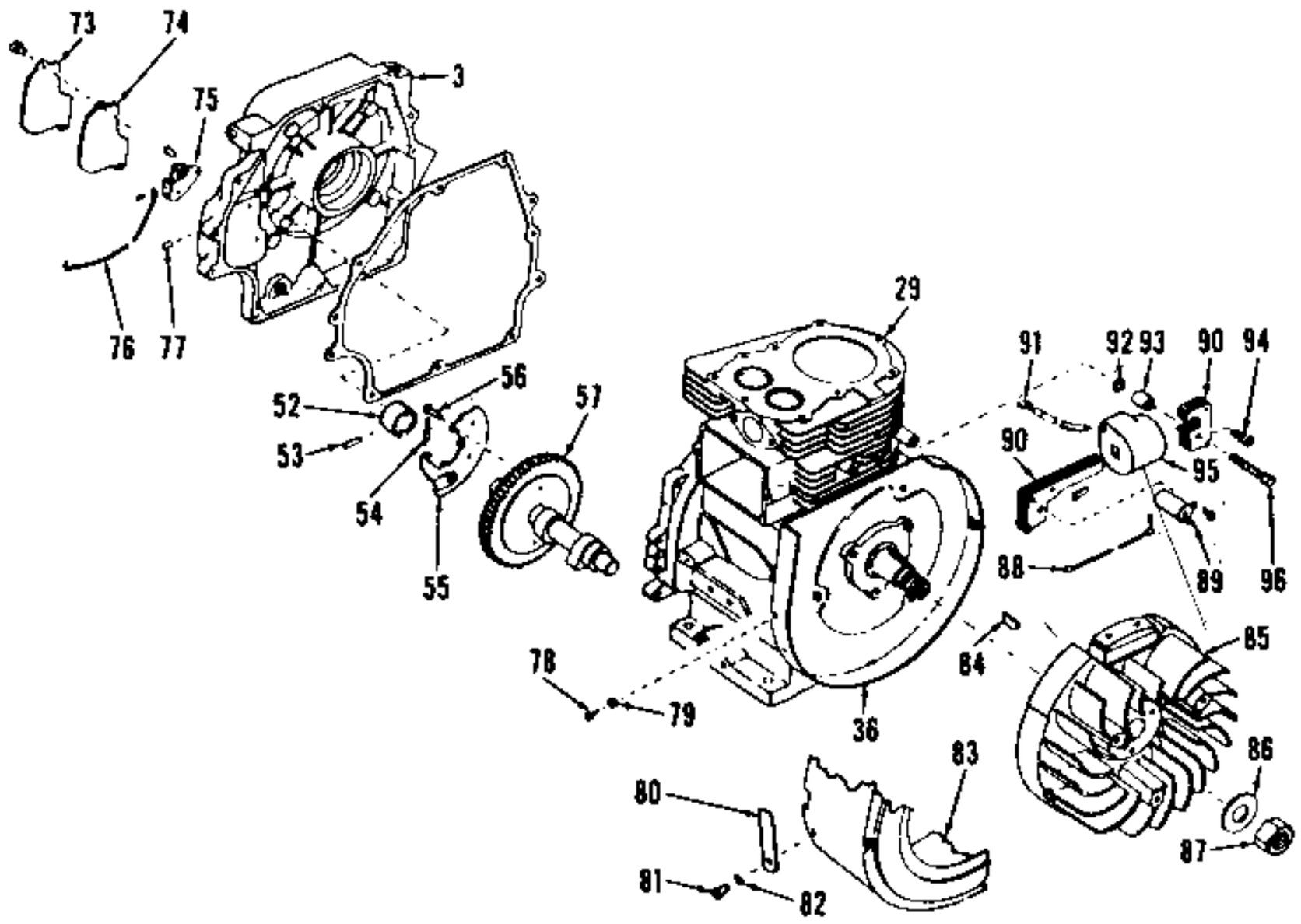


Fig. T16 – Exploded view of magneto ignition components used on Models HH80, HH100 and HH120. Timing advance and breaker points used on engines equipped with battery ignition are identical.

3. Crankcase cover
29. Cylinder block
36. Blower air baffle
52. Breaker cam
53. Push rod
54. Spring
55. Timing advance weight
56. Rivet
57. Camshaft assy.
73. Breaker box cover
74. Gasket
75. Breaker points
76. Ignition wire
77. Pin
78. Screw
79. Clip
80. Ground switch
81. Screw
82. Washer
83. Blower housing
84. Flywheel key
85. Flywheel
86. Washer
87. Nut
88. Condenser wire
89. Condenser
90. Armature core
91. High tension lead
92. Washer
93. Spacer
94. Screw
96. Coil
96. Screw

by the flywheel. Breaker point gap must be adjusted to 0.020 inch (0.508 mm). Timing is correct when timing mark on stator plate is in line with mark on bearing plate as shown in Fig. T15. If timing marks are defaced, points should start to open when piston is 0.085-0.095 inch (2.159-2.413 mm) BTDC.

Breaker points on Models HH80, VH80, HH100, VH100 and HH120 are located in crankcase cover as shown in Fig. T16. Timing should be correct when points are adjusted to 0.020 inch (0.508 mm) gap. To check timing with a continuity light, refer to Fig. T17. Remove "pop" rivets securing identification plates to blower housing. Remove plate to expose timing port hole. Connect continuity light to terminal screw (78–Fig. T16) and suitable engine ground. Rotate engine clockwise until piston is on compression stroke and timing mark is just below stator laminations as shown in Fig. T17. At this time, points should be ready to open and continuity light should be on. Rotate flywheel until mark just passes under edge of laminations. Points should open and light should be out. If not, adjust points slightly until light goes out. The points are actuated by push rod (53 – Fig. T16) which rides against breaker cam (52). Breaker cam is driven by a tang on advance weight (55). When cranking, spring (54) holds advance weight in retarded position (TDC). At operating speeds, centrifugal force overcomes spring pressure and weight moves cam to advance ignition so spark occurs when piston is at 0.095 inch (2.413 mm) BTDC.

An air gap of 0.006-0.010 inch (0.152-0.254 mm) should be between flywheel and stator laminations. To adjust gap, turn flywheel magnet into position under coil core. Loosen holding screws and place shim stock or feeler gage between coil and magnet. Press coil against gage and tighten screws.

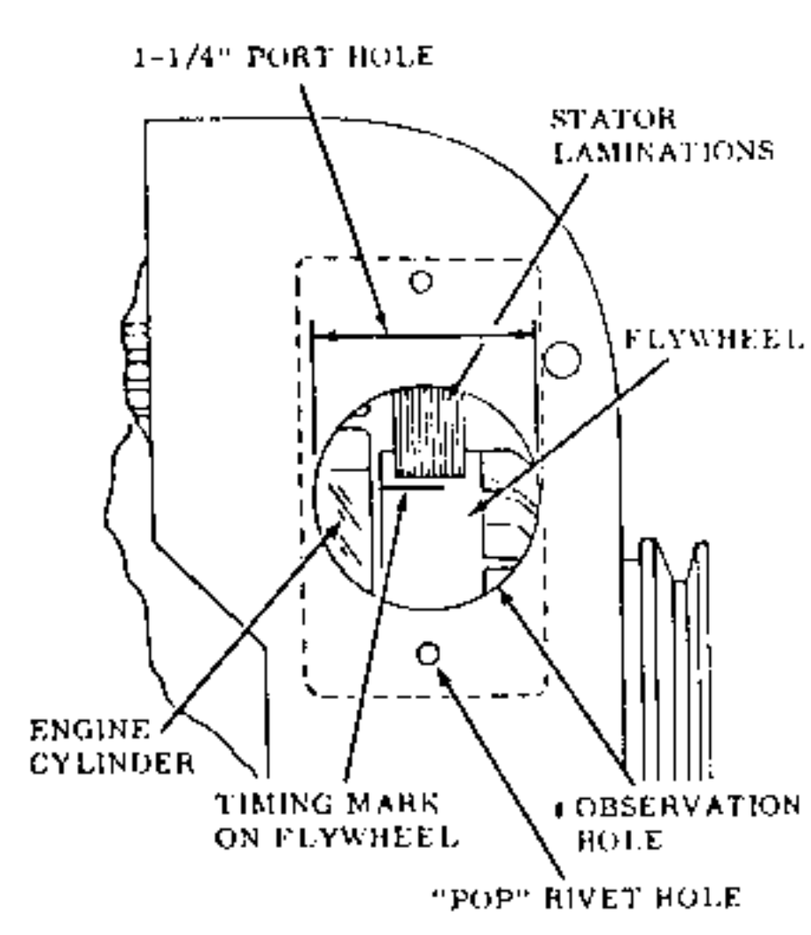


Fig. T17 – On Models HH80, HH100 and HH120, remove identification plate to observe timing mark on flywheel through port hole in blower housing.

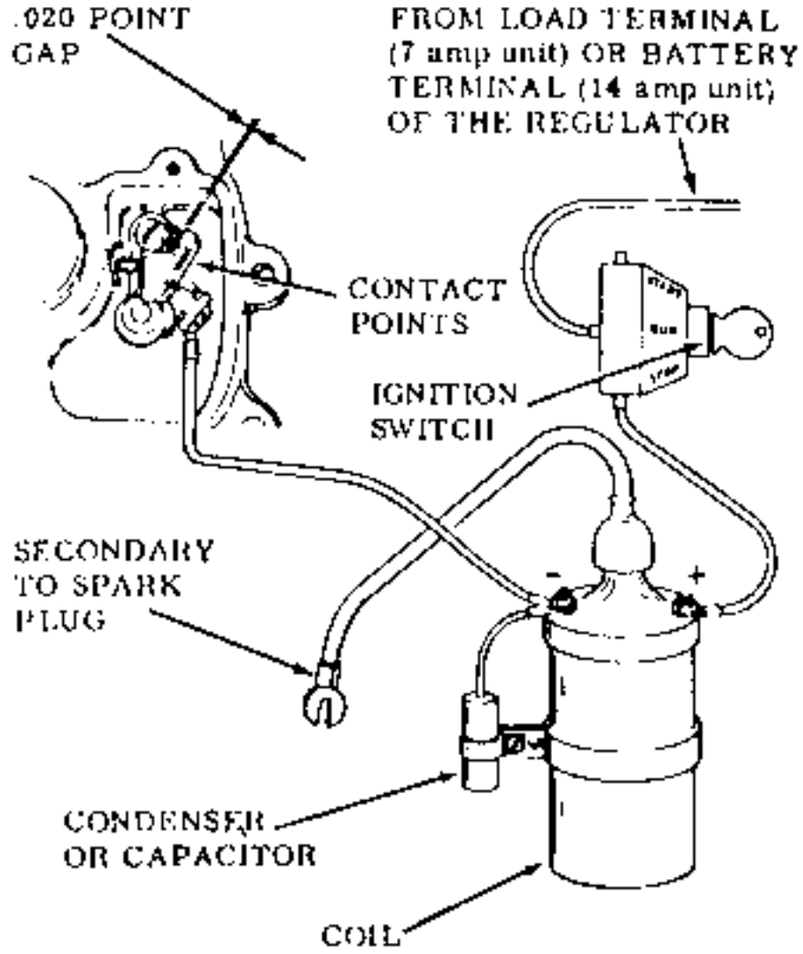


Fig. T18 – Typical battery ignition wiring diagram used on some HH80, HH100 and HH120 engines.

BATTERY IGNITION. Models HH80, HH100 and HH120 may be equipped with a battery ignition. Delco-Remy 1115222 coil and 1965489 condenser are externally mounted while points are located in crankcase cover. See Fig. T18. Points should be adjusted to 0.020 inch (0.508 mm) gap. To check timing, disconnect primary wire between coil and points and follow same procedure as described in MAGNETO IGNITION section.

SOLID STATE IGNITION (WITHOUT ALTERNATOR). The Tecumseh solid state ignition system shown in Fig. T19 may be used on some models not equipped with flywheel alternator. This system does not use ignition breaker points. The only moving part of the system is the rotating flywheel with charging magnets. As flywheel magnet passes

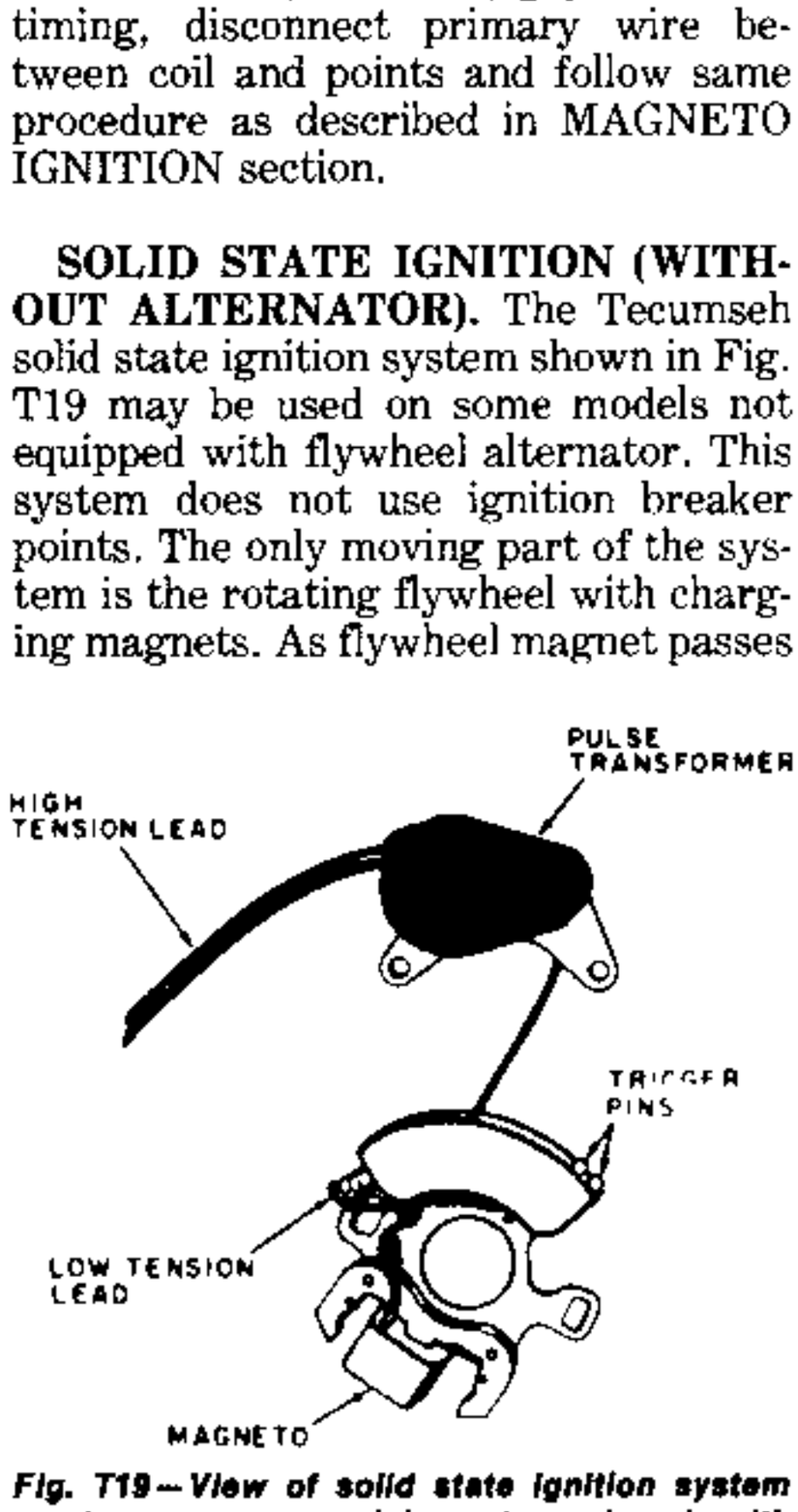


Fig. T19 – View of solid state ignition system used on some models not equipped with flywheel alternator.

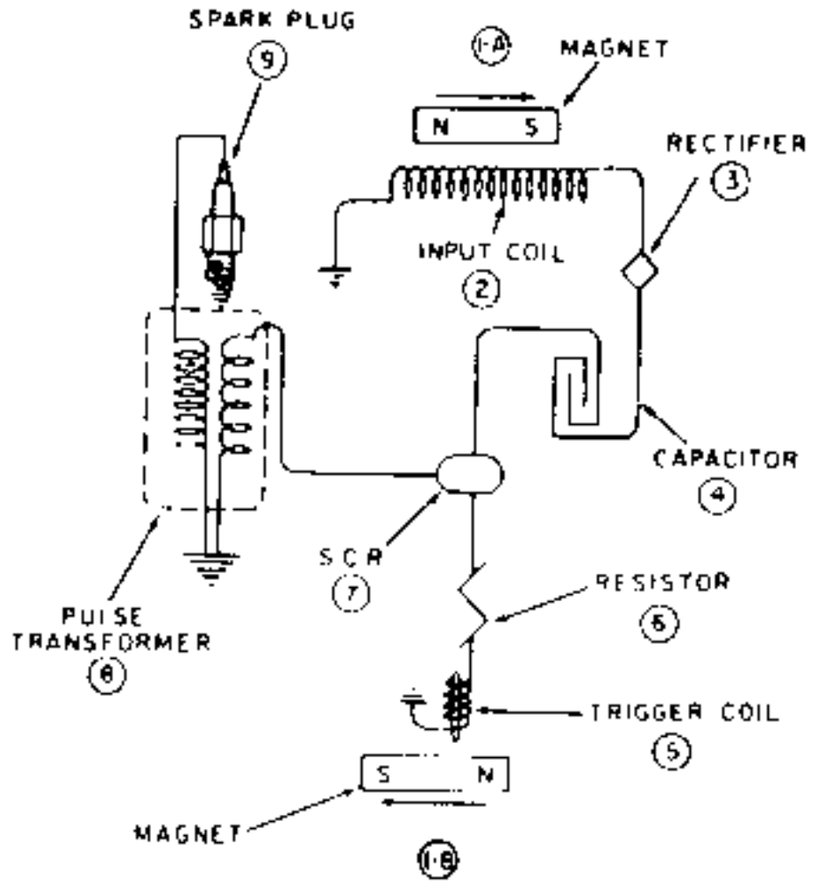


Fig. T20—Diagram of solid state ignition system used on some models.

position (1A–Fig. T20), a low voltage AC current is induced into input coil (2). Current passes through rectifier (3) converting this current to DC. It then travels to capacitor (4) where it is stored. The flywheel rotates approximately 180 degrees to position (1B). As it passes trigger coil (5), it induces a very small electric charge into the coil. This charge passes through resistor (6) and turns on the SCR (silicon controlled rectifier) switch (7). With SCR switch closed, low voltage current stored in capacitor (4) travels to pulse transformer (8). Voltage is stepped up instantaneously and current is discharged across electrodes of spark plug (9), producing a spark before top dead center.

Some units are equipped with a second trigger coil and resistor set to turn SCR switch on at a lower rpm. This second trigger pin is closer to the flywheel and produces a spark at TDC for easier starting. As engine rpm increases, the first (shorter) trigger pin picks up the small electric charge and turns SCR switch on, firing spark plug BTDC.

If system fails to produce a spark to spark plug, first check high tension lead Fig. T19. If condition of high tension lead is questionable, renew pulse transformer and high tension lead assembly. Check low tension lead and renew if insulation is faulty. The magneto charging coil, electronic triggering system and mounting plate are available only as an assembly. If necessary to renew this assembly, place unit in position on engine. Start retaining screws, turn mounting plate counter-clockwise as far as possible, then tighten retaining screw to a torque of 5-7 ft.-lbs. (7-9.5 N·m).

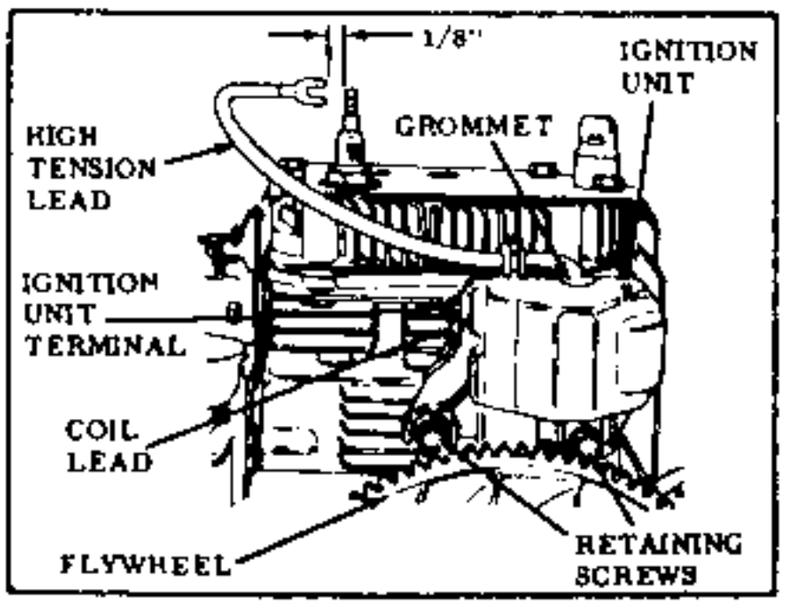


Fig. T21—View of solid state ignition unit used on some models equipped with flywheel alternator. System should produce a good blue spark ⅛-inch (3 mm) long at cranking speed.

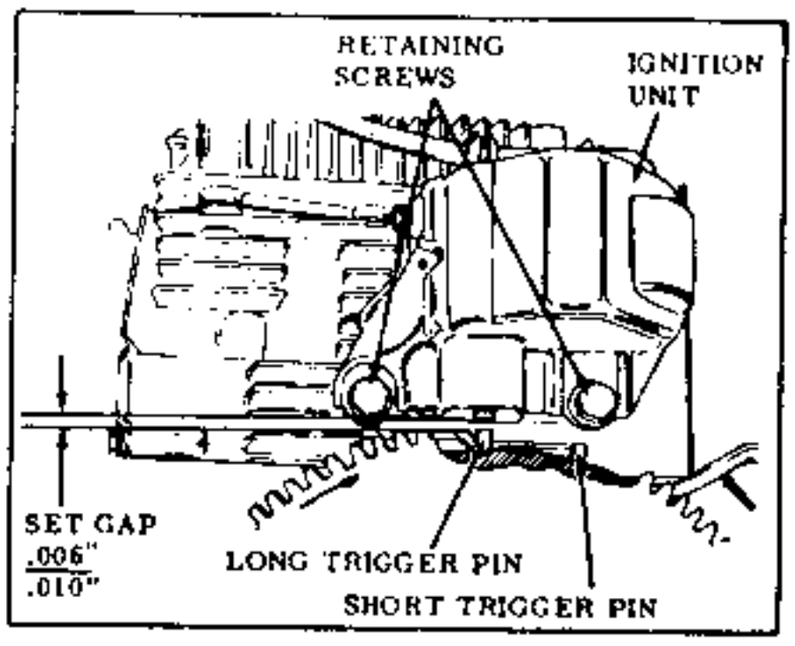


Fig. T22—Adjust air gap between long trigger pin and ignition unit to 0.006-0.010 inch (0.152-0.254 mm).

SOLID STATE IGNITION (WITH ALTERNATOR). The Tecumseh solid state ignition system used on some models equipped with flywheel alternator does not use ignition breaker points. The only moving part of the system is the rotating flywheel with charging magnets and trigger pins. Other components of system are ignition generator coil and stator assembly, spark plug and ignition unit.

The long trigger pin induces a small charge of current to close the SCR (silicon controlled rectifier) switch at engine cranking speed and produces a spark at TDC for starting. As engine rpm increases, the first (shorter) trigger pin induces the current which produces a spark when piston is 0.095 inch (2.413 mm) BTDC.

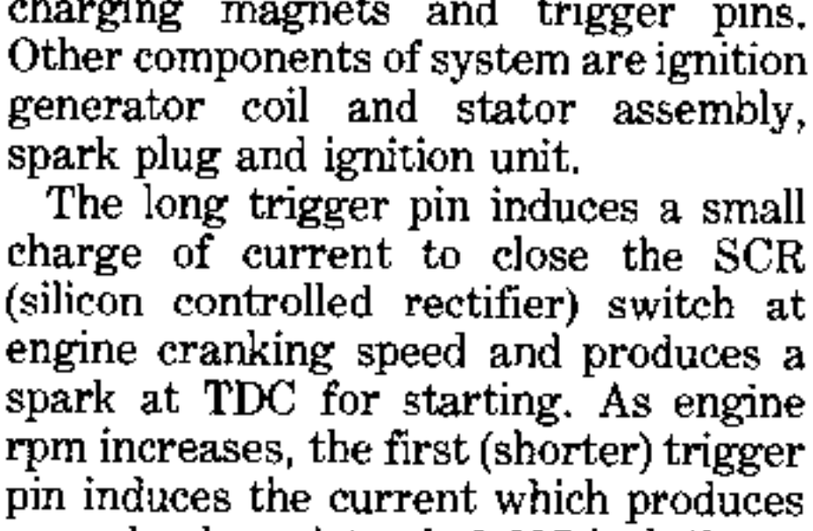


Fig. T23—Remove flywheel and drive trigger pins in or out as necessary until long pin is extended 0.250 inch (6.35 mm) and short pin is extended 0.187 inch (4.75 mm) above mounting surface.

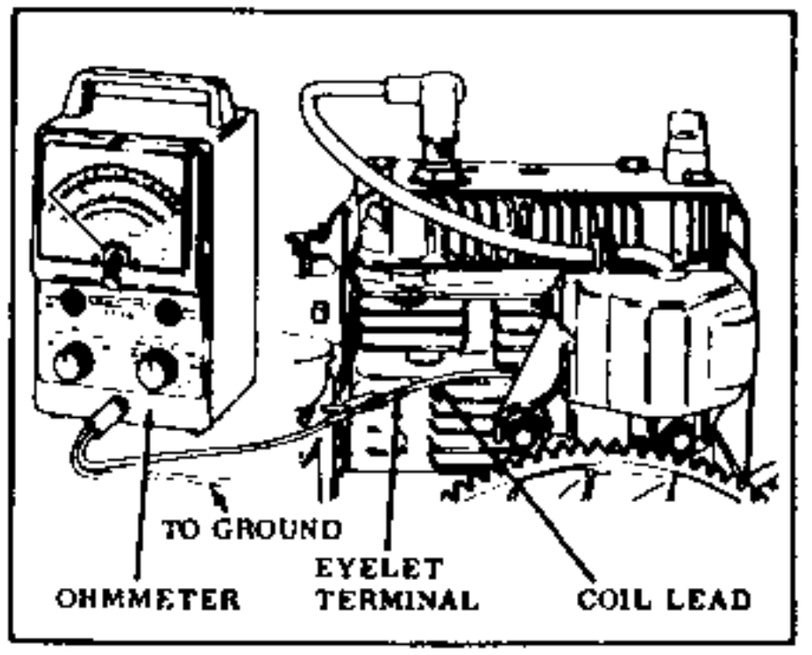


Fig. T24—View showing an ohmmeter connected for resistance test of ignition generator coil.

Test ignition system as follows: Hold high tension lead ⅛-inch (3 mm) from spark plug (Fig. T21), crank engine and check for a good blue spark. If no spark is present, check high tension lead and coil lead for loose connections or faulty insulation. Check air gap between long trigger pin and ignition unit as shown in Fig. T22. Air gap should be 0.006-0.010 inch (0.152-0.254 mm). To adjust air gap, loosen the two retaining screws and move ignition unit as necessary, then tighten retaining screws.

NOTE: The long trigger pin should extend 0.250 inch (6.35 mm) and the short trigger pin should extend 0.187 inch (4.75 mm), measured as shown in Fig. T23. If not, remove flywheel and drive pins in or out as required.

Remove coil lead from ignition terminal and connect an ohmmeter as shown in Fig. T24. If series resistance test of ignition generator coil is below 400 ohms, renew stator and coil assembly (Fig. T25). If resistance is above 400 ohms, renew ignition unit.

LUBRICATION. On Models VH70, VM70, VM80 and VM100, a barrel and plunger type oil pump (Fig. T26 or T27) driven by an eccentric on camshaft, pressure lubricates upper main bearing and connecting rod journal. When installing early type pump (Fig. T26), chamfered side of drive collar must be

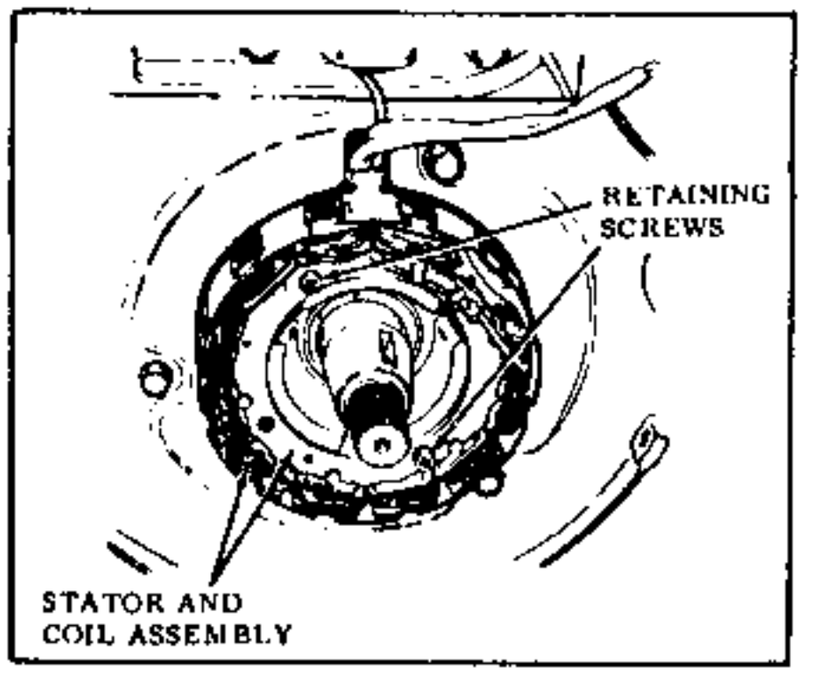


Fig. T25—Ignition generator coil and stator serviced only as an assembly.

against thrust bearing surface on camshaft gear. When installing late type pump, place side of drive collar with large flat surface shown in Fig. T27 away from camshaft gear.

An oil slinger (59 – Fig. T28), installed on crankshaft between gear and lower bearing is used to direct oil upward for complete engine lubrication on Models VH80 and VH100. A tang on slinger hub, when inserted in slot in crankshaft gear, correctly positions slinger on crankshaft as shown in Fig. T28.

Splash lubrication system on all other models is provided by use of an oil dipper on connecting rod. See Figs. T30 and T31.

Use only high quality, detergent motor oil having API classification SE, SF or SG. SAE 30 oil is recommended for operating in temperatures above 32°F (0°C) and SAE 10W for operating in temperatures below 32°F (0°C).

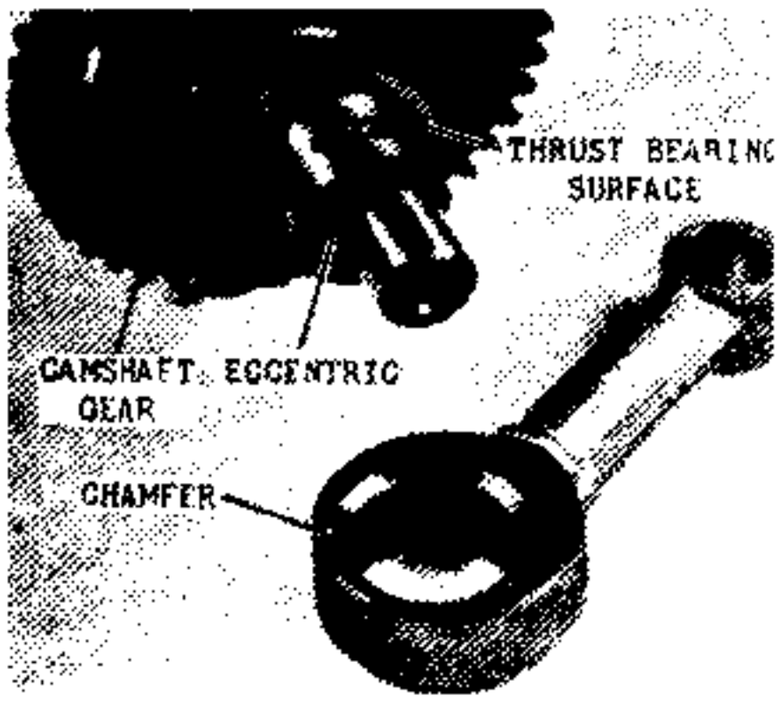


Fig. T26 – View of early type oil pump used on Models VH70, VM70 and VM80. Chamfered face of drive collar should be towards camshaft gear.

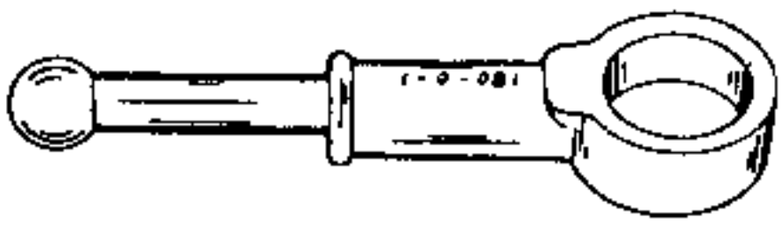


Fig. T27 – Install late type oil pump so large flat surface on drive collar is away from camshaft gear.

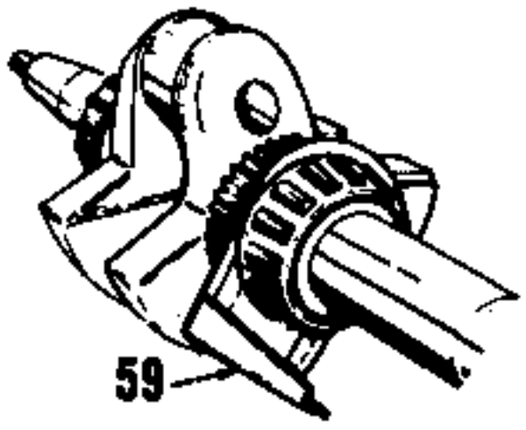


Fig. T28 – Oil slinger (59) on Models VH80 and VH100 must be installed on crankshaft as shown.

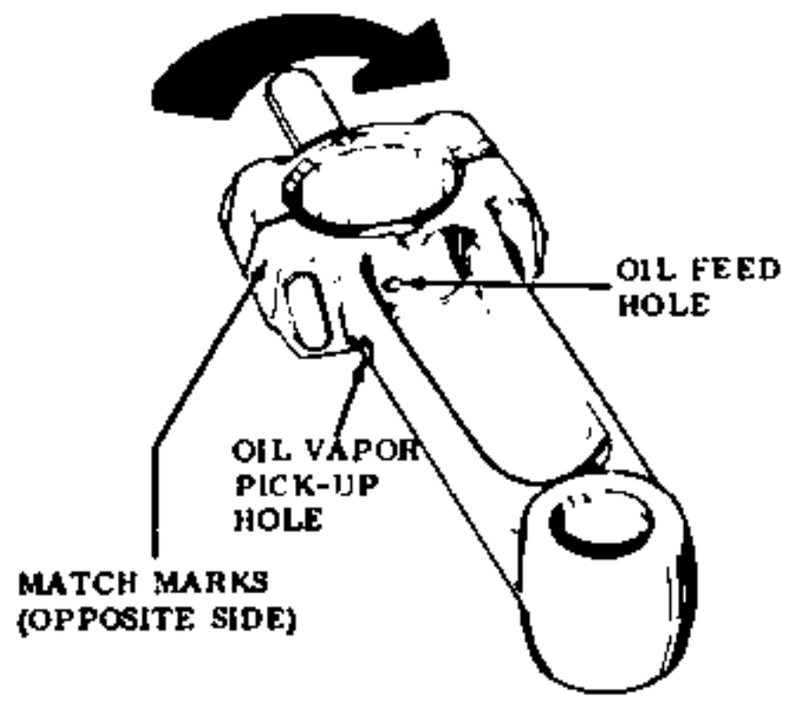


Fig. T29 – Connecting rods used on Models VH80 and VH100 have two oil holes.

REPAIRS

TIGHTENING TORQUE. Recommended tightening torques are as follows:

Models VM70, HM70, VM80, HM80, VM100, HM100, HH70, VH70

Cylinder Head	180 in.-lbs. (20.3 N·m)
Connecting Rod	120 in.-lbs. (13.5 N·m)
Crankcase Cover	110 in.-lbs. (12.4 N·m)
Ball Bearing Retainer Nut	20 in.-lbs. (2.3 N·m)

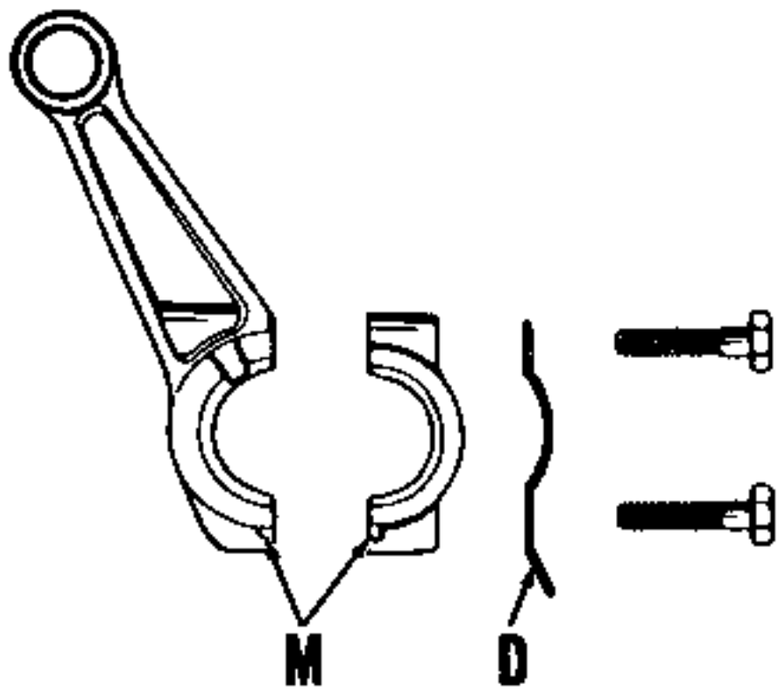


Fig. T30 – Connecting rod assembly used on Models VH70, VM70, VM80, VM100, HH70, HM70, HM80 and HM100. Note position of oil dipper (D) and match marks (M).

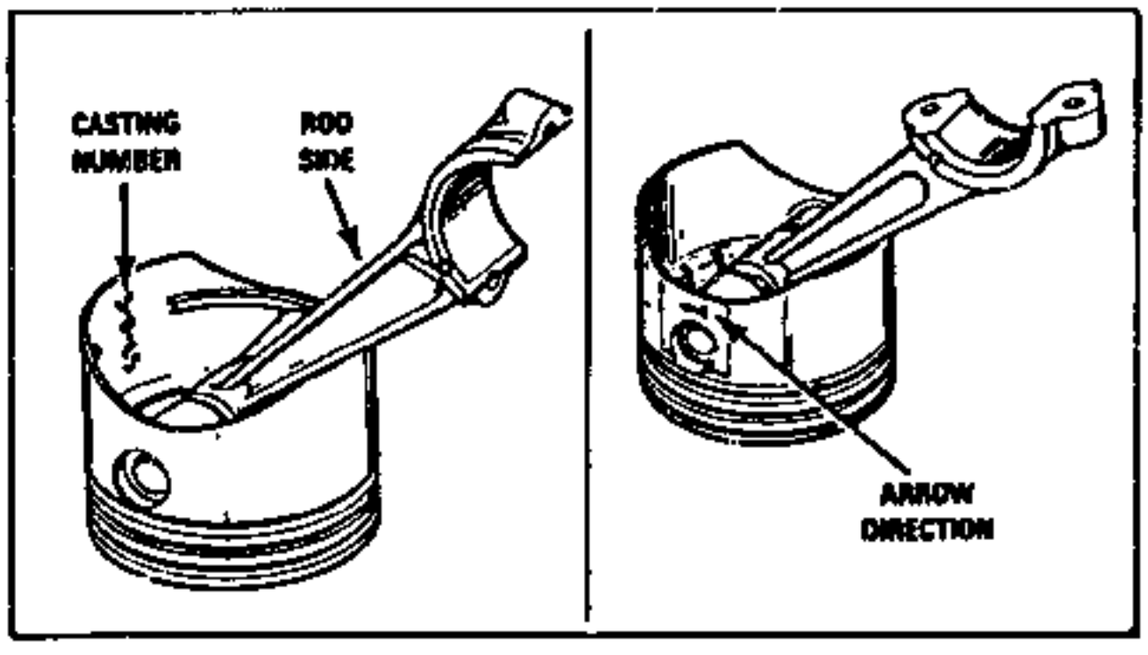


Fig. T30A – On Models VM70, HM70, HM80, HM100 and VM100, install piston on rod with arrow or casting number positioned as shown.

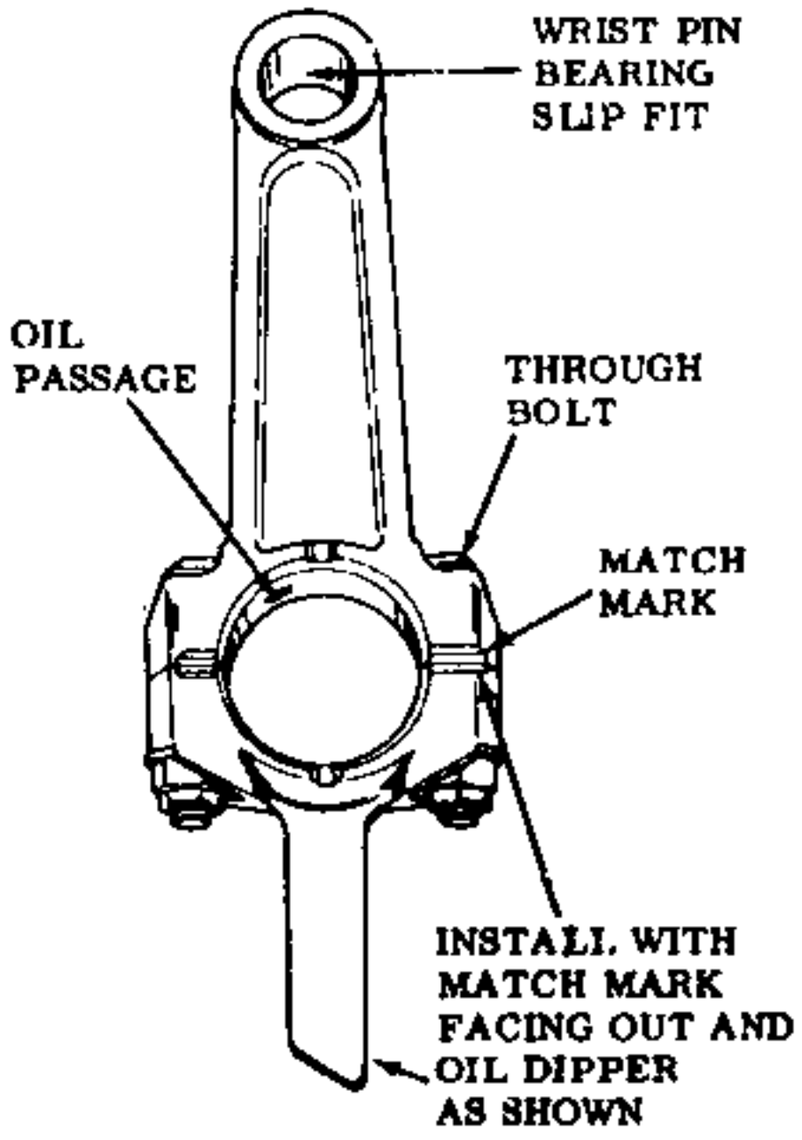


Fig. T31 – Connecting rod assembly used on Models HH80, HH100 and HH120.

Flywheel Nut	440 in.-lbs. (49.7 N·m)
Spark Plug	250 in.-lbs. (28.2 N·m)
Magneto Stator Mounting	75 in.-lbs. (8.5 N·m)
Carburetor Mounting	60 in.-lbs. (6.8 N·m)

Models HH80, VH80, HH100, VH100, HH120

Cylinder Head	200 in.-lbs. (22.6 N·m)
Connecting Rod	110 in.-lbs. (12.4 N·m)
Crankcase Cover	110 in.-lbs. (12.4 N·m)
Bearing Retainer	110 in.-lbs. (12.4 N·m)
Flywheel Nut	650 in.-lbs. (73.5 N·m)
Spark Plug	250 in.-lbs. (28.3 N·m)
Magneto Stator Mounting	85 in.-lbs. (9.6 N·m)
Carburetor Mounting	85 in.-lbs. (9.6 N·m)

CONNECTING ROD. Piston and connecting rod assembly is removed from cylinder head end of engine. The aluminum alloy rod rides directly on the crankshaft. Running clearance is not adjustable. Crankpin diameter is 1.1865-1.1870 inches (30.137-30.150 mm) on Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and VH70 and 1.3750-1.3755 inches (34.925-34.938 mm) on all other models.

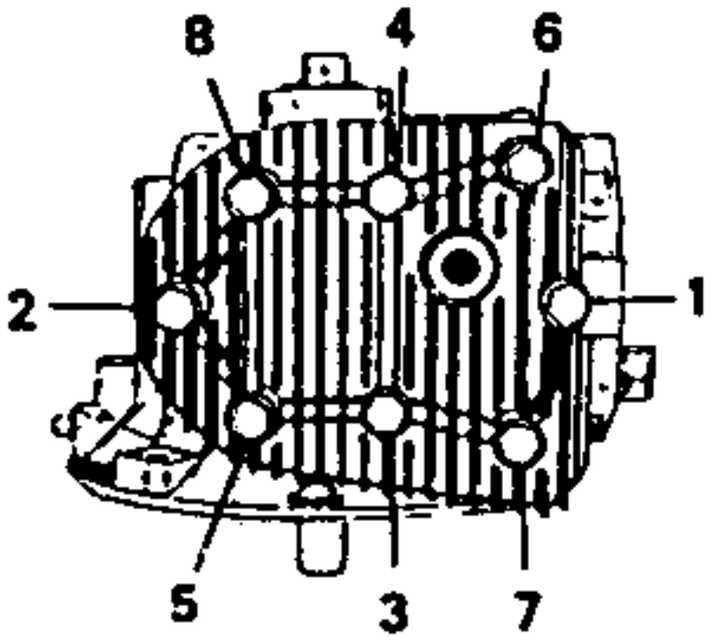


Fig. T32—On Models VM70, HM70, VH70 and HH70, tighten cylinder head cap screws evenly to a torque of 180 in.-lbs. (20 N·m) using tightening sequence shown.

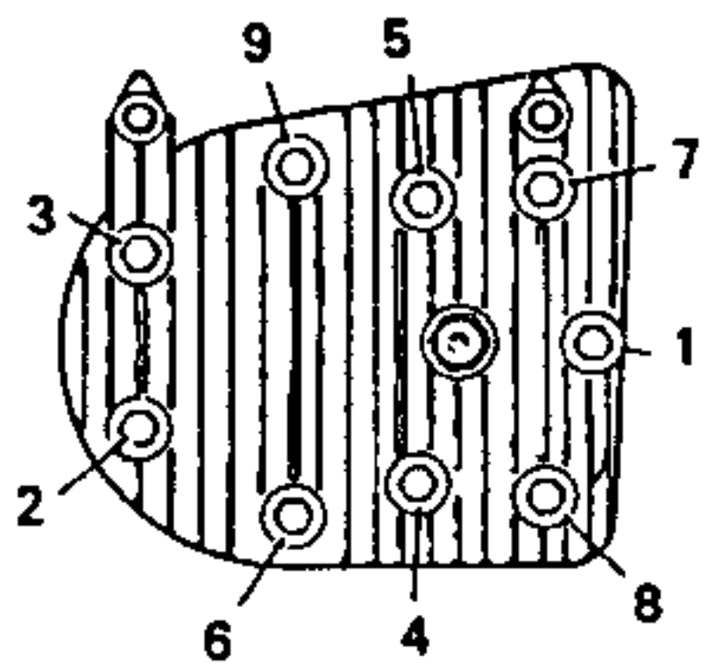


Fig. T33—Tighten cylinder head cap screws on Models HM80, VM80, HM100 and VM100 in sequence shown to a torque of 180 in.-lbs. (20 N·m).

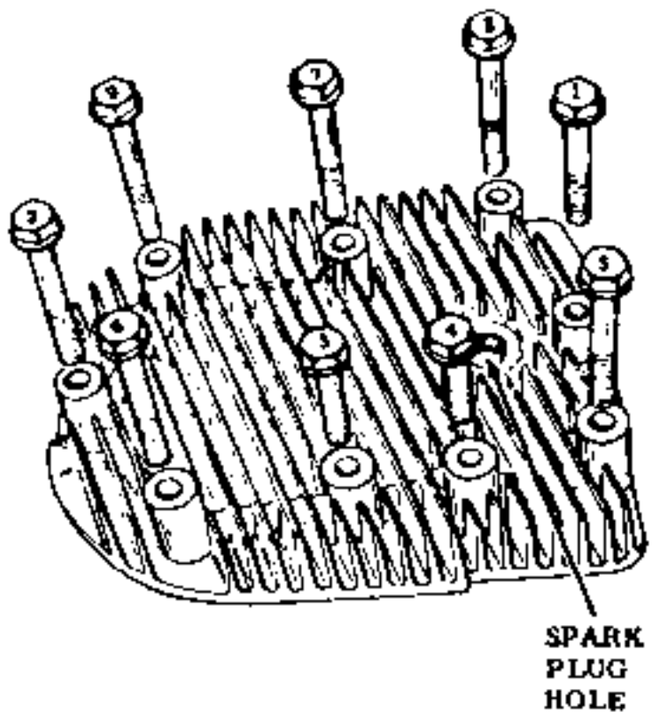


Fig. T34—View showing cylinder head cap screw tightening sequence used on early HH80, HH100 and HH120 engines. Tighten cap screws to a torque of 200 in.-lbs. (22.6 N·m). Note type and length of cap screws.

Connecting rods are equipped with match marks and on some models pistons are marked for correct assembly. See Figs. T29, T30, T30A and T31. Install rod on all models so marks are toward pto end of crankshaft. Use new self-locking nuts or rod bolt lock each time rod is installed.

CYLINDER HEAD. When removing cylinder head, be sure to note location of different length cap screws for aid in correct assembly. Always install new head gasket and tighten cap screws evenly in sequence shown in Figs. T32, T33, T34 or T35. Refer to TIGHTENING TORQUE section for correct torque values.

PISTON, PIN AND RINGS. Aluminum alloy piston is fitted with two compression rings and one oil control ring. Ring end gap on all models should be 0.010-0.020 inch (0.254-0.508 mm). Side clearance of new rings in ring grooves of a new piston should be 0.002-0.0035 inch (0.051-0.0889 mm) on Models HH80, HH100, HH120; 0.0025-0.003 inch (0.0635-0.076 mm) on Models VH80 and VH100; 0.002-0.003 inch (0.051-0.076 mm) on Models VM70, HM70, HM80, VM80, HH70, VH70; 0.002-0.005 inch (0.051-0.127 mm) on Models VM100 and HM100. Piston rings and pistons are available in standard size and oversizes of 0.010 and 0.020 inch for Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and VH70 or in standard size and oversizes of 0.010, 0.020, 0.030 and 0.040 inch for all other models.

The top compression ring must be installed with inside chamfer to top of piston. If second compression ring has a notch on outside of ring, install ring with notch towards bottom of piston skirt. Oil ring can be installed either side up. Stagger ring gaps about 90 degrees around piston.

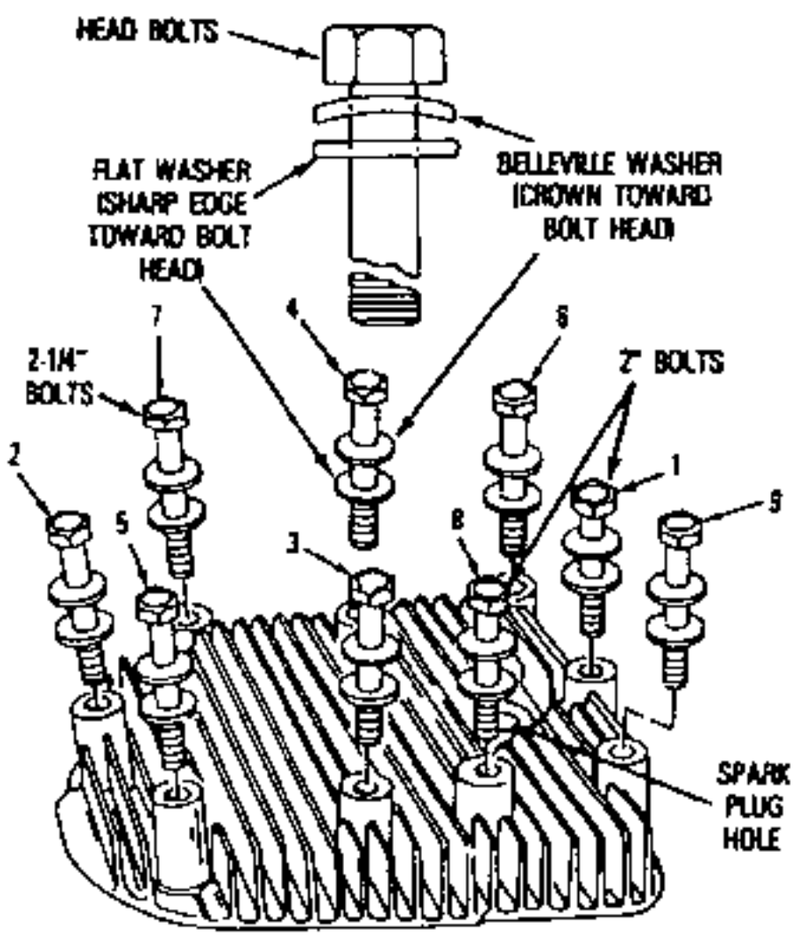


Fig. T35—Flat washers and Belleville washers are used on cylinder head cap screws on late HH80, HH100 and HH120 and all VH80 and VH100 engines. Tighten cap screws in sequence shown to a torque of 200 in.-lbs. (22.6 N·m).

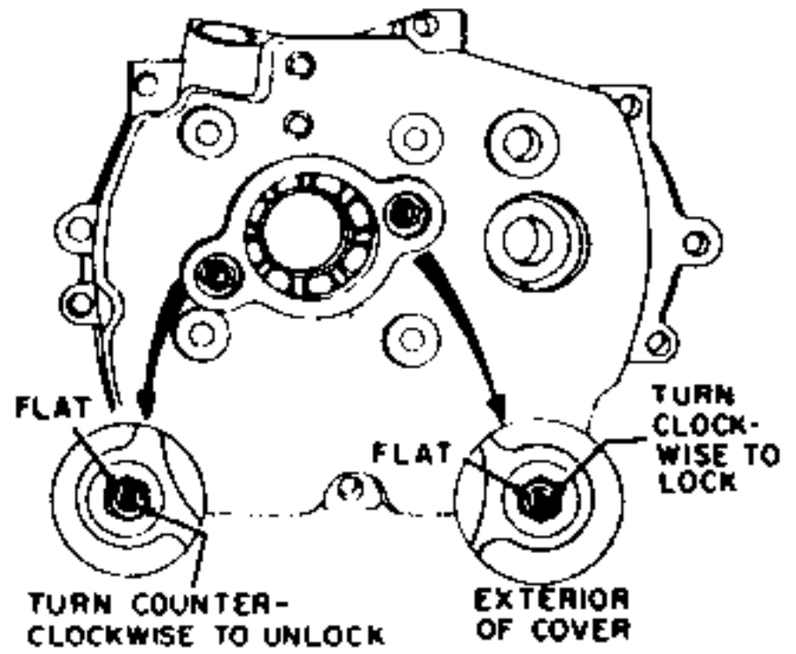


Fig. T36—View showing bearing locks on Models HM70, HH70, HM80 and HM100 equipped with ball bearing main. Locks must be released before removing crankcase cover. Refer to Fig. T37 for interior view of cover and locks.

Piston skirt clearance in cylinder, measured at thrust side of piston just below oil ring, should be 0.010-0.012 inch (0.254-0.305 mm) on Model HH120; 0.006-0.008 inch (0.152-0.203 mm) on HH80 and HH100; 0.003-0.004 inch (0.076-0.203 mm) on VH80 and VH100; 0.0045-0.006 inch (0.1143-0.152 mm) on all other models.

Piston pin diameter is 0.6248-0.6250 inch (15.870-15.875 mm) on Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and VH70 or 0.6873-0.6875 inch (17.457-17.462) on all other models. Piston pin clearance should be 0.0001-0.0008 inch (0.0025-0.0203 mm) in rod and 0.0002-0.0005 inch (0.0051-0.0127 mm) in piston. If excessive clearance exists, both piston and pin must be renewed as pin is not available separately.

CYLINDER. If cylinder is scored or if taper or out-of-round exceeds 0.005 inch (0.127 mm), cylinder should be rebored to next suitable oversize. Standard cylinder bore is 2.9375-2.9385 inches (74.6125-74.6379 mm) on Models VM70 and HM70; 3.062-3.063 inches (77.775-77.800 mm) on early Models VM80 and HM80; 3.125-3.126 inches (79.375-

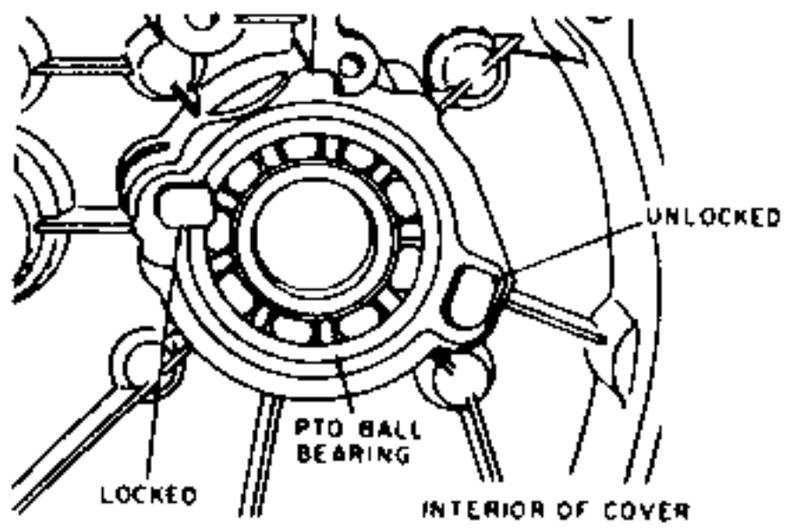


Fig. T37—Interior view of crankcase cover and ball bearing locks used on Models HM70, HH70, HM80 and HM100.

79.400 mm) on late Models VM80 and HM80; 3.187-3.188 inches (80.950-80.975 mm) on Models VM100 and HM100; 2.750-2.751 inches (69.850-69.875 mm) on Models HH70 and VH70; 3.312-3.313 inches (84.125-84.150 mm) on Models HH80, VH80, HH100 and VH100; 3.500-3.501 inches (88.900-88.925 mm) on Model HH120.

CRANKSHAFT. Crankshaft main journals ride directly in aluminum alloy bearings in crankcase and mounting flange (engine base) on vertical crankshaft engines or in two renewable steel backed bronze bushings. On some horizontal crankshaft engines, crankshaft rides in a renewable sleeve bushing at flywheel end and a ball bearing or bushing at pto end. Models HH80, VH80, HH100, VH100 and HH120 are equipped with taper roller bearings at both ends of crankshaft.

Normal running clearance of crankshaft journals in aluminum bearings or bronze bushings is 0.0015-0.0025 inch (0.0381-0.0635 mm). Renew crankshaft if main journals are more than 0.001 inch (0.025 mm) out-of-round or if crankpin is more than 0.0005 inch (0.0127 mm) out-of-round.

Check crankshaft gear for wear, broken tooth or loose fit on crankshaft. If gear is damaged, remove from crankshaft with an arbor press. Renew gear pin and press new gear on shaft making certain timing mark is facing pto end of shaft.

On models equipped with ball bearing at pto end of shaft, refer to Figs. T36 and T37 before attempting to remove crankcase cover. Loosen locknuts and rotate protruding ends of lock pins counter-clockwise to release bearing and remove cover. Ball bearing will remain on crankshaft. When reassembling, turn lock pins clockwise until flats on pins face each other, then tighten locknuts to 20 in.-lbs. (2.3 N·m).

Crankshaft end play on Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and VH70 should be 0.0005-0.027 inch (0.127-0.686 mm), and is controlled by washers (25 and 27 – Fig. T40) or (35 and 37 – Fig. T41).

To remove tapered roller bearings (30 and 51 – Fig. T42 or T43) from crankshaft on Models HH80, VH80, HH100, VH100 and HH120, use a suitable puller. Bearings will be damaged during removal and new bearings must be installed. Heat bearings in oil to approxi-

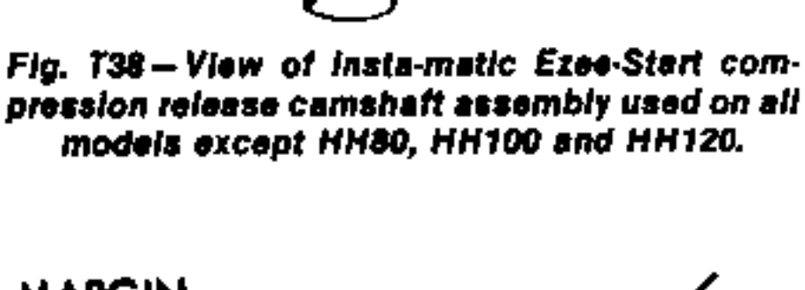


Fig. T38 – View of Insta-matic Ezee-Start compression release camshaft assembly used on all models except HH80, HH100 and HH120.

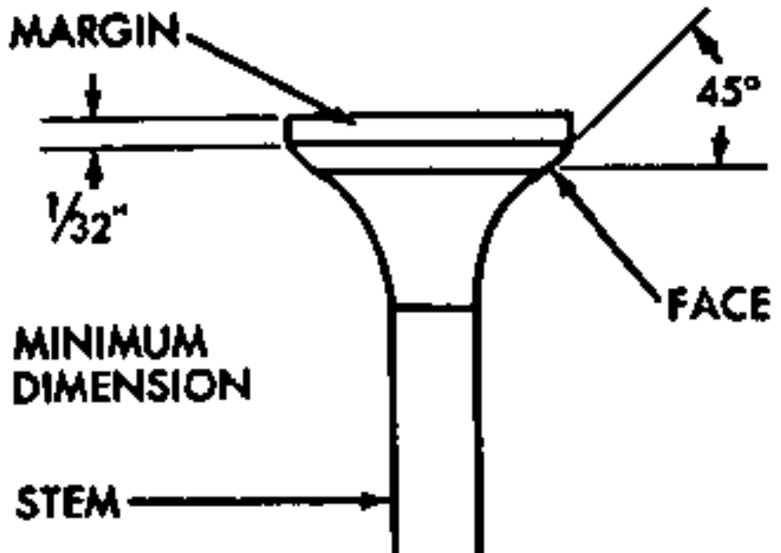


Fig. T39 – Valve face angle should be 45 degrees. Minimum valve head margin is 1/32-inch (0.8 mm).

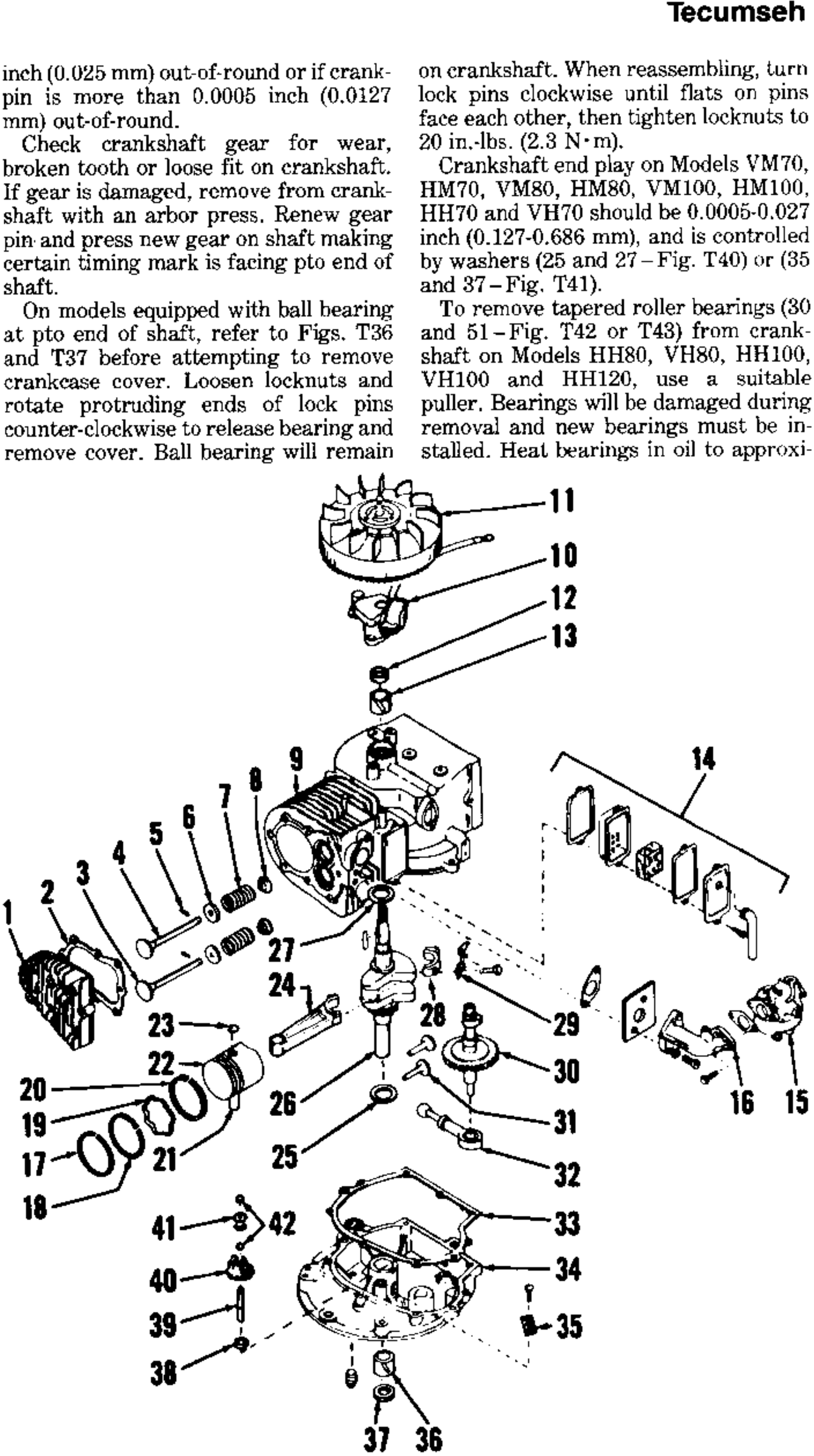


Fig. T40 – Exploded view of vertical crankshaft engine typical of Models VH70, VM70, VM80 and VM100. Renewable bushings (13 and 36) are not used on Models VM70, VM80 and VM100.

1. Cylinder head
2. Head gasket
3. Exhaust valve
4. Intake valve
5. Pin
6. Spring cap
7. Valve spring
8. Spring cap
9. Cylinder block
10. Magneto
11. Flywheel
12. Oil seal
13. Crankshaft bushing
14. Breather assy.
15. Carburetor
16. Intake pipe
17. Top compression ring
18. Second compression ring
19. Oil ring expander
20. Oil control ring
21. Piston pin
22. Piston
23. Retaining ring
24. Connecting rod
25. Thrust washer
26. Crankshaft
27. Thrust washer
28. Rod cap
29. Rod bolt lock
30. Camshaft assy.
31. Valve lifters
32. Oil pump
33. Gasket
34. Mounting flange (engine base)
35. Oil screen
36. Crankshaft bushing
37. Oil seal
38. Spacer
39. Governor shaft
40. Governor gear assy.
41. Spool
42. Retaining rings

mately 300°F (150°C), then quickly slide bearings into position. Bearing cup (12) is a press fit in crankcase cover or engine base. Bearing cup (31) is a slip fit in block (29). To adjust crankshaft bearings, first assemble crankshaft assembly, piston and rod and crankcase cover or engine base. Tighten all bolts to correct torque value. Install bearing retaining cap (35) without shim gaskets (32), steel washers (33) or "O" ring (58). Tighten screws finger tight. Use a feeler gage to measure gap between bearing retainer flange and block. If no measurable clearance exists, install 0.010 inch steel washer between bearing retainer and cup until such clearance is obtained. If clearance does not exceed 0.007 inch (0.178 mm), no shim gasket (32) will be required and when retainer cap screws are tightened to correct torque, bearing preload will be 0.001-0.007 inch (0.025-0.178 mm). If clearance measures more than 0.007 inch (0.178 mm), subtract 0.001 inch (0.025 mm) from measurement to allow for preload; this will give actual distance to be shimmed. Since shim gaskets compress approximately ⅓ their thickness, shim pack should be 1½ times actual distance. Shim gaskets are available in thicknesses of 0.003-0.004, 0.004-0.005 and 0.005-0.007 inch. Remove bearing retainer, install "O" ring (58) and desired shim gaskets and reinstall retainer. Tighten cap screws to 110 in.-lbs. (12 N·m). Crankshaft seal should be installed to 0.025 inch (0.635 mm) below surface.

Crankshaft dimensions are as follows:

Main Journal Diameter

VH70, HH70
Flywheel and pto ends . . . . . 0.9985-0.9990 in. (25.362-25.375 mm)

VM70, HM70, VM80, HM80, VM100, HM100
Flywheel end . . . . . 0.9985-0.9990 in. (25.362-25.375 mm)
Pto end . . . . . 1.1870-1.1875 in. (30.150-30.162 mm)

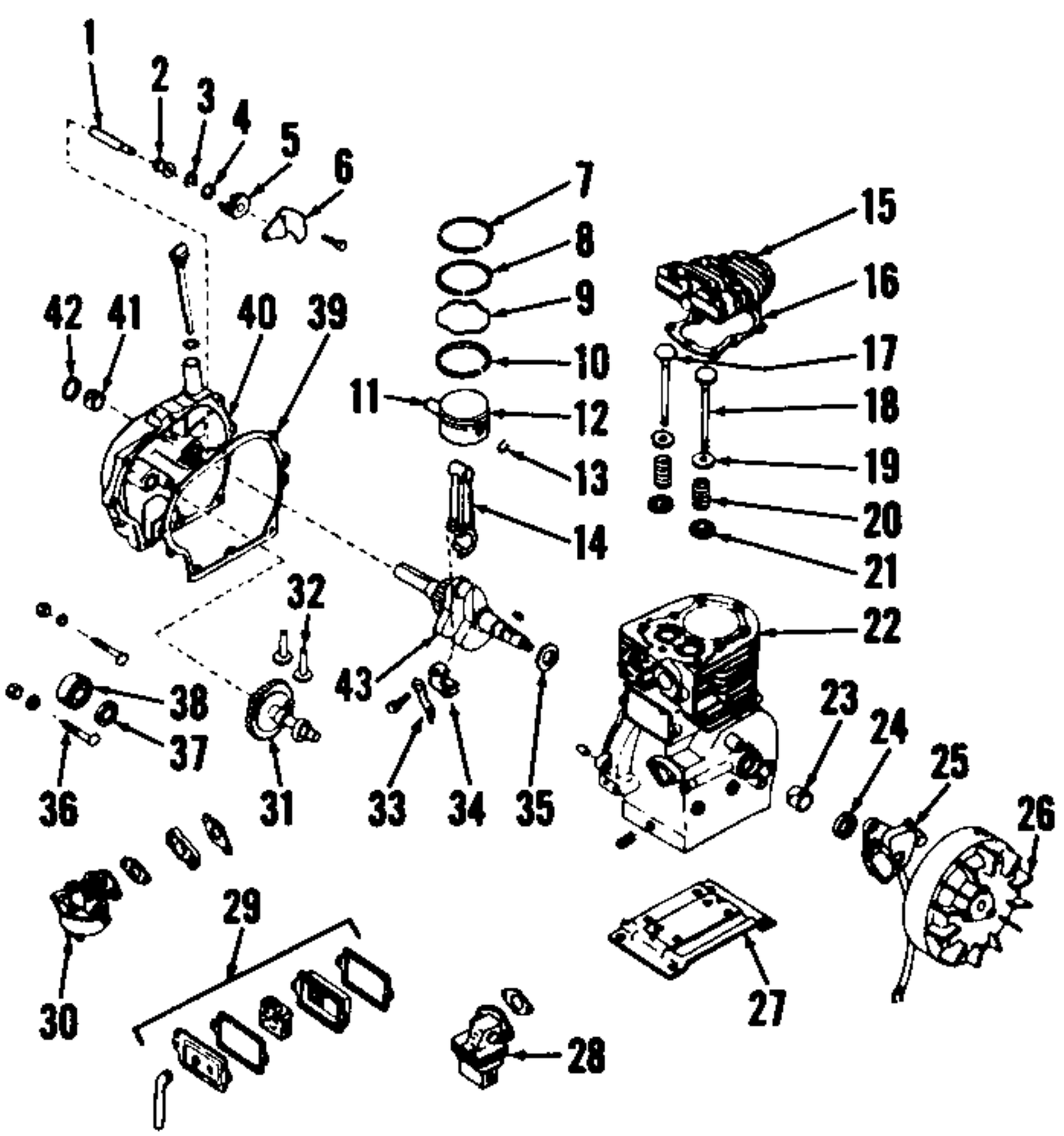
HH80, VH80, HH100, VH100, HH120
Flywheel and pto ends . . . . . 1.1865-1.870 in. (30.137-30.150 mm)

Crankpin Journal Diameter

HH80, VH80, HH100, VH100, HH120 . . . . . 1.3750-1.3755 in. (34.925-34.938 mm)
All other models . . . . . 1.1860-1.1865 in. (30.124-30.137 mm)

CAMSHAFT. The camshaft and camshaft gear are an integral part which rides on journals at each end of shaft. Renew camshaft if gear teeth are worn or if bearing surfaces are worn or scored. Cam lobe nose to heel diameter should be 1.3045-1.3085 inches (33.134-33.236 mm) on Models HH80, VH80, HH100 and HH120 or 1.263-1.267 inches (32.080-32.182 mm) on all other models. Camshaft journal diameter is 0.6235-0.6240 inch (15.837-15.850 mm). Maximum allowable clearance between camshaft journal and bearing is 0.003 inch (0.076 mm).

Medium frame engines and Models VH70 and VH80 are equipped with Insta-matic Ezee-Start compression release camshaft (Fig. T38). Check compression release parts for binding, or excessive wear or other damage. If any parts are damaged or worn, renew com-



1. Governor shaft
2. Spool
3. Washer
4. Retaining ring
5. Gear & flyweight assy.
6. Bracket
7. Top compression ring
8. Second compression ring
9. Oil ring expander
10. Oil control ring
11. Piston pin
12. Piston
13. Retaining ring
14. Connecting rod
15. Cylinder head
16. Head gasket
17. Exhaust valve
18. Intake valve
19. Spring cap
20. Valve spring
21. Spring retainer
22. Cylinder block
23. Crankshaft bushing
24. Oil seal
25. Magneto
26. Flywheel
27. Mounting plate
28. Fuel pump
29. Breather assy.
30. Carburetor
31. Camshaft assy.
32. Valve lifter
33. Rod bolt lock
34. Rod cap
35. Thrust washer
36. Bearing lock pin
37. Thrust washer
38. Ball bearing
39. Gasket
40. Crankcase cover
41. Bushing
42. Oil seal
43. Crankshaft

Fig. T41—Exploded view of horizontal crankshaft engine typical of Models HH70, HM70, HM80 and HM100. Engines may be equipped with crankshaft bushing (41) or ball bearing (38) at pto end of shaft.

plete camshaft assembly. Compression release parts are not serviced separately.

On Models HH80, HH100 and HH120, timing advance unit should be inspected and any worn or damaged parts renewed. Refer to Fig. T43 for exploded view of timing advance (52 through 56).

On all models, when installing camshaft, align timing mark on cam gear with mark on crankshaft gear. Timing mark on crankshaft gear is a chamfered tooth.

VALVE SYSTEM. On Models HH80, VH80, HH100, VH100 and HH120, valve tappet gap with engine cold is 0.010 inch (0.254 mm) for intake and 0.020 inch (0.508 mm) for exhaust. Valve tappet gap on all other models with engine cold is 0.010 inch (0.254 mm) for both valves. To obtain correct gap, grind valve stem end off squarely. Valve seat angle width is 3/64-inch (1.2 mm) on all models. When valve head margin is less than 1/32-inch (0.8 mm), renew valve. See Fig. T39.

Valve guides are non-renewable on all models. If excessive clearance exists, valve guide should be reamed and a new valve with oversize stem installed. Ream guide to 0.344-0.345 inch (8.738-8.763 mm) on Models HH80, VH80, HH100, VH100 and HH120 and to 0.3432-0.3442 inch (8.717-8.743 mm) on all other models.

Valve spring free length should be 1.885 inches (47.88 mm) on Models HH80, VH80, HH100, VH100 and HH120. Valve spring free length should be 1.562 inches (39.67 mm) on all other models.

DYNA-STATIC BALANCER. The Dyna-Static engine balancer operates by means of a pair of counterweighted gears driven by crankshaft to counteract the unbalance caused by counterweights on crankshaft. The balancer used on medium frame engine is similar to those used on heavy frame models. On medium frame models, balancer gears are held in position on the shafts by a bracket bolted to crankcase or engine base (Fig. T44). Snap rings are used on heavy frame models to retain balancer gears on shafts.

The renewable balancer gear shafts are pressed into crankcase cover or engine base. On medium frame models,

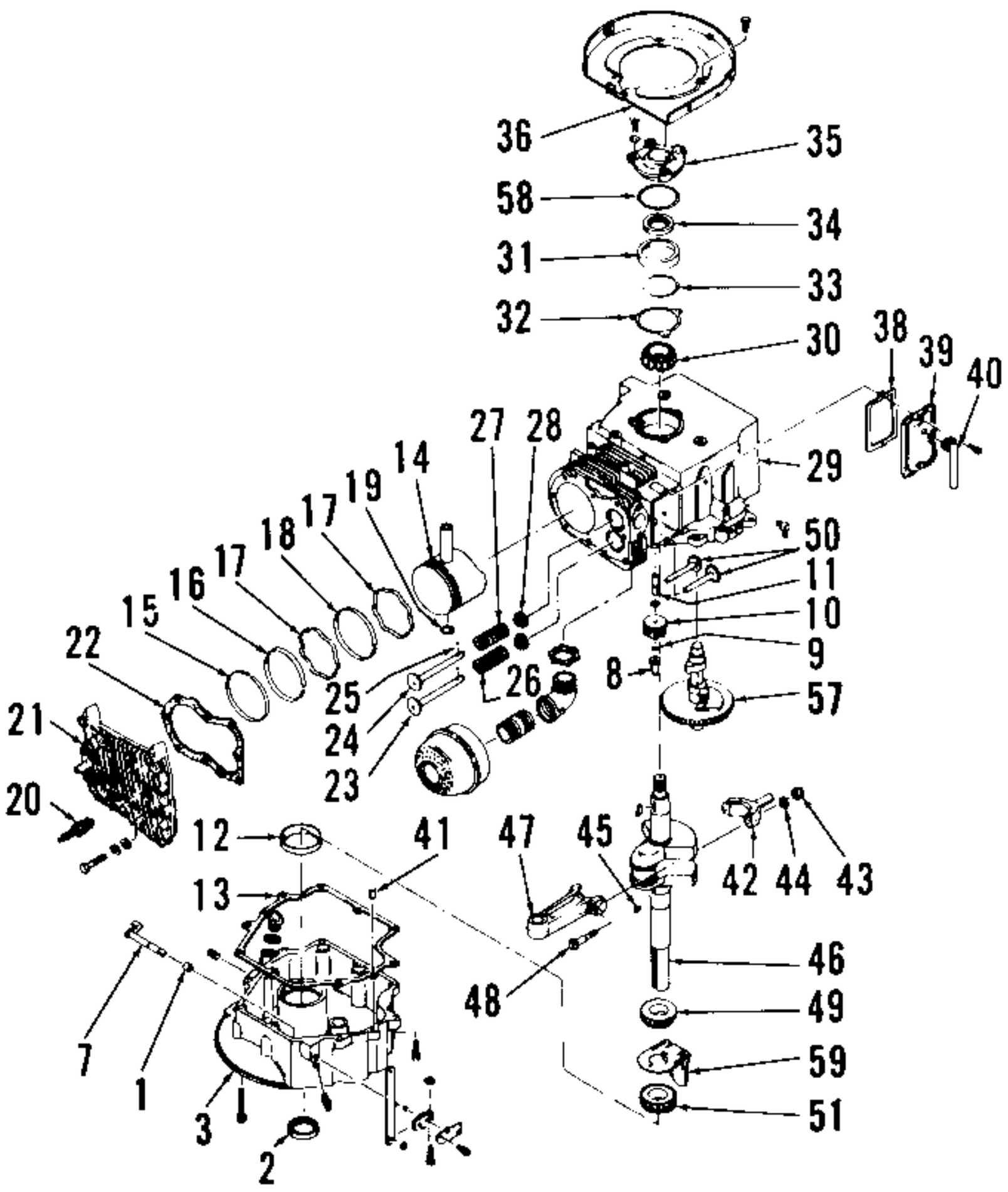


Fig. T42—Exploded view of Model VH80 or VH100 vertical crankshaft engine.

1. Governor arm bushing
2. Oil seal
3. Mounting flange (engine base)
7. Governor arm
8. Thrust spool
9. Snap ring
10. Governor gear & weight assy.
11. Governor shaft
12. Bearing cup
13. Gasket
14. Piston & pin assy.
15. Top compression ring
16. Second compression ring
17. Ring expanders
18. Oil control ring
19. Retaining ring
20. Spark plug
21. Cylinder head
22. Head gasket
23. Exhaust valve
24. Intake valve
25. Pin
26. Exhaust valve spring
27. Intake valve spring
28. Spring cap
29. Cylinder block
30. Bearing cone
31. Bearing cup
32. Shim gasket
33. Steel washer (0.010 in.)
34. Oil seal
35. Bearing retainer cap
36. Blower air baffle
38. Gasket
39. Breather
40. Breather tube
42. Rod cap
43. Self-locking nut
44. Washer
45. Crankshaft gear pin
46. Crankshaft
47. Connecting rod
48. Rod bolt
49. Crankshaft gear
50. Valve lifters
51. Bearing cone
57. Camshaft assy.
58. "O" ring
59. Oil slinger

Fig. T43 – Exploded view of Model HH80, HH100 or HH120 horizontal crankshaft engine.

1. Governor arm bushing
2. Oil seal
3. Crankcase cover
4. Dipstick
5. Gasket
6. Oil filler tube
7. Governor arm
8. Thrust spool
9. Snap ring
10. Governor gear & weight assy.
11. Governor shaft
12. Bearing cup
13. Gasket
14. Piston & pin assy.
15. Top compression ring
16. Second compression ring
17. Oil ring expander
18. Oil control ring
19. Retaining ring
20. Spark plug
21. Cylinder head
22. Head gasket
23. Exhaust valve
24. Intake valve
25. Pin
26. Exhaust valve spring
27. Intake valve spring
28. Spring cap
29. Cylinder block
30. Bearing cone
31. Bearing cup
32. Shim gaskets
33. Steel washer (0.010 in.)
34. Oil seal
35. Bearing retainer cap
36. Blower air baffle
37. Plug
38. Gasket
39. Breather assy.
40. Breather tube
41. Dowel pin
42. Rod cap
43. Self-locking nut
44. Washer
45. Crankshaft gear pin
46. Crankshaft
47. Connecting rod
48. Rod bolt
49. Crankshaft gear
50. Valve lifters
51. Bearing cone
52. Breaker cam
53. Push rod
54. Spring
55. Timing advance weight
56. Rivet
57. Camshaft assy.
58. "O" ring

press shaft into cover or engine base until a distance of 1.757-1.763 inches (44.628-44.780 mm) exists between shaft bore boss and edge of step cut on shafts as shown in Fig. T46. Heavy frame model shafts should be pressed until a distance of 1.7135-1.7185 inches (43.523-43.650 mm) exists between cover boss and the outer edge of snap ring groove as shown in Fig. T47.

All balancer gears are equipped with renewable cage needle bearings. See Figs. T48 and T49. Using tool #670210, press new bearings into gears until cage is flush to 0.015 inch (0.381 mm) below edge of bore.

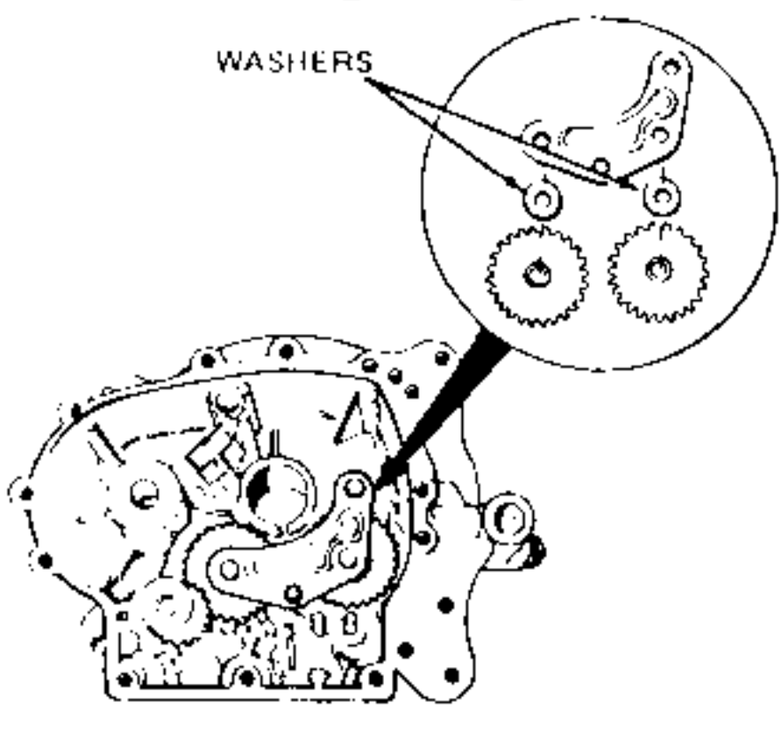


Fig. T44 – View showing Dyna-Static balancer gears installed in Model VM80 or VM100 engine base. Balancer gears are identically located in Model HM80 or HM100 crankcase cover. Note location of washers between gears retaining bracket.

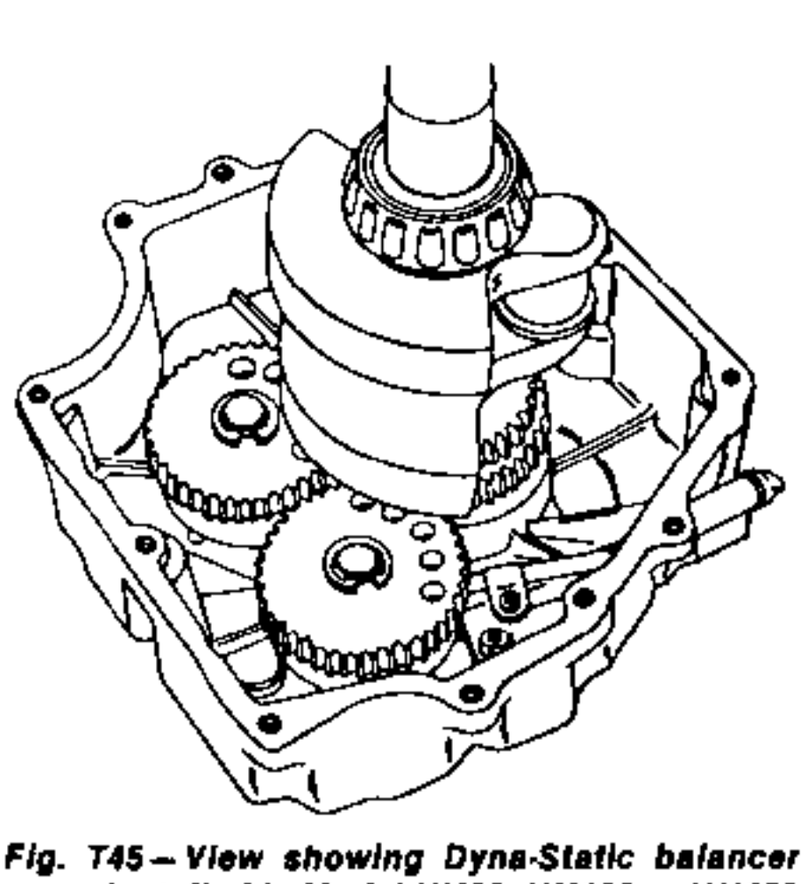


Fig. T45 – View showing Dyna-Static balancer gears installed in Model HH80, HH100 or HH120 crankcase cover. Note gear retaining snap rings.

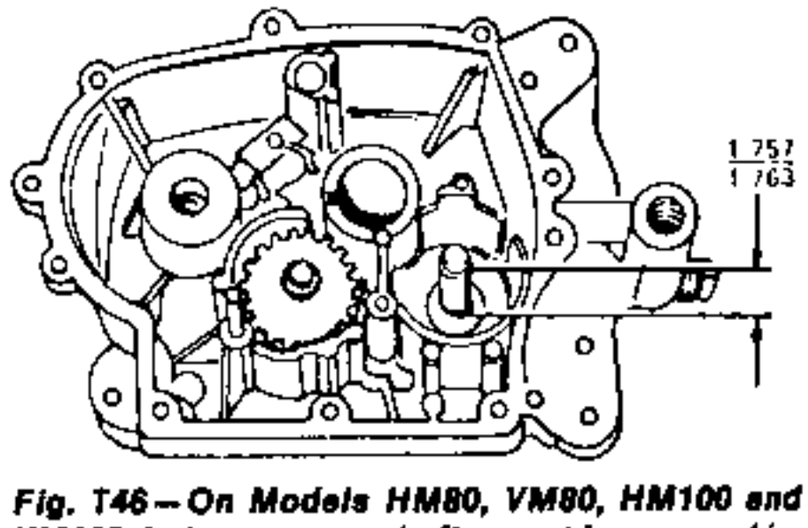


Fig. T46 – On Models HM80, VM80, HM100 and VM100, balancer gear shafts must be pressed into cover or engine base so a distance of 1.757-1.763 inches (44.628-44.780 mm) exists between shaft bore boss and edge of step cut as shown.

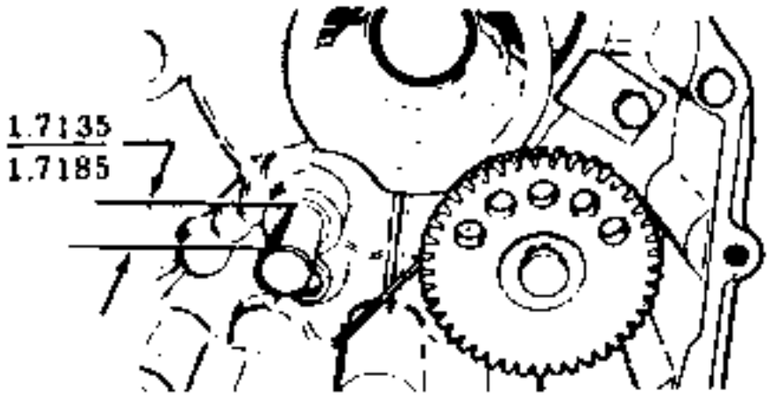


Fig. T47—On Models HH80, HH100 and HH120, press balancer gear shafts into cover to dimension shown.

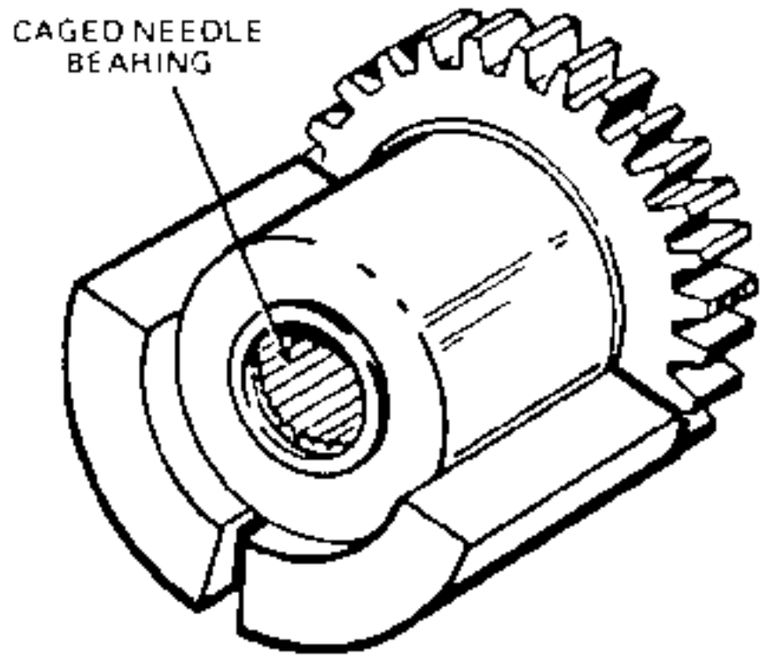


Fig. T48—Using tool #670210, press new needle bearings into Model HM80, VM80, HM100 or VM100 balancer gears until bearing cage is flush to 0.015 inch (0.381 mm) below edge of bore.

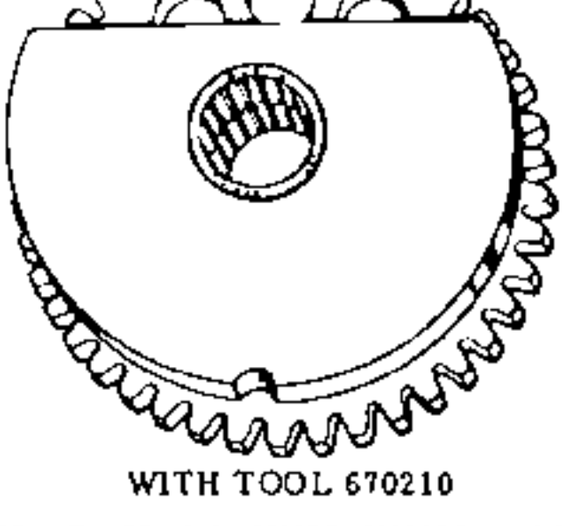
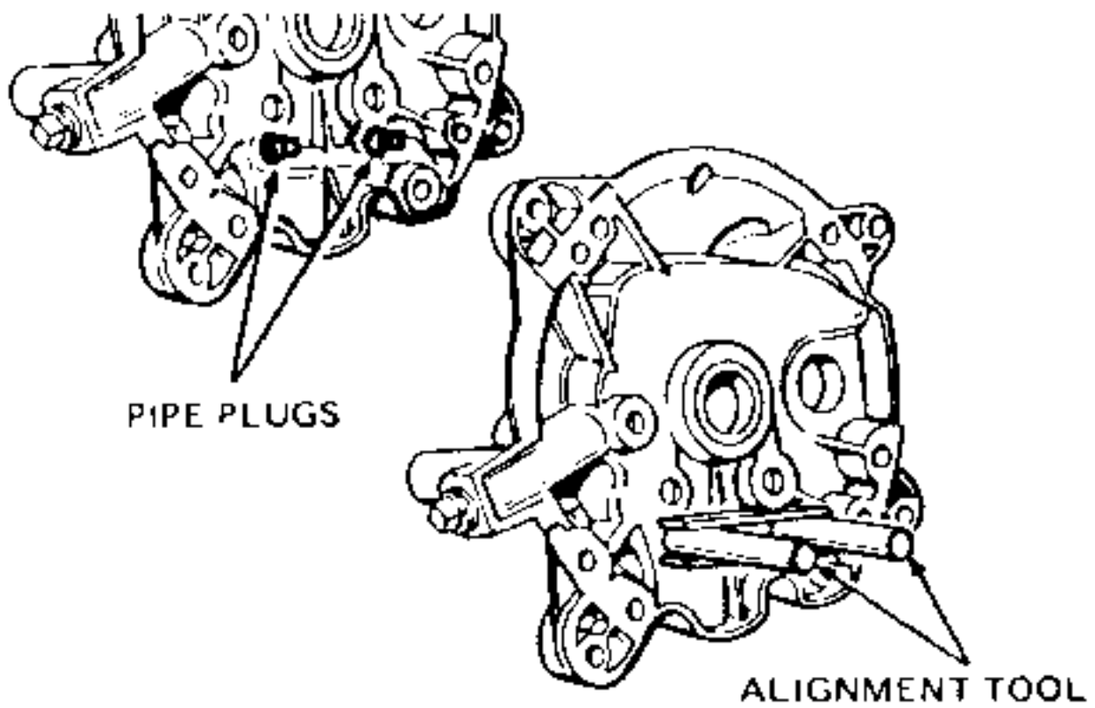


Fig. T49—On Models HH80, HH100 and HH120, needle bearings are installed flush to 0.015 inch (0.381 mm) below edge of bore. Note tool alignment notch at lower side of balancer.

When reassembling engine, balancer gears must be timed with crankshaft for correct operation. Refer to Figs. T50 and T51 and remove pipe plugs. Insert alignment tool #670240 through crankcase cover of Models HM80 and HM100 or engine base of Models VM80 and VM100 and into timing slots in balancer gears. On Models HH80, HH100 and HH120, insert timing tool #670239 through cover and into balancer gears. Then, on all models, turn crankshaft to place piston at TDC and carefully install engine base or cover with balancer gears. When correctly assembled, piston should be on TDC and weights on balancer gears should be in directly opposite position. See Figs. T52 and T53.

Fig. T50—To time engine balancer gears, remove pipe plugs and insert alignment tool #670240 through crankcase cover (HM80 and HM100) or engine base (VM80 and VM100) and into slots in balancer gears. Refer also to Fig. T52.



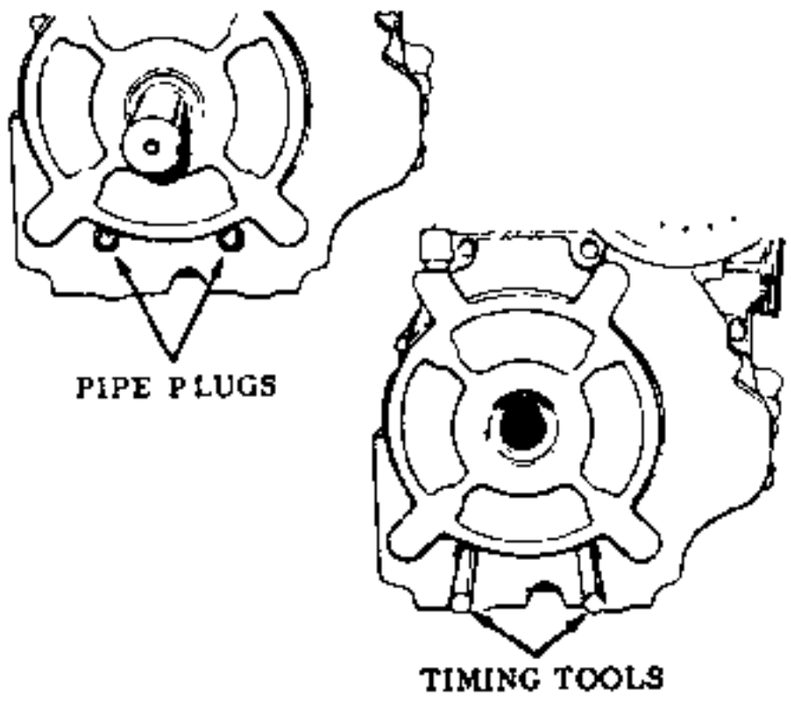


Fig. T51—To time balancer gears on Models HH80, HH100 and HH120, remove pipe plugs and insert timing tools #670239 through crankcase cover and into timing slots in balancer gears. Refer also to Fig. T53.

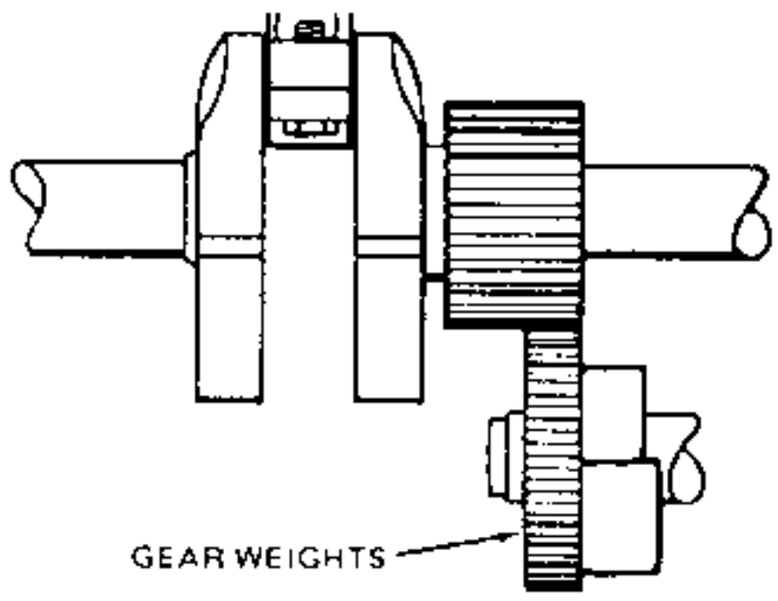


Fig. T52—View showing correct balancer gear timing to crankshaft gear on Models HM80, VM80, HM100 and VM100. With piston at TDC, weights should be directly opposite.

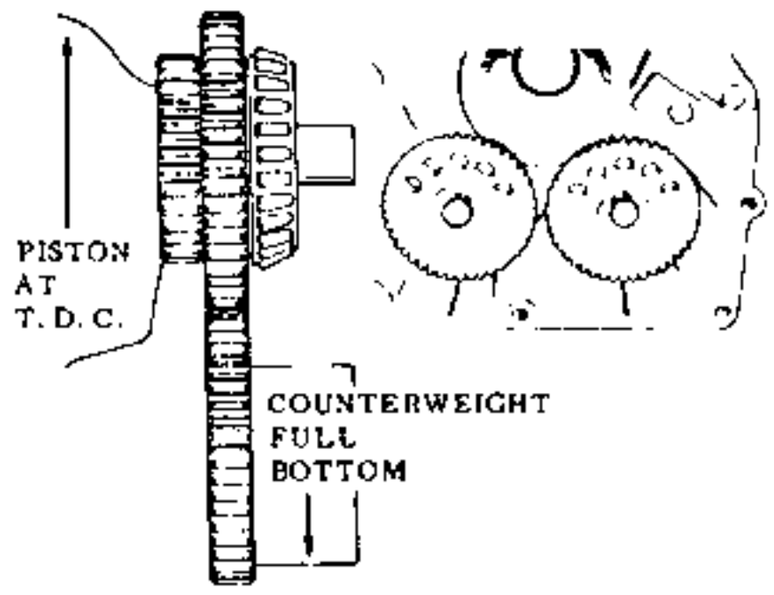


Fig. T53—On Models HH80, HH100 and HH120, balancer gears are correctly timed to crankshaft when piston is at TDC and weights are at full bottom position.

TECUMSEH

Model	No. Cyls.	Bore	Stroke	Displacement	Horsepower
OH120	1	3-1/8 in. (79.4 mm)	2-3/4 in. (69.8 mm)	21.1 cu. in. (346 cc)	12 (8.9 kW)
OH140	1	3-5/16 in. (84.1 mm)	2-3/4 in. (69.8 mm)	23.75 cu. in. (389 cc)	14 (10.4 kW)
OH160	1	3-1/2 in. (88.9 mm)	2-7/8 in. (73.0 mm)	27.66 cu. in. (453 cc)	16 (11.9 kW)
HH140	1	3-5/16 in. (84.1 mm)	2-3/4 in. (69.8 mm)	23.75 cu. in. (389 cc)	14 (10.4 kW)
HH150	1	3-1/2 in. (88.9 mm)	2-7/8 in. (73.0 mm)	27.66 cu. in. (453 cc)	15 (11.2 kW)
HH160	1	3-1/2 in. (88.9 mm)	2-7/8 in. (73.0 mm)	27.66 cu. in. (453 cc)	16 (11.9 kW)

Engines must be identified by complete model number, including specification number in order to obtain correct repair parts. It is important to transfer ID tags from original engine to replacement short block so unit can be identified later.

All models in this section are heavy frame cast iron engines and are valve-in-head, horizontal crankshaft type.

MAINTENANCE

SPARK PLUG. A Champion L-7 or equivalent spark plug is used. Set electrode gap to 0.030 inch (0.762 mm). Spark plug should be removed, cleaned and adjusted periodically. Renew plug if electrodes are burned and pitted or if porcelain is cracked.

CARBURETOR. A Walbro Model LM float type carburetor is used. To adjust carburetor, refer to Fig. T55 and proceed as follows: Turn idle mixture screw (9) clockwise until lightly seated, then back out 1¾ turns. Turn main fuel adjusting needle (27) clockwise until lightly seated, then back out 2¾ turns. Start and operate engine until normal operating temperature is reached. Then, readjust main fuel needle, if necessary, until engine runs smoothly and evenly under operating conditions.

Adjust idle speed screw (8) until engine idle speed of 1200 rpm is obtained. Readjust idle mixture needle (9), if necessary, until engine idles smoothly.

To check float setting, hold carburetor and float assembly in inverted position. A distance of 0.275-0.315 inch (7.0-8.0 mm) should exist between float and center boss measured as shown in Fig. T56. Carefully bend adjusting tab on float to adjust float setting. A Viton seat (12–Fig. T55) is used with fuel inlet valve (13). The renewable seat must be installed grooved side first in bore so inlet valve will seat at smooth side. See Fig. T57.

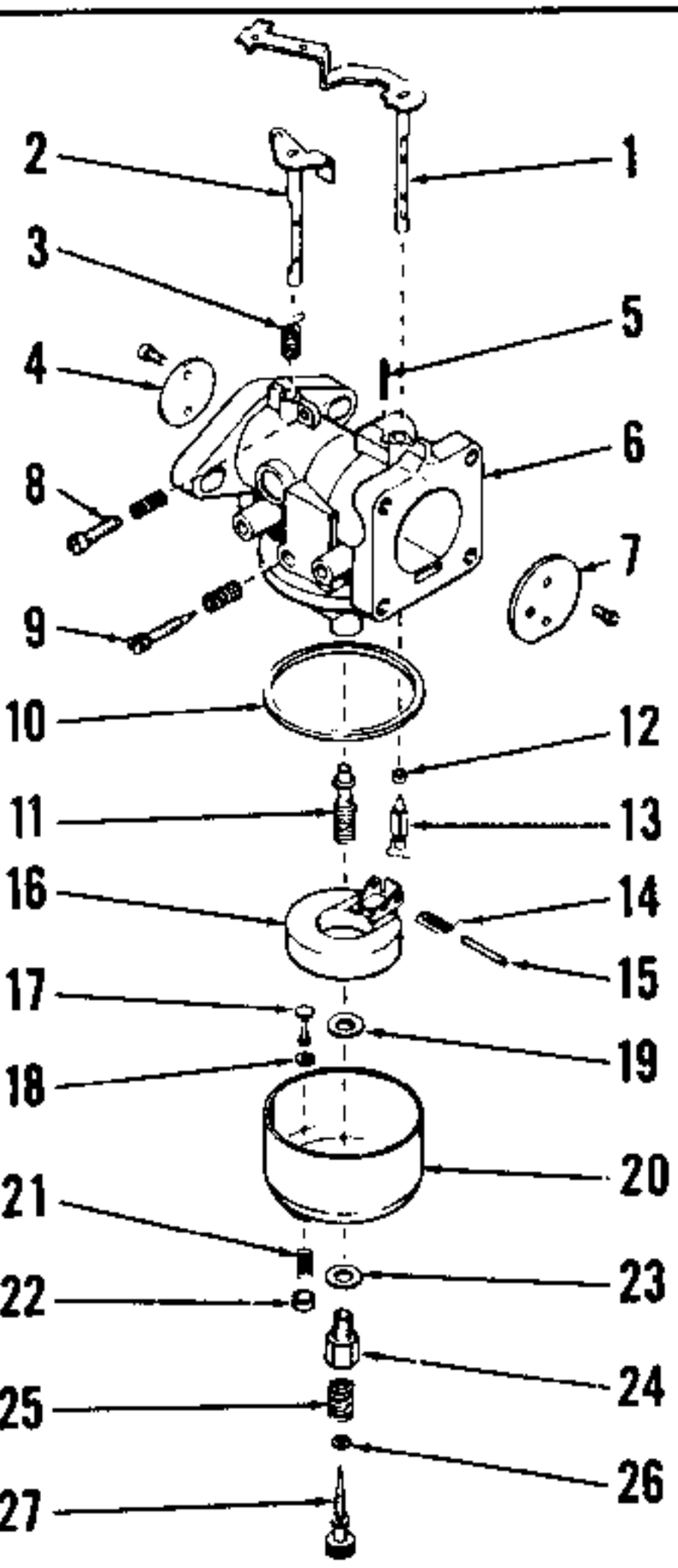


Fig. T55—Exploded view of typical Walbro carburetor used on all models.

1. Choke shaft
2. Throttle shaft
3. Throttle return spring
4. Throttle plate
5. Choke stop spring
6. Carburetor body
7. Choke plate
8. Idle speed stop screw
9. Idle mixture needle
10. Bowl gasket
11. Main nozzle
12. Inlet valve seat
13. Inlet valve
14. Float spring
15. Float shaft
16. Float
17. Drain stem
18. Gasket
19. Gasket
20. Bowl
21. Spring
22. Retainer
23. Gasket
24. Bowl retainer
25. Spring
26. "O" ring
27. Main fuel adjusting needle

If main nozzle (11–Fig. T55) is removed and is the original type (Fig. T58), obtain and install a new service

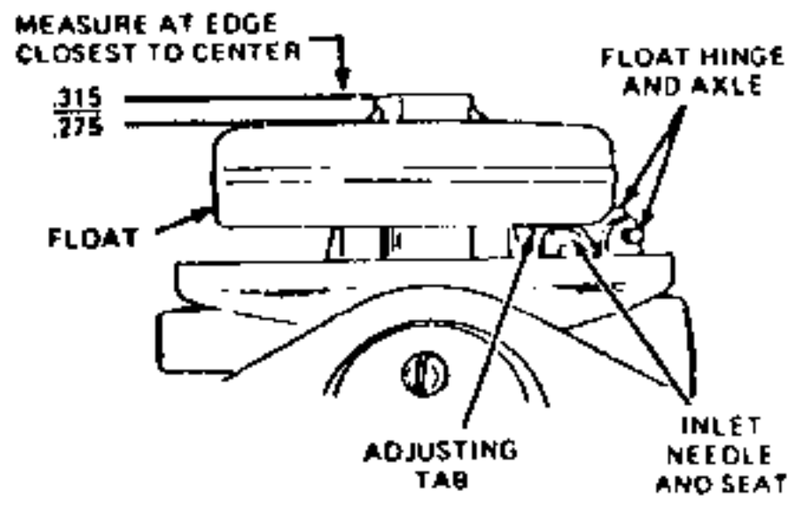


Fig. T56—Float setting should be measured as shown. Bend adjusting tab to adjust float setting.

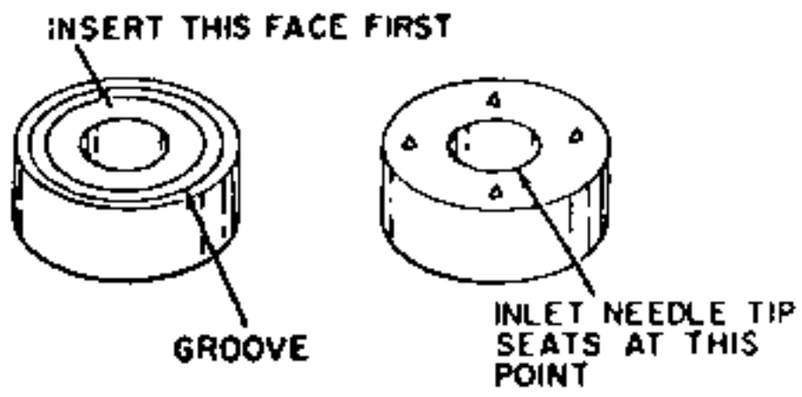


Fig. T57—The Viton inlet fuel valve seat must be installed grooved side first.

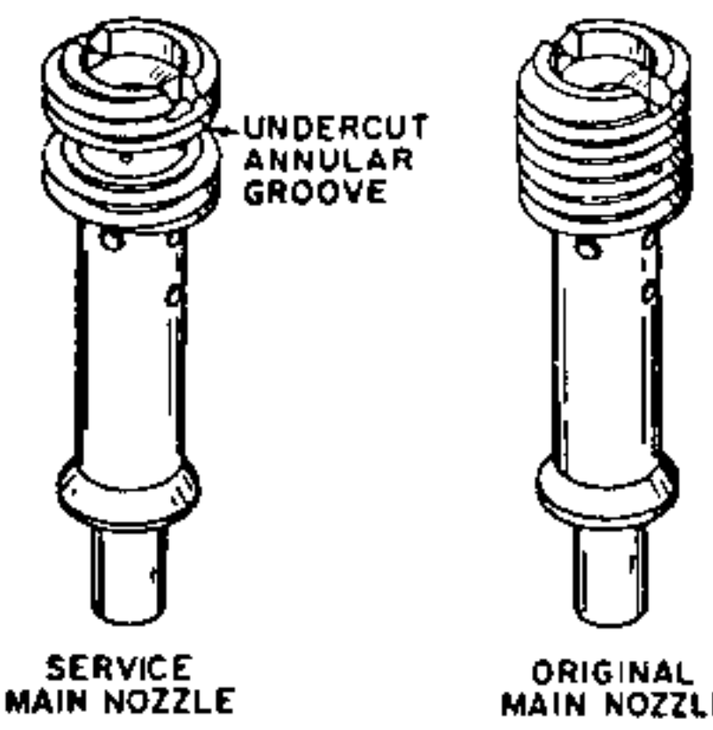


Fig. T58—The main nozzle originally installed is drilled after installation through hole in body. Service main nozzles are grooved so alignment is not necessary.

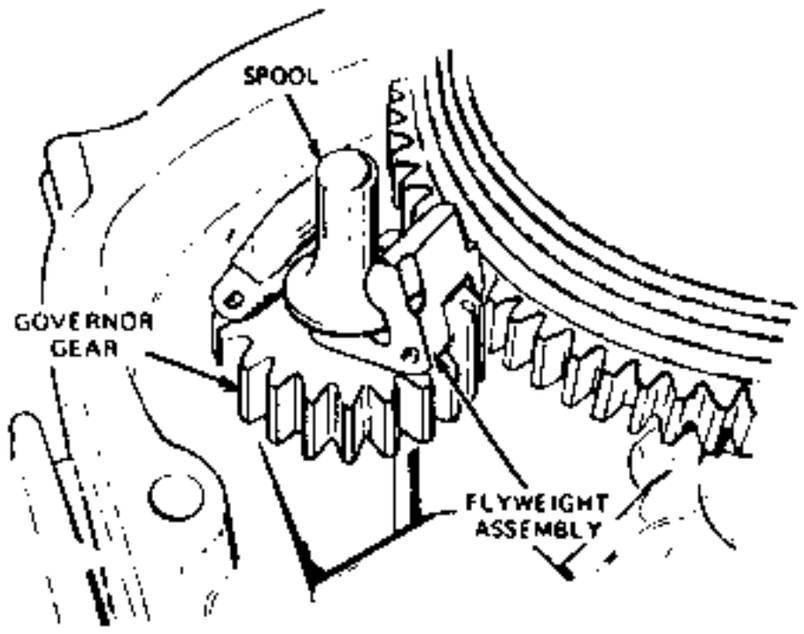


Fig. T59—View showing governor assembly installed in crankcase. Governor gear is driven by camshaft gear.

nozzle. The service nozzle will have an undercut annular groove in threaded area as shown in Fig. T58.

GOVERNOR. A mechanical flyweight type governor is used on all models. Governor gear, flyweights and shaft are serviced only as an assembly. Refer to Fig. T59 for view showing governor assembly installed in crankcase. Governor gear is driven by camshaft gear.

To adjust external governor linkage, refer to Fig. T60 and proceed as follows: Loosen screw (A), turn plate (B) counter-clockwise as far as possible and move governor lever (C) to the left until throttle is in wide open position. Tighten screw (A). Governor spring must be hooked in hole (D) as shown. Adjusting screws on bracket are used to adjust fixed or variable speed settings. Engine high idle speed should not exceed 3600 rpm.

SOLID STATE IGNITION (WITH OUT ALTERNATOR). The Tecumseh solid state ignition system shown in Fig. T61 is used on engines not equipped with flywheel alternator. This system does not use ignition breaker points. The only moving part of the system is the

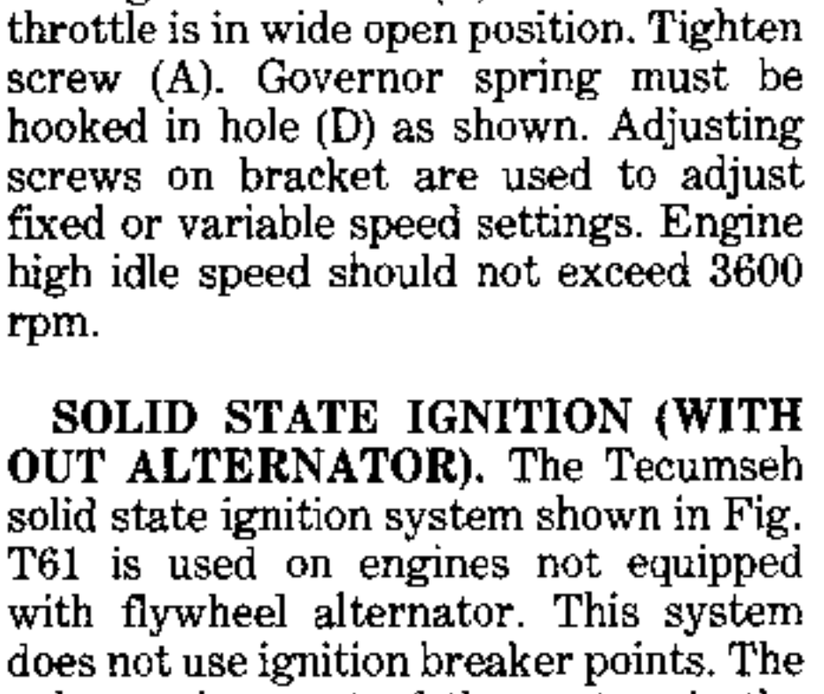


Fig. T60—Typical external governor linkage. Refer to text for adjustment procedures.

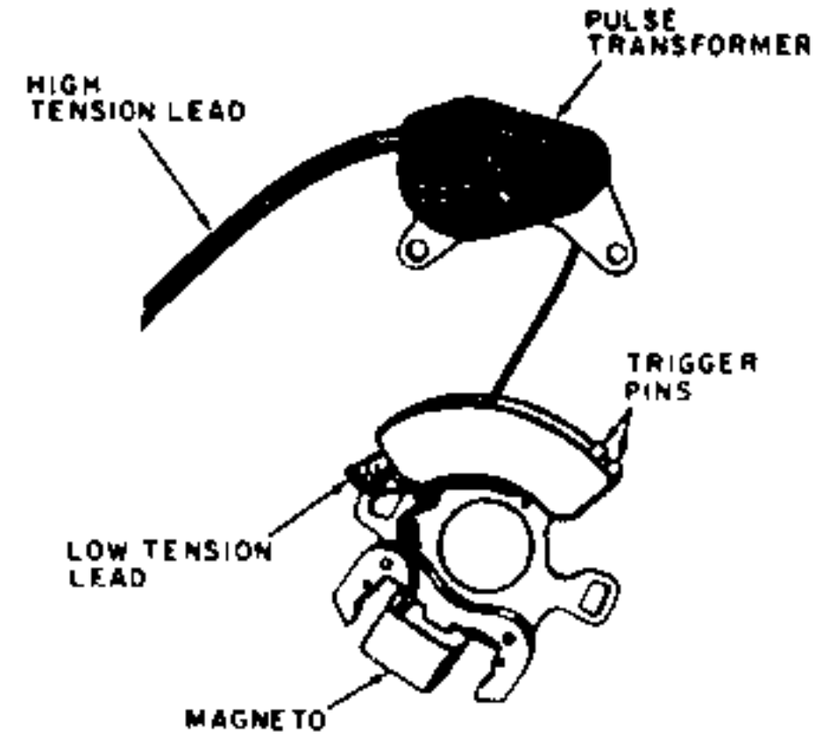


Fig. T61—View of solid state ignition system used on engine not equipped with flywheel alternator.

rotating flywheel with charging magnets. As flywheel magnet passes position (1A—Fig. T62), a low voltage AC current is induced into input coil (2). Current passes through rectifier (3) converting this current to DC. It then travels to capacitor (4) where it is stored. The flywheel rotates approximately 180 degrees to position (1B). As it passes trigger coil (5), it induces a very small electric charge into the coil. This charge passes through resistor (6) and turns on the SCR (silicon controlled rectifier) switch (7). With SCR switch closed, low voltage current stored in capacitor (4) travels to pulse transformer (8). Voltage is stepped up instantaneously and current is discharged across electrodes of spark plug (9), producing a spark before top dead center.

Units may be equipped with a second trigger coil and resistor set to turn SCR switch on at a lower rpm. This second trigger pin is closer to flywheel and produces a spark at TDC for easier starting. As engine rpm increases, the first (shorter) trigger pin picks up the small electric charge and turns SCR switch on, firing spark plug BTDC.

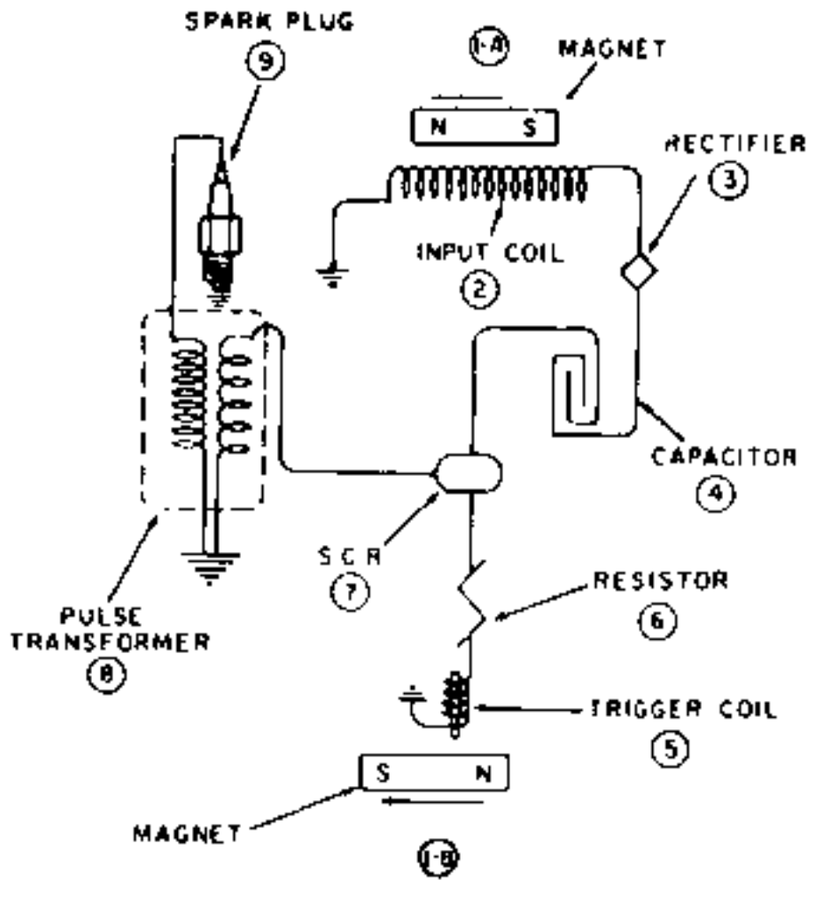


Fig. T62—Operational diagram of solid state ignition system.

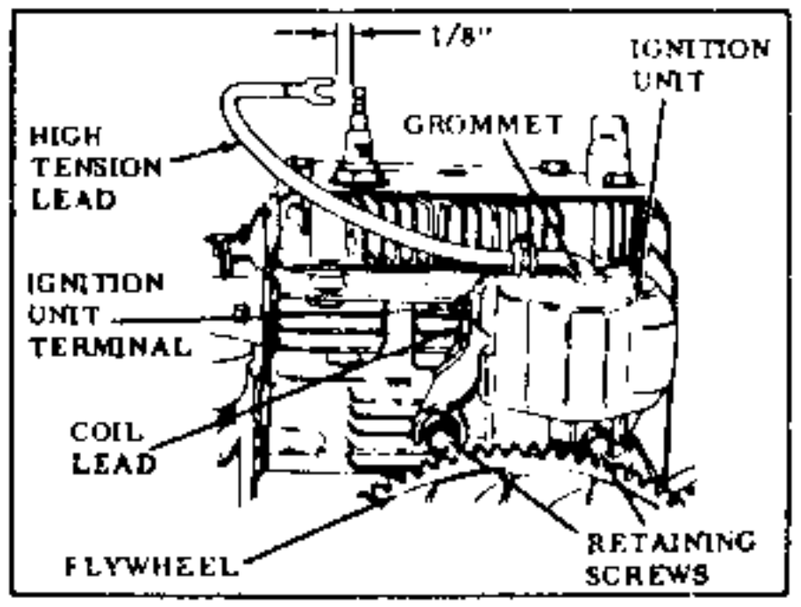


Fig. T63—View of solid state ignition unit used on engine equipped with flywheel alternator. System should produce a good blue spark 1/8-inch (3 mm) long at cranking speed.

If system fails to produce a spark to spark plug, first check high tension lead (Fig. T61). If condition of high tension lead is questionable, renew pulse transformer and high tension lead assembly. Check low tension lead and renew if insulation is faulty. The magneto charging coil, electronic triggering system and mounting plate are available only as an assembly. If necessary to renew this assembly, place unit in position on engine. Start retaining screws, turn mounting plate counter-clockwise as far as possible, then tighten retaining screws to a torque of 5-7 ft.-lbs. (7-9 N·m).

SOLID STATE IGNITION (WITH ALTERNATOR). The Tecumseh solid state ignition system used on engines equipped with flywheel alternator does not use ignition points. The only moving part of the system is the rotating flywheel with charging magnets and trigger pins. Other components of the system are ignition generator coil and stator assembly, spark plug and ignition unit.

The long trigger pin induces a small charge of current to close SCR (silicon controlled rectifier) switch at engine cranking speed and produces a spark at TDC for starting. As engine rpm increases, the first (shorter) trigger pin induces the current which produces a spark when piston is BTDC.

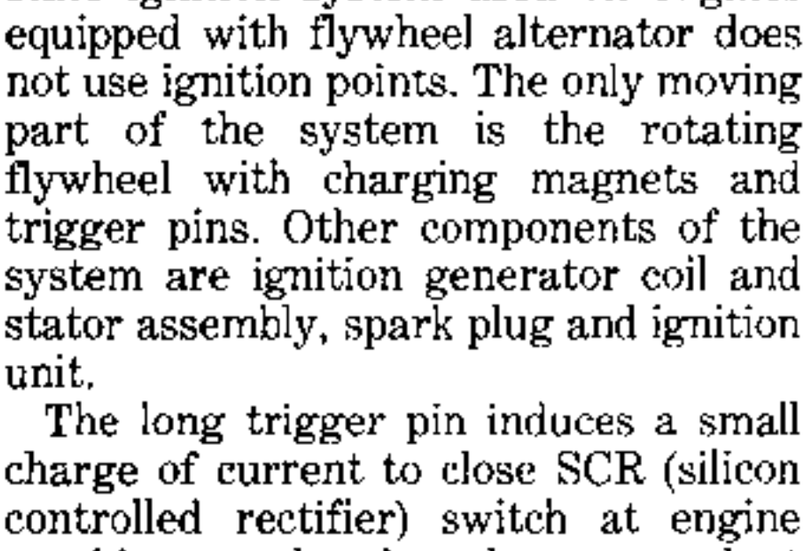


Fig. T64—Adjust air gap between long trigger pin and ignition unit to 0.006-0.010 inch (0.152-0.254 mm).

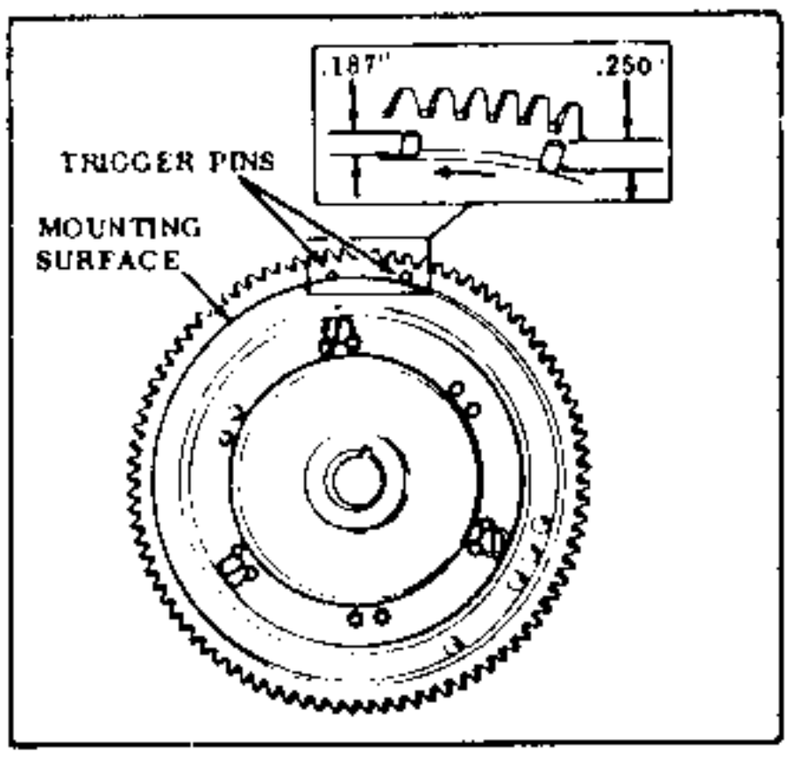


Fig. T65—Remove flywheel and drive trigger pins in or out as necessary until long pin is extended 0.250 (6.35 mm) inch and short pin is extended 0.187 inch (4.75 mm) above mounting surface.

Test ignition system as follows: Hold high tension lead ⅛-inch (3 mm) from spark plug (Fig. T63), crank engine and check for a good blue spark. If no spark is present, check high tension lead and coil lead for loose connections or faulty insulation. Check air gap between long trigger pin and ignition unit as shown in Fig. T64. Air gap should be 0.006-0.010 inch (0.152-0.254 mm). To adjust air gap, loosen the two retaining screws and move ignition unit as necessary, then tighten retaining screws.

NOTE: The long trigger pin should extend 0.250 inch (6.35 mm) and the short trigger pin should extend 0.187 inch (4.75 mm), measured as shown in Fig. T65. If not, remove flywheel and drive pins in or out as required.

Remove coil lead from ignition terminal and connect an ohmmeter as shown in Fig. T66. If series resistance test of ignition generator coil is below 400 ohms, renew stator and coil assembly (Fig. T67). If resistance is above 400 ohms, renew ignition unit.

LUBRICATION. Splash lubrication is provided by use of an oil dipper on connecting rod cap. See Fig. T68.

Use only high quality, detergent motor oil having API classification SE, SF or SG. SAE 30 oil is recommended for operating in temperatures above 32°F (0°C) and SAE 10W for operating in temperatures below 32°F (0°C).

REPAIRS

TIGHTENING TORQUES. Recommended tightening torques are as follows:

Cylinder head	220 in.-lbs. (24.8 N·m)
Connecting rod	110 in.-lbs. (12.4 N·m)
Crankcase cover	65-110 in.-lbs. (7.3-12.4 N·m)
Bearing retainer	65-110 in.-lbs. (7.3-12.4 N·m)
Flywheel nut	600-660 in.-lbs. (67.8-74.6 N·m)
Spark plug	270-360 in.-lbs. (30.5-40.7 N·m)
Stator mounting	60-84 in.-lbs. (6.8-9.5 N·m)
Carburetor to inlet pipe	48-72 in.-lbs. (5.4-8.1 N·m)
Inlet pipe to head	72-96 in.-lbs. (8.1-10.8 N·m)
Rocker arm housing to head	80-90 in.-lbs. (9.0-10.1 N·m)
Rocker arm shaft screw	180-220 in.-lbs. (20.3-24.8 N·m)
Rocker arm cover	15-20 in.-lbs. (1.7-2.2 N·m)

CONNECTING ROD. The aluminum alloy connecting rod rides directly on the crankpin. Piston and connecting rod assembly is removed from above after removing rocker arm housing, cylinder head, crankcase cover and connecting rod cap.

Crankpin diameter is 1.3750-1.3755 inches (34.925-34.938 mm) and running clearance of connecting rod to crankpin should be 0.001-0.0015 inch (0.025-0.381 mm). Renew connecting rod if clearance is excessive. If crankpin is scored, out-

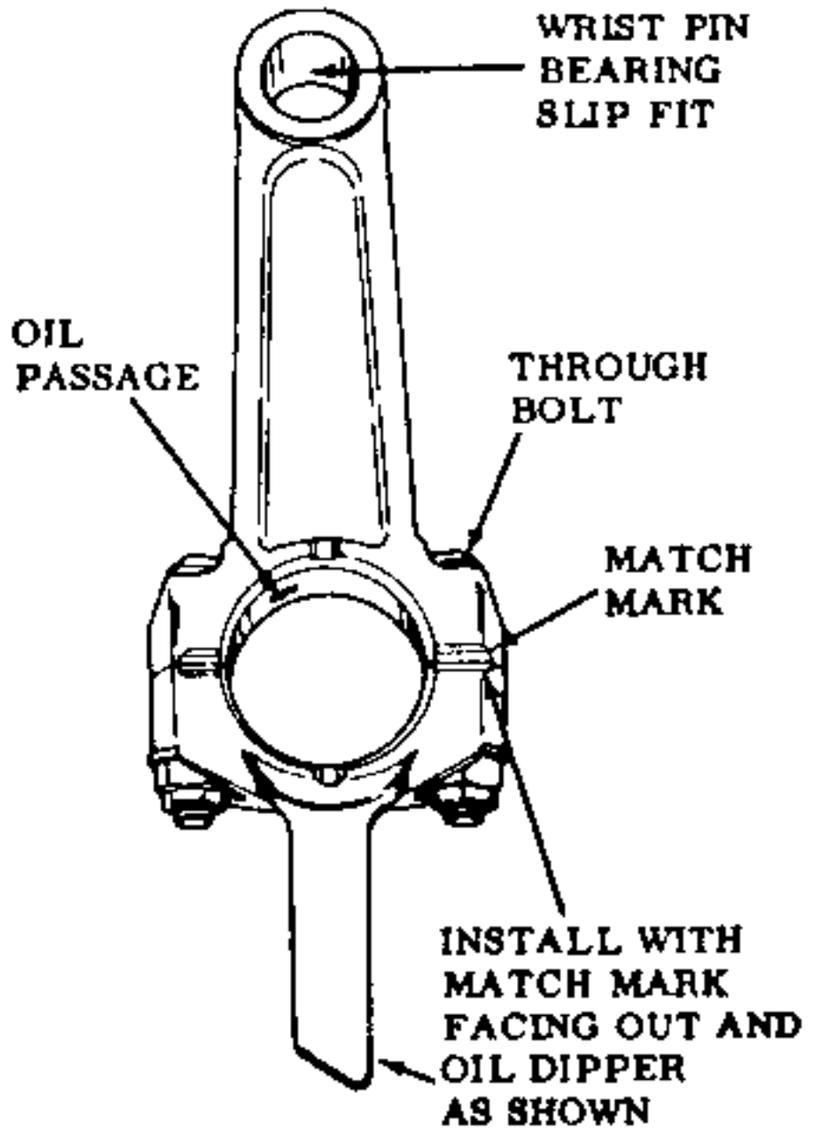


Fig. T68—Connecting rod assembly used on all models. Note oil dipper on rod cap and match marks.

of-round or excessively worn, crankshaft must be renewed. Connecting rod is available in standard size only. Standard diameter of piston pin hole in connecting rod is 0.6876-0.6881 inch (17.465-17.478 mm). Renew connecting rod if piston pin hole is excessively worn.

When installing piston and connecting rod assembly, make certain match marks on connecting rod and rod cap (Fig. T68) are aligned and marks are facing pto end of shaft. Always renew self-locking nuts on connecting rod bolts and tighten nuts to a torque of 110 in.-lbs. (12 N·m).

CYLINDER HEAD AND VALVE SYSTEM. To remove cylinder head and/or valves, first unbolt and remove blower housing and valve cover and breather assembly. Turn crankshaft until piston is at top dead center of compression stroke. Refer to Fig. T69,

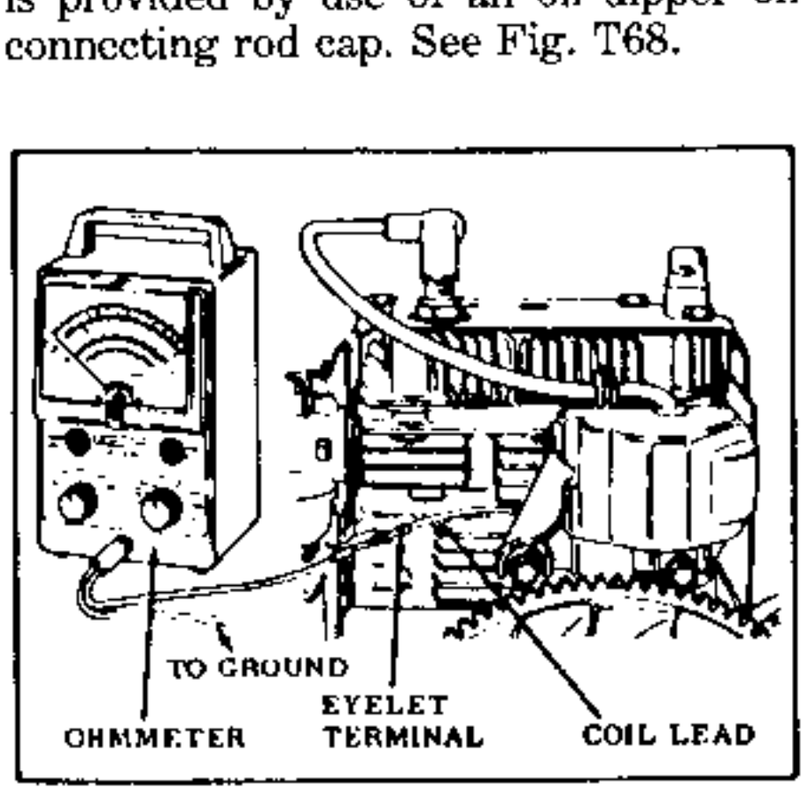


Fig. T66—View showing ohmmeter connected for resistance test of ignition generator coil.

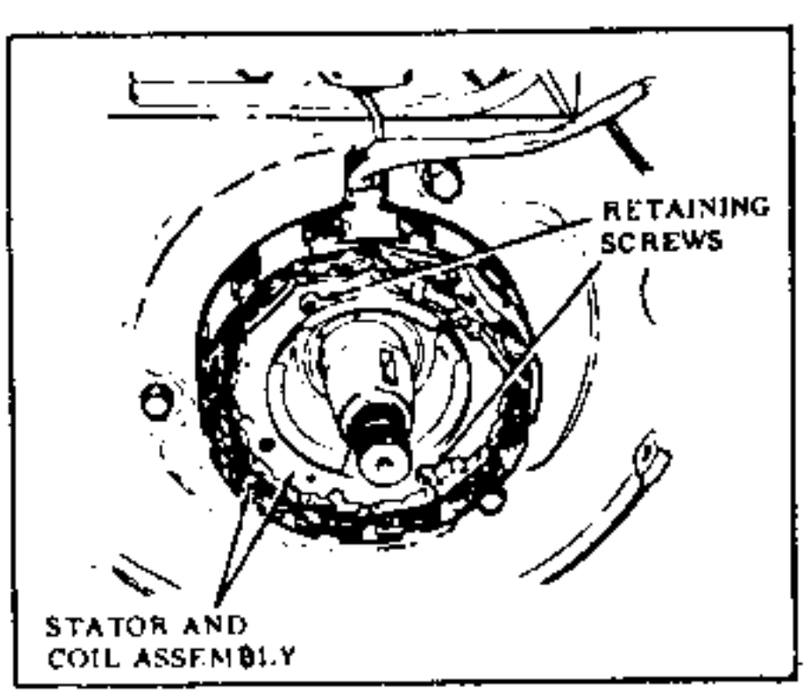


Fig. T67—Ignition generator coil and stator is serviced only as an assembly.

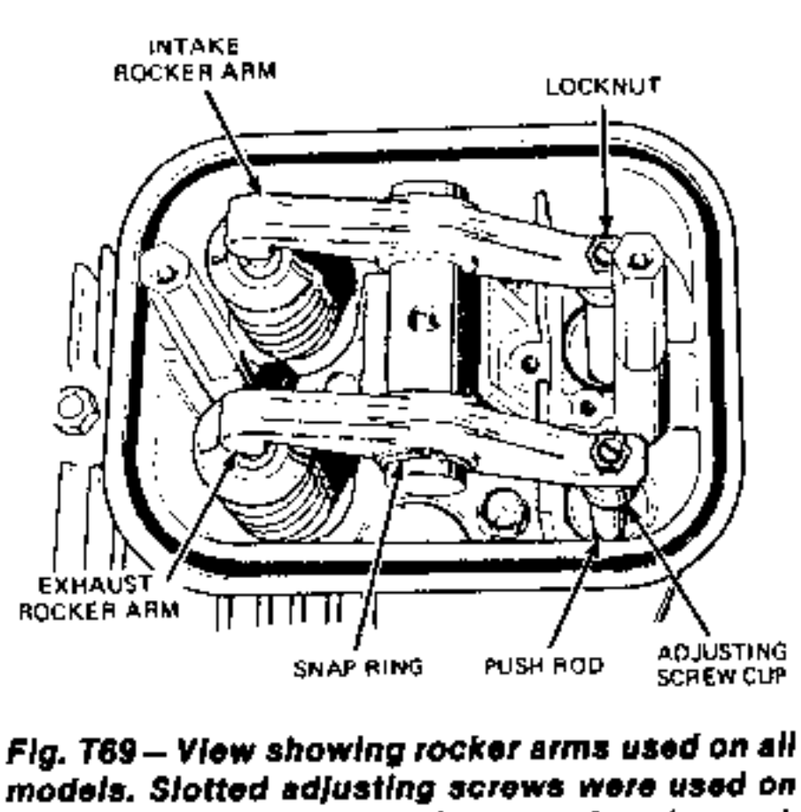


Fig. T69—View showing rocker arms used on all models. Slotted adjusting screws were used on early production engines. Later engines have adjusting nut on screw below rocker arm.

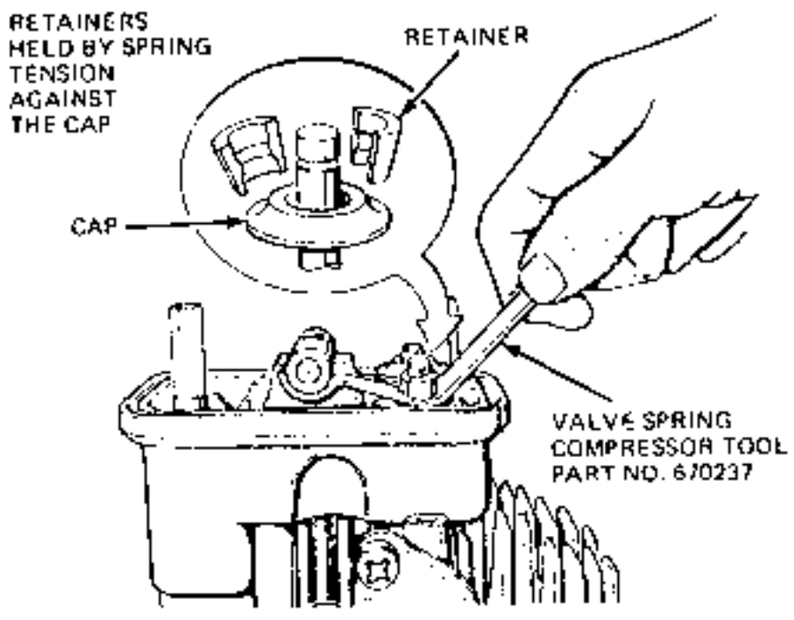


Fig. T70—Use tool #670237 to compress valve springs while removing retainers.

loosen locknuts on rocker arms and back off adjusting screws. Remove snap rings from rocker shaft and remove rocker arms. Using valve spring compressor tool #670237 as shown in Fig. T70, remove valve retainers. Then, remove upper spring cap, valve spring, lower spring cap and "O" ring from each valve. Remove the three cap screws, washers and "O" rings from inside rocker arm housing and carefully lift off housing. Push rods and push rod tubes can now be withdrawn. Unbolt and remove carburetor and inlet pipe assembly from cylinder head. Remove cylinder head cap screws and lift off cylinder head, taking care not to drop intake and exhaust valves.

Standard inside diameter of both guides is 0.312-0.313 inch (7.925-7.950 mm). If excessive clearance exists between valve stem and guide, ream guide to 0.343-0.344 inch (8.712-8.737 mm) and install 1/32-inch (0.8 mm) oversize valve, or renew valve guides. To renew valve guides, remove and submerge head in large pan of oil. Heat on a hot plate until oil begins to smoke, about 15-20 minutes. Remove head from pan and place head on arbor press with valve seats facing up. Use a drift punch ½-inch (13 mm) in diameter to press guides out.

CAUTION: Be sure to center punch. DO NOT allow punch to contact head when pressing guides out.

To install new guides, place guides in freezer or on ice for 30 minutes prior to installation. Submerge head in pan of oil. Heat on hot plate until oil begins to smoke, about 15-20 minutes. Remove head and place, gasket surface down, on a 6 x 12 inch piece of wood. Using snap rings to locate both guides, insert silver colored guide in intake side and brass colored guide in exhaust side. It may be necessary to use a rubber or rawhide mallet to fully seat snap rings. **DO NOT** use a metal hammer or guide damage will result. Allow head to cool and reface both valve seats.

Valve spring free length should be 1.915 inches (48.64 mm) and springs should test 25.6-28.6 pounds (113.9-127.2 N) when compressed to a length of 1.550 inches (39.37 mm). Renew springs if coils are rusted, pitted or cracked, or if springs fail to meet specifications.

Valves seat directly in cylinder head. Valve seat angle is 46 degrees and valve face angle is 45 degrees. Valve seat width should be 0.042-0.052 inch (1.07-1.32 mm). Renew valve when valve head margin is less than 0.060 inch (1.52 mm) after valve is refaced.

Use new head gasket and reinstall cylinder head and valves. Make certain Belleville washer and flat washer are installed on cylinder head cap screws as shown in Fig. T71 and the two short cap screws, 1-⅜ inches (35 mm), are installed in correct holes as shown in Fig. T72. Tighten cylinder head cap screws evenly to a torque of 220 in.-lbs. (24.8 N·m) using sequence shown in Fig. T72.

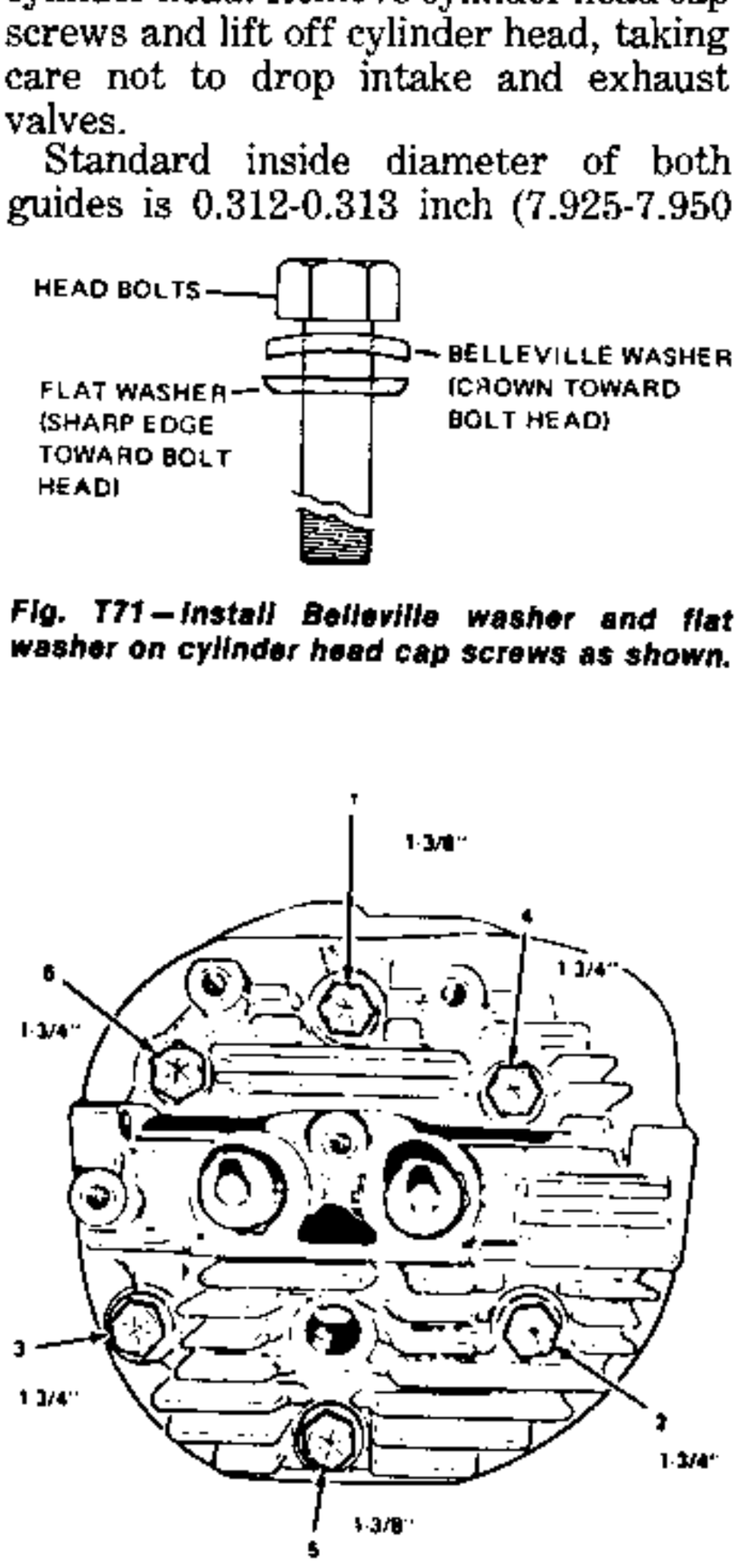


Fig. T71—Install Belleville washer and flat washer on cylinder head cap screws as shown.

Fig. T72—Tighten cylinder head cap screws evenly to a torque of 220 in.-lbs. (24.8 N·m) using tightening sequence shown. Note location of different length cap screws.

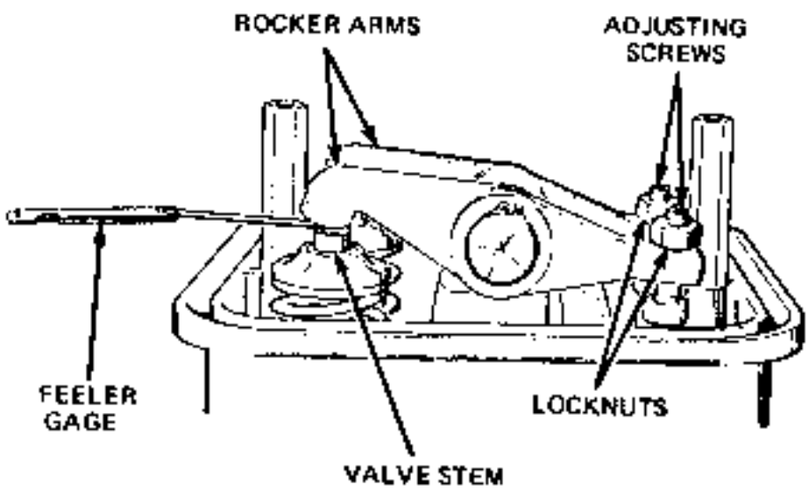


Fig. T73—Use a feeler gage when adjusting valve clearance. Refer to text for adjustment procedure.

Place new "O" rings on push rod tubes and install push rods and tubes. Install rocker arm housing and using new "O" rings on the three mounting cap screws, tighten cap screws to a torque of 80-90 in.-lbs. (9.0-10.1 N·m). Install new "O" ring, lower spring cap, valve spring and upper spring cap on each valve. Using tool #670237, compress valve spring and install retainers. Install rocker arms and secure them with snap rings.

To adjust valve clearance, make certain piston is positioned at TDC of compression stroke and proceed as follows: Refer to Fig. T73 and with locknuts loosened, turn adjusting screws until correct valve clearance is measured with feeler gage as shown. Valve clearance (cold) should be 0.005 inch (0.127 mm) for intake valve and 0.010 inch (0.254 mm) for exhaust valve. Tighten locknuts to secure adjusting screws.

NOTE: Slotted adjusting screws were used on early production engines, while later engines have adjusting nut on screw below rocker arm. Locknuts are above rocker arms on all models.

Reinstall valve cover and breather assembly, carburetor and inlet pipe assembly and blower housing.

PISTON, PIN AND RINGS. Aluminum alloy piston is fitted with two compression rings and one oil control ring. Recommended end gap for all rings is 0.010-0.020 inch (0.254-0.508 mm). Side clearance of new rings in ring grooves of new piston is 0.0015-0.0035 inch (0.038-0.089 mm). Maximum allowable (wear limit) piston ring side clearance is 0.006 inch (0.152 mm). Compression ring groove width of new piston is 0.095-0.096 inch (2.413-2.438 mm) and oil ring groove width (new) is 0.188-0.189 inch (4.775-4.800 mm). Piston rings and piston are available in standard size and oversizes.

The top compression ring must be installed with inside chamfer to top of piston. If second compression ring has a

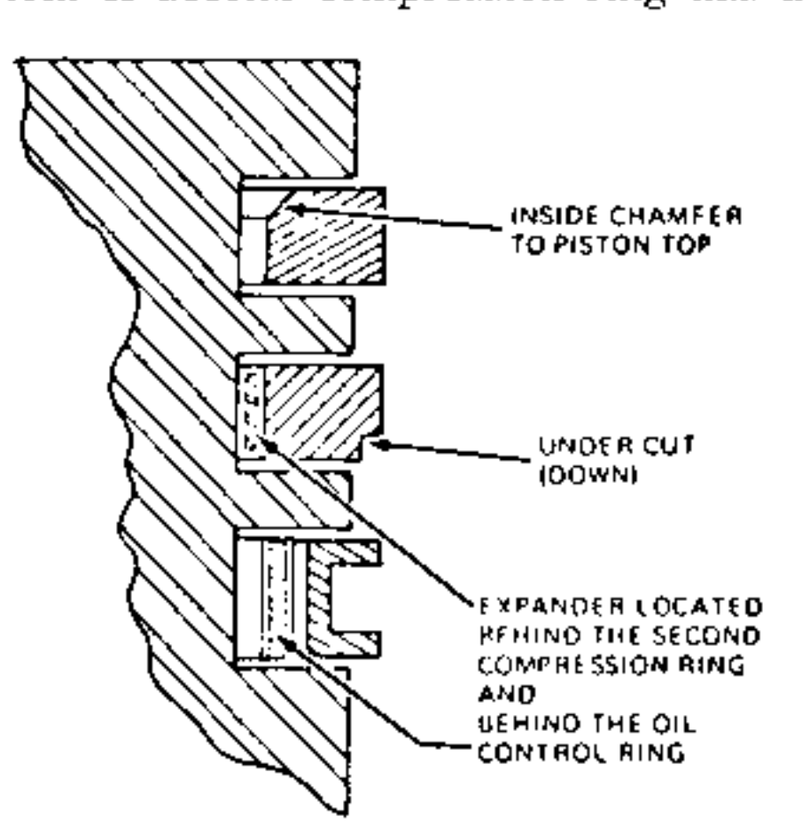


Fig. T74—Cross-sectional view showing correct installation of piston rings.

notch on outside of ring, install ring with notch toward bottom end of piston. Oil ring can be installed either side up. See Fig. T74. Stagger ring end gaps about 90 degrees around piston.

Piston skirt clearance in cylinder, measured at thrust side of piston just below oil ring should be 0.010-0.012 inch (0.254-0.305 mm).

Piston pin diameter is 0.6873-0.6875 inch (17.457-17.462 mm). Piston pin clearance should be 0.0001-0.0008 inch (0.0025-0.0203 mm) in rod and 0.0002-0.0005 inch (0.0051-0.0127 mm) in piston. If clearance is excessive, both piston and pin must be renewed as pin is not serviced separately.

CYLINDER. If cylinder is scored or if taper or out-of-round exceeds 0.005 inch (0.127 mm), cylinder should be rebored to next suitable oversize. Standard cylinder bore is 3.125-3.126 inches (79.375-79.400 mm) on Model OH120, 3.312-3.313 inches (84.125-84.150 mm) on Models HH140 and OH140 and 3.500-3.501 inches (88.900-88.925 mm) on all other models. Pistons and rings are available in standard size and oversizes.

CAMSHAFT. The camshaft and camshaft gear are an integral part which rides on journals at each end of camshaft. The camshaft is equipped with a compression release mechanism. See Fig. T75. Check compression release parts for binding, excessive wear or other damage. If any parts are excessively worn or damaged, renew complete camshaft assembly. Parts are not serviced separately for compression release mechanism.

Renew camshaft if gear teeth are excessively worn or if bearing surfaces or lobes are worn or scored. Camshaft lobe nose-to-heel diameter should be 1.3117-1.3167 inches (33.3172-33.4442 mm). Diameter of camshaft journals is 0.6235-0.6240 inch (15.8369-15.8496 mm). Maximum allowable clearance between camshaft journal and bearing bore is 0.003 inch (0.076 mm).

When installing camshaft, align timing mark on camshaft gear with timing mark (chamfered tooth) on crankshaft gear. This will provide correct valve timing.

CRANKSHAFT. The crankshaft is supported by tapered roller bearings (20 and 54 – Fig. T76). Use a suitable puller to remove bearings. Bearings will be damaged during removal and new bearings must be installed when reassembling. Heat bearings in oil to approximately 300°F (150°C), then quickly slide bearings into position on crankshaft. Bearing cup (55) in a press fit in crankcase cover (62) and must be pressed in against shoulder. Bearing cup (19) is a slip fit in cylinder block (21). To adjust crankshaft bearings, assemble engine to the point where cylinder block, crankshaft assembly, piston and connecting rod assembly and crankcase cover are assembled and all bolts are tightened to correct torque values given in TIGHTENING TORQUES paragraph. With bearing cup (19) installed in cylinder block, install bearing retainer cap (15) without shim gaskets (17), steel washers (16) or "O" ring (18). Tighten cap screws finger tight. Using a feeler gage, measure gap between bearing retainer flange and cylinder block. If no measurable clearance exists, install 0.010 inch steel washers (as required) between bearing retainer (15) and bearing cup (19) until such clearance is obtained. If measured

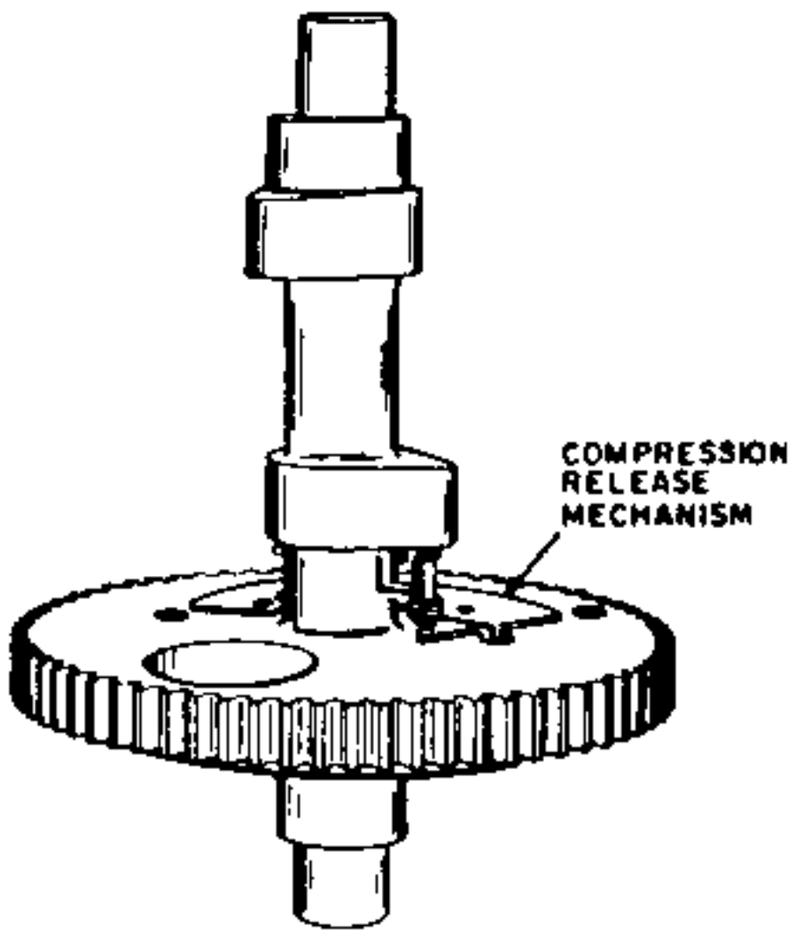


Fig. T75 – View of Insta-matic Ezee-Start compression release camshaft assembly.

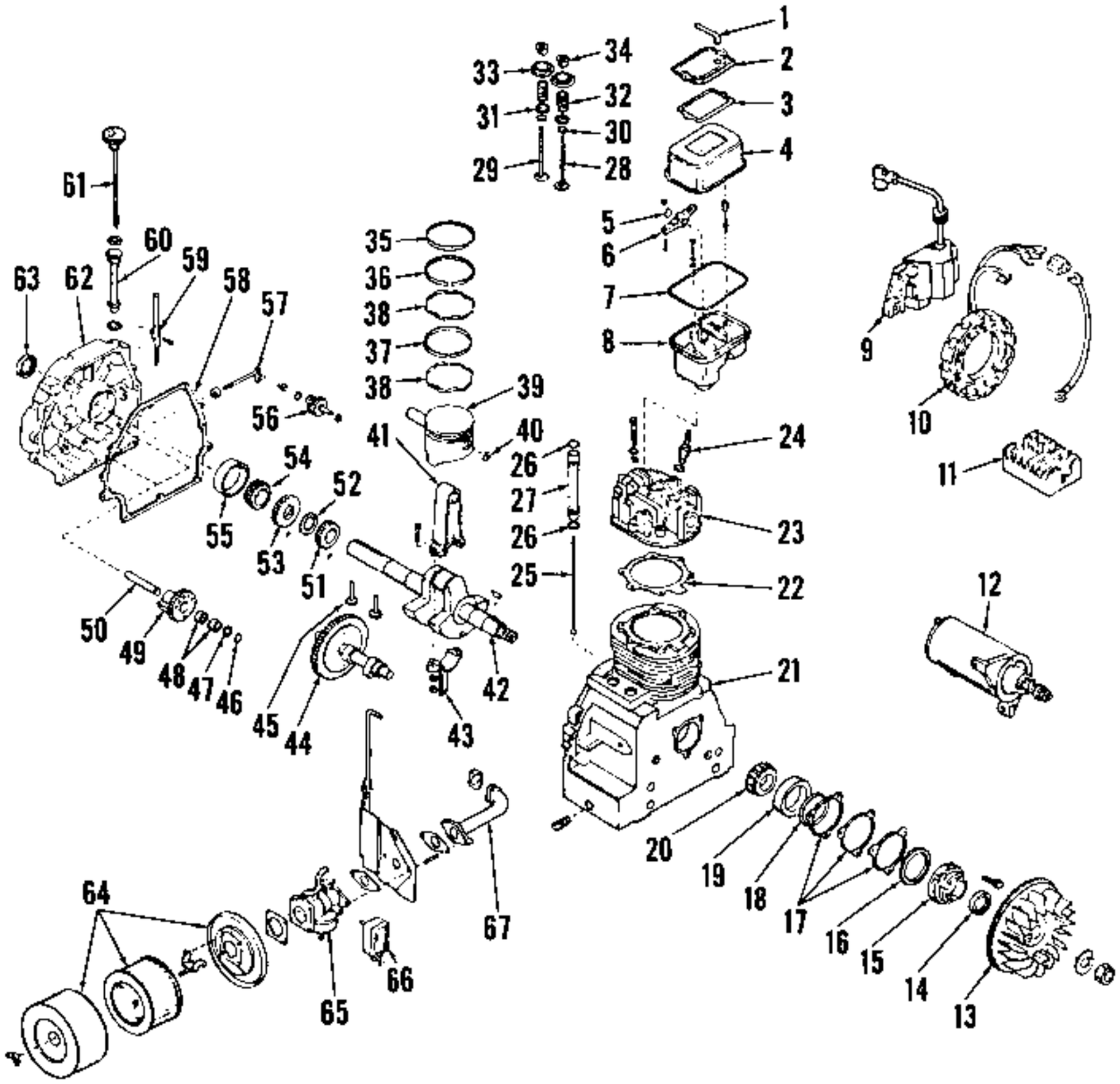


Fig. T76 – Exploded view of basic engine.

1. Breather tube
2. Breather
3. Gasket
4. Valve cover
5. Snap ring
6. Rocker arm (2 used)
7. Seal ring
8. Rocker arm housing
9. Ignition unit
10. Stator assy.
11. Regulator-rectifier
12. Starter motor
13. Flywheel
14. Oil seal
15. Bearing retainer cap
16. Steel washer (0.010 in.)
17. Shim gaskets
18. "O" ring
19. Bearing cup
20. Bearing cone
21. Cylinder block
22. Head gasket
23. Cylinder head
24. Spark plug
25. Push rod
26. "O" ring
27. Push rod tube
28. Intake valve
29. Exhaust valve
30. "O" ring
31. Lower spring cap
32. Valve spring
33. Upper valve cap
34. Valve retainers
35. Top compression ring
36. Second compression ring
37. Oil control ring
38. Ring expanders
39. Piston & pin assy.
40. Retaining ring
41. Connecting rod
42. Crankshaft
43. Rod cap
44. Camshaft assy.
45. Valve lifters
46. Snap ring
47. Thrust washer
48. Needle bearings
49. Dyna-Static balancer
50. Balancer shaft
51. Crankshaft gear
52. Spacer
53. Balancer drive gear
54. Bearing cone
55. Bearing cup
56. Governor assy.
57. Governor arm
58. Gasket
59. Oil filler tube extension
60. Oil filler tube
61. Dipstick
62. Crankcase cover
63. Oil seal
64. Air cleaner assy.
65. Carburetor
66. Fuel pump
67. Inlet pipe

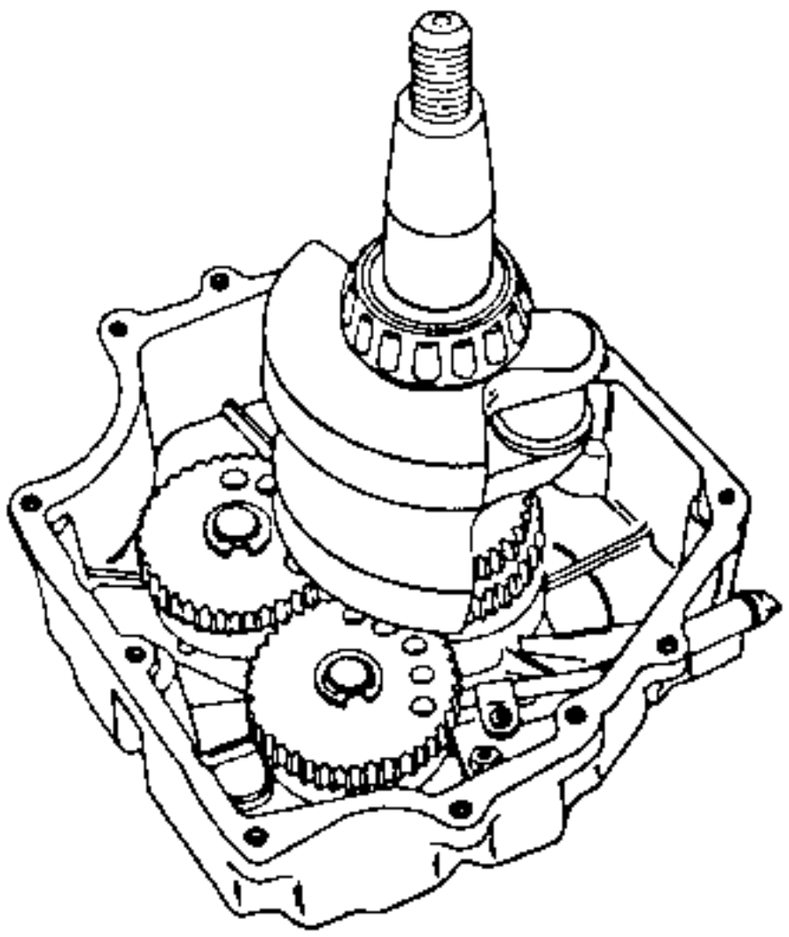


Fig. T77—View showing Dyna-Static balancer gears installed in crankcase cover. Note gear retaining snap rings.

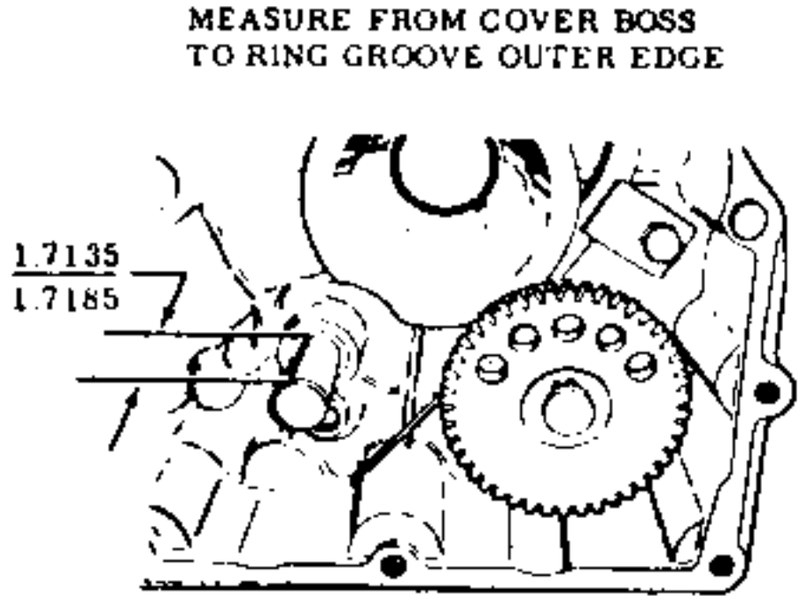


Fig. T78—Press balancer gear shafts into crankcase cover to dimension shown.

clearance does not exceed 0.007 inch (0.178 mm) no shim gasket (17) will be required. When retainer cap screws are tightened to correct torque, bearing preload will be within recommended range of 0.001-0.007 inch (0.025-0.178 mm). If clearance measures more than 0.007 inch (0.178 mm), subtract 0.001 inch (0.025 mm) from measured clearance to allow for preload. This will give actual distance to be shimmed. However, since shim gaskets will compress approximately ⅓ of their thickness, shim pack thickness to be installed should be 1½ times actual distance. Shim gaskets are available in thickness of 0.003-0.004, 0.004-0.005 and 0.005-0.007 inch. Remove bearing cap, install "O" ring and thickness of shim gaskets previously determined and reinstall bearing retainer cap. Tighten cap screws to a torque of 65-110 in.-lbs. (7.3-12.4 N·m).

Crankshaft seat diameter for roller bearings is 1.1865-1.1870 inches (30.1371-30.1498 mm). Crankpin journal diameter is 1.3750-1.3755 inches (34.9250-34.9377 mm). Renew crankshaft if crankpin is scored or is tapered or worn over 0.002 inch (0.051 mm) or is out-of-round more than 0.0005 inch (0.0127 mm).

When installing crankshaft, align timing mark on crankshaft gear (chamfered tooth) with timing mark on camshaft gear.

Crankshaft oil seals should be installed flush to 0.025 inch (0.635 mm) below surface, with lips on seals facing inward.

DYNA-STATIC BALANCER. The Dyna-Static engine balancer operates by means of a pair of counterweighted gears driven by the crankshaft to counteract unbalance caused by counterweights on crankshaft. The balancer gears are held in position on balancer shafts by snap rings. See Fig. T77. The renewable balancer shafts are pressed into crankcase cover. Press shafts into cover until a distance of 1.7135-1.7185 inches (43.523-43.650 mm) exists between boss on cover and outer edge of snap ring groove on shafts as shown in Fig. T78.

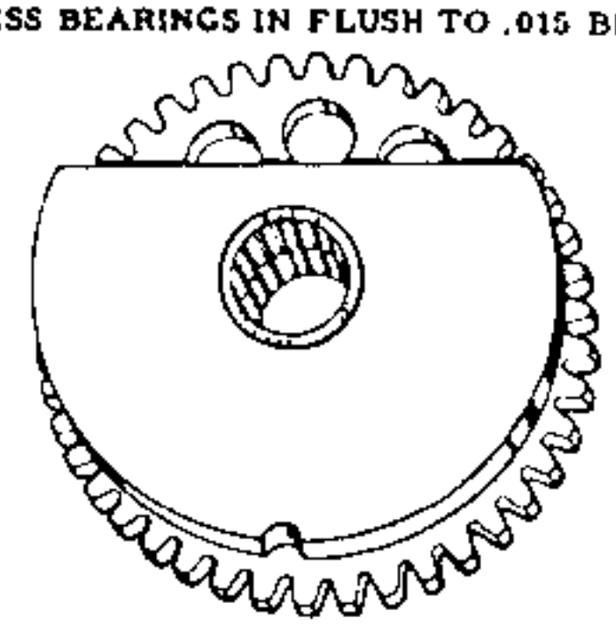


Fig. T79—Using tool #670210, press new needle bearings into balancer gears until bearing cage is flush to 0.015 inch (0.381 mm) below edge of bore. Note tool alignment notch at lower side of balancer.

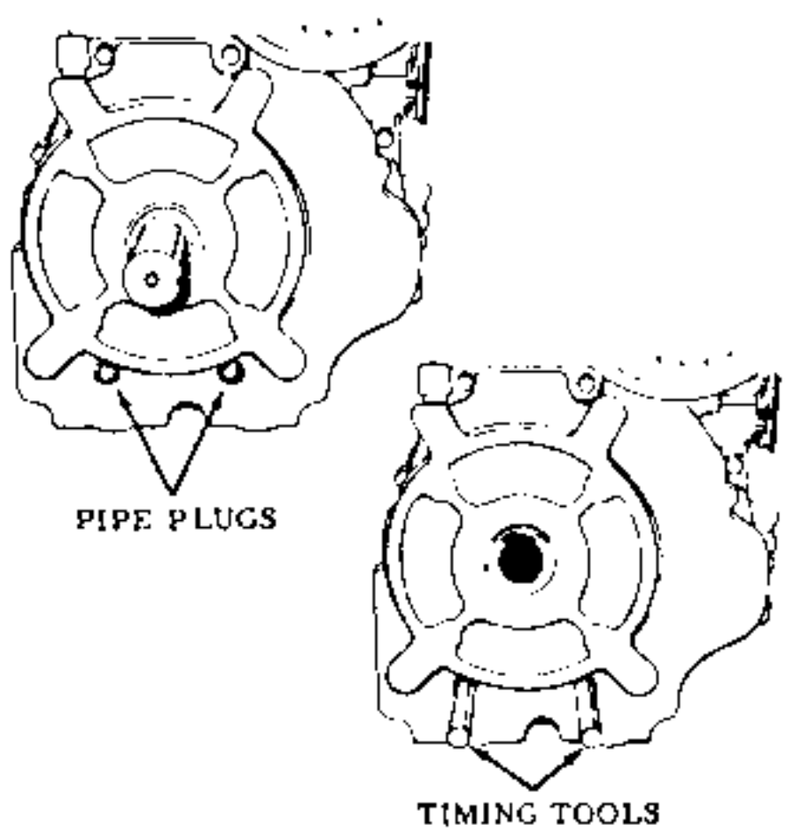


Fig. T80—To time engine balancer gears, remove pipe plugs and insert timing tools #670239 through crankcase cover and into slots in balancer gears. Refer also to Fig. T81.

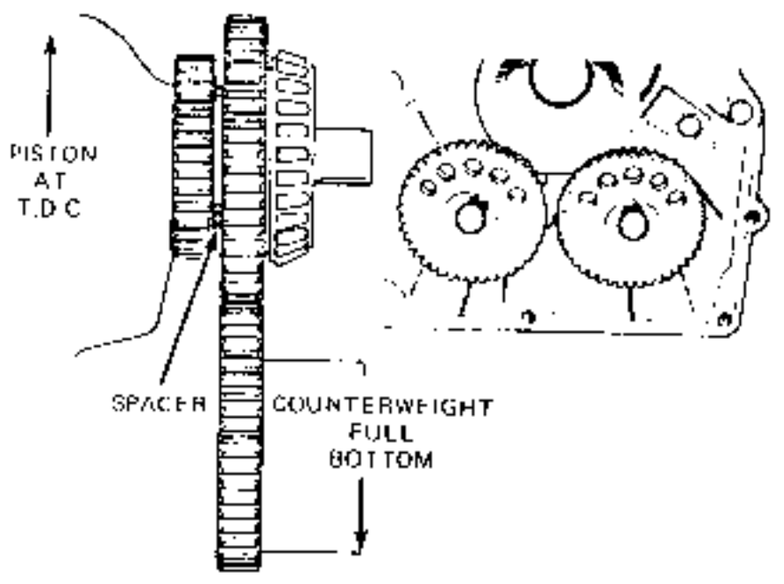


Fig. T81—Balancer gears are correctly timed to crankshaft when piston is at TDC and weights are at full bottom position.

Balancer gears are equipped with renewable caged needle bearings. See Fig. T79. Using tool #670210, press new bearings into balancer gears until bearing cage is flush to 0.015 inch (0.381 mm) below edge of bore.

When reassembling engine, balancer gears must be timed with crankshaft for correct operation. To time balancer gears, refer to Fig. T80 and remove pipe plugs. Insert timing tools #670239 through crankcase cover and into timing slots in balancer gears. Then, turn crankshaft to place piston at TDC position and carefully install crankcase cover with balancer gears. When correctly assembled, piston should be exactly at TDC and weights should be at full bottom position. See Fig. T81.

TECUMSEH

Model	No. Cyls.	Bore	Stroke	Displacement	Power Rating
OVM120	1	3.31 in. (84.2 mm)	2.53 in. (64.3 mm)	21.82 cu. in. (357 cc)	12 hp (8.9 kW)
OVXL120	1	3.31 in. (84.2 mm)	2.53 in. (64.3 mm)	21.82 cu. in. (357 cc)	12 hp (8.9 kW)
OVXL125, OVXL/C125	1	3.31 in. (84.2 mm)	2.53 in. (64.3 mm)	21.82 cu. in. (357 cc)	12.5 hp (9.3 kW)

ENGINE IDENTIFICATION

All models are four-stroke, overhead valve, single-cylinder, vertical crankshaft gasoline engines. Aluminum alloy cylinder and crankcase assembly is equipped with a cast iron cylinder sleeve which is an integral part of the cylinder. Pressurized lubrication to bearing areas is provided by a plunger type oil pump.

Engine model number, serial number and specification number are stamped into the cooling shroud just above the rocker arm cover. Always furnish correct engine model, serial and specification numbers when ordering parts.

MAINTENANCE

SPARK PLUG. Recommended spark plug is a Champion L86C or equivalent. Recommended electrode gap is 0.030 in. (0.76 mm).

CARBURETOR. All models are equipped with a float type carburetor. Some models are equipped with a carburetor with both an idle and a high speed fuel mixture adjustment screw. However, some models are equipped with just an idle speed fuel mixture screw; the high speed mixture is controlled by a fixed main jet. Other than adjustment, service procedure is similar for either type carburetor.

Initial adjustment of idle mixture screw (2—Fig. TC1) for all models is one turn open from a lightly seated position. Initial adjustment of high speed adjustment screw (3), if so equipped, is one turn open for Model OVM120 and 1½ turns open for Models OVXL120 and OVXL125 from a lightly seated position.

Make final adjustments on all models with engine at normal operating temperature. On models with high speed adjustment screw, set engine speed at full throttle and turn adjusting screw to find the lean drop-off point and the rich drop-off point. Then, set adjusting screw midway between the two extremes. When correctly set, engine should accelerate smoothly and run under load with steady governor operation. On all models, turn idle speed adjustment screw (1) to obtain desired idle speed as specified by the equipment manufacturer. Adjust idle mixture adjustment screw (2) to obtain smoothest idle operation using the same procedure as outlined for high speed adjustment screw.

As each adjustment affects the other, adjustment procedure may have to be repeated.

To clean carburetor, disassemble and clean all metallic parts with solvent or carburetor cleaner. Welch plugs should be removed from carburetor body to expose drilled passages to thoroughly clean carburetor. Use a small, sharp pointed chisel to pierce the Welch plug and pry plug out of carburetor body. When installing new plugs, use a flat punch equal, or greater in size than the plug and just flatten the plug. Do not drive the center of plug below surface of carburetor body.

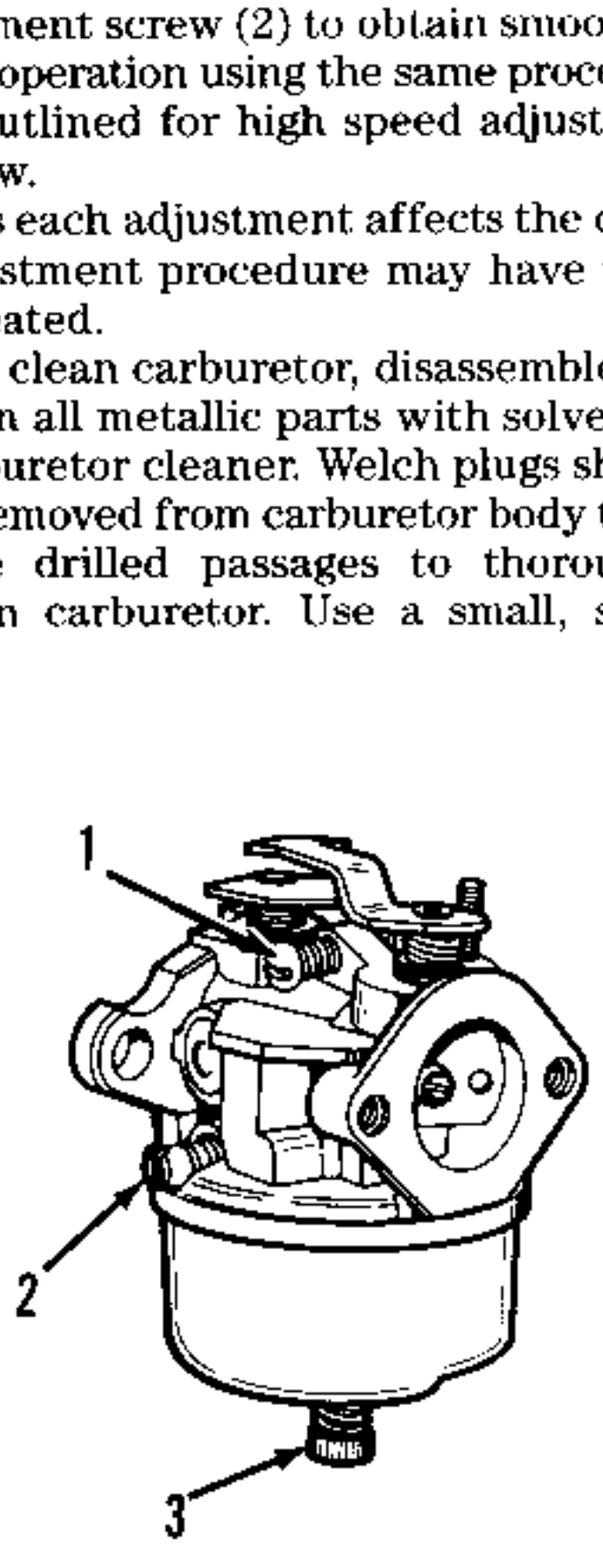


Fig. TC1—View of carburetor showing idle speed screw (1), idle mixture adjusting screw (2) and high speed fuel mixture adjusting screw (3). Some models may not be equipped with adjustable high speed fuel mixture screw (3).

NOTE: Brass or ball plugs should not be removed from carburetor body. Do not remove main nozzle tube (11—Fig. TC2). Tube is installed to a predetermined depth, and altering its position in carburetor body will affect metering characteristics of the carburetor.

Use compressed air and solvent to clean drilled passages and jets. Do not use drill bits or wire to clean jets or passages as carburetor calibration may be affected if openings are enlarged.

There are two different types of bowl nuts (24—Fig. TC2) that are used on carburetors equipped with adjustable main jets. One type has one fuel inlet port at bottom of the nut, and the other type has two fuel inlet ports at bottom of the nut (Fig. TC3). The difference between the nuts has to do with calibration changes of the carburetor, depending on engine application. DO NOT interchange bowl nuts. Fuel inlet port(s) and idle fuel transfer port, located in annular groove at top of nut, must be open and free of any debris to ensure proper fuel flow to high and low speed circuits.

When reassembling carburetor, it is important that throttle plate is installed with line on the plate facing outward and positioned at the 3 o'clock position. Choke plate must be installed with cut-out section facing downward. Be sure that throttle and choke plates open and close without binding.

Fuel inlet needle (13—Fig. TC2) and seat (12) are renewable. If needle tip or seat is worn or deformed, new needle and seat should be installed. Make cer-

tain when installing new seat that grooved side of seat is installed in bore first so the inlet needle will seat against the smooth side of seat (Fig. TC4).

Assemble choke, inlet needle and needle clip as shown in Fig. TC5. To prevent binding, the long end of clip should face choke end of carburetor body.

To check float height, invert carburetor body and use float setting tool No. 670253A as shown in Fig. TC6. Float height is correct if float does not touch step portion of tool (1) and contacts step (2) as tool is pulled toward float hinge pin as shown. If tool is not available, measure distance from top of main nozzle boss to surface of float. Distance should be 0.275-0.315 inch (7-8 mm). If adjustment is required, bend float tab that contacts fuel inlet needle being careful not to force inlet needle onto its seat.

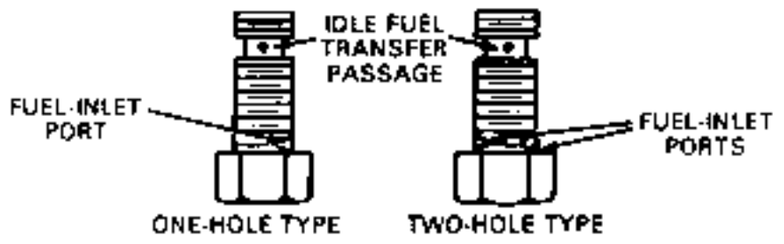


Fig. TC3—Two different types of fuel bowl retaining nuts are used on adjustable main jet type carburetors. Different type nuts must not be interchanged. Refer to text.

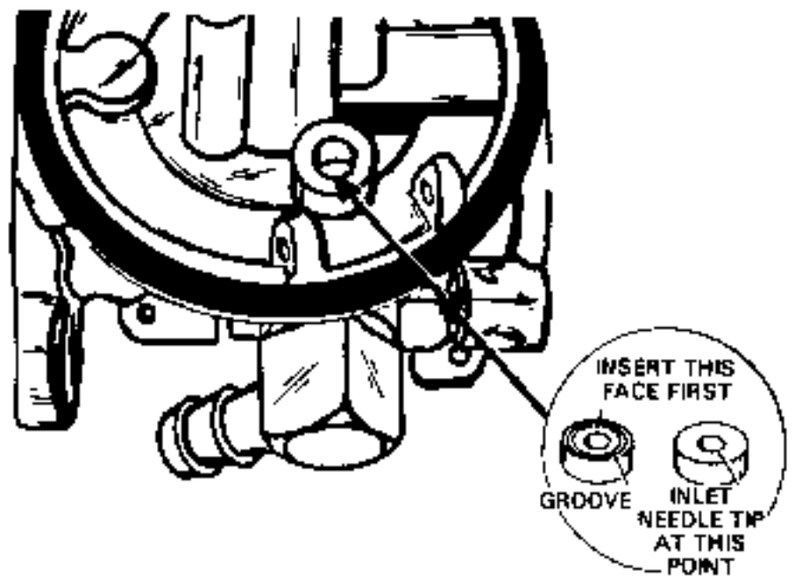


Fig. TC4—Fuel inlet needle seat must be installed with grooved side against carburetor body. Refer to text.

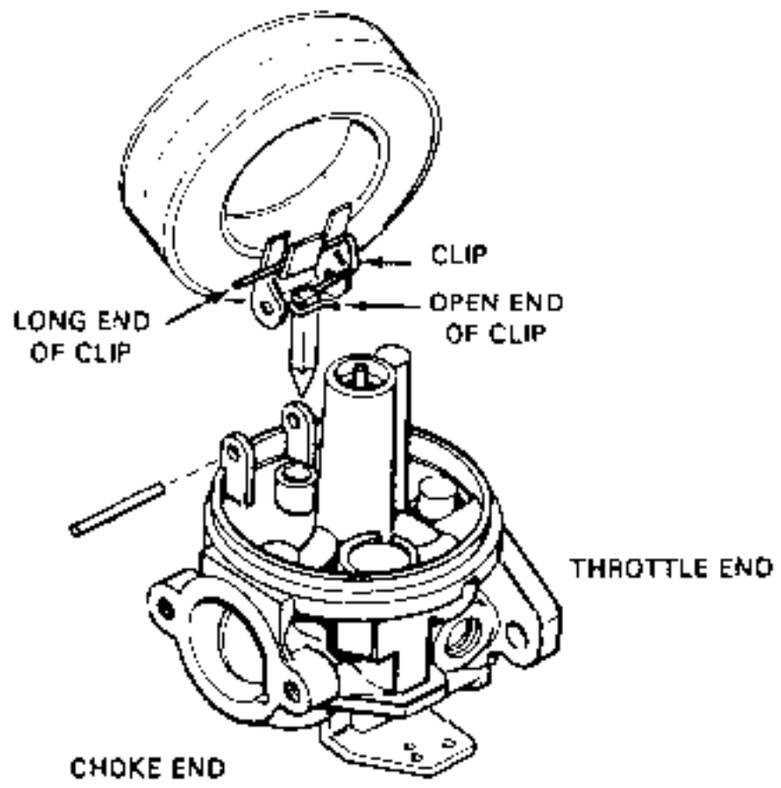


Fig. TC5—View of carburetor float assembly showing correct installation of fuel inlet needle clip.

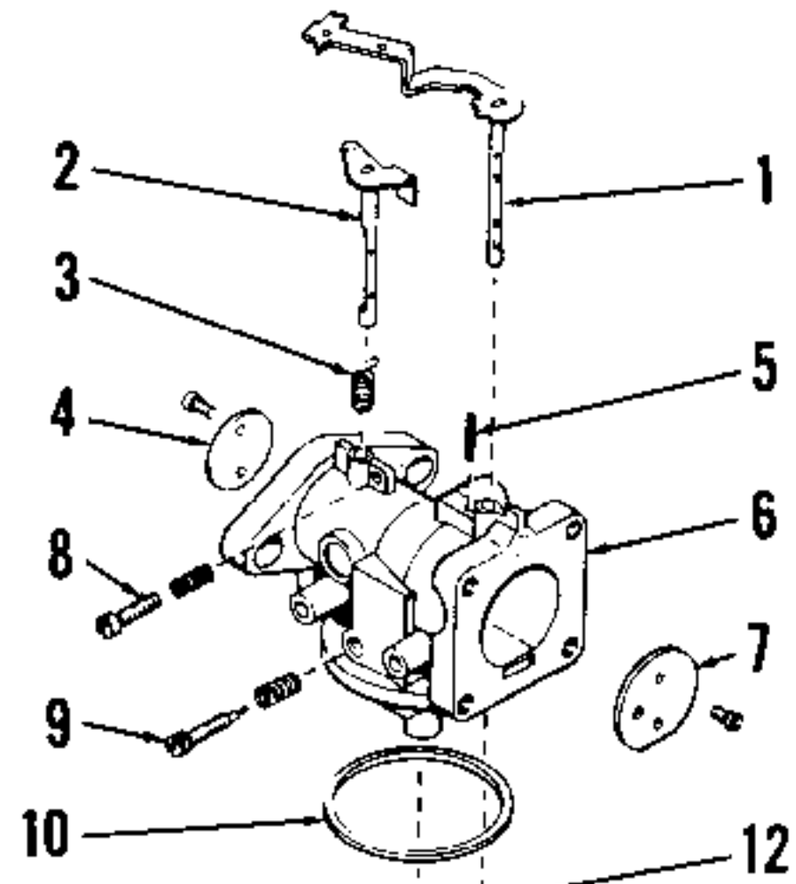


Fig. TC2—Exploded view of carburetor.

1. Choke shaft
2. Throttle shaft
3. Throttle return spring
4. Throttle plate
5. Choke stop spring
6. Carburetor body
7. Choke plate
8. Idle speed stop screw
9. Idle mixture needle
10. Bowl gasket
11. Main nozzle
12. Inlet valve seat
13. Inlet valve
14. Float spring
15. Float shaft
16. Float
17. Drain stem
18. Gasket
19. Gasket
20. Bowl
21. Spring
22. Retainer
23. Gasket
24. Bowl retainer
25. Spring
26. "O" ring
27. Main fuel adjusting needle

Fig. TC6—Float height may be adjusted using float setting tool, No. 670253A.

GOVERNOR. All models are equipped with a mechanical flyweight type governor located inside the crankcase. Governor gear, flyweights and shaft are serviced only as an assembly. If governor gear shaft is renewed, new shaft should be pressed into crankcase cover boss until exposed shaft length is $1^{23}/_{64}$ inches (34.5 mm).

To adjust external governor linkage, stop engine and loosen the screw securing governor lever (1—Fig. TC7 or Fig. TC8) and governor clamp (2). Push governor lever to fully open carburetor throttle, then turn governor clamp counterclockwise as far as it will go. While holding clamp and lever in this position, tighten screw.

On 1985 and later production OVM120 and OVXL120 engines, a governor override system is used. Linkage is shown in Fig. TC8. On these engines, high speed setting is adjusted by turning top screw

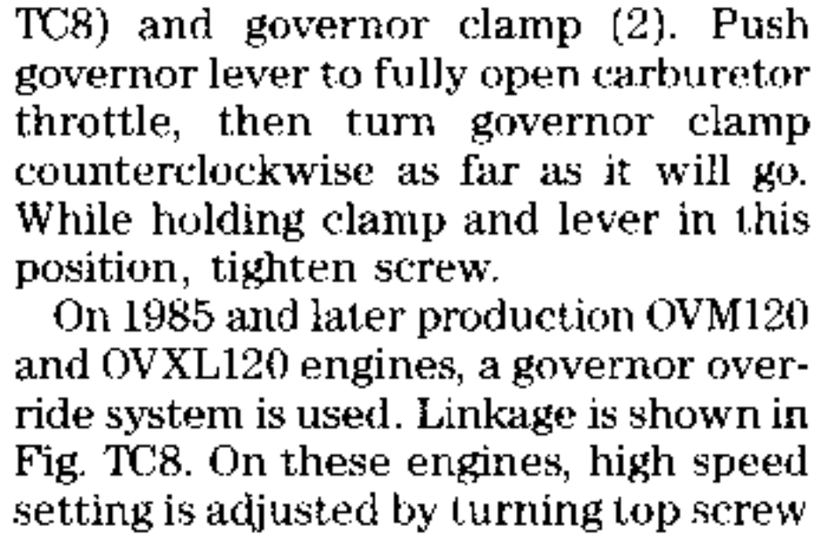
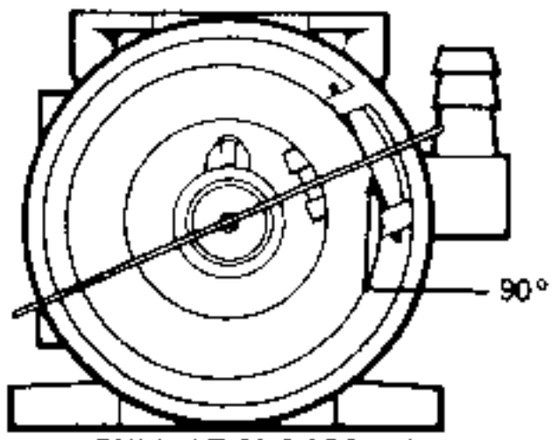
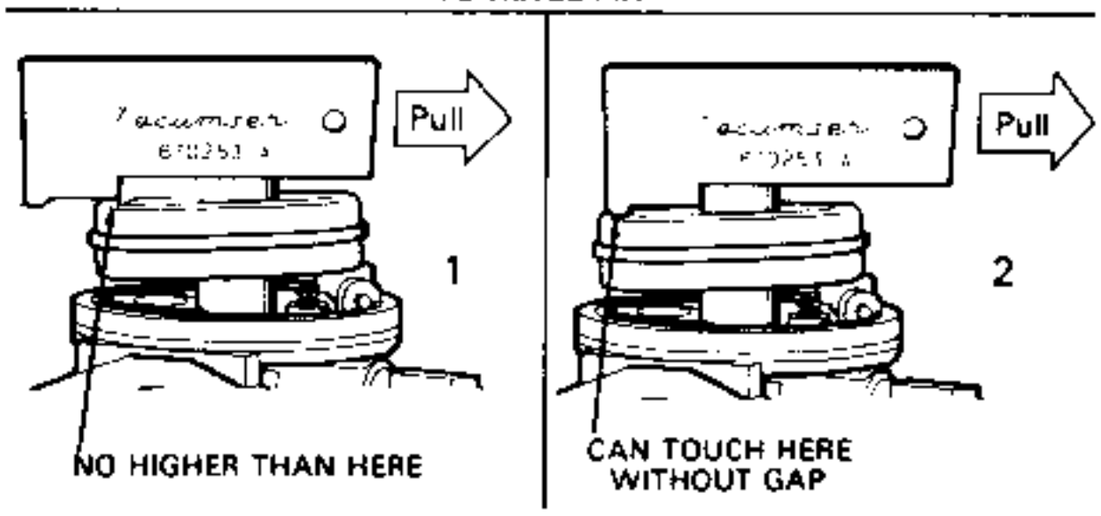


Fig. TC7—Drawing of governor external linkage typical of standard engines without governor override system. Refer to text for adjustment procedure.





(H) of override lever and low idle speed is adjusted by turning bottom screw (L).

Various types of speed controls are used. A typical panel used with remote control lever is shown in Fig. TC9. To adjust speed control panel, loosen panel mounting screws. Move speed control lever to full speed position and insert a wire through hole in panel, hole in choke actuating lever and hole in choke shaft arm. With components aligned in this manner, tighten panel mounting screws. Move control linkage to choke position, and check for 0.040-0.070 inch (1.0-1.8 mm) gap at control lever as shown in Fig. TC9. Bend choke adjusting tab if necessary. Engine idle speed may be set by turning idle speed adjusting screw. Maximum governed speed is adjusted by bending high speed adjusting lever. Bend lever away from panel to increase speed and the opposite direction to decrease speed.

IGNITION SYSTEM. A solid-state ignition system is used on all models. Ignition system has no moving parts and is considered satisfactory if a spark will jump a $^1/_8$ inch (3.2 mm) air gap when engine is cranked at 125 rpm.

Ignition module is mounted on outside of flywheel. Air gap setting between ignition module and flywheel magnets is 0.0125 inch (0.32 mm). To set air gap, loosen module mounting screws, move module as necessary and retighten screws.

VALVE ADJUSTMENT. Clearance between rocker arms and valve stem ends should be checked and adjusted with engine cold. Specified clearance is 0.002 inch (0.05 mm) for intake valve and 0.004 inch (0.10 mm) for exhaust valve.

To adjust valves, remove rocker arm cover and rotate crankshaft to position piston at top dead center (TDC) of compression stroke. Both valves should be closed and the push rods loose at this point. Use a feeler gage to measure clearance between rocker arm and valve stem as shown in Fig. TC10. Turn rocker arm locking/adjusting nut to obtain specified clearance.

LUBRICATION. A positive displacement plunger type oil pump is located in the bottom of crankcase cover. An eccentric on camshaft works the oil pump plunger back and forth in the barrel to force oil up the center of the camshaft. The pressurized oil lubricates top main bearing and top camshaft bearing. Oil is sprayed out of a hole between camshaft and main bearings to lubricate connecting rod and other internal parts.

Oil level should be checked before initial start-up and at five hour intervals. Maintain oil level at "FULL" mark on dipstick.

Recommended oil change interval is every 25 hours of normal operation. Oil should be drained when engine is warm. Manufacturer recommends using oil with API service classification SE, SF or SG. Use SAE 30 oil for temperatures above 32°F (0°C) and SAE 5W-20 or 10W-30 for temperatures below 32°F (0°C).

REPAIRS

TIGHTENING TORQUES. Recommended tightening torques are as follows:

Connecting rod bolts	200-220 in.-lbs. (22.6-24.8 N·m)
Crankcase cover	100-130 in.-lbs. (11.3-14.7 N·m)
Cylinder head bolts	180-240 in.-lbs. (20.4-27.1 N·m)
Flywheel nut	50-55 ft.-lbs. (68-74 N·m)
Intake pipe	72-96 in.-lbs. (8.2-10.8 N·m)
Rocker arm studs	170-210 in.-lbs. (19.2-23.7 N·m)
Rocker cover	15-20 in.-lbs. (1.7-2.2 N·m)
Spark plug	220-280 in.-lbs. (24.9-31.6 N·m)

CYLINDER HEAD. Always allow engine to cool completely before loosening cylinder head bolts. To remove cylinder head, first locate piston at top dead center of compression stroke. Remove rocker arm adjusting nuts (1—Fig. TC11), bearing (2) and rocker arms (3).

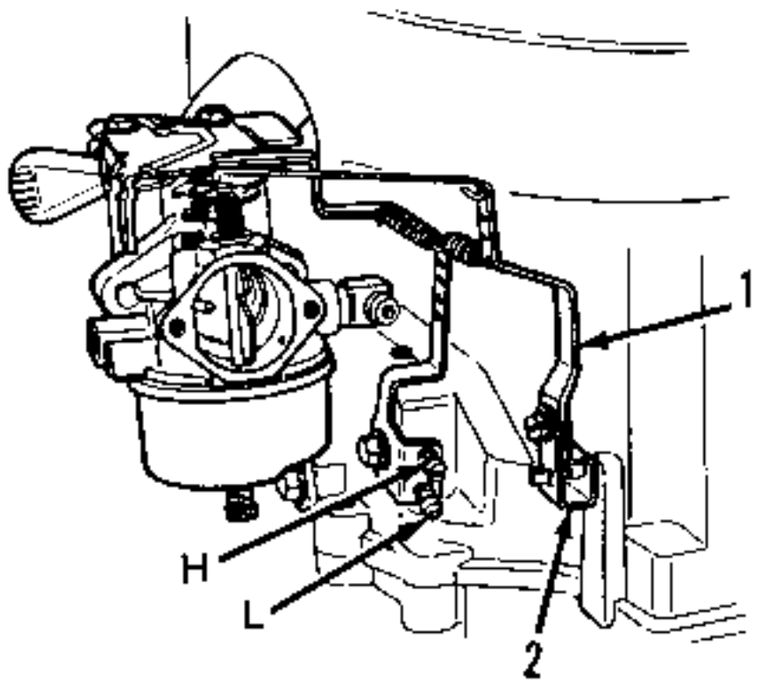


Fig. TC8—Drawing of governor external linkage typical of engines equipped with governor override system. Refer to text for adjustment procedure.

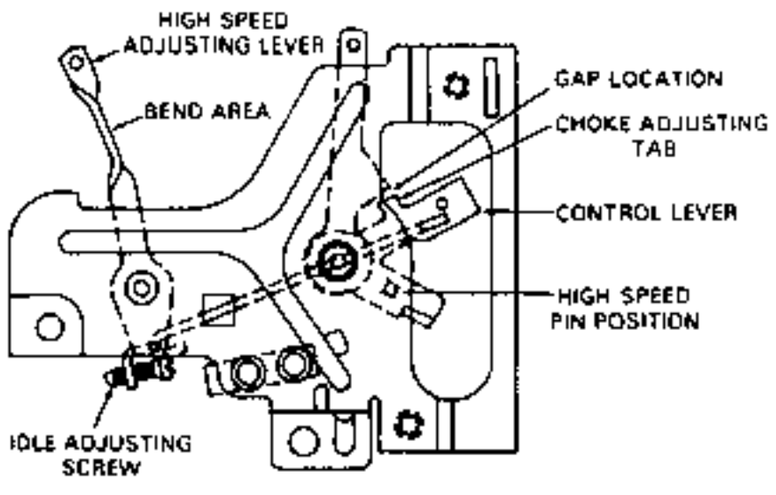


Fig. TC9—Drawing of typical speed control plate used on engines equipped with remote control linkage.

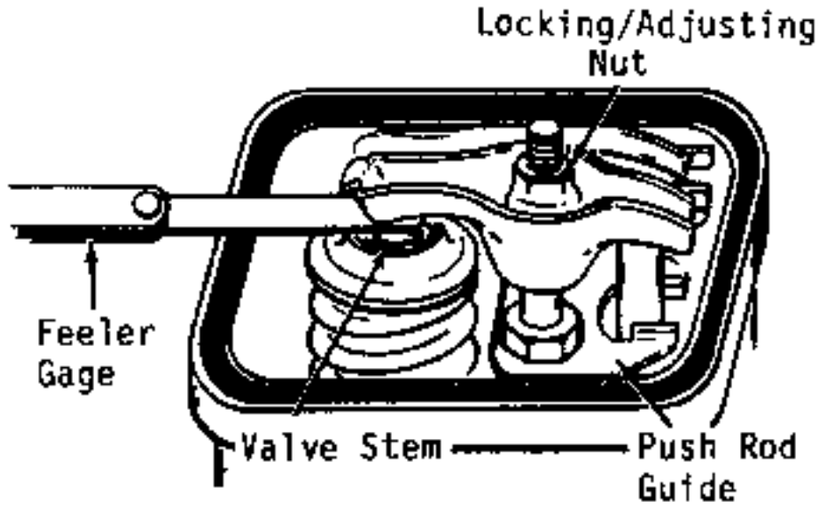
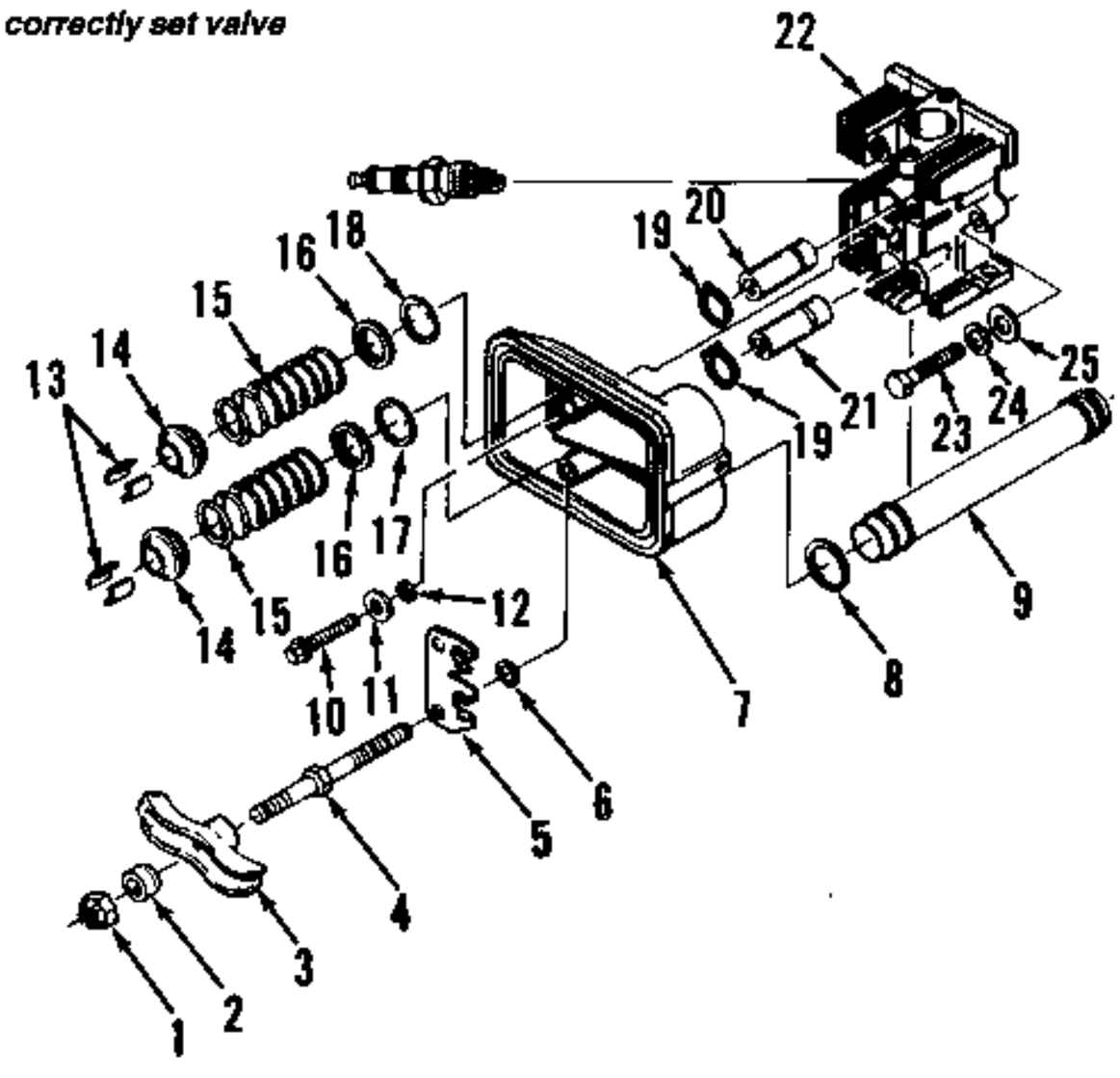


Fig. TC10—Use a feeler gage to correctly set valve clearance.

Fig. TC11—Exploded view of cylinder head assembly.

1. Adjusting nut
2. Rocker arm bearing
3. Rocker arm
4. Rocker arm stud
5. Push rod guide
6. "O" ring
7. Rocker arm housing
8. "O" ring
9. Push rod tube
10. Cap screw
11. Washer
12. "O" ring
13. Split retainers
14. Spring cap
15. Valve springs
16. Spring seats
17. "O" ring (white)
18. "O" ring (black)
19. Snap rings
20. Valve guide (intake)
21. Valve guide (exhaust)
22. Cylinder head
23. Head bolt
24. Belleville washer
25. Flat washer



Depress valve spring caps (14) and remove split retainers (13), caps, springs (15), spring seats (16) and "O" rings (17) and (18). Note that a white Teflon "O" ring (17) is used on exhaust valve guide and a black rubber "O" ring (18) is used on intake valve guide. Remove rocker arm studs (4), push rod guide (5) and rocker arm housing retaining screw (10) and withdraw rocker arm housing (7). Remove cylinder head mounting bolts and remove cylinder head (22) and valves. Remove valves from cylinder head.

Thoroughly clean cylinder head and inspect for cracks or other damage. Position cylinder head on a flat plate and use a feeler gage to check flatness of head gasket sealing surface. Renew cylinder head if necessary.

Use a new head gasket when installing cylinder head. Install Belleville washer on cylinder head bolt with crown up toward bolt head, then install flat washer (Fig. TC12). The two 1⅜ inch (34.9 mm) long head bolts go in positions marked "1" and "5" in Fig. TC13. Tighten head bolts in 60 in.-lbs. (6.8 N·m) increments following sequence shown in Fig. TC13 until specified torque is obtained.

When installing valve guide seals, be sure that white Teflon "O" ring (17—Fig. TC11) is installed on exhaust valve guide (guide is bronze in color) and black "O" ring (18) is installed on intake valve guide (guide is silver in color). Switching the position of "O" rings may result in improper sealing and possible engine damage. Be sure to install new "O" rings on push rod tube (9) and underneath push rod guide (5) and retaining screw (10).

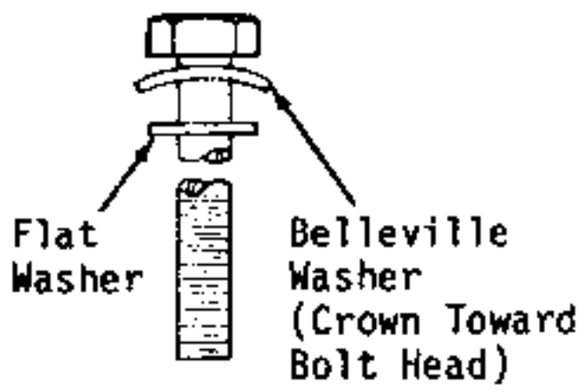


Fig. TC12—Belleville washer is installed on head bolt with crown toward bolt head, then install flat washer with sharp edge toward bolt head.

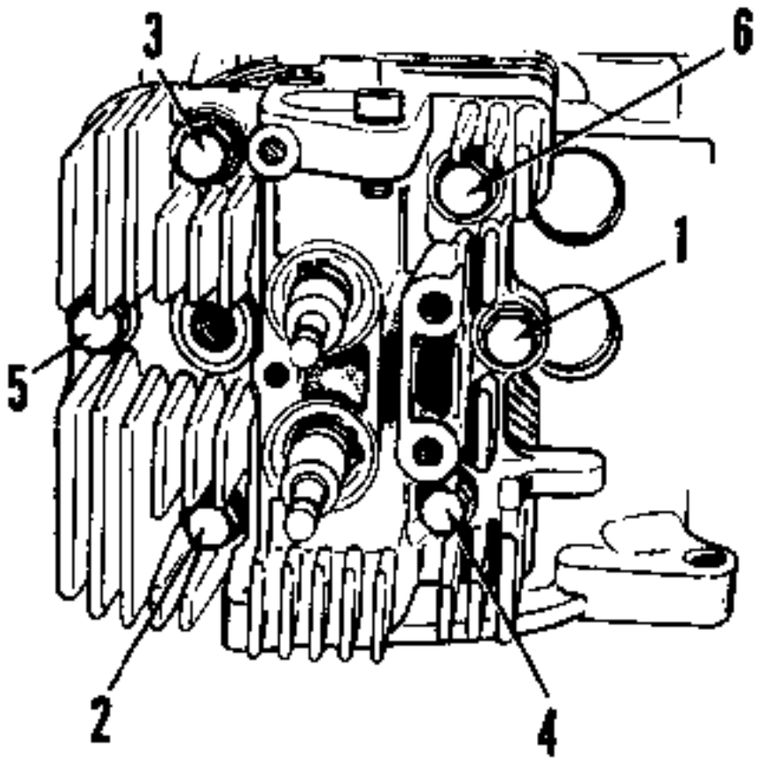


Fig. TC13—Cylinder head bolts should be loosened and tightened following the sequence shown. The two 1-3/8 inch (34.9 mm) long bolts are installed in positions "1" and "5."

To install valve springs, valves must be raised and held on their seats. One way to do this is to insert a piece of rubber fuel line through intake and exhaust ports and wedge each end of the hose on opposite sides of the valve stem. Install valve springs with dampening coils (coils closer together) toward cylinder head. Place spring retainer on spring, use suitable tool to compress valve spring and install split retainer.

NOTE: Anytime rocker arm housing assembly is removed from engine, new rocker arm locking/adjusting nuts and rocker arm cover screws should be installed.

Tighten rocker arm studs (4) to 170-210 in.-lbs. (19.2-23.7 N·m). Install rocker arms and adjust valve clearance as outlined in MAINTENANCE section.

VALVE SYSTEM. Valve seats are machined directly in the cylinder head. Seats should be cut at a 46 degree angle and valve faces cut or ground at a 45 degree angle. Valve seat width should be 3/64 inch (1.2 mm). The recommended procedure to cut the valve seats is as follows: First, use a 60 degree cutter to narrow seat from bottom toward the center. Second, use a 30 degree cutter to narrow seat from top toward the center. Then, use 46 degree cutter to cut seat to desired width.

Clean all combustion deposits from valves. Renew valves that are burned, excessively pitted, warped or if valve head margin after grinding is less than 1/32 inch (0.8 mm). Valves should be lapped to their seats using fine lapping compound.

Valve spring free length should be 1.980 inches (50.29 mm). It is recommended that valve springs be renewed when engine is overhauled. The valve spring dampening coils are coils wound closer together at one end than the other. The end with closer coils should be installed against cylinder head.

Standard valve guide inside diameter is 0.312-0.313 inch (7.93-7.95 mm). Guides may be reamed to 0.343-0.344 inch (8.71-8.74 mm) for use with oversize valve stems.

To renew valve guides, submerge cylinder head in a large pan of oil. Heat on a hot plate to temperature of 375°-400°F (190°-205°C) for about 20 minutes. Remove cylinder head from the oil and use an arbor press and ½ inch (13 mm) driver to push valve guides out top side of cylinder head. Make certain that driver does not contact and damage head as guide is removed.

To install new guides, place replacement guides in a freezer or on ice for minimum of 30 minutes prior to installation. Heat head in a pan of oil as previously outlined. Install locating snap rings on new guides, then press guides into cylinder head from the top until snap rings contact surface of head. Make certain that silver colored guide is installed in intake side and brass colored guide is installed in exhaust side. Allow cylinder head to cool, then reface both valve seats to ensure that they are concentric with valve guides.

CONNECTING ROD. Piston and connecting rod are removed as an assembly as follows: Remove all cooling shrouds. Remove rocker arm cover and cylinder head as previously outlined. Drain oil and remove oil pan (crankcase base). Remove connecting rod cap. Remove carbon or ring ridge (if present) from top of cylinder before removing piston. Push the connecting rod and piston out top of cylinder.

Connecting rod rides directly on crankshaft crankpin. Inside diameter of connecting rod bearing bore at crankshaft end should be 1.3760-1.3765 inches (34.950-34.963 mm) on Model OVM120 and 1.3775-1.3780 inches (34.989-35.001 mm) on Models OVXL120, OVXL125 and OVXL/C125.

Piston must be assembled on connecting rod so arrow on top of piston will be pointing toward push rod side of engine and match marks on connecting rod and cap will face outward when installed in engine. Tighten connecting rod cap bolts evenly to specified torque.

PISTON, PIN AND RINGS. Piston and connecting rod are removed as an assembly. Refer to CONNECTING ROD section for removal procedure.

Standard piston skirt diameter, measured at bottom of skirt 90 degrees from piston pin bore, is 3.309-3.311 inches (84.05-84.09 mm) for all models. Specified clearance between piston skirt and cylinder wall is 0.0012-0.0032 inch (0.031-0.081 mm). Oversize pistons are available. Oversize piston size should be stamped on top of piston.

To check piston ring grooves for wear, clean carbon from ring grooves and install new rings in grooves. Use a feeler gage to measure side clearance between ring land and ring. Specified side clearance is 0.0015-0.0035 inch (0.038-0.089 mm) for compression rings and 0.001-0.004 inch (0.025-0.102 mm) for oil control ring. Renew piston if ring side clearance is excessive.

Ring end gap should be 0.010-0.020 inch (0.25-0.51 mm) for all rings.

Rings must be installed on piston as shown in Fig. TC14. Stagger ring end gaps around piston. Lubricate piston and cylinder with engine oil prior to installing piston. Be sure that arrow on top of piston points toward push rod side of engine and match marks on connecting rod and cap are toward open side of crankcase after installation.

CYLINDER AND CRANKCASE. A cast iron liner is permanently cast into the aluminum alloy cylinder and crankcase assembly. Standard piston bore inside diameter is 3.312-3.313 inches (84.125-84.150 mm). If cylinder taper or out-of-round exceeds 0.004 inch (0.10 mm), cylinder should be bored to nearest oversize for which piston and rings are available.

CRANKSHAFT, MAIN BEARINGS AND SEALS. To remove crankshaft, first remove all shrouds. Remove flywheel. Remove connecting rod and piston as previously outlined. Remove balancer gear and shaft assembly. Remove balancer drive gear from crankshaft. Position engine so tappets fall away from camshaft, then withdraw camshaft from cylinder block and remove crankshaft.

Crankshaft is supported at each end in renewable steel backed bronze bushing type main bearings on Models OVM120, OVXL125 and OVXL/C125. On other models, main bearings are integral part of crankcase and crankcase base plate. On all models, main bearing inside diameter should be 1.3765-1.3770 inches (34.963-34.976 mm).

Standard crankshaft main journal diameter is 1.3745-1.3750 inches (34.912-34.925 mm) for each end. Standard crankpin journal diameter is 1.3740-1.3745 inches (34.900-34.912 mm).

Crankshaft end play should be 0.001-0.004 inch (0.025-0.10 mm) and is controlled by varying thickness of thrust washers between crankshaft and crankcase base plate (oil pan).

When renewing crankshaft oil seals, note if old seal is raised or flush with outer surface of crankcase or crankcase base and install new seal to same dimension. Attempting to install seal too far into casting bore may damage seal or engine. Use suitable installing tool to install new seal until it is lightly seated in casting bore.

When installing crankshaft, align timing mark on crankshaft gear with timing mark on camshaft gear to ensure correct valve timing. See Fig. TC15. With piston at top dead center, install counterbalance gear assembly and crankshaft balancer drive gear with timing marks (arrow) on gears facing each other as shown in Fig. TC16. Install oil pump and crankcase base plate. Apply Loctite 242 to threads of base plate cap screws and tighten to 100-130 in.-lbs. (11.3-14.7 N·m).

ULTRA-BALANCE SYSTEM. All models are equipped with Tecumseh's Ultra-Balance system which consists of a single counterbalance shaft driven by a gear on the crankshaft (Fig. TC17).

To correctly time the balancer shaft and the crankshaft during installation, position piston at top dead center and insert the counterbalance shaft into its boss in the crankcase with arrow on counterbalance gear pointing toward crankshaft. Slide drive gear onto the crankshaft, making certain the drive gear is secured in its keyway and that the arrow on the drive gear is aligned with the arrow on counterbalance shaft gear (Fig. TC16).

CAMSHAFT. Camshaft and camshaft gear are an integral part which may be removed from engine after removing the rocker arms, push rods and crankcase base plate (oil pan). Identify position of tappets as they are removed so they can be reinstalled in original position if reused.

Camshaft bearings are an integral part of crankcase and crankcase plate. Camshaft journal diameter should be 0.6235-0.6240 inch (15.84-15.85 mm). Camshaft bearing inside diameter should be 0.6245-0.6255 inch (15.86-15.89 mm). Clearance between camshaft journal and camshaft bearing should not exceed 0.003 inch (0.08 mm). Inspect camshaft lobes for pitting, scratches or excessive wear and renew as necessary. Tappets should be renewed whenever a new camshaft is installed.

Camshaft is equipped with a compression release mechanism (Fig. TC18) to aid starting. Compression release mechanism parts should work freely with no binding or sticking. Parts are not serviced separately from camshaft.

When installing camshaft, be sure that timing marks on camshaft gear and crankshaft gear are aligned as shown in Fig. TC15.

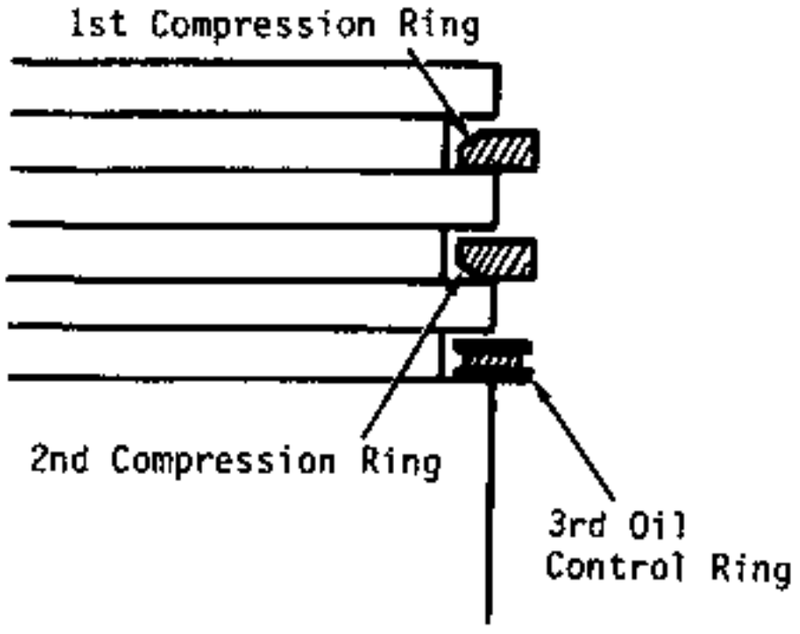


Fig. TC14—Piston rings must be installed on piston so chamfered edge of top ring is facing up and chamfered edge of second ring is facing down.

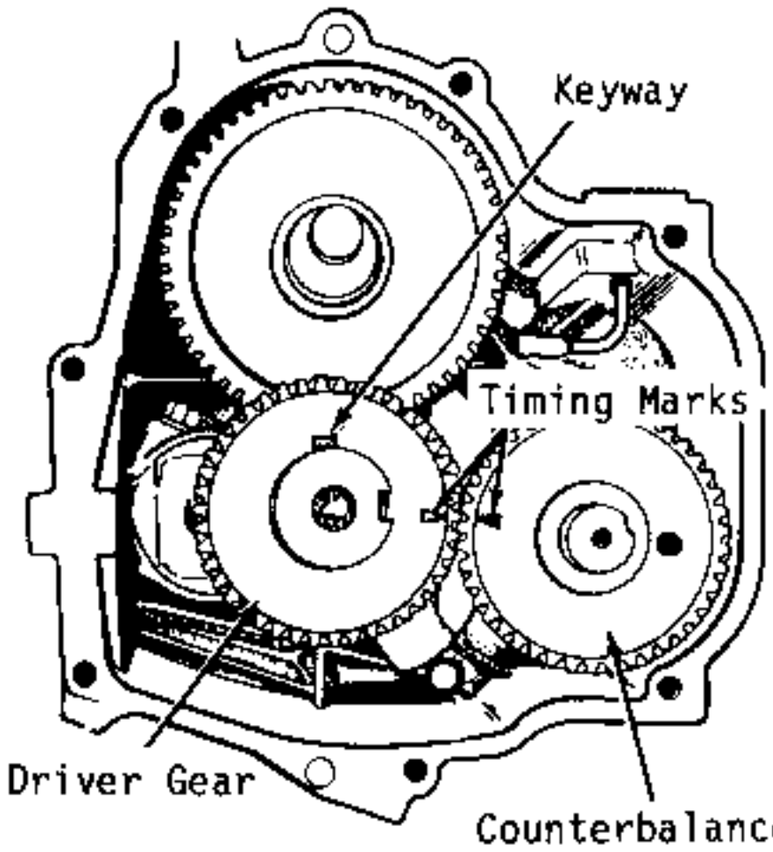


Fig. TC16—Counterbalance gear and drive gear timing marks must be aligned after installation.

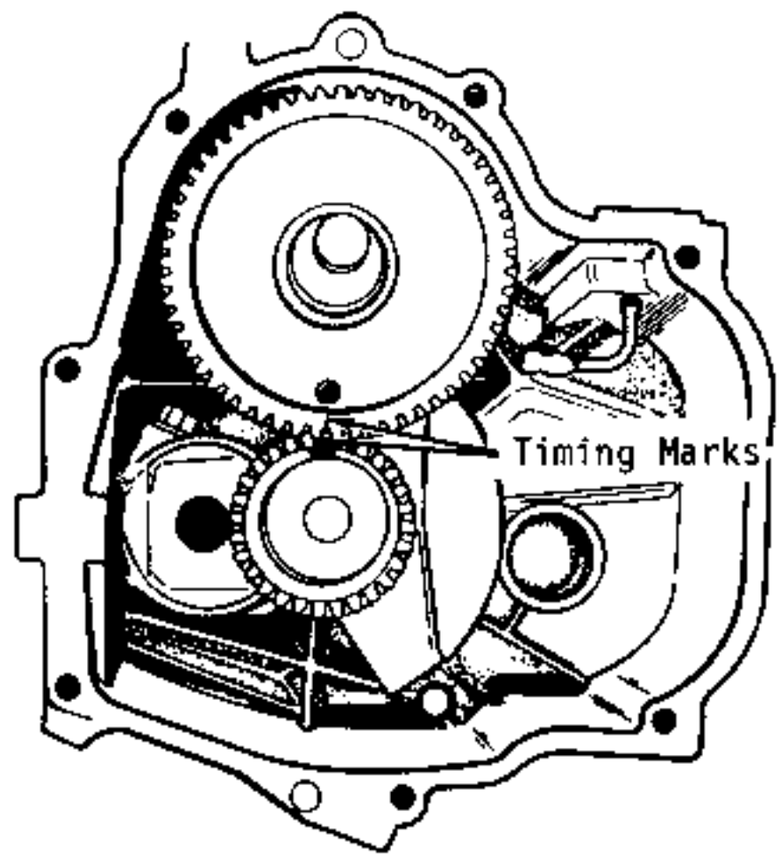


Fig. TC15—Camshaft and crankshaft timing marks must be aligned after installation for proper valve timing.

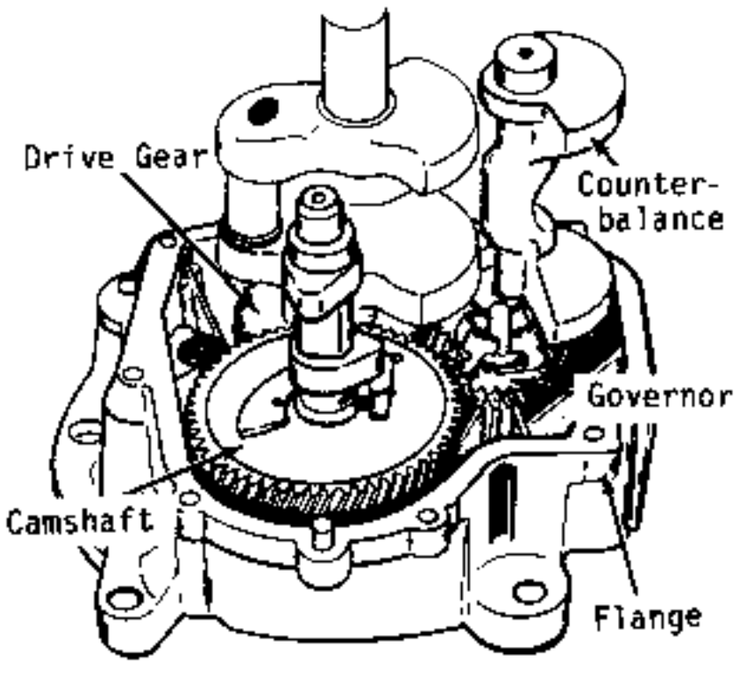


Fig. TC17—View of relative position of camshaft, crankshaft and counterbalance shaft in crankcase base plate (oil pan).

OIL PUMP. All models are equipped with a positive displacement oil pump. Oil pump is located in crankcase base plate (oil pan) and is driven by an eccentric on camshaft.

When installing oil pump, be sure that chamfered side of pump faces the camshaft, and that plunger ball seats in recess in base plate.

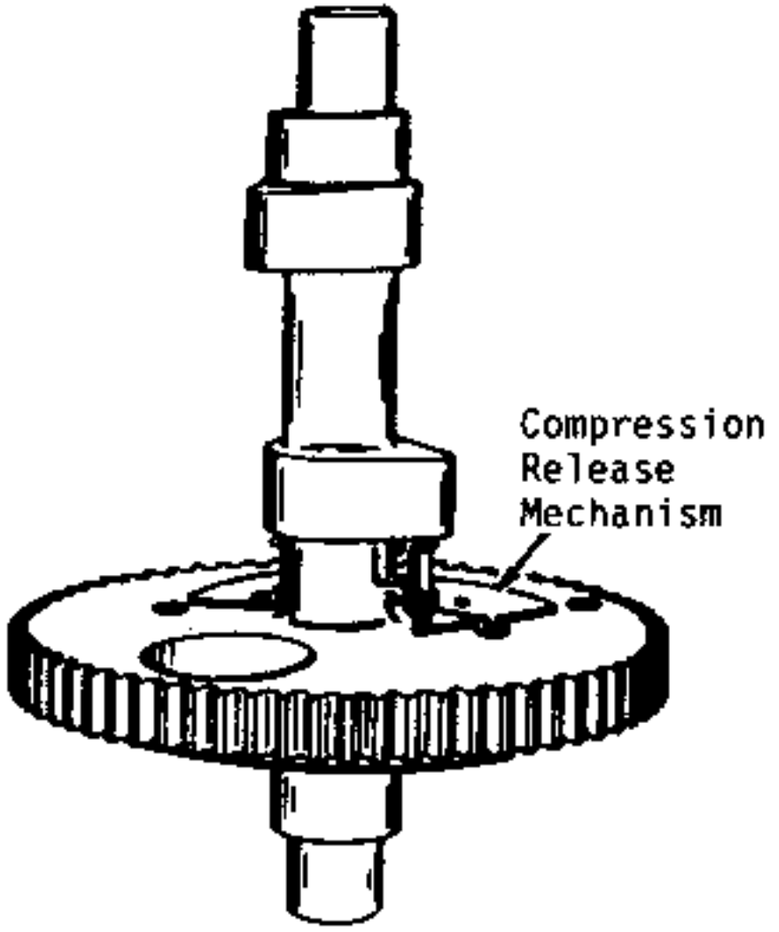


Fig. TC18—Camshaft is equipped with a compression release mechanism.

TECUMSEH

SERVICING TECUMSEH ACCESSORIES

12 VOLT STARTING AND CHARGING SYSTEMS

Some Tecumseh engines may be equipped with 12-volt electrical systems. Refer to the following paragraphs for servicing Tecumseh electrical units and 12-volt Delco-Remy starter-generator used on some models.

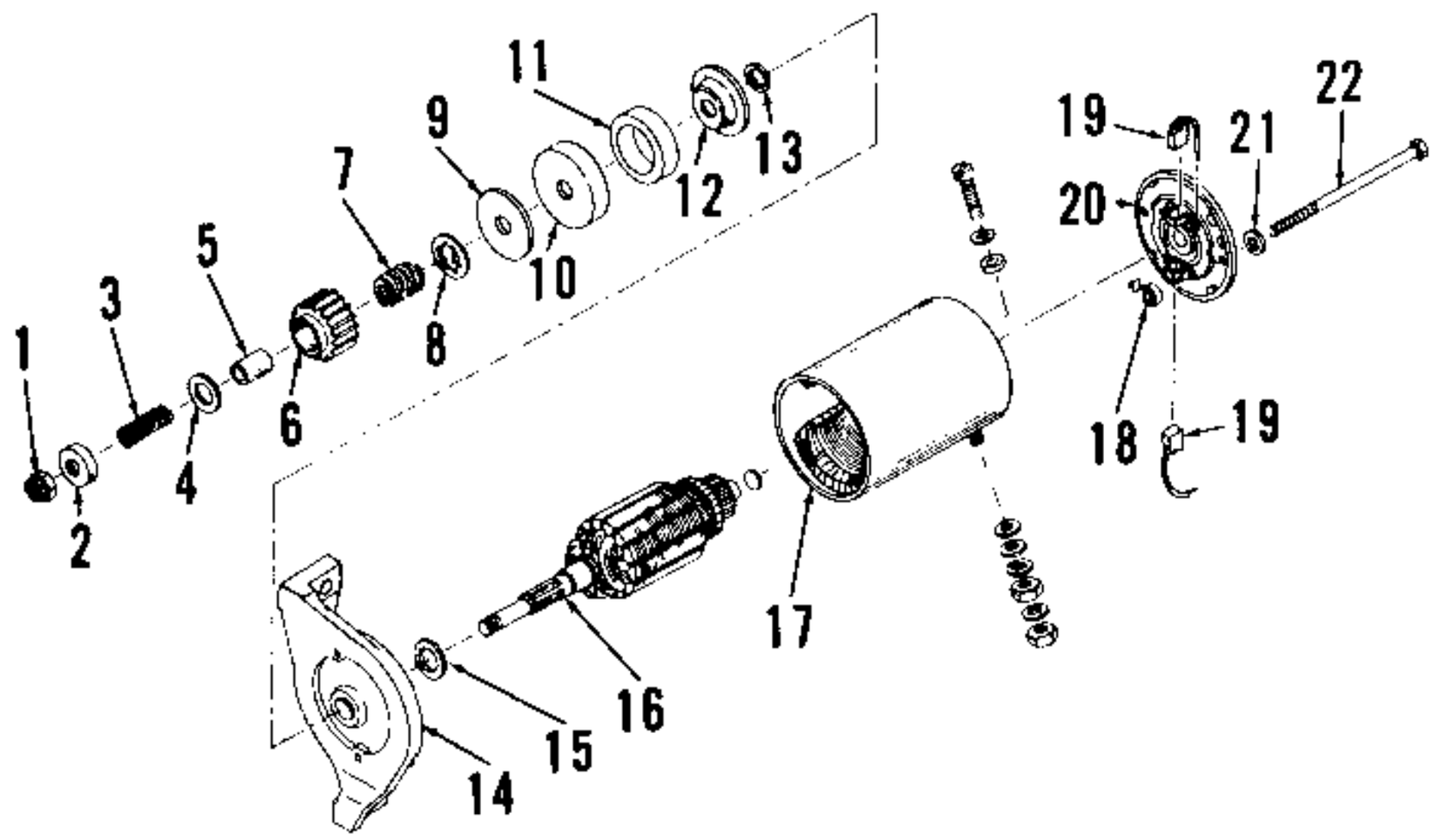


Fig. T85—Exploded view of 12-volt starter motor Model No. 32817. Other starter motors are similar except as shown in Fig. T86. Spacer (15) is available in different thicknesses to adjust armature end play.

1. Nut
2. Pinion stop
3. Spring
4. Washer
5. Anti-drift sleeve
6. Pinion gear
7. Screw shaft
8. Stop washer
9. Thrust washer
10. Cushion cup
11. Rubber cushion
12. Thrust washer
13. Thrust bushing
14. Drive end cap
15. Spacer washer
16. Armature
17. Frame & field coil assy.
18. Brush spring
19. Brushes
20. End cap
21. Washer
22. Bolt

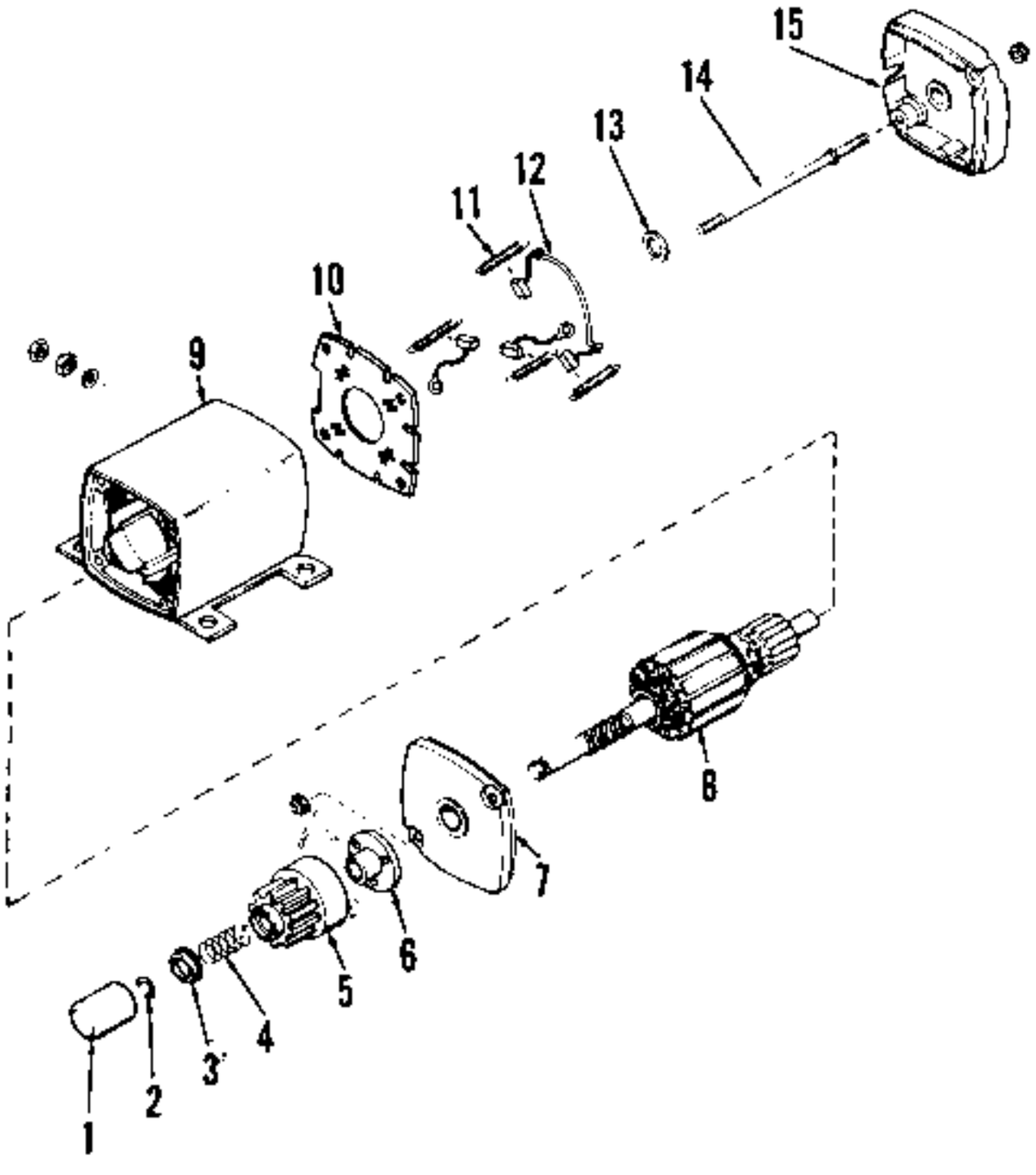


Fig. T86—Exploded view of 12-volt starter motor used on some models.

1. Dust cover
2. Snap ring
3. Spring retainer
4. Anti-drift spring
5. Gear
6. Engaging nut
7. Drive end plate
8. Armature
9. Frame & field coil assy.
10. Brush card
11. Brush spring
12. Brushes
13. Thrust washer
14. Through-bolts
15. Commutator end plate

12-VOLT STARTER MOTOR (BENDIX DRIVE TYPE). Refer to Fig. T85 or T86 for exploded view of 12-volt starter motor and Bendix drive unit used on some engines. To identify starter, refer to service number stamped on end cap.

When assembling starter motor in Fig. T85, use spacers (15) of varying thicknesses to obtain an armature end play of 0.005-0.015 inch (0.127-0.381 mm). Tighten armature nut (1) to 100 in.-lbs. (11.3 N·m) on motor numbers 29965, 32468, 32468A, 32468B and 33202, to 130-150 in.-lbs. (14.7-16.9 N·m) on motor number 32510 and to 170-220 in.-lbs. (19.2-24.8 N·m) on motor number 32817. Tighten through-bolts to 30-35 in.-lbs. (3.4-3.9 N·m) on motor numbers 29965, 32468 and 32468A, to 35-44 in.-lbs. (3.9-5.0 N·m) on motor number 32817 and to 45-50 in.-lbs. (5.0-5.6 N·m) on motor number 32510.

To perform no-load test for starter motors 29965, 32468 and 32468A, use a fully charged 6-volt battery. Maximum current draw should not exceed 25 amps at 6 volts. Minimum rpm is 6500.

No-load test for Models 32468B and 33202 requires a fully charged 12-volt battery. Maximum current draw should not exceed 25 amps at 11.8 volts. Minimum rpm is 8000.

No-load test for starter motors 32510 and 32817 must be performed with a 12-volt battery. Maximum current draw should not exceed 25 amps at 11.5 volts. Minimum rpm is 8000.

Disassembly and reassembly of starter motors 33605, 33606 and 33835 is evident after inspection of unit and referral to Fig. T86. Note that stops on through-bolts (14) are used to secure brush card (10) in housing (9).

Through-bolts must be installed with stops toward end cover (15).

Maximum current draw with starter on engine should not exceed 55 amps at a minimum of 850 rpm for starters 33605 and 33606 or 70 amps at a minimum of 600 rpm for starter 33835. Cranking test should not exceed 10 seconds.

ALTERNATOR CHARGING SYSTEMS. Flywheel alternators are used on some engines for the charging system. The generated alternating current is converted to direct current by two rectifiers on rectifier panel (Figs. T87 and T88) or regulator-rectifier (Fig. T89).

The system shown in Fig. T87 has a maximum charging output of about 3 amps at 3600 rpm. No current regulator is used on this low output system. The rectifier panel includes two diodes (rectifiers) and a 6 amp fuse for overload protection.

The system shown in Fig. T88 has a maximum output of 7 amps. To prevent overcharging battery, a double pole switch is used in low output position to reduce output to 3 amps for charging battery. Move switch to high output position (7 amps) when using accessories.

The system shown in Fig. T89 has a maximum output of 7 amps on engine of 7 hp; 10 or 20 amps on engines of 8 hp and larger. This system uses a solid state regulator-rectifier which converts generated alternating current to direct current for charging the battery. The regulator-rectifier also allows only required amount of current flow for existing battery conditions. When battery is fully charged, current output is decreased to prevent overcharging battery.

TESTING. On models equipped with rectifier panel (Figs. T87 or T88), remove rectifiers and test them with either a continuity light or an ohmmeter. Rectifiers should show current flow in one direction only. Alternator output can be checked using an induction ampere meter over positive lead wire to battery.

On models equipped with regulator-rectifier (Fig. T89), check system as follows: Disconnect B+ lead and connect a DC voltmeter as shown in Fig. T90. With engine running near full throttle, voltage should be 14.0-14.7. If voltage is above 14.7 or below 14.0 but above 0, regulator-rectifier is defective. If voltmeter reading is 0, regulator-rectifier or alternator coils may be defective. To test alternator coils, connect an AC voltmeter to AC leads as shown in Fig. T91. With engine running at near full throttle, check AC voltage.

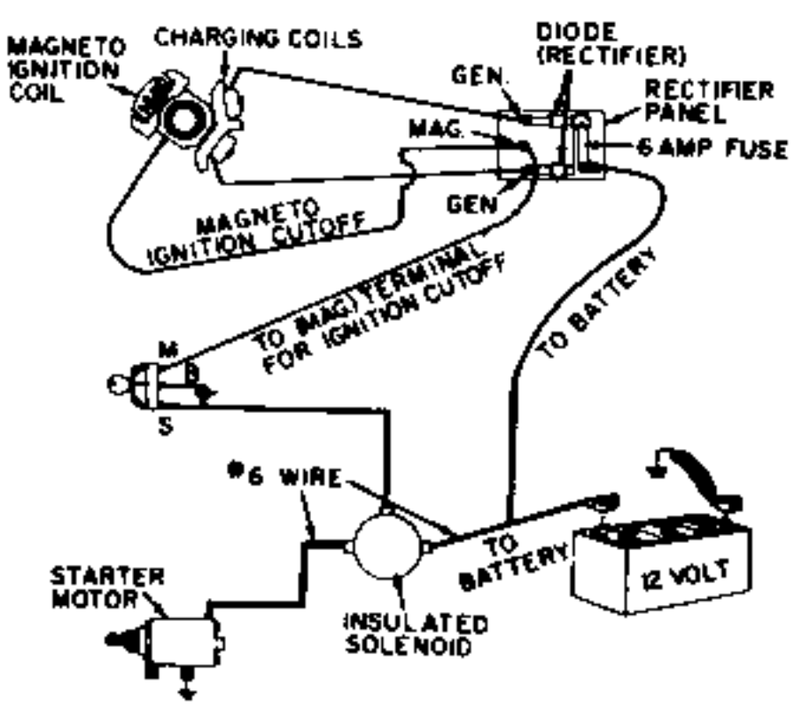


Fig. T87 — Wiring diagram of typical 3 amp alternator and rectifier panel charging system.

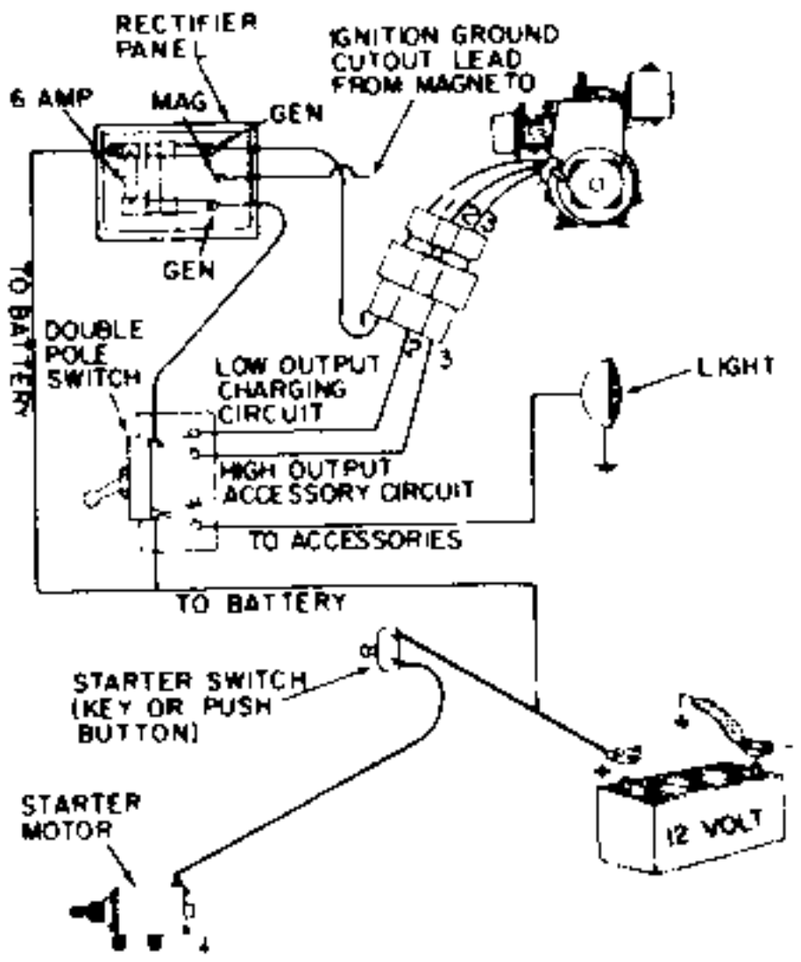


Fig. T88 — Wiring diagram of typical 7 amp alternator and rectifier panel charging system. The double pole switch in one position reduces output to 3 amps for charging or increases output to 7 amps in other position to operate accessories.

If voltage is less than 20.0 volts, alternator is defective.

MOTOR-GENERATOR. The combination motor-generator (Fig. T92) functions as a cranking motor when starting switch is closed. When engine is operating and starting switch is open, unit operates as a generator. Generator output and circuit voltage for battery and various accessories are controlled by current-voltage regulator.

To determine cause of abnormal operation, motor-generator should be given a "no-load" test or a "generator output" test. The generator output test can be performed with a motor-generator on or off the engine. The no-load test must be made with motor-generator removed from engine.

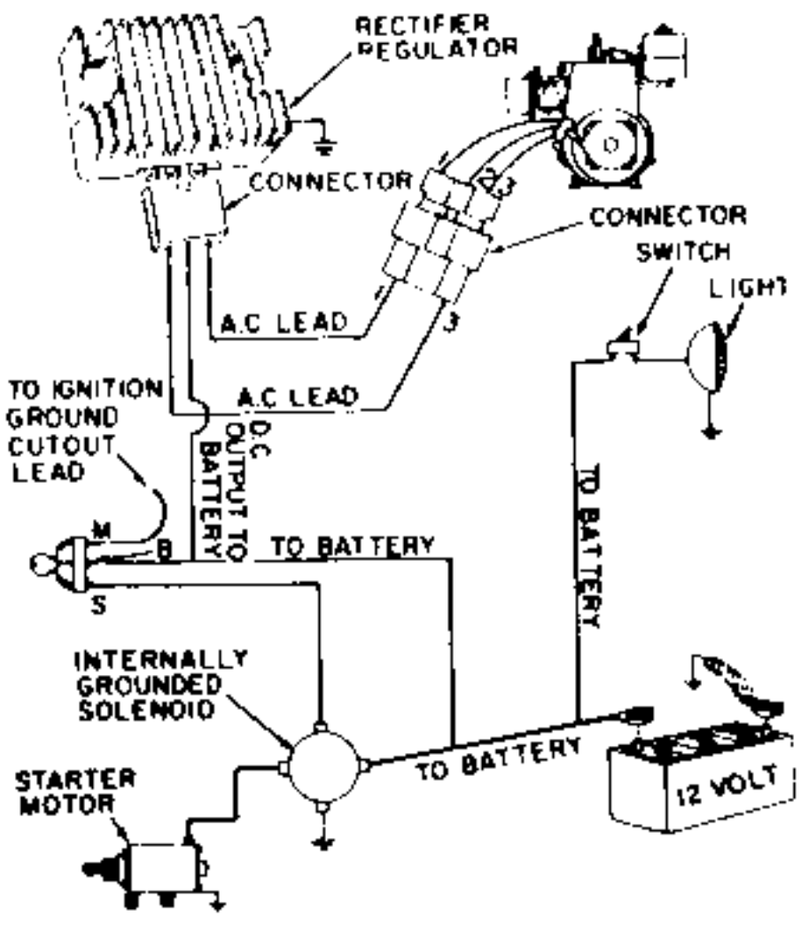


Fig. T89 — Wiring diagram of typical 7, 10 or 20 amp alternator and regulator-rectifier charging system.

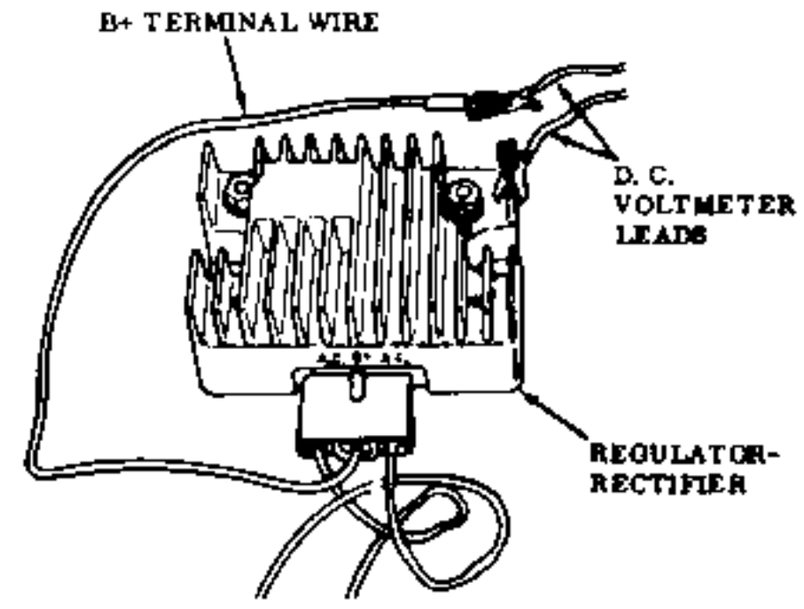


Fig. T90 — Connect DC voltmeter as shown when checking regulator-rectifier.

Motor-generator test specifications are as follows:

Motor-Generator Delco-Remy No. 1101980

Brush spring tension	24-32 oz. (680-900g)
Field draw,	
Amperes	1.52-1.62
Volts	12
Cold output,	
Amperes	12
Volts	14
Rpm	4950
No-load test,	
Amperes (max.)	18
Volts	11
Rpm (min.)	2500
Rpm (max.)	2900

CURRENT-VOLTAGE REGULATORS. Two types of current-voltage regulators are used with motor-generator system. One is a low output unit which delivers a maximum of 7 amps. The high output unit delivers a maximum of 14 amps.

The low output (7 amp) unit is identified by its four connecting terminals (three on one side of unit and one on underside of regulator). The battery ignition coil has a 3 amp draw. This leaves a maximum load of 4 amps which may be used on accessory lead.

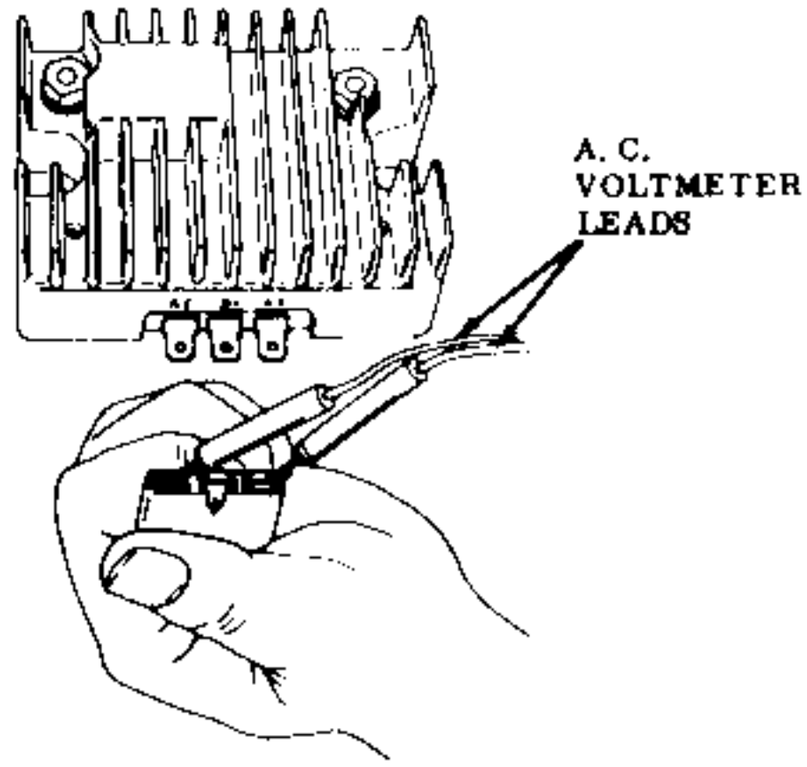


Fig. T91 — Connect AC voltmeter to AC leads as shown when checking alternator coils.

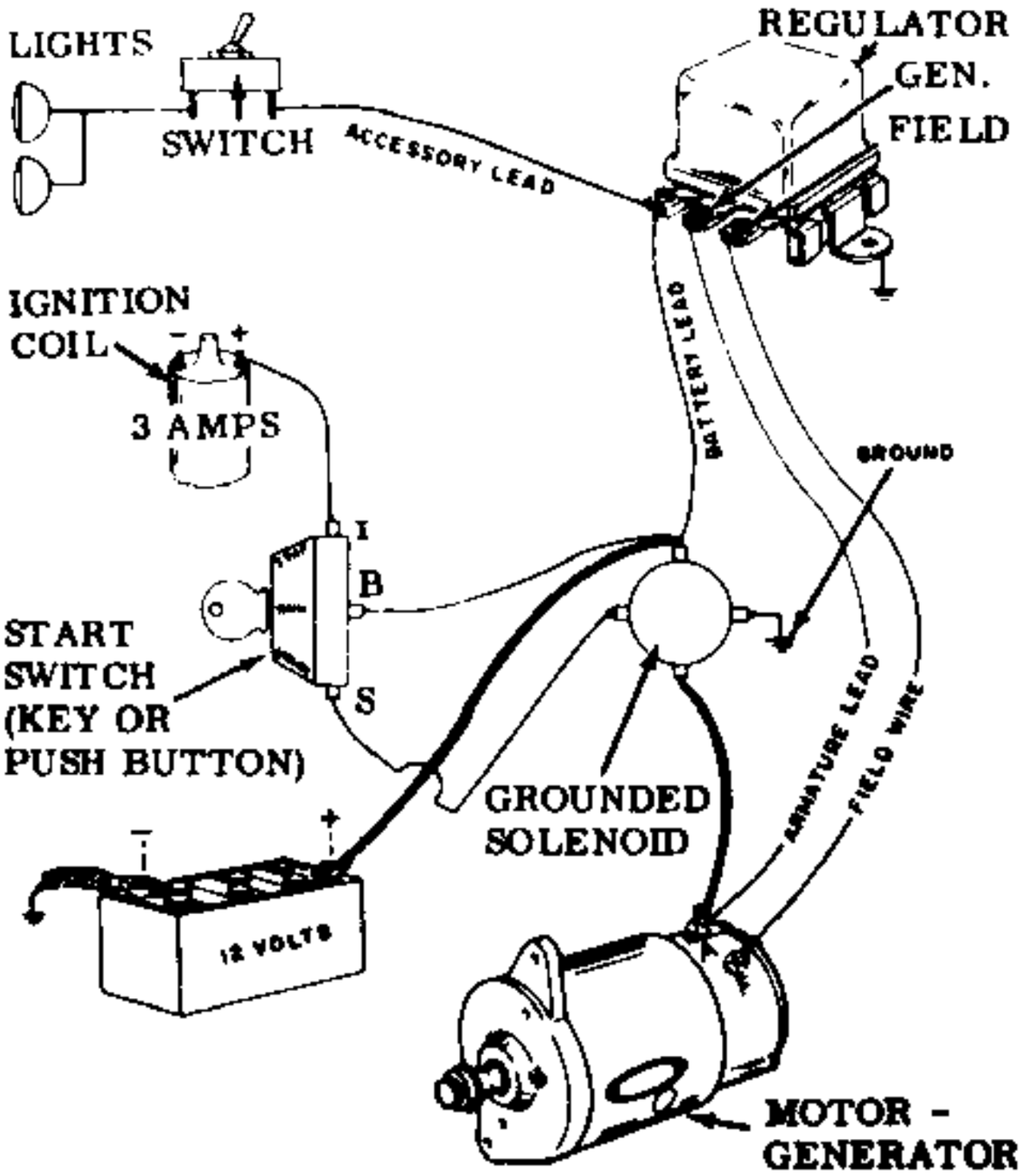


Fig. T92 — Wiring diagram of typical 14 amp output current-regulator and motor-generator system. The 7 amp output system is similar.

The high output (14 amp) unit has only three connecting terminals (all on side of unit). So with a 3 amp draw for battery ignition coil, a maximum of 11 amps can be used for accessories.

Regulator service test specifications are as follows:

Regulator Delco-Remy No. 1118988 (7 amp)

Ground polarity ..... Negative
Cut-out relay,
- Air gap ..... 0.020 in. (0.5 mm)
- Point gap ..... 0.020 in. (0.5 mm)
- Closing voltage, range 11.8-14.0
- Adjust to 12.8

Voltage regulator,
- Air gap ..... 0.075 in. (1.9 mm)
- Setting volts, range 13.6-14.5
- Adjust to 14.0

Regulator Delco-Remy No. 1119207 (14 amp)

Ground polarity ..... Negative
Cut-out relay,
- Air gap ..... 0.020 in. (0.5 mm)
- Point gap ..... 0.020 in. (0.5 mm)
- Closing voltage, range 11.8-13.5
- Adjust to 12.8

Voltage regulator,
- Air gap ..... 0.075 in. (1.9 mm)
- Voltage setting @ degrees F.
- 14.4-15.4 @ 65°
- 14.2-15.2 @ 85°
- 14.0-14.9 @ 105°
- 13.8-14.7 @ 125°
- 13.5-14.3 @ 145°
- 13.1-13.9 @ 165°

Current regulator,
- Air gap ..... 0.075 in. (1.9 mm)
- Current setting 13-15

WIND-UP STARTER

RATCHET STARTER. On models equipped with ratchet starter, refer to Fig. T93 and proceed as follows: Move release lever to "RELEASE" position to remove tension from main spring. Remove starter assembly from engine. Remove left hand thread screw (26), retainer hub (25), brake (24), washer (23) and six starter dogs (22). Note position of starter dogs in hub (21). Remove hub (21), washer (20), spring and housing (12), spring cover (18), release gear (17) and retaining ring (19) as an assembly. Remove retaining ring, then carefully separate these parts.

CAUTION: Do not remove main spring from housing (12). The spring and housing are serviced only as an assembly.

Remove snap rings (16), spacer washers (29), release dog (14), lock dog (15) and spring (13). Winding gear (8), clutch (4), clutch spring (5), bearing (6) and crank handle (2) can be removed after first removing retaining screw and washers (10, 30 and 9).

Reassembly procedure is reverse of disassembly. Centering pin (27) must align screw (26) with crankshaft center hole.

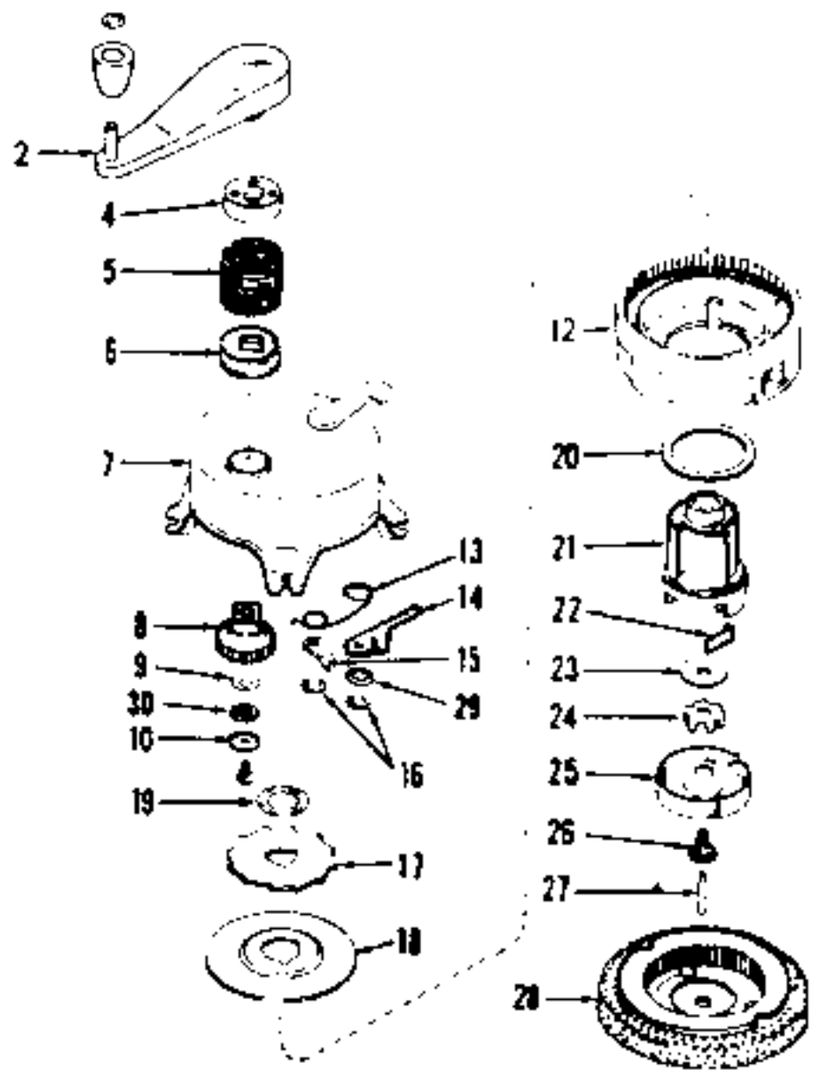


Fig. T93 — Exploded view of ratchet starter used on some engines.

2. Handle
4. Clutch
5. Clutch spring
6. Bearing
7. Housing
8. Wind gear
9. Wave washer
10. Clutch washer
12. Spring & housing
13. Release dog spring
14. Release dog
15. Lock dog
16. Dog pivot retainers
17. Release gear
18. Spring cover
19. Retaining ring
20. Hub washer
21. Starter hub
22. Starter dog
23. Brake washer
24. Brake
25. Retainer
26. Screw (left hand thread)
27. Centering pin
28. Hub & screen
29. Spacer washers
30. Lockwasher

REWIND STARTERS

FRICTION SHOE TYPE. To disassemble starter, refer to Fig. T94 and proceed as follows: Hold starter rotor (12) securely with thumb and remove the four screws securing flanges (1 and 2) to cover (15). Remove flanges and release thumb pressure enough to allow spring to rotate pulley until spring (13) is un-

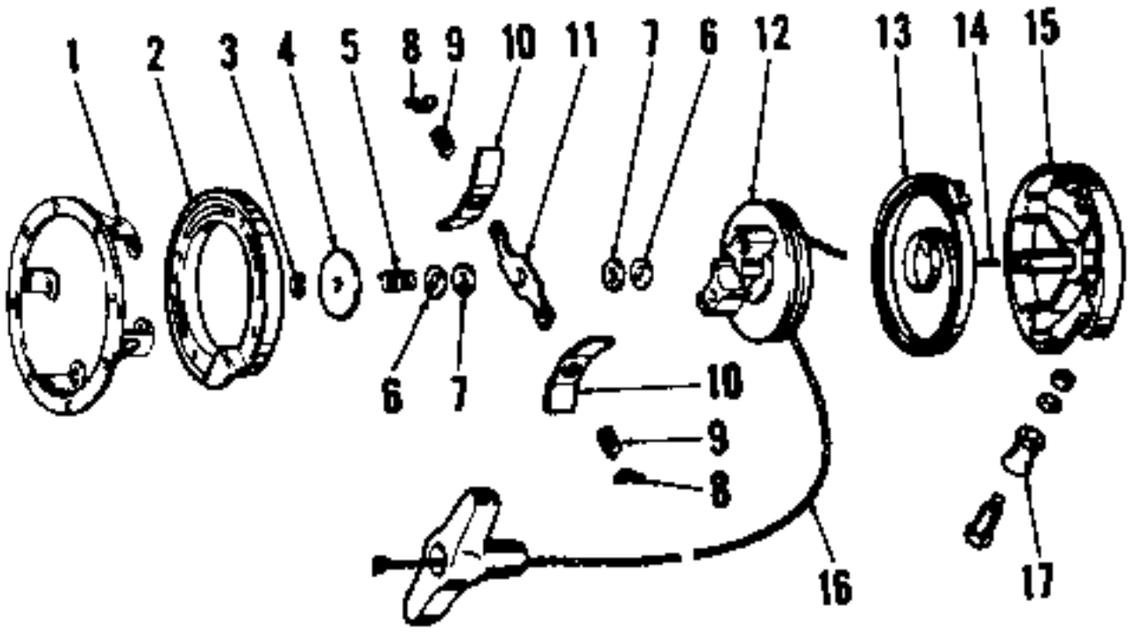


Fig. T94 — Exploded view of typical friction shoe rewind starter assembly.

1. Mounting flange
2. Flange
3. Retaining ring
4. Washer
5. Spring
6. Slotted washer
7. Fibre washer
8. Spring retainer
9. Spring
10. Friction shoe
11. Actuating lever
12. Rotor
13. Rewind spring
14. Centering pin
15. Cover
16. Rope
17. Roller

wound. Remove retaining ring (3), washer (4), spring (5), slotted washer (6) and fibre washer (7). Lift out friction shoe assembly (8, 9, 10 and 11), then remove second fibre washer and slotted washer. Withdraw rotor (12) with rope from cover and spring. Remove rewind spring from cover and unwind rope from rotor.

When reassembling, lubricate rewind spring, cover shaft and center bore in rotor with a light coat of "Lubriplate" or equivalent. Install rewind spring so windings are in same direction as removed spring. Install rope on rotor, then place rotor on cover shaft. Make certain inner and outer ends of spring are correctly hooked on cover and rotor. Preload rewind spring by rotating rotor two full turns. Hold rotor in preload position and install flanges (1 and 2). Check sharp end of friction shoes (10) and sharpen or renew as necessary. Install washers (6 and 7), friction shoe assembly, spring (5), washer (4) and retaining ring (3). Make certain friction shoe assembly is installed properly for correct starter rotation. If properly installed, sharp ends of friction shoes will extend when rope is pulled.

Remove brass centering pin (14) from cover shaft, straighten pin if necessary, then reinsert pin ⅓ of its length into cover shaft. When installing starter on engine, centering pin will align starter with center hole in end of crankshaft.

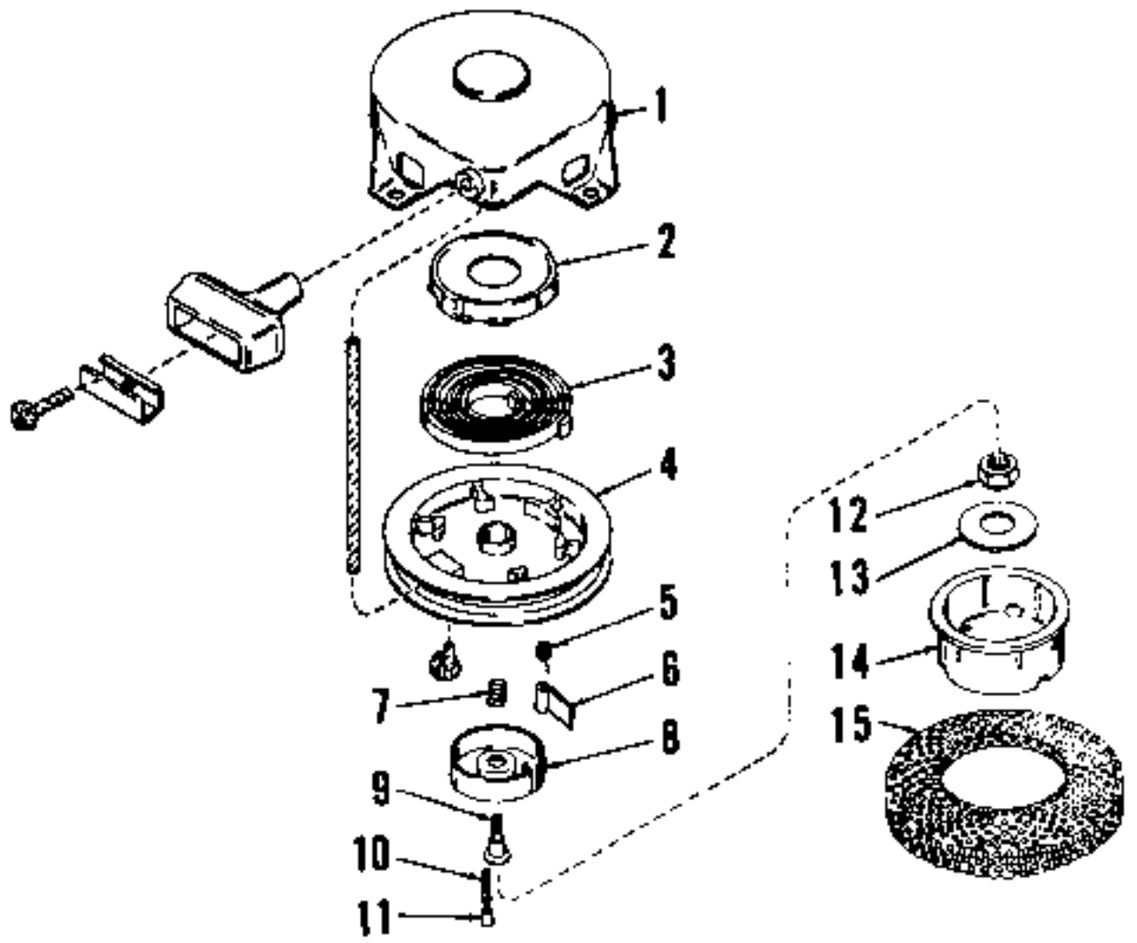


Fig. T95—Exploded view of typical dog type recoil starter assembly. Some units of similar construction use three starter dogs (6).

1. Cover
2. Keeper
3. Recoil spring
4. Pulley
5. Spring
6. Dog
7. Brake spring
8. Retainer
9. Screw
10. Centering pin
11. Sleeve
12. Nut
13. Washer
14. Cup
15. Screen

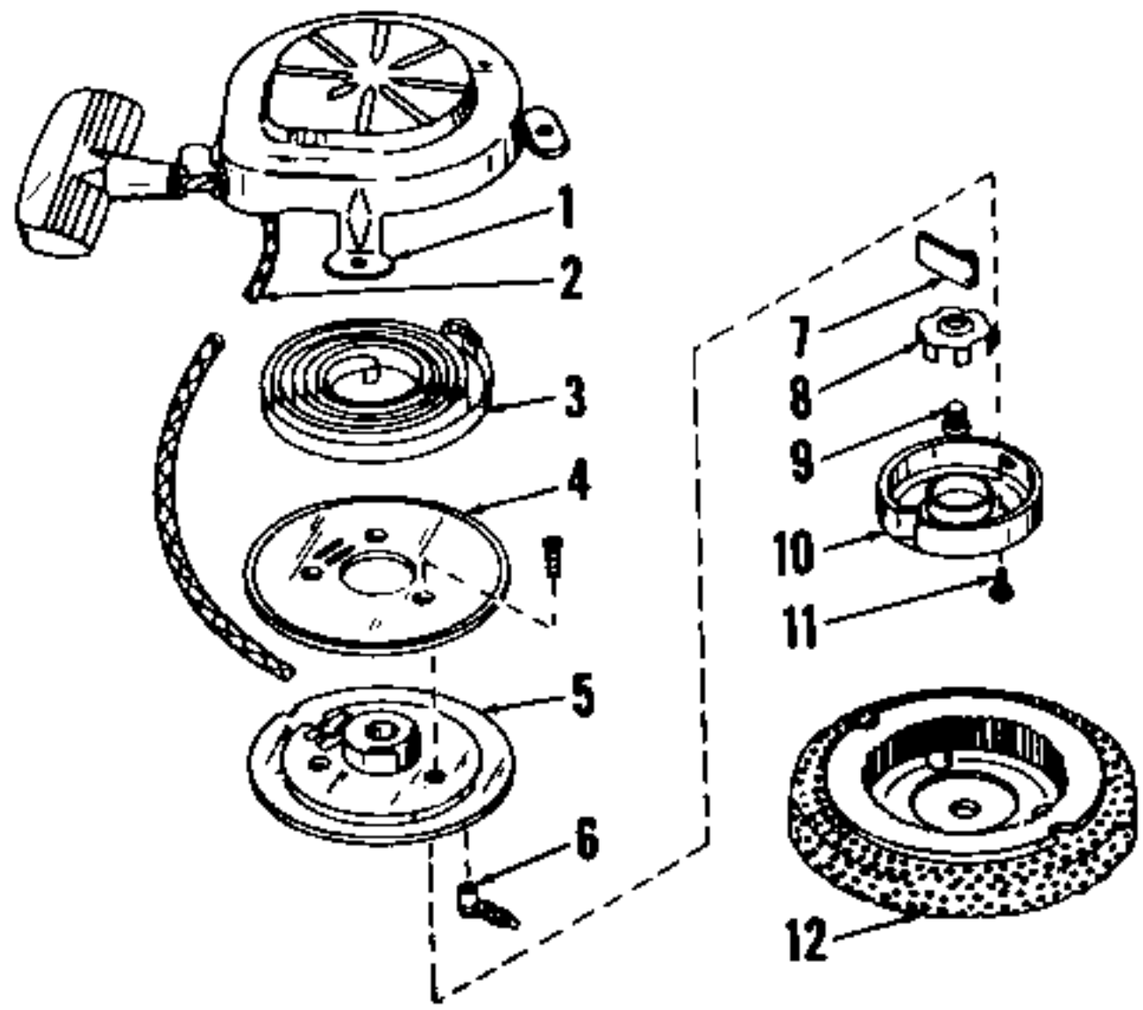


Fig. T96—Exploded view of dog type recoil starter used on some models. Refer to Fig. T95 for view of other dog type recoil starter.

1. Cover
2. Rope
3. Rewind spring
4. Pulley half
5. Pulley half & hub
6. Retainer spring
7. Starter dog
8. Brake
9. Brake screw
10. Retainer
11. Retainer screw
12. Hub & screen assy.

DOG TYPE. Two dog type starters may be used as shown in Fig. T95 and Fig. T96. Disassembly and assembly of both types is similar. To disassemble starter shown in Fig. T95, remove starter from engine and while holding pulley remove rope handle. Allow recoil spring to unwind. Remove starter components in order shown in Fig. T95 noting position of dog (6) and direction spring (3) is wound. Be careful when removing recoil spring (3). Reassemble by reversing disassembly procedure. Turn pulley six turns before passing rope through cover so spring (3), is preloaded. Tighten retainer screw (9) to 45-55 in.-lbs. (5.08-6.21 N·m).

To disassemble starter shown in Fig. T96, pull starter rope until notch in pulley half (5) is aligned with rope hole in cover (1). Hold pulley and prevent from rotating. Engage rope in notch and allow pulley to slowly rotate so recoil spring will unwind. Remove components as shown in Fig. T96. Note direction recoil spring is wound being careful when removing spring from cover. Reassemble by reversing disassembly procedure. Preload recoil spring by turning pulley two turns with rope.