CLINTON

CLINTON ENGINES CORPORATION
Maquoketa, Iowa

Horizontal Crankshaft Engines

MODEL SERIES	Cyls.	Bore	Stroke	Displ.
500, 650, 700-A, B-700 & C-700	1	2	1⅞	5.89
D-700	1	2⅛	1⅞	6.65
800, A-800, 900, A-1100, B-1100, C-1100 & D-1100	1	2⅜	1⅞	8.3
1200, A-1200 & B-1200	1	2 15/32	2⅛	10.2
494-0000-000 & 494-0101-000	1	2⅜	1⅞	8.3
498-0000-000 & 498-0301-000	1	2 15/32	2⅛	10.2

Vertical Crankshaft Engines

MODEL SERIES	Cyls.	Bore	Stroke	Displ.
VS-700 & VS-750	1	2	1⅞	5.89
VS-800, VS-900, V-1000 & VS-1000	1	2⅜	1⅞	8.3
V-1100 & VS-1100	1	2⅜	2⅛	9.5
V-1200 & VS-1200	1	2 15/32	2⅛	10.2
497-0000-000 & 499-0000-000	1	2 15/32	2⅛	10.2

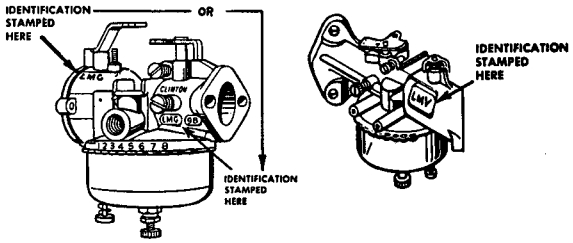

Fig. CL46 — View showing locations of identification numbers on "LMB", "LMG" and "LMV" carburetors. Identification number must be used when ordering service parts.

MAINTENANCE

SPARK PLUG. All models use a 14 mm., ⅜-inch reach spark plug. Recommended plug is a Champion J-8 or equivalent. Set electrode gap to 0.025-0.028. When installing, apply graphite to threads and tighten to a torque of 275-300 inch-pounds.

CARBURETOR. Several different carburetors, both suction lift and float type, have been used on this series of Clinton engines. Refer to the following paragraphs for information on each carburetor model.

Note: The throttle shaft on some carburetors may have several holes in which the throttle link and governor backlash spring (if used) may be installed. On these carburetors, be sure to mark the holes in which spring and linkage were installed so that they may be reinstalled correctly.

CLINTON SUCTION TYPE CARBURETORS. The following Clinton suction type carburetors have been used:

4730-2 4484-2

Refer to Fig. CL45 for exploded view of typical carburetor. Carburetor is equipped with only one fuel adjustment needle (7). Average adjustment is 3½ turns open. Make final adjustment with engine running at operating temperature and with fuel tank approximately ½-full. Adjust for best high speed operation under load.

CLINTON FLOAT CARBURETORS. Several different Clinton LMG and LMV series float type carburetors have been used. To identify a particular carburetor, look for the identification number on the carburetor body as shown in Fig. CL46.

Refer to the exploded view shown in Fig. CL47 for exploded view of typical "LM" series carburetor. When overhauling or

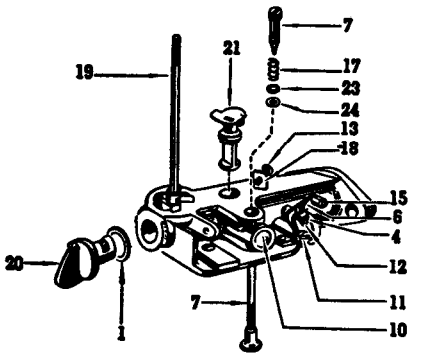

Fig. CL45 — Exploded view of suction lift carburetor. Only one fuel mixture adjustment needle (7) is used.

1. Throttle shaft
2. Choke shaft
3. Spring
4. Throttle disc
5. Spring
6. Carburetor body
7. Idle stop screw
8. Springs
9. Idle fuel needle
10. Spring
11. Choke disc
12. Inlet needle & seat
13. Main nozzle
14. Float
14A. Float pin
15. Gasket
16. Gaskets
17. Float bowl
18. Drain valve
19. Retainer
20. Seal
21. Spring
22. Main fuel needle
23. Lever (optional)

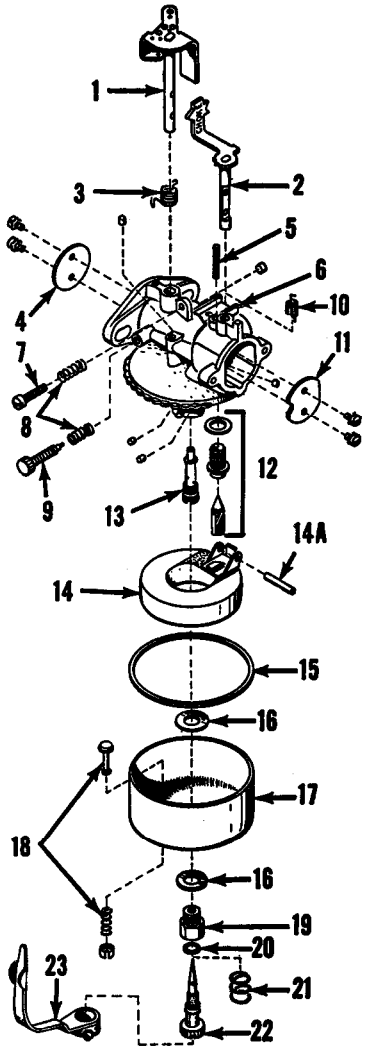

Fig. CL47 — Exploded view of typical "LMG" series carburetor. "LMV" and "LMB" series are similar.

cleaning carburetor, do not remove the main fuel nozzle (13) unless necessary. If nozzle is removed, it must be discarded and a service type nozzle (See Fig. CL48) installed.

Choke plate (11—Fig. CL47) should be installed with the "W" or part number to outside. Install throttle plate with the side marked "W" facing towards mounting flange and with the part number towards idle needle side of carburetor bore when plate is in closed position. When installing throttle plate, back idle speed adjustment screw out, turn plate and throttle shaft to closed position and seat plate by gently tapping with small screwdriver before tightening plate retaining screws.

If either the float valve or seat is damaged, install a new matched valve and seat assembly (12) and tighten seat to a torque of 40-50 inch-pounds. When carburetor body (6) and float (14) assembly are inverted, there should be 5/32-inch clearance between body casting and free side of float.

Adjust float level by bending the tab that contacts the float valve. When carburetor body and float assembly are returned to normal position, float should not drop more than 3/16-inch at free side of float; adjust by bending tab that contacts the carburetor body. Reassemble carburetor using new gaskets.

Initial adjustment for both idle needle and high speed needle is 1¼ turns open. Make final adjustment with engine at operating temperature. If engine does not accelerate properly, open high speed adjustment needle slightly.

CARTER FLOAT TYPE CARBURETORS. Refer to Fig. CL49 for exploded view typical of the Carter "N" series carburetors used on this group of Clinton engines. Some carburetors may differ as to shape of float and bowl.

Refer to the following chart for float setting and for initial adjustment (turns open) of idle and high speed fuel adjustment needles:

Carburetor Model	Float Setting	—Initial Adjustment— Idle	High Speed
N-705S	13/64 in.	1½	1½
N-707S, SA	13/64 in.	1½	1½
N-2020S	11/64 in.	1½	1½
N-2147S	11/64 in.	1½	1½
N-2236S	11/64 in.	1	2
N-2246S	11/64 in.	1	1½
N-2399S	11/64 in.	1½	2
N-2449S	13/64 in.	1½	1½
N-2456S	13/64 in.	1½	1½
N-2459S	11/64 in.	1	1½
N-2466S	11/64 in.	1½	2

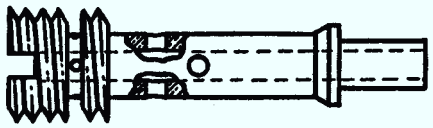

Fig. CL48—When original main fuel nozzle is removed from "LM" series carburetor, it must be discarded and service type nozzle shown must be installed.

Float setting is measured by inverting carburetor casting and float assembly and gaging distance between casting and free side of float. Adjust by bending tab that contacts float valve.

Make final idle and high speed fuel mixture adjustments after engine is at operating temperature.

TILLOTSON FLOAT CARBURETOR. Some early models were equipped with Tillotson "ML" series carburetorrs. Float setting on all ML carburetors is 1 5/64 to 1 3/32-inch from edge of carburetor casting to farthest side of float when carburetor body and float assembly is held in inverted position.

Initial adjustment for idle fuel adjustment needle is 1 turn open; initial adjustment for the high speed needle is 1½ turns open.

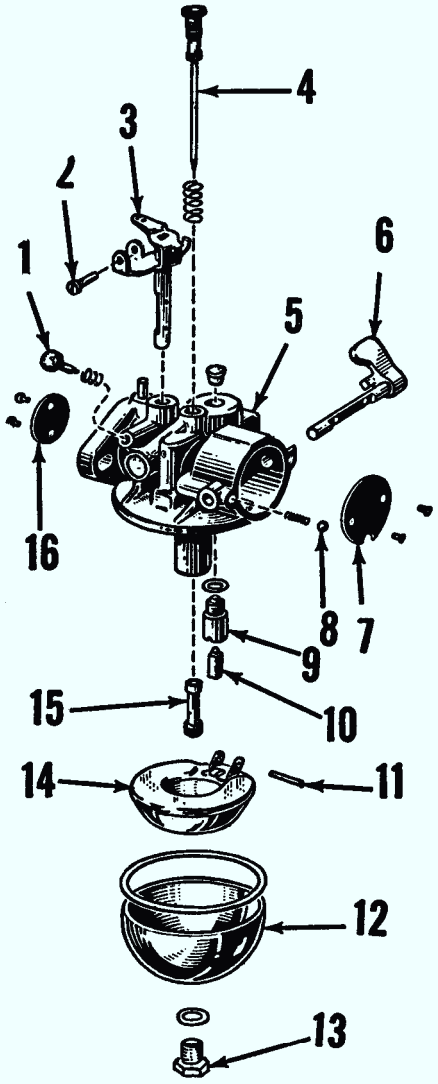

Fig. CL49 — Exploded view of typical Carter model "N" carburetor. Design of float and float bowl may vary from that shown.

1. Idle fuel needle
2. Idle stop screw
3. Throttle shaft
4. Main fuel needle
5. Carburetor body
6. Choke shaft
7. Choke disc
8. Detent ball
9. Inlet valve seat
10. Inlet needle
11. Float pin
12. Float bowl
13. Retainer
14. Float
15. Main nozzle
16. Throttle disc

Make final adjustment with engine running at operating temperature.

ZENITH FLOAT TYPE CARBURETORS. The following Zenith float type carburetors were used on some early model engines:

10390
10658
10665

The 10390 model carburetor has only one fuel mixture adjustment needle. Set this fuel mixture ¼-turn rich (counter-clockwise) from setting producing maximum high idle speed. On models 10658 and 10665, turning the idle fuel needle clockwise will enrichen the fuel mixture, and turning the main fuel needle clockwise will lean the fuel mixture. Float setting is non-adjustable on this series of Zenith carburetors.

FUEL PUMP. Some vertical shaft engines are equipped with a diaphragm type fuel pump located on the crankcase cover and operated by pressure pulsations within the crankcase. Service consists of renewing the diaphragm (79—Fig. CL 53).

GOVERNOR. Either a mechanical or an air vane type governor is used. All vertical shaft engines and some horizontal shaft engines use an air vane type governor as shown at (126) in the exploded view of engine in Fig. CL53. Mechanical governors are of the type shown in the exploded views of engines in Figs. CL50 and CL56.

NOTE: The carburetor throttle shaft, governor arm and speed control devices may have several different holes in which springs and linkage can be installed. Before removing carburetor, governor arm, springs, linkage or controls, be sure to mark location of holes in which springs and linkage were installed so that they may be reassembled correctly.

MECHANICAL GOVERNOR. The governor weight unit (112—Fig. CL 50 or 126—Fig. CL56) is driven by the cam gear, and is retained to the gear by a pin (59—Fig. CL 50 or 70—Fig. CL 56) driven into the gear. The governor collar (14—Fig. CL 50 or 25—Fig. CL 56) has a notch in the inner flange of the collar which fits around the weight unit retaining pin. The governor

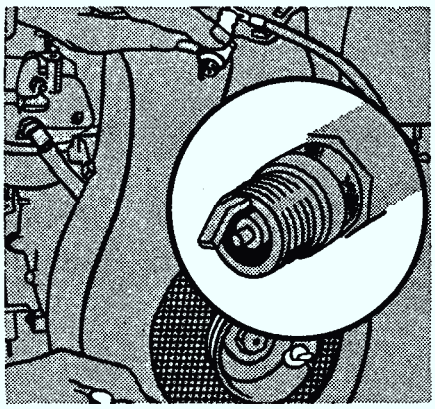

Fig. CL49A—Magneto can be considered in satisfactory condition if it will fire an 18 mm. spark plug with electrode gap set at 0.156-0.187.

shaft (2—Fig. CL 50 or 4—Fig. CL 56) is fitted with a square cross-section weight that contacts the outer flange of the governor collar, and the shaft is supported in a renewable bushing (6—Fig. CL 50 or 55—Fig. CL 56).

It is very important that the travel of the governor and the carburetor throttle be synchronized. With the engine not running, move the governor throttle arm (1—Fig. CL50 or 3—Fig. CL56) so that the governor shaft holds the governor weight unit in fully closed position. At this time, there should be 1/32 to 1/16-inch clearance between the high speed stop on the carburetor throttle arm and the carburetor casting. To obtain this adjustment, increase or decrease the loop in the carburetor to governor link (49—Fig. CL50) on older model engines or loosen the adjustment screw (89—Fig. CL56) on newer model engines and reposition the arm (3) on the adjuster (2) and tighten adjustment screw (89).

Adjust desired maximum speed (do not

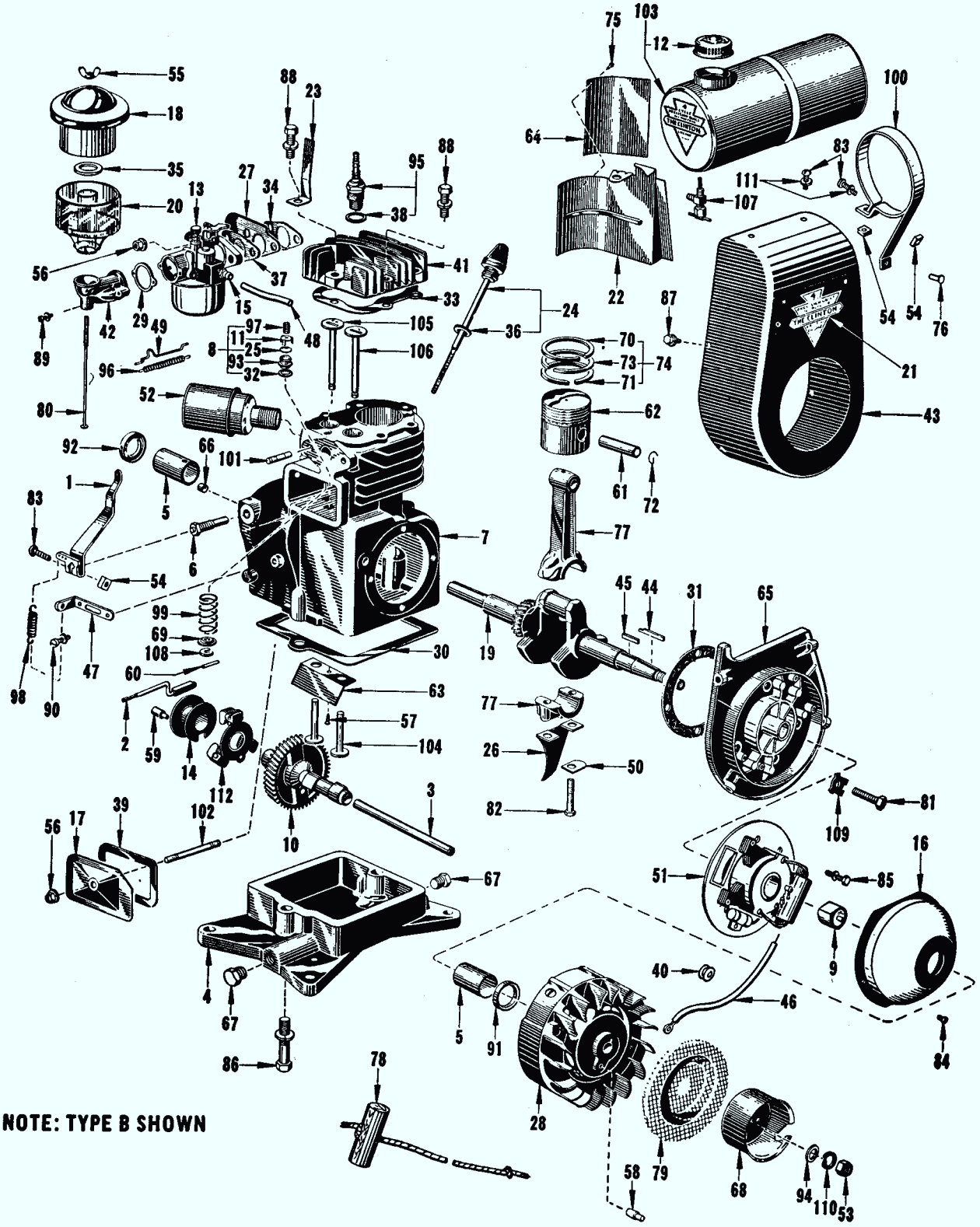

Fig. CL50 — Exploded view of series 700 engine. Early models were equippped with Scintilla magneto (51) as shown.

exceed 3600 RPM) by adjusting tension of governor spring (98—Fig. CL50 or 110—Fig. CL56). CAUTION: Do not use any spring other than correct Clinton part specified for a particular engine as spring must be balanced to governor weight unit for proper speed control.

On most models, a backlash spring (96—Fig. CL50) is used to hold any free play out of governor to carburetor linkage and therby reduce any tendency for engine to surge.

AIR VANE GOVERNOR. Refer to Fig. CL53. The governor air vane (126) pivots on a renewable pin (69) that is driven into a hole in the bearing plate (72). The vane is connected to the carburetor throttle shaft by the link (58).

Check to see that the vane and link are not bent from their original shape; renew vane and/or link if damaged. To maintain proper speed control, the correct governor spring must be used. Be sure to use the correct Clinton part number when ordering the governor spring (113). (The tension of the spring is balanced to the force on the air vane from the air blast off of the engine flywheel.) Be sure that vane and linkage move through their full range of travel without binding and take care when servicing engine not to bend the vane or link.

Adjust speed control (tension on governor spring) for desired maximum RPM, but do not exceed 3600 RPM.

MAGNETO AND TIMING. Some early model engines were equipped with Scintilla magnetos (51—Fig. CL50). Condensor, breaker points and armature coil are located under the flywheel on all models.

On Scintilla magnetos, condensor capacity is 0.15 mfd. (minimum). Adjust breaker contact gap to 0.015-0.018. Edge gap should be not less than 5 degrees. Magneto can be rotated on early 700-A models to advance or retard timing; timing is fixed and non-adjustable on other models. Timing for all models is 21° BTDC.

On later magnetos, condensor capacity is 0.15-0.19 mfd. Adjust breaker point gap to 0.018-0.021. Armature air gap should be 0.007-0.017. Timing is fixed and non-adjustable at 21° BTDC.

On all magnetos, magneto can be assumed to be in satisfactory condition if it will fire an 18 mm. spark plug with electrode gap set at 0.156-0.187 (5/32 to 3/16-inch). See Fig. CL49A.

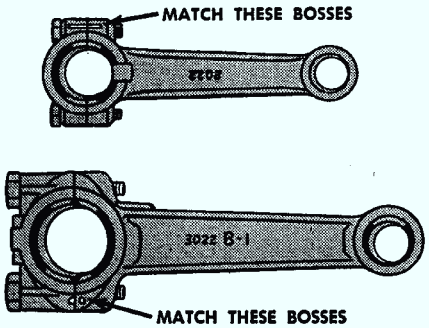

Fig. CL52—When assembling cap to connecting rod, be sure that embossments on rod and cap are aligned as shown.

LUBRICATION. Motor oil of MM or MS grade should be used. Use SAE 30 above 32° F., SAE 10W from —10° F. to 32° F., and SAE 5W below —10° F.

On models equipped with reduction gearing, use SAE 30 oil in gear box.

CRANKCASE BREATHER. Crankcase breather assembly (8—Fig. CL50, 10—Fig. CL53 or 14—Fig. CL56) should be removed and cleaned if difficulty is experienced with oil loss through hole in valve cover or whenever the engine is being overhauled. Be sure that the breather is correctly reassembled and reinstalled.

REPAIRS

TIGHTENING TORQUES. Recommended torque values in inch-pounds are as follows:

Adapter flange	120-150
Base bolts	325-375
Carburetor to manifold	35-50
Carburetor (or manifold) to block	60-65
Connecting rod	70-80
Cylinder head	200-220
End cover	120-150
Flywheel	400-450*
Spark plug	275-300
Stator plate	50-60

*350 maximum on 7/16-inch crankshaft.

CONNECTING ROD. Rod and piston assembly can be removed from engine after cylinder head and engine base (on horizontal crankshaft models) or crankcase end cover (on vertical crankshaft models) are removed.

Recommended clearances are as follows:

Connecting rod to crankshaft	0.0018-0.0035
Maximum allowable	0.0045
Connecting rod to piston pin	0.0004-0.0011
Maximum allowable	0.002
Rod side play	0.005-0.020

Connecting rod is available in standard size only. When reassembling, be sure that embossments on connecting rod and cap are aligned as shown in Fig. CL52. Oil hole or oil access slot in connecting rod should face flywheel side of engine. On some models, the connecting rod has a "clearance side" which must be towards the camshaft. Be sure that rod locks and oil distributor (on horizontal crankshaft models) clears the camshaft after assembly.

On horizontal crankshaft engines, refer to Fig. CL52A for view of "old" and "new" rod locks and oil distributor. CAUTION: "Old" type rod locks must be used with "old" type distributor and "new" type locks with "new" distributor. Also, a few oil distributors have been made incorrectly; do not install an oil distributor if bolting flange faces in direction opposite to that shown in Fig. CL52A. NOTE: If installing a new connecting rod in a vertical crankshaft engine equipped with an oil pump, refer to LUBRICATING SYSTEM paragraph.

PISTON, PIN AND RINGS. Piston is fitted with two compression rings and one oil control ring. Recommended piston ring end gap is 0.007-0.017; renew rings if end gap of top ring is 0.025 or more. Ring side clearance in groove should be 0.002-0.005; maximum allowable side clearance is 0.006. Rings are available in oversizes of 0.010 and 0.020 as well as standard size.

The piston pin is retained in the piston with a snap ring at each end of the pin. Piston pin is available in standard size only and should be a "hand push fit" in piston. Specifications are as follows:

	2 in. Dia. Piston	2¼ in. & Larger Piston
Piston pin. dia.	0.4999-0.5001	0.5624-0.5626
Pin bore in piston	0.5000-0.5003	0.5625-0.5628
Pin bore in rod	0.5005-0.5010	0.5630-0.5635
Max. pin to rod clearance	0.002	0.002

Piston skirt clearance should be 0.0045-0.0065 in 2-inch cylinder bore and 0.005-0.007 in 2¼-inch and larger cylinder bore. Maximum skirt clearance for all models is 0.008. Piston is available in oversizes of 0.010 and 0.020 as well as standard size.

CYLINDER. Standard cylinder bore diameters are as follows:

Nominal Bore Size	Standard Cylinder Dia.
2 inches	2.000-2.001
2⅛ inches	2.125-2.126
2⅜ inches	2.375-2.376
2-15/32 inches	2.4685-2.4695

If piston skirt clearance is 0.008 or more with new piston or ring end gap is 0.025 or more with new rings, cylinder must be rebored or honed and oversize piston and rings installed or cylinder and crankcase assembly must be renewed. Piston and rings are available in oversizes of 0.010 and 0.020 as well as standard size.

CRANKSHAFT. Connecting rod to crankpin clearance should be 0.0018-0.0035; renew rod and/or crankshaft if clearance exceeds 0.0045. Standard crankpin diameter is either 0.8745-0.8752 or 0.9114-0.9120. Recommended maximum crankpin out-of-round condition is 0.001; crankshaft must be renewed if crankpin out-of-round is 0.0015 or more. Connecting rod is available in standard size only.

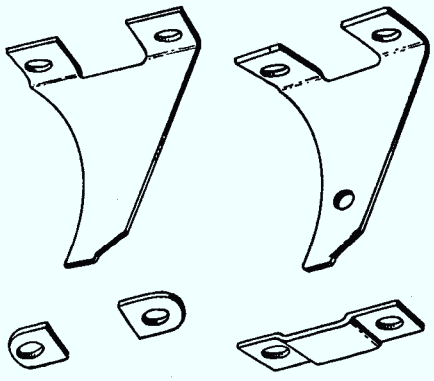

Fig. CL52A — New type oil distributor at right is identified by hole drilled through it as shown. One piece rod lock shown below new type distributor should be used only with new distributor; two-piece rod lock should be used with old type distributor. Refer to text.

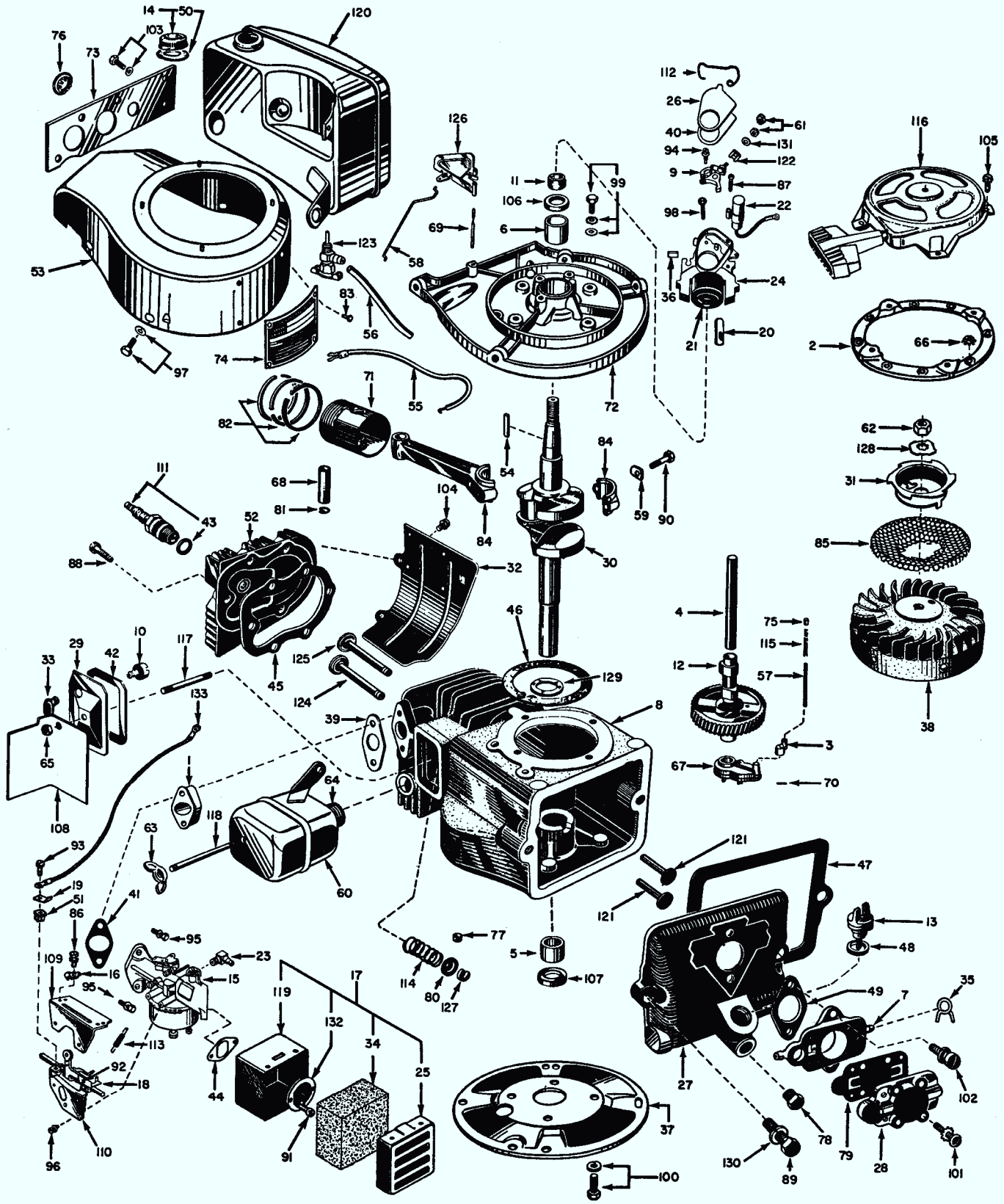

Fig. CL53—Exploded view of model 499-0000-000 vertical shaft engine. Note the fuel pump (items 7, 28 and 79) which attaches to the crankcase cover (27). Engine is lubricated by oil pump (67) although some vertical shaft models are splash lubricated by an oil scoop riveted to the bottom side of camshaft gear.

Main bearing clearance should be 0.0018-0.0035 on all plain bushing models; renew crankshaft and/or bushings if clearance exceeds 0.005. Flywheel end journal is 0.8745-0.8752; pto end journal is either 0.8745-0.8752 or 0.9995-1.0002. Bushings are available in standard size only and must be reamed after installation for proper size. On some vertical crankshaft engines, upper crankshaft journal rides directly in aluminum bearing plate; if bearing wear is excessive, renew bearing plate or ream bearing out oversize to accept a bronze service bushing. Bushing driving tools, reamers and reamer alignment plates are available through Clinton parts sources.

On vertical crankshaft models with needle roller mains, renew needle roller bearing if any needle has flat spots or is in any way damaged. Also renew needle bearing if needles can be separated the width of one needle. Renew crankshaft if rough, scored or shows signs of wear where contacted by needle rollers. Check upper pto bushing and journal as outlined in preceding paragraph.

On models with tapered roller main bearings, renew bearing cones and cups if roller or cup is scored or rough.

On ball bearing equipped models, renew ball bearing assembly if excessive wear is noted or if bearing is rough when turned.

On 800 and 900 models, crankshaft end play should be 0.008-0.012 with maximum allowable end play of 0.020. On models with tapered roller main bearings, crankshaft end play should be 0.001-0.006 with maximum allowable end play of 0.008. On all other models with plain bushings, needle bearings or ball bearings, crankshaft end play should be 0.008-0.018 with maximum allowable end play of 0.025. Bearing plate gaskets are available in thicknesses of 0.005, 0.010, 0.015 and 0.020 for adjustment of end play. All vertical shaft models are equipped with either one or two thrust washers between the lower thrust surface of the crankshaft and the cylinder block.

CAMSHAFT AND GEAR. The hollow camshaft and cam gear unit rotates on a cam axle that is pressed into the engine crankcase. Camshaft can be removed after removing engine crankshaft and pressing camshaft axle from crankcase. On models with mechanical governor, governor weight unit is attached to cam gear by a pin that is pressed into the gear.

Operating clearance between camshaft axle and camshaft should be 0.001-0.003; renew axle and/or camshaft if clearance exceeds 0.005.

Camshaft end play should be 0.003-0.010; maximum allowable end play is 0.015.

VALVE SYSTEM. Recommended valve tappet gap for both intake and exhaust valves on all models is 0.009-0.011. Adjust clearance by grinding end of valve stem. A 45 degree bevel should be maintained on ends of stems.

Recommended valve stem to guide clearance is 0.002-0.0045. If clearance is 0.006 or more, guides may be reamed to 0.260 or 0.2812 (9/32-inch) for valves with 0.010 or 1/32-inch oversize stem. Also, valve guide may be knurled and reamed to 0.250 for standard size stem.

Stellite exhaust valves and seats are available; also, stellite exhaust valves with roto-caps are available for service. Install regular exhaust valve in place of intake valve if installing a stellite exhaust valve and seat. Stellite valves are available with standard and 0.010 oversize stems only.

The intake and exhaust valves are actuated by mushroom type tappets that ride directly in unbushed bores in the engine crankcase. Stem diameter of the tappets is 0.2475-0.2485; tappet guide bore diameter is 0.2495-0.2510. Tappets are available in standard size only. If guides are worn excessively, they may be knurled and reamed with same tools as used to knurl and ream valve guides. Tappets may be removed from the engine block after removing the camshaft.

CAUTION: If ends of valve stems or ends of tappet stems have become enlarged or burred, do not force the stems through the bores in block. Remove burrs with emery cloth before attempting to remove valves and tappets.

Valve seat inserts are available for service; also, tools for cutting counterbore and installing the valve seat inserts are available through Clinton parts sources.

LUBRICATING SYSTEM. All horizontal crankshaft engines and some vertical crankshaft engines are splash lubricated; an oil distributor is attached to the connecting rod cap on horizontal crankshaft models and an oil scoop is riveted to the lower side of the cam gear on vertical crankshaft models.

A gear type oil pump, driven by a pin on the lower end of the engine crankshaft, is used on some vertical crankshaft models. On early models equipped with an oil pump, the crankpin bearing was lubricated by oil spraying from a hole in the oil pump tube as shown in Fig. CL54. On later models, the oil pump tube does not have the spray hole and the crankpin bearing is lubricated by oil spray from the top main bearing. If renewing older type connecting rod (with oil cup on cap) using a new type connecting rod (without oil cup), also install a new oil tube adapter and oil tube without the spray hole. Refer to Fig. CL55. Oil pump is available for service as an assembly only.

NOTE: When reassembling engine using early type oil tube with spray hole, be sure the squared-off lower end of the oil tube fits into the recess in the oil tube adapter. Also, if renewing oil pump, adapter and/or oil tube, be sure the correct oil tube and adapter are used. Refer to Fig. CL54 and Fig. CL55.

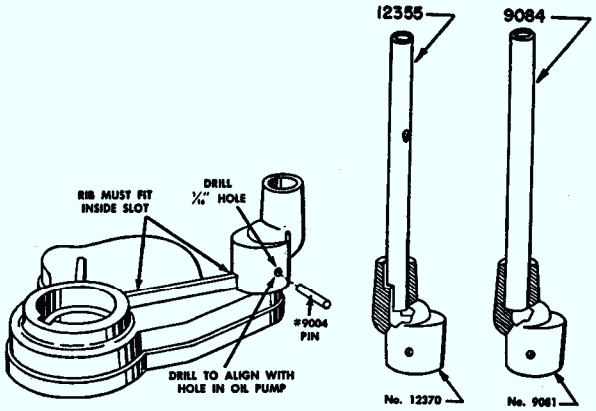

Fig. CL55—Oil pump adapters and oil lines for early and late model vertical shaft engines are shown. If late type connecting rod without oil cup is installed in early engine, it is recommended that the 12370 adapter and the 12355 oil line be discarded and the 9084 line and 9081 adapter be installed as shown.

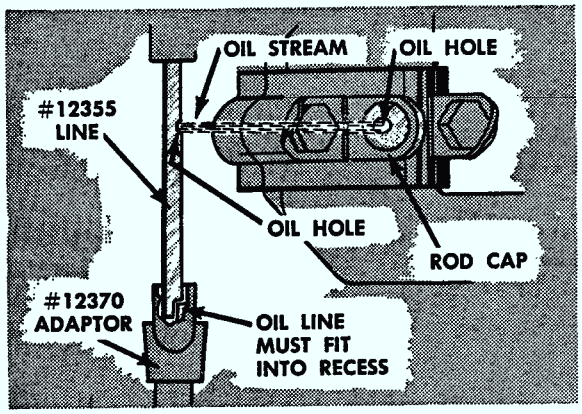

Fig. CL54—On early models, connecting rod bearing was lubricated by oil spray from hole in oil line as shown. Be sure the squared-off end of the oil line fits into the recess in oil pump adapter when reassembling engine.

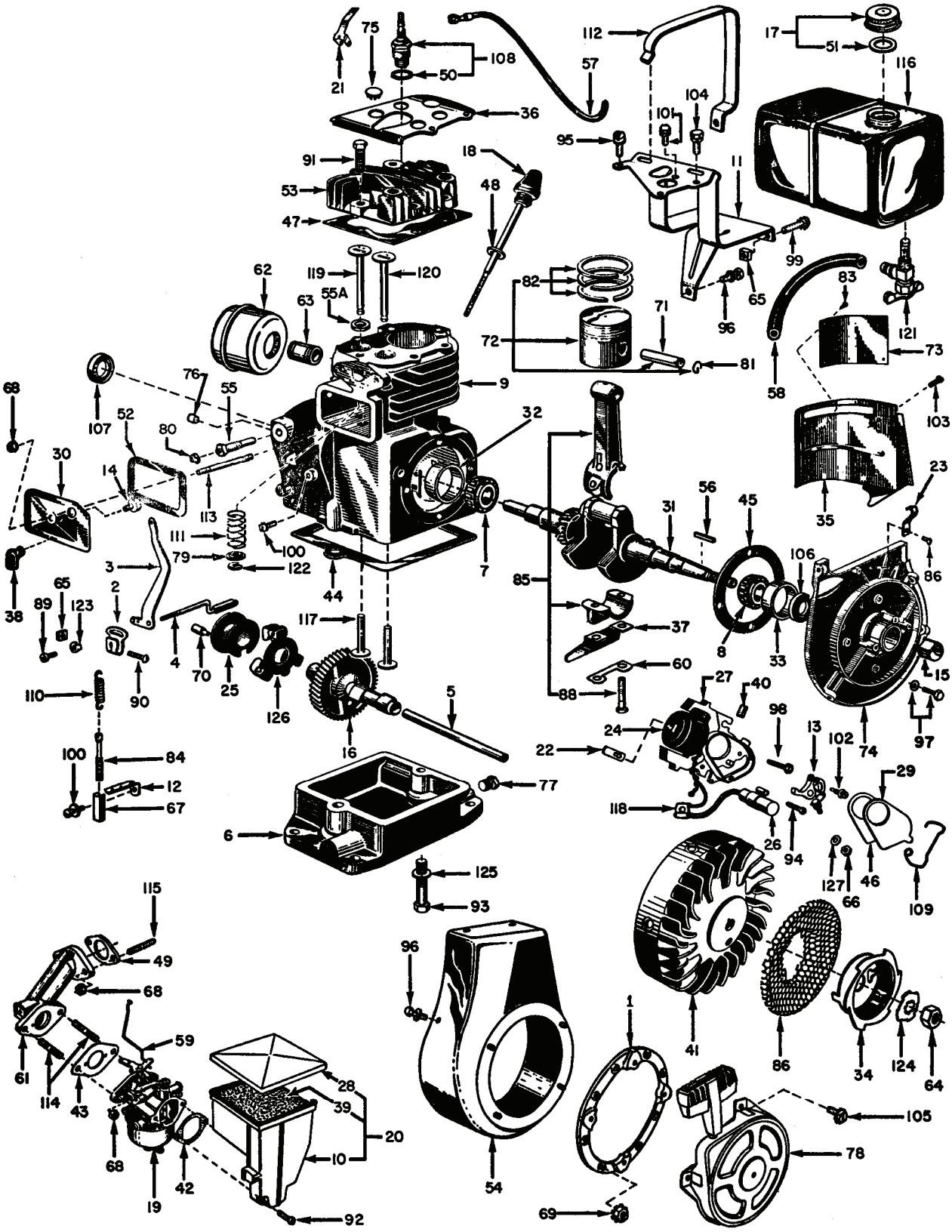

Fig. CL56—Exploded view of model 498-0000-000 engine. Governor weight assembly (126) is retained to camshaft gear by pin (70) that is pressed into the gear.