TELEDYNE
CONTINENTAL MOTORS

Overhaul Manual

Operation and Maintenance
Instructions

L-HEAD ENGINES

FOUR CYLINDER

N56 — N62
Y69 — Y91 — Y112
F124 — F135 — F140 — F162 — F163

SIX CYLINDER

F186 — F209 — F226 — F227 — F244 — F245
M271 — M290 — M330 — M363
B371 — B427

TELEDYNE CONTINENTAL MOTORS

TELEDYNE CONTINENTAL MOTORS
Printed in U. S. A.

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QUICK REFERENCE SECTION INDEX

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FOREWORD

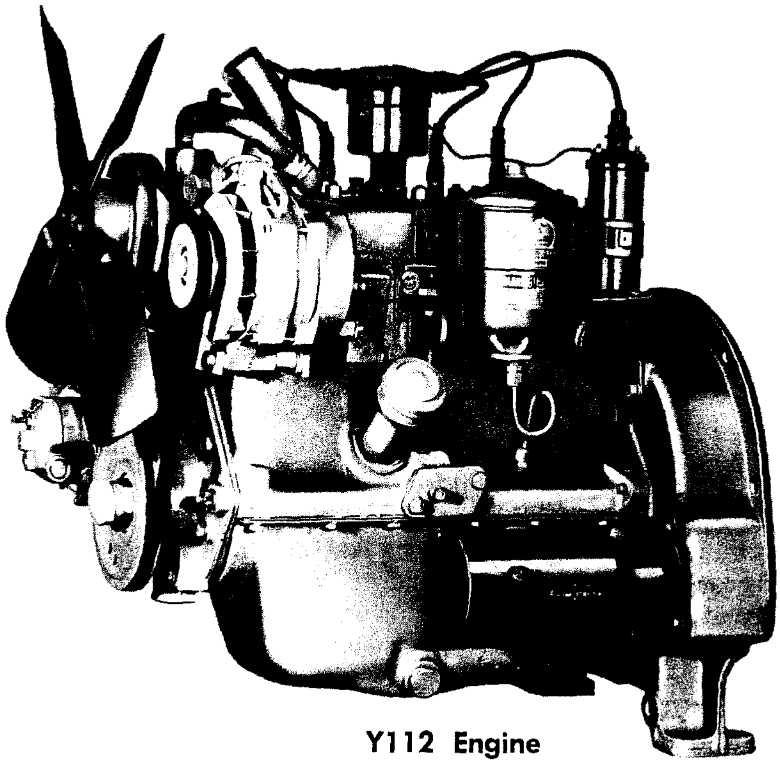
Good operation and a **planned** maintenance program as outlined in this manual are of vital importance in obtaining maximum engine performance, and long engine life. The instructions on the following pages have been written with this in mind, to give the operator a better understanding of the various problems which may arise, and the manner in which these problems can best be solved or avoided.

Procedure in the Preventive Maintenance Section must be set up and followed by the owner and operator to obtain dependable service and long life from the engine. Owners and operators are expected to perform these maintenance procedures as outlined under the daily schedule as well as 50-hr., 250-hr., and 500-hr. periods WHILE IN THE WARRANTY PERIOD AS WELL AS DURING THE LIFE OF THE ENGINE.

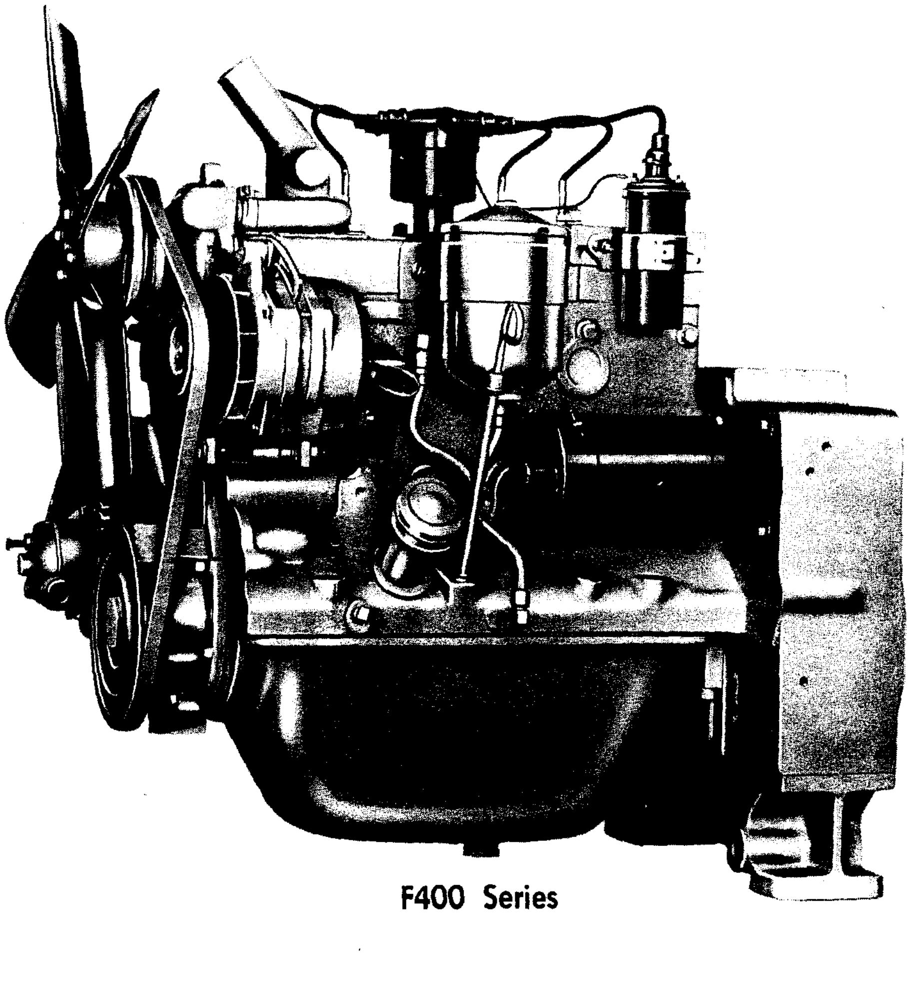
Warranty service does not include tune-up of the engine such as replacing spark plugs, distributor points, tappet settings, ignition timing, ignition wiring, air cleaner service and lubrication and filter maintenance.

The operator is cautioned against the use of any parts, other than **Genuine Teledyne Continental Parts** for replacement or repair. These parts have been engineered and tested for their particular job, and the use of any other parts may result in unsatisfactory performance and short engine life. Likewise, Teledyne-Continental distributors and dealers, because of their close factory relations, can render the best and most efficient service.

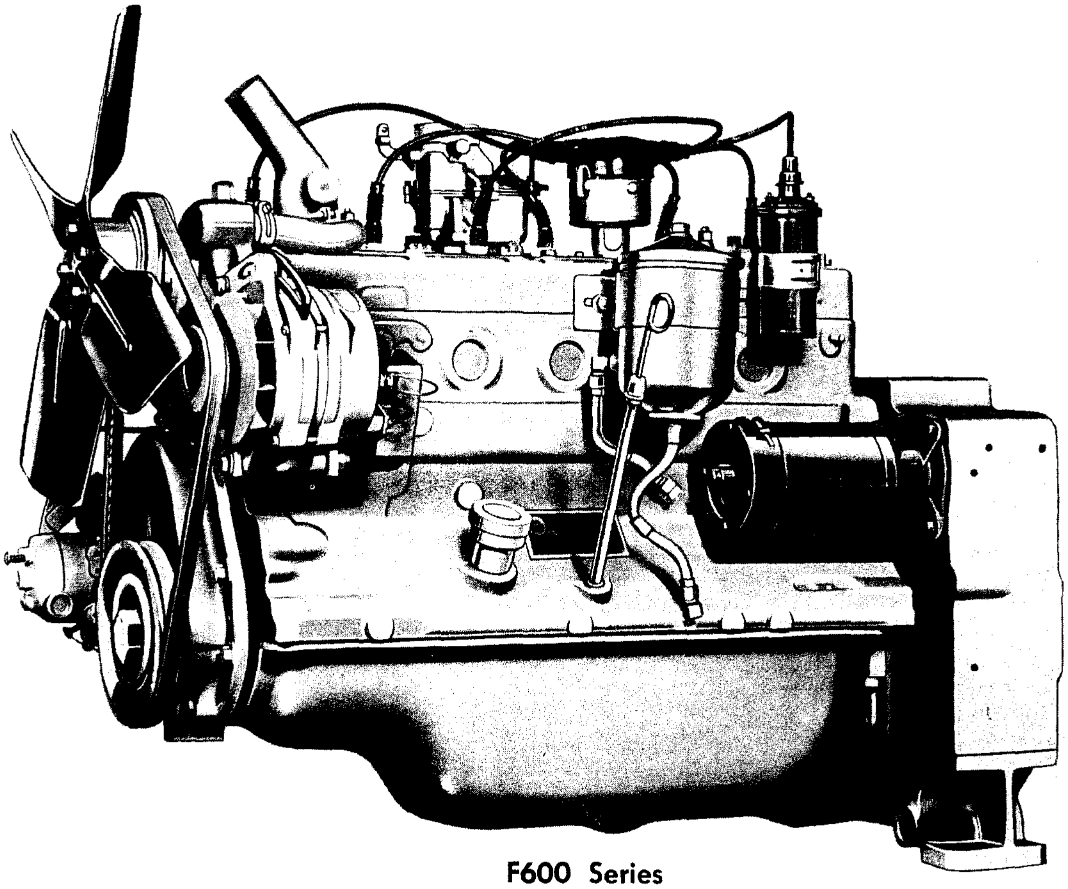
THE LIFE OF YOUR ENGINE DEPENDS ON THE CARE IT RECEIVES.



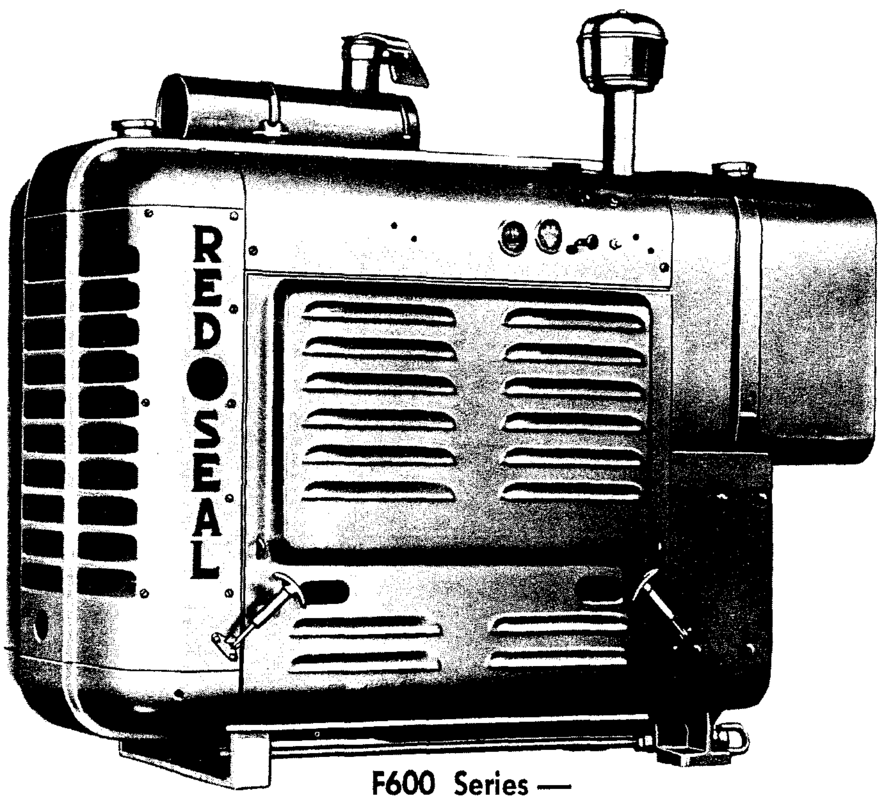
Y112 Engine



F400 Series



F600 Series



F600 Series —

Closed Power Unit

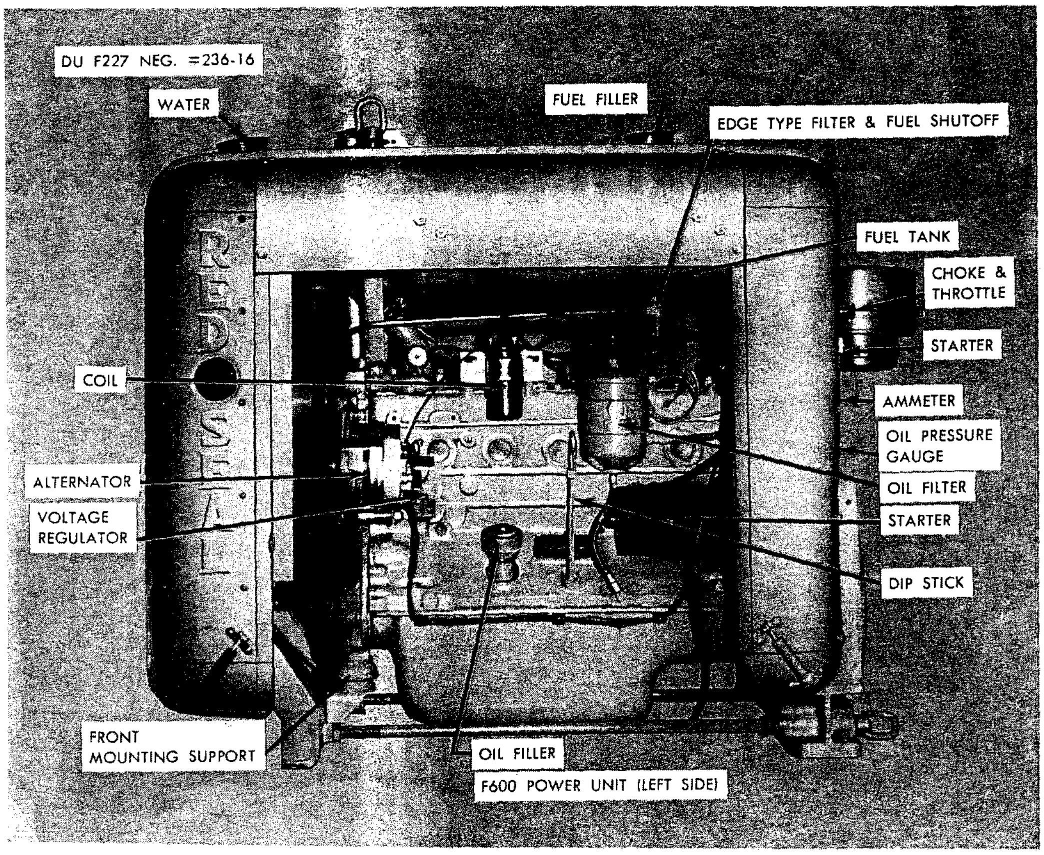


Figure 7 — F600 Power Unit (left side)

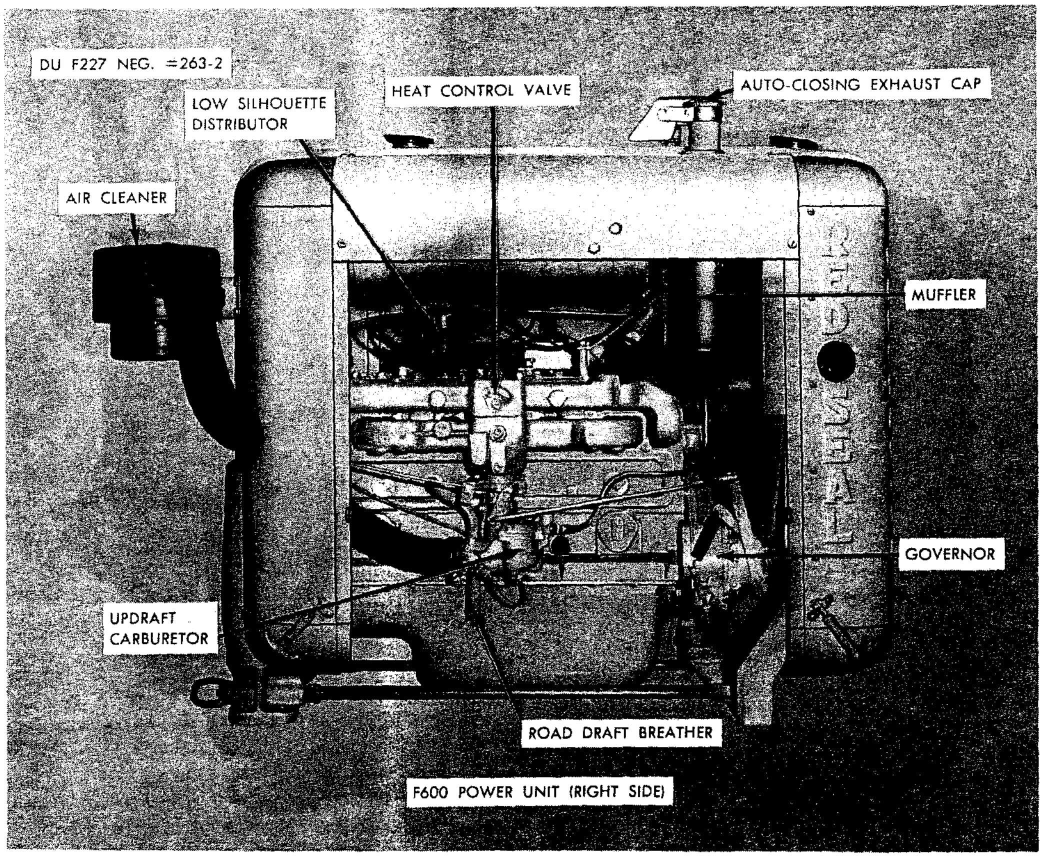


Figure 8 — F600 Power Unit (right side)

FOUR CYLINDER INDUSTRIAL L-HEAD ENGINES*

MODEL	N-56	N-62	Y-69	Y-91	Y-112	F-124	F-135	F-140	F-162	F-163
No. of cylinders	4	4	4	4	4	4	4	4	4	4
Bore and Stroke	2 1/4 x 3 1/2	2 3/8 x 3 1/2	2 1/2 x 3 1/2	2 7/8 x 3 1/2	3 3/16 x 3 1/2	3 x 4 3/8	3 1/8 x 4 3/8	3 3/16 x 4 3/8	3 7/16 x 4 3/8	3 7/16 x 4 3/8
Displacement Cu. In.	56	62	69	91	112	124	135	140	162	162
Compression Ratio	6.12	6.46	6.66	6.46	6.07	6.28	7.2:1	6.00	6.01	7.4:1
Max. Oil Pressure**	20-30	20-30	30-40	30-40	30-40	20-30	30-40***	20-30	20-30	30-40***
Min. Oil Pressure (Idling)	7	7	7	7	7	7	7	7	7	7
Firing Order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Main Brg. Frt.	2 x 1 7/32	2 x 1 7/32	1 3/4 x 1 7/32	1 3/4 x 1 7/32	1 3/4 x 1 7/32	2 1/4 x 1 1/8	2 3/8 x 1 1/16	2 1/4 x 1 1/8	2 1/4 x 1 1/8	2 3/8 x 1 1/16
Main Brg. Center			1 3/4 x 1 7/16	1 3/4 x 1 7/16	1 3/4 x 1 7/16	2 1/4 x 1 5/8	2 3/8 x 1 23/64	2 1/4 x 1 5/8	2 1/4 x 1 5/8	2 3/8 x 1 23/64
Main Brg. Rear	2 x 1 7/32	2 x 1 7/32	1 3/4 x 1 7/16	1 3/4 x 1 7/16	1 3/4 x 1 7/16	2 1/4 x 1 5/8	2 3/8 x 1 5/8	2 1/4 x 1 5/8	2 1/4 x 1 5/8	2 3/8 x 1 5/8
Conn. Rod Brg.										
Dia. and Length	1 1/2 x 3/4	1 1/2 x 3/4	1 1/2 x 1	1 1/2 x 1	1 1/2 x 1	1 15/16 x 1 1/8	2 1/16 x 1 1/8	1 15/16 x 1 1/8	1 15/16 x 1 1/8	2 1/16 x 1 1/8
Oil Capacity Crankcase	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	4	4	4	4	4
Filter	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Total	4	4	4	4	4	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2
Valve Clearance										
Intake	.015	.012	.012	.012	.012	.014	.012	.014	.014	.012
Exhaust	.015	.012	.012	.020	.020	.016 ◇	.020	.016 ◇	.016 ◇	.020
Water Capacity	(Given in quarts — add approximately 1 quart for hoses)									
Engine	2	2	3 3/4	3 3/4	3 3/4	5	5	5	5	5
Engine and Radiator	11	11	14	15	15	14	14	14	15	15
Weight (Bare Engine)	180	210	290	290	290	415	415	415	415	415

*Dimensions and data shown are for Standard Industrial Engines.

**Note: Other oil pressures are available, based on customer specifications.

***Oil pressure with oil pressure relief valve spring number 10EL00230 on engines built after December 1971. Previous to that, oil pressure relief valve spring F400L00223 was used with 20-30# pressure.

◇ Static or cold setting .017

SIX CYLINDER L-HEAD ENGINES*

MODEL	F-186	F-209	F-226	F-227	F-244	F-245	M-271	M-290	M-330	M-363	B-371	B-427
No. of Cylinders	6	6	6	6	6	6	6	6	6	6	6	6
Bore & Stroke	3 x 4 3/8	3 3/16 x 4 3/8	3 5/16 x 4 3/8	3 5/16 x 4 3/8	3 7/16 x 4 3/8	3 7/16 x 4 3/8	3 5/8 x 4 3/8	3 3/4 x 4 3/8	4 x 4 3/8	4 x 4 13/16	4 1/8 x 4 5/8	4 5/16 x 4 7/8
Displacement Cu. In.	186	209	226	226	244	244	271	290	330	363	371	427
Compression Ratio	6.43	6.09	6.02	7.28	6.9	7.2	6.12	5.96	6.75	6.70	5.96	5.76
Max. Oil Pressure**	20-30	20-30	20-30	30-40***	20-30	30-40***	30-40	30-40	30-40	30-40	40-50	40-50
Min. Oil Pressure	7	7	7	7	7	7	7	7	7	7	7	7
Firing Order	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Main Brg. — Front	2 1/4 x 1 1/8	2 1/4 x 1 1/8	2 3/8 x 1 1/16	2 3/8 x 1 1/16	2 3/8 x 1 1/16	2 3/8 x 1 1/16	2 5/8 x 1 21/64	2 5/8 x 1 21/64	2 5/8 x 1 21/64	2 5/8 x 1 21/64	2 7/8 x 1 15/32	2 7/8 x 1 15/32
Main Brg. — Int.	(2) 2 1/4 x 1 5/16	(2) 2 1/4 x 1 5/16	(2) 2 3/8 x 1 5/16	(2) 2 3/8 x 1 5/16	(2) 2 3/8 x 1 5/16	(2) 2 3/8 x 1 5/16	(4) 2 5/8 x 1 5/16	(4) 2 5/8 x 1 5/16	(4) 2 5/8 x 1 5/16	(4) 2 5/8 x 1 5/16	(4) 2 7/8 x 1 7/16	(4) 2 7/8 x 1 7/16
Main Brg. — Center							2 5/8 x 2 1/8	2 5/8 x 2 1/8	2 5/8 x 2 1/8	2 5/8 x 2 1/8	2 7/8 x 2 7/16	2 7/8 x 2 7/16
Main Brg. — Rear	2 1/4 x 1 5/8	2 1/4 x 1 5/8	2 3/8 x 1 31/64	2 3/8 x 1 23/64	2 3/8 x 1 31/64	2 3/8 x 1 23/64	2 5/8 x 1 15/16	2 5/8 x 1 15/16	2 5/8 x 1 15/16	2 5/8 x 1 15/16	2 7/8 x 2 1/2	2 7/8 x 2 1/2
Conn. Rod Brg. Dia. & Length	1 15/16 x 1 1/8	1 15/16 x 1 1/8	2 1/16 x 1 1/8	2 1/16 x 1 1/8	2 1/16 x 1 1/8	2 1/16 x 1 1/8	2 1/4 x 1 3/8	2 1/4 x 1 3/8	2 1/4 x 1 3/8	2 1/4 x 1 3/8	2 1/2 x 1 1/2	2 1/2 x 1 1/2
Oil Capacity												
Crankcase	5	5	5	5	5	5	7	7	7	7	8	8
Filter	1/2	1/2	1/2	1/2	1/2	1/2	1	1	1	1	1	1
Total	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	8	8	8	8	9	9
Valve Clearance												
Intake	.014	.014	.014	.012	.014	.012	.017	.017	.017	.017	.017	.017
Exhaust	.016◇	.016◇	.016◇	.020	.016◇	.020	.020	.020	.020	.020	.022	.022
Water Capacity		(Given in quarts — add approximately 1 qt. for hoses)										
Engine	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	6 1/2	13 1/2	13 1/2	13 1/2	13 1/2	16	16
Radiator	10 1/2	10 1/2	10 1/2	10 1/2	10 1/2	10 1/2	17 1/2	17 1/2	19 1/2	19 1/2	20	20
Total	17	17	17	17	17	17	31	31	33	33	36	36
Weight — Bare Engine	550	550	555	555	565	565	800	800	800	800	945	950

*Dimensions and data shown are for Standard Industrial Engines.

**Note: Other oil pressures are available, based on customer specifications.

***Oil pressure with oil pressure relief valve spring number 10EL00230 on engines built after December 1971. Previous to that, oil pressure relief valve spring F400L00223 was used with 20-30# pressure.

◇ Static or cold setting .017

INFORMATION FOR ORDERING PARTS

When ordering parts, refer to the **engine name plate** attached to side of the cylinder block, which lists the **model** and **serial number.** In most cases a **specification** number is listed. This data is of vital importance in obtaining the correct parts: **always include this information on your parts order.**

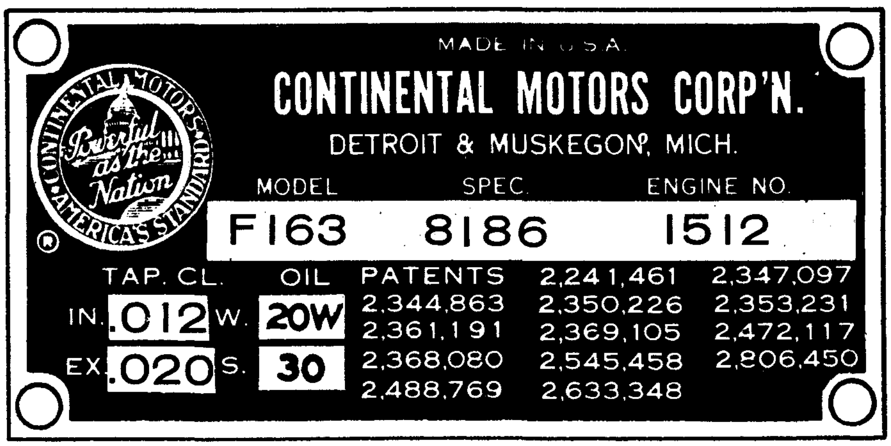


Figure 9 — Nameplate

SECTION 1
GENERAL INFORMATION

L-Head engines have inherent design advantages which result in a more simple engine of lower height, weight and cost. All valves, cams, valve lifters and all other moving parts are a part of the cylinder block assembly.

The cross-section of an L-Head engine resembles the letter "L" written upside down and engines with this type of combustion chamber are also called side-valve engines.

Intake and exhaust valves are located in the side pocket and both are directly operated through tappets from a single camshaft. This provides a simple and heavy duty valve gear, since there is no deflection.

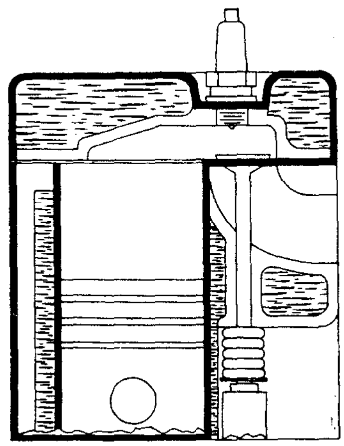


Figure 10 — L-head design

CONTINENTAL L-HEAD ENGINES

Continental has eight basic four-cylinder and ten six-cylinder L-Head type engines, ranging in size from 56 to 427 cubic inch displacement.

The combustion chamber design has been tailored for the required turbulence, charge flow and burning characteristics to provide dependable and economical heavy duty service.

Some of the principal design features are:

1. **Individual Porting** — of the intake manifold whereby each cylinder is fed with the fuel-air mixture individually and not influenced by other cylinders of the engine.

This is accomplished by casting the cylinder block with individual intake valve passages for each cylinder and connecting these passages to an intake manifold which also has individualized passages for each cylinder.

This equal distribution results in maximum power, smooth operation, easy starting and longer engine life.

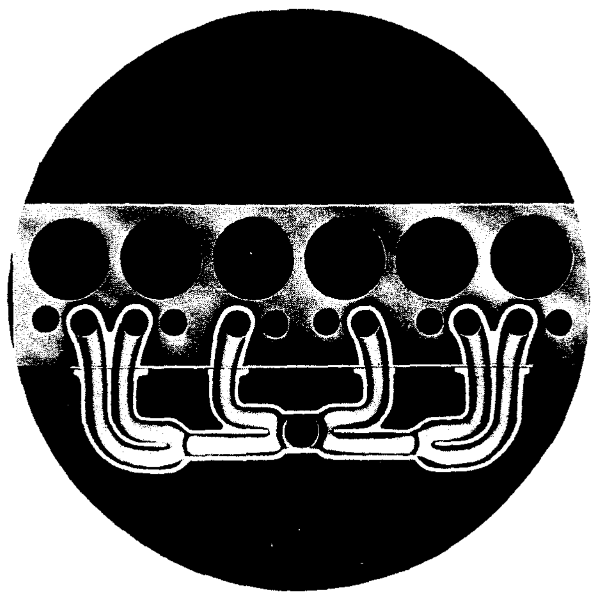


Figure 11 — Individual Porting

2. **Directional Cooling** — is accomplished by regulating the course of the cool water from the water pump so it first comes in contact with exhaust valve seats and then to other points as indicated by their relative temperatures.

This feature promotes uniform cooling throughout the system, prevents hot-spots and prolongs valve life.

This coupled with the by-pass and thermostat included in the engine assembly, insures rapid warm-up and even temperature distribution.

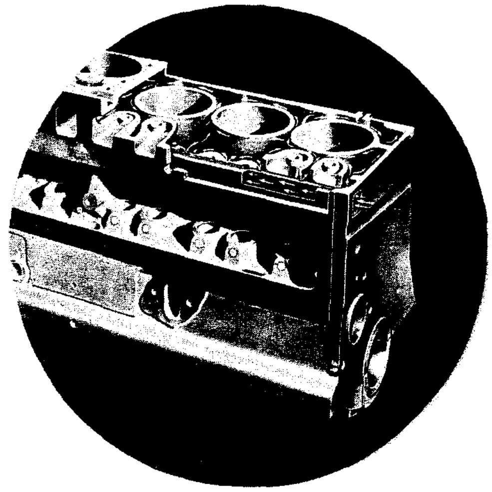


Figure 12 — Directional Cooling in Block

3. **Full Length Water Jackets** — completely surround all cylinder bores the full length of the piston travel.

This insures uniform cooling with minimum bore distortion — which results in lower oil consumption; less blow-by and minimum tendency to sludge.

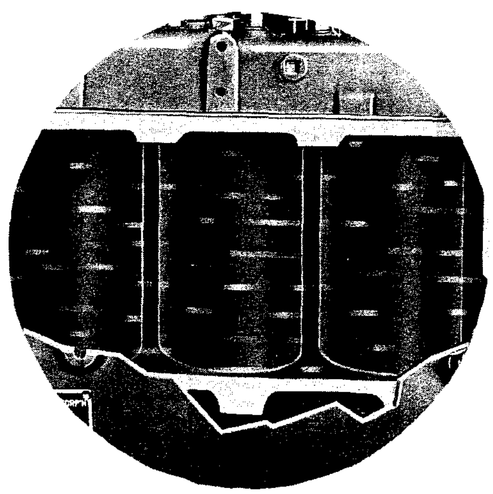


Figure 13 — Full Length Water Jackets

4. **Removable Tappets** — The large, barrel shaped, pressure lubricated tappets are so designed that by removing the adjusting screw — the main body can be lifted out and replaced from above through the valve chamber. This eliminates the costly service operation of dropping the oil pan and pulling the camshaft. Locking of the adjustment is both simple and effective.

Figure 14 — Removable Tappets

5. **Choice of Fuels** — Gasoline - LPG - Natural Gas - Fuel Oil — Continental L-Head engines have been tailored for heavy-duty operation using gasoline - LPG - natural gas - fuel oil fuels.

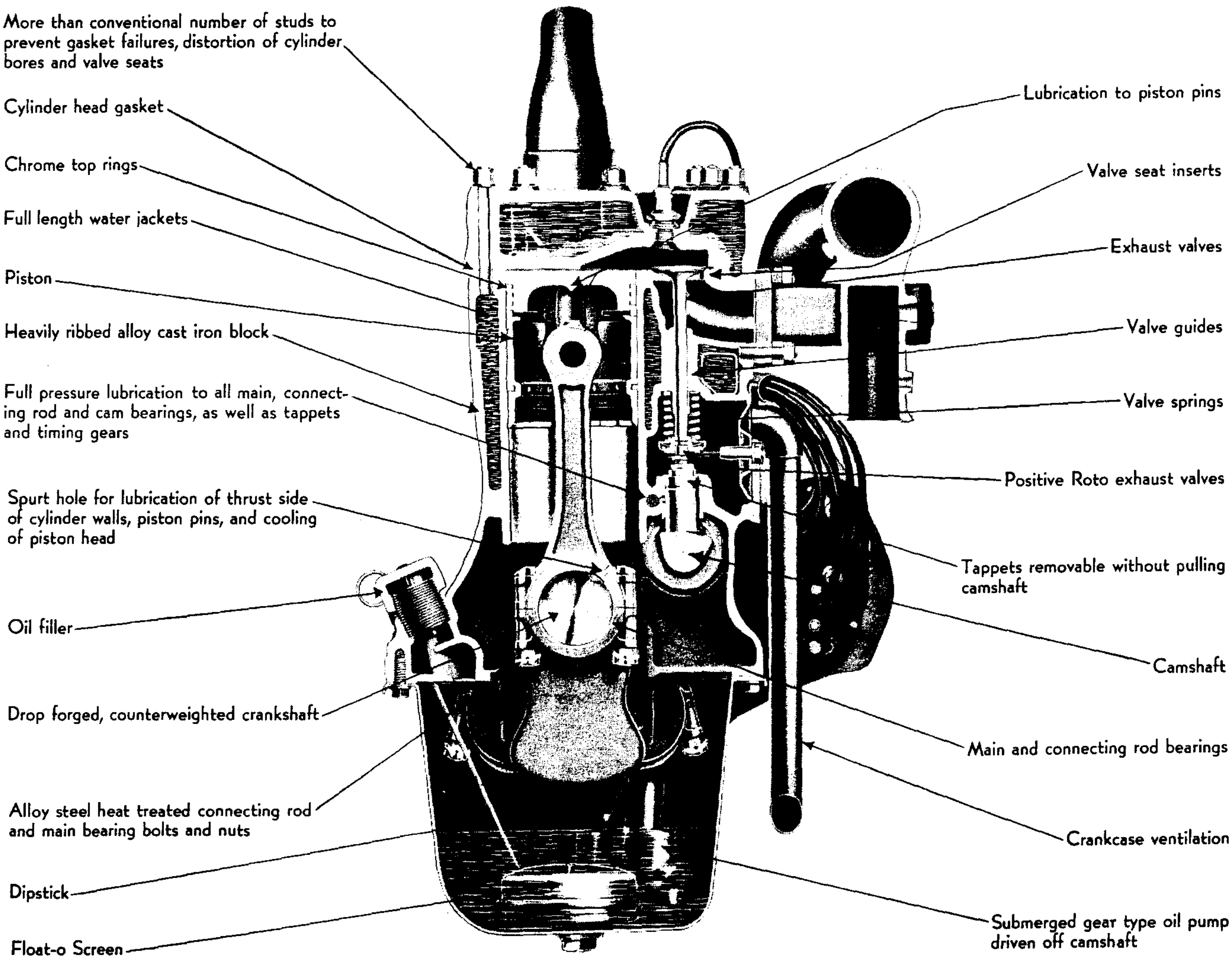


Figure 15 — Cross Section of a Typical Continental "L" Head Engine

SECTION II
LUBRICATION

ENGINE LUBRICATION SYSTEM

Continental L-Head engines have full pressure lubrication to all main, connecting rod and camshaft bearings as well as tappets and timing gears.

To insure piston pin lubrication and prevent piston scuffing during the warm-up period in cold weather — the large end of the connecting rods have drilled spurt holes pointing toward the thrust side of the pistons. These line up with the oil hole in the crank pin so that once each revolution, oil is sprayed on the cylinder wall for lubrication.*

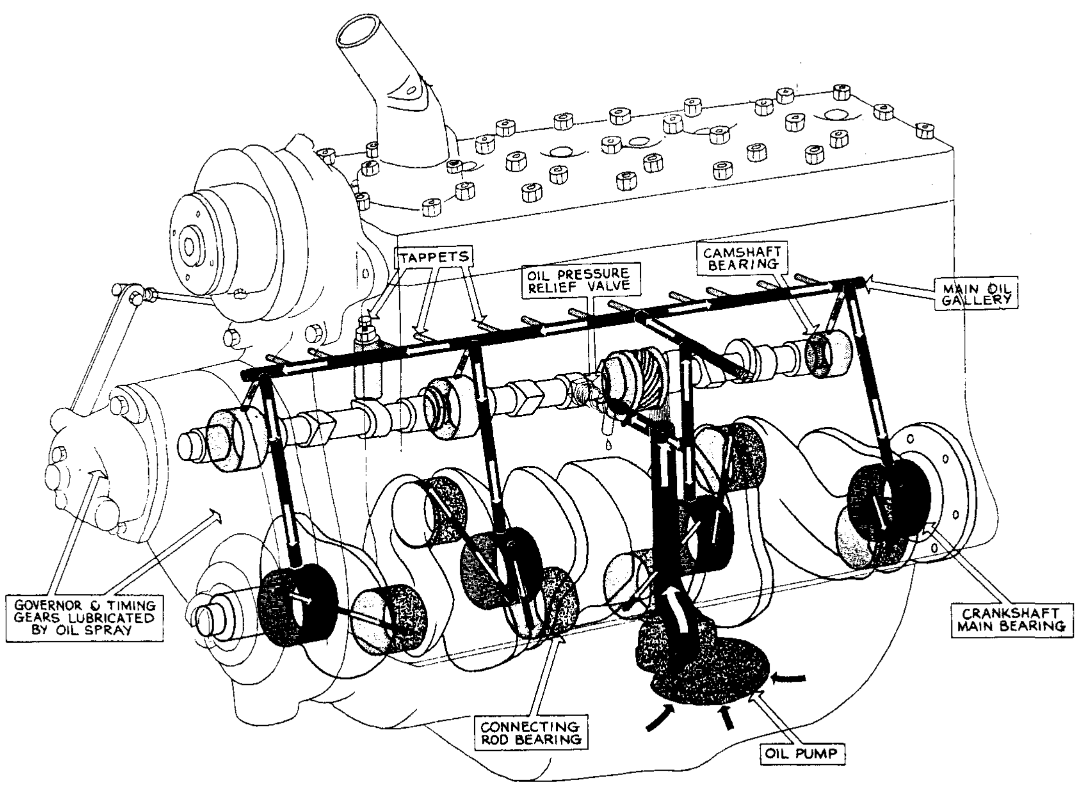


Figure 16 — Oiling Diagram

* NOTE: On some recent models, the connecting rod spurt holes have been plugged or eliminated. This does not in any way effect the lubrication of the engine.

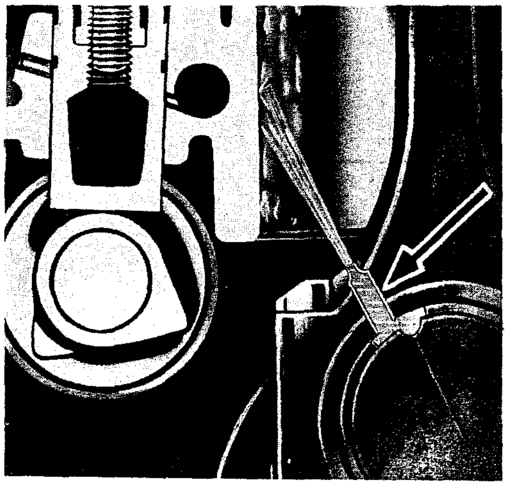


Figure 17 — Connecting Rod Spurt Hole
(see note on page 11)

OIL PUMP

On all engines except the N-series, a large capacity, submerged, gear type oil pump is driven off the camshaft and protected by a large screen inlet; on the N-series the oil pump is mounted on the rear end plate.

An adjustable by-pass valve maintains suitable oil pressure from idle to maximum speed automatically.

Refer to pages 5 and 6 for complete oil pressure figures.

> *CAUTION: If the oil pressure is erratic or falls below these limits, stop the engine IMMEDIATELY and find the cause of the trouble. Refer to trouble shooting section for this information.*

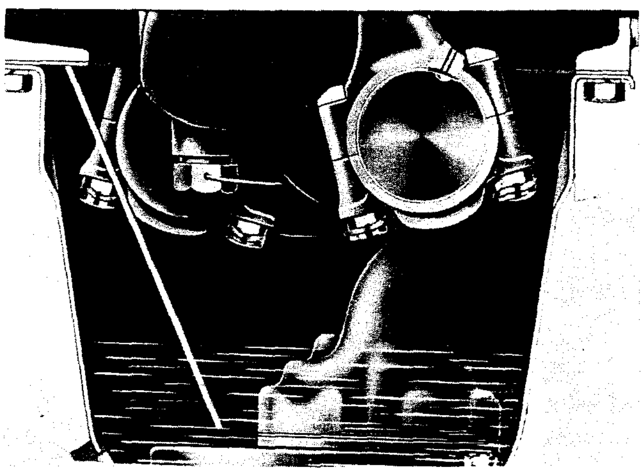


Figure 18 — Oil Pump

*Other pressures are available, based on customer specifications.

A by-pass type oil filter is normally provided to remove dirt and foreign elements from the oil, a percentage of which is passed through the filter during the operating period. The removal of grit, sludge and foreign particles causes filter elements to clog and become ineffective unless they are normally replaced every 150 hours.

OIL CHANGE FREQUENCY

Engine oil does not "wear out". However, the lubricating oil in internal-combustion engines becomes contaminated from the by-products of combustion: dirt, water, unburned fuel entering the crankcase, and the detergents holding the carbon particles in suspension in the crankcase.

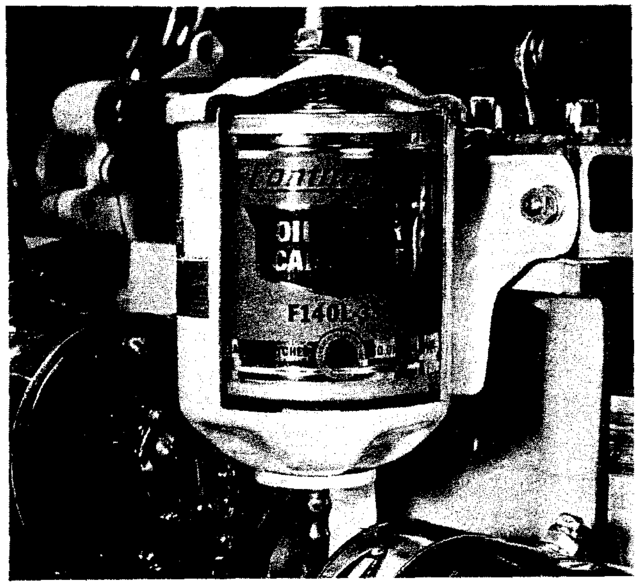


Figure 19 — Oil Filter

The schedule for changing oil is directly dependent upon the operational environment: an extremely clean operation could go 150 hours while a dirty operation (foundry or cement factory) could be 50 hours **or less.**

RUNNING-IN NEW OR RECONDITIONED ENGINES

No special oil is required — use the oil recommended for the ambient temperature. (See chart on page 14.)

DO NOT FLUSH CRANKCASE WITH KEROSENE

Some operators unwisely put kerosene in the crankcase after draining the engine oil, then turn the engine over with the starter — in the belief they are doing a better job of crankcase cleaning.

In doing this, kerosene is circulated through the oil pump, the main oil header and the branches leading into the engine bearings — thereby washing away the protective oil film. In addition, some of the kerosene will be trapped and remain to thin out the new oil, reducing its lubricating qualities.

Do not put kerosene into the crankcase. The best method is to drain the oil when the engine is thoroughly heated — which will carry off most of the sediment.

AIR CLEANER

All engines, when operating, consume several thousand cubic feet of air per hour. Since dusty air is full of abrasive matter, the engine will soon **wear excessively** if the air cleaner does not remove the dust before entering the cylinders.

Two basic types of air cleaners are normally used — the oil bath type and the dry replaceable element type.

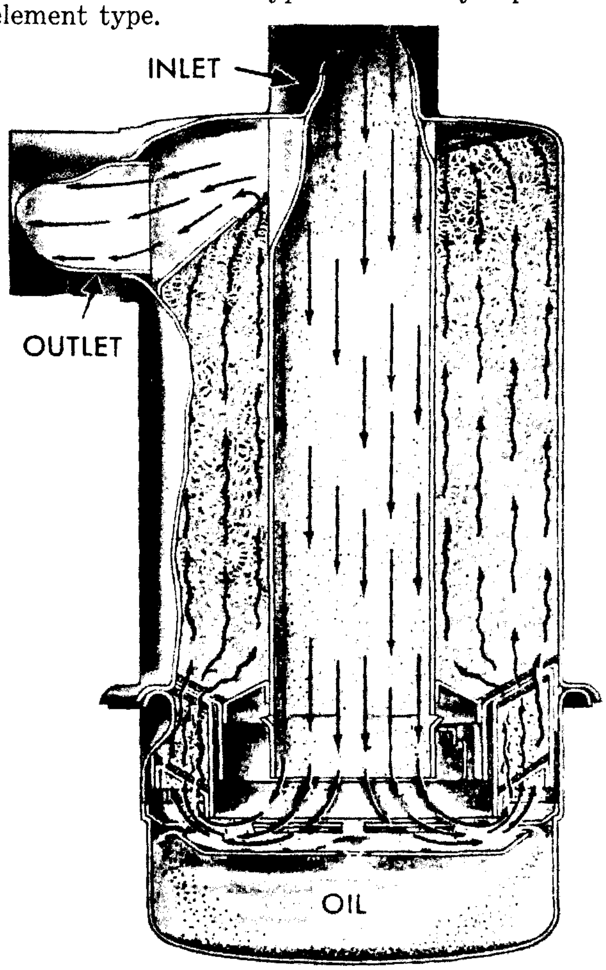


Figure 20 — Sectional View of Oil Bath Air Cleaner

Operating conditions determine the air cleaner service periods. In extremely dusty operations, this may be once or twice daily. In dust protected areas, the air cleaner should be serviced when changing oil.

As the dirt is strained from the air flowing through the cleaner, it thickens the oil in the cup and raises the level. If the level is too high, agitation of the oil on the screen is affected and gritty oil is carried over into the air stream, through the carburetor and into the engine cylinders. This would actually introduce a grinding compound with resulting very rapid wear.

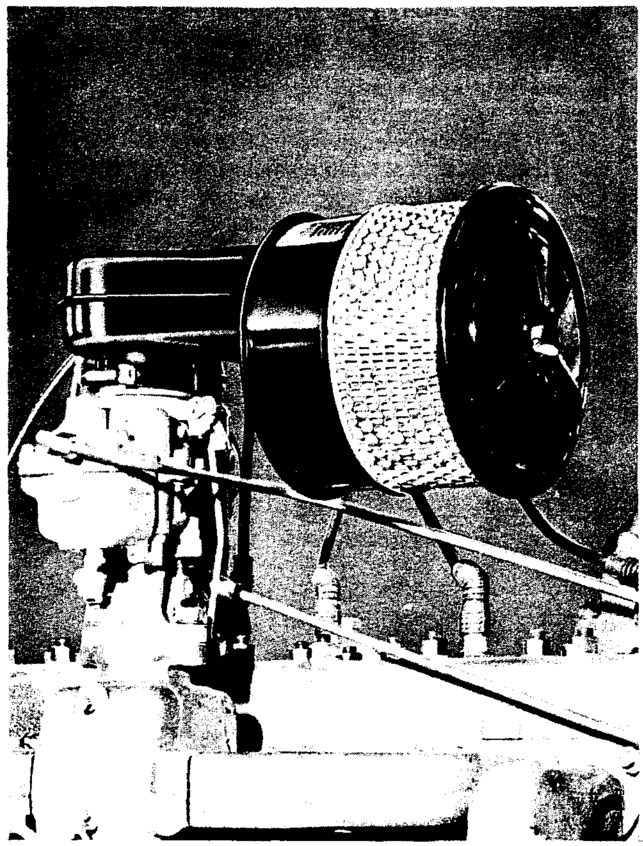


Figure 21 — Dry Replaceable Element Type Air Cleaner

By actual measurement, the amount of dust shown below, when admitted in the volume shown every hour, will completely ruin an engine in an eight hour day.

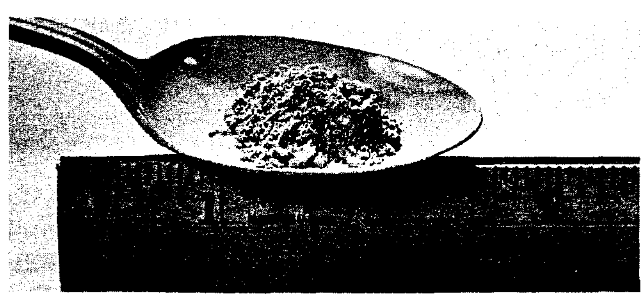


Figure 22

Proper servicing means **Cleaning Thoroughly and Refilling with New Engine Oil, and Maintaining Air-Tight Connections** between the air cleaner and intake manifold so that **All Air Entering The Engine Is Filtered.**

LUBRICATION RECOMMENDATIONS

Motor oils used for internal-combustion engine lubrication perform many useful functions including: Dissipating heat, sealing piston rings, preventing metal-to-metal contact wear and reducing power loss through friction.

The lubricating oil recommendation is based upon engine design, type of service, and the atmospheric temperature prevailing. High quality oils are required to assure maximum performance, long engine life, and minimum cost of operation.

L-Head gasoline engines operate in a wide range of service conditions and seasonal temperatures, so our recommendations are given for various types of service and ambient temperatures.

NEW API SERVICE DESIGNATIONS

API has adopted a new Engine Oil Performance and Engine Service Classification System. We recommend using the two oils described below for all L-Head engine applications (Gasoline - LPG - Natural Gas).

The new API designations are explained as follows:

SD - SERVICE CLASS D

Service typical of industrial gasoline engines operating under engine manufacturers' warranties. Oils designed for this service provide more protection from high and low temperature engine deposits, wear, rust and corrosion in gasoline engines than oils which are satisfactory for API Service Classification SC* is recommended.

SE - SERVICE CLASS E

Service typical of industrial gasoline engines operating under engine manufacturers' warranties. Oils designed for this service provide more protection against oil oxidation, high temperature engine deposits, rust and corrosion in gasoline engines than oils which are satisfactory for API Engine Service Classifications SD or SC* and may be used when either of these classifications is recommended.

Former	New	Oil Type
MS	SD	High Detergent - Exceeds engine manufacturer warranty requirements.
MS	SE	High Detergent - Exceeds engine manufacturer warranty requirements.

* SC mild detergent oil, formerly MM.

S.A.E. OIL BODY GRADES

The oil body grades available from the lightest (SAE 5W) to the heaviest (SAE 40) are:

5W	10W	20W	20	30	40
← 5W - 20 →					
	← 10W - 30 →				

Multi-Grade Oils such as SAE 5W-20 and SAE 10W-30 have the starting grade characteristics of the lighter oil and after it warms up it has the running characteristic of the heavier grade.

The following SAE grades are general recommendations for Continental L-Head engines during changing seasonal atmospheric temperatures:

ENGINE SERIES	SEVERE WINTER BELOW 0°F.	NORMAL WINTER 0° - 32°F.	SPRING-FALL 32° - 75°F.	SUMMER ABOVE 75°F.
N	SAE 5W-20	10W	SAE 20W	SAE 30
Y	SAE 5W-20	10W	SAE 20W	SAE 30
F	SAE 5W-20	10W	SAE 20W	SAE 30
M	SAE 5W-20	20W	SAE 30	SAE 40
B	SAE 5W-20	20W	SAE 30	SAE 40

The Multi-Grade oil used should cover the single grade recommendation for the atmospheric temperature involved, e.g. SAE 10W-30 covers SAE-10W, SAE-20W, SAE 20 and SAE 30.

Generators, Starters, Distributors - Add 3-5 drops of engine oil to the generator and starter oil cups every 50 hours and to the distributor every 250 hours.

AIR COMPRESSORS (ENGINE MOUNTED) normally are engine lubricated. However, if lubricated separately from the engine, use the same type and grade as used in the engine.

Clutches — Use a high temperature bearing grease. Do not over-lubricate.

Conventional Transmissions — For the greatest efficiency over the life of the transmission, use a high quality straight mineral oil. The oil should be changed seasonally.

Use the following proper grades:

	SUMMER	WINTER
Clark	SAE 90	SAE 90
Fuller	SAE 140	SAE 90
Twin Disc	SAE 40	SAE 40
Warner	SAE 140	SAE 90

Torque Converters and Hydraulic or Automatic Transmissions — These units employ a fluid medium to transmit power which must be very stable to resist formation of harmful deposits or change in body in use. The correct fluid must be selected to obtain maximum efficiency of the transmission. All fluids should be changed seasonally.

Type "A" Automatic Transmission fluid is most widely used. There are many widely distributed brands of this type.

For some models of Twin Disc Clutch Company's torque converters, a Special Fluid having a viscosity of 35 Saybolt seconds @ 100° F. is required — other models use SAE 10W engine oil. The Special low viscosity fluid may be obtained from Twin Disc Clutch Company Dealers. To satisfy the SAE 10W requirement, we recommend the use of MS type oils.

Allison Division torque converters and Torqmatic transmissions require a type C fluid.

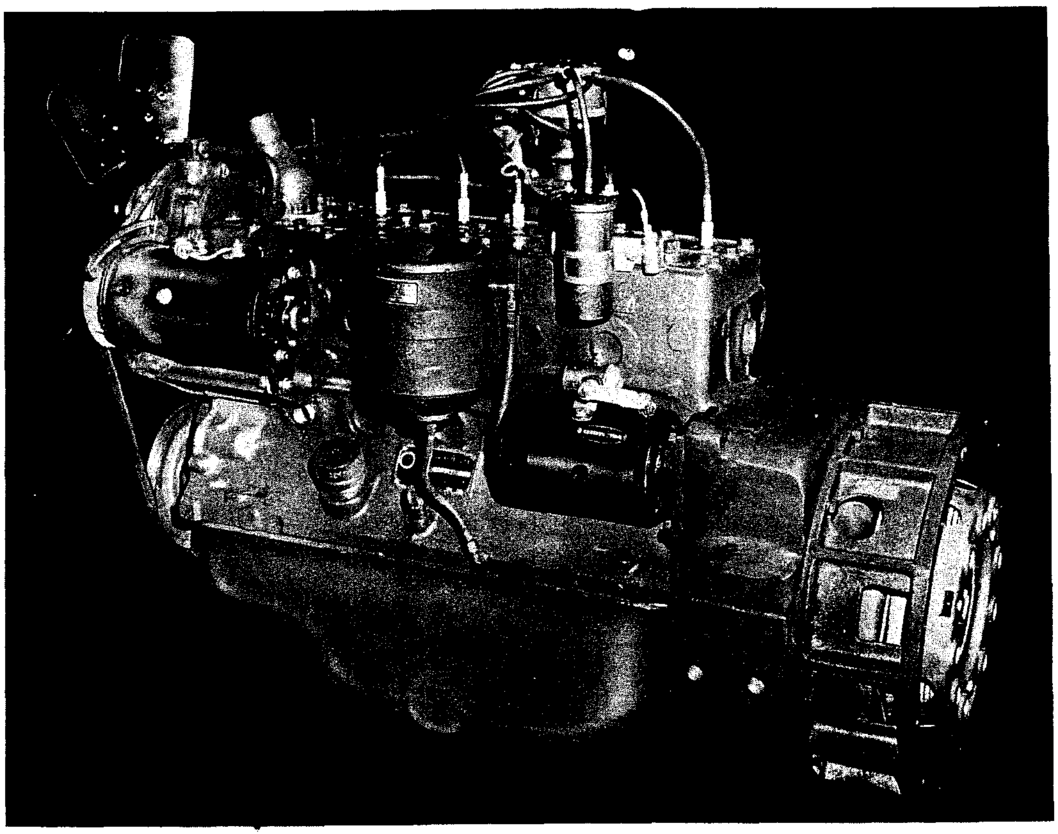


Figure 22A
F600 Engine with a Hydraulic Coupling

TRANSMISSION AND CONVERTER LUBRICATION RECOMMENDATIONS

The following grades are generally recommended for hydraulic torque converters and transmissions for Summer and Winter operation:

MANUFACTURER	SUMMER	WINTER
Continental Motors Corp.		
Co-Matic Drive	Type A	Type A
Fluid Coupling HC15	Type A	Type A
Clark Equipment Co.		
Torcon (converter only)	SAE 10W	Type A (below 10° F.)
Torcon Converter and Transmission	Type A	Type A
Fuller Mfg. Co.		
Torque Converter	SAE 10W	Type A (below 0° F.)
Borg-Warner		
Borg & Beck & Long Mfg. Co. All converters and hydraulic transmissions	Type A	Type A
Allison Division		
Torque Converters and Torqmatic Transmissions	Type C	Type C
Twin Disc Clutch Co.		
Hydraulic Reverse Gears Coupling or Power Take-off	SAE 10W	SAE 10W
Hydraulic Converter Transmissions Input shaft & impeller bearings (C, FC)	Same as Engine	
Fluid Medium	Special Twin-Disc Fluid	
except Two speed transmission and converter transmission combinations (Models T-DRR-FT-IT)	Type A	Type A
Reverse Transmissions Models RR-CRR-ICRR	SAE 40	SAE 20

NOTE: For all Grease applications on the above units a good high temperature grease should be used.

SECTION III
OPERATING INSTRUCTIONS

The person operating the engine naturally assumes responsibility for its care while it is being operated. This is a very important responsibility since the care and attention given the engine goes a long way in determining how long a period it will operate satisfactorily before having to be shut down for repairs.

The operating and preventive maintenance instructions for the L-Head type engines are simple and should be followed without deviation.

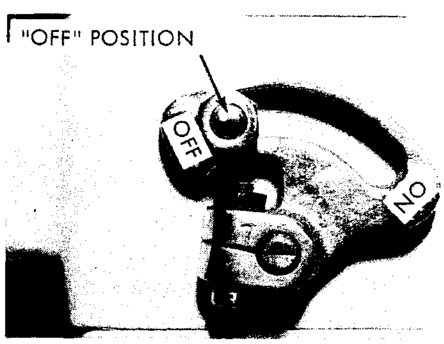
The entire aim in setting forth these instructions is to give you the benefit of the knowledge and experience gained over a long period of collaboration between Engineering Research and Field Service.

PREPARATION OF NEW ENGINE FOR OPERATION

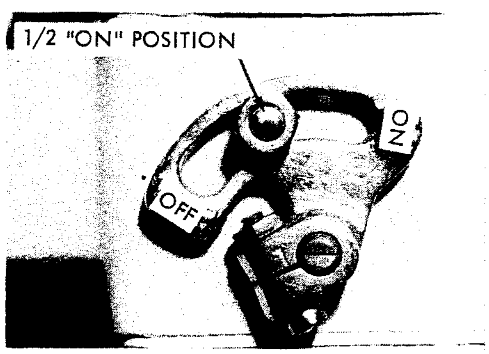
Before placing a new engine in operation, it must be thoroughly inspected for external damage and particular attention paid to the following items:

1. **Inspect Engine Hold Down Bolts** — To make certain that they are firmly set.

2. **Manifold Heat Valve Setting** — The "F" series of industrial engines have an adjustable sector on the exhaust manifold which can provide added heat on the intake manifold for **light operations with excessive idling.**



Normal Operation



Low Speed - Light Load Operat n

Figure 23 — Heat Valve Settin

NORMAL OPERATION

Set the sector on "OFF" position for warm weather operation, as there is enough heat on the intake manifold to properly vaporize the fuel.

CAUTION: Adding more heat will **reduce** the power.

LOW SPEED - LIGHT LOAD OPERATIONS

Set the sector at ¼ to ½ "ON" position - or **minimum position** for good idling.

This setting provides added heat from the exhaust manifold to circulate around a section of the intake manifold and assist vaporization.

This setting results in some power loss - but will provide good idling and low speed operation with normal fuel - air ratio.

COLD WEATHER OPERATION

Set the sector to "FULL ON" position.

CAUTION: Tighten sector nut in correct position - so it will not loosen in operation.

3. **Open Fuel Tank Shut Off Valve**—By turning handle counter-clockwise as far as it will go.

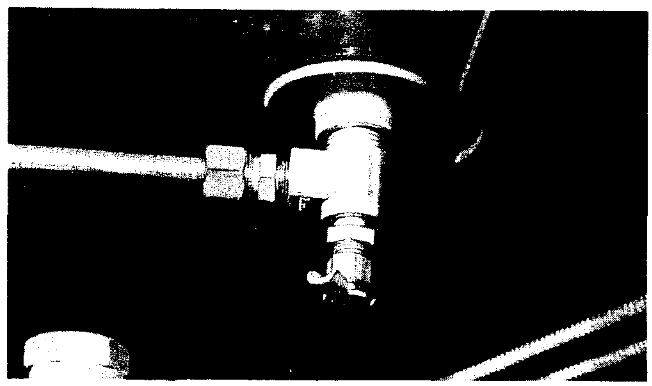


Figure 24 — Fuel Shut-off Valve

4. **Close water drain cock — in lower radiator connection, also on the side of the block. (In some cases, this may be a pipe plug.)**

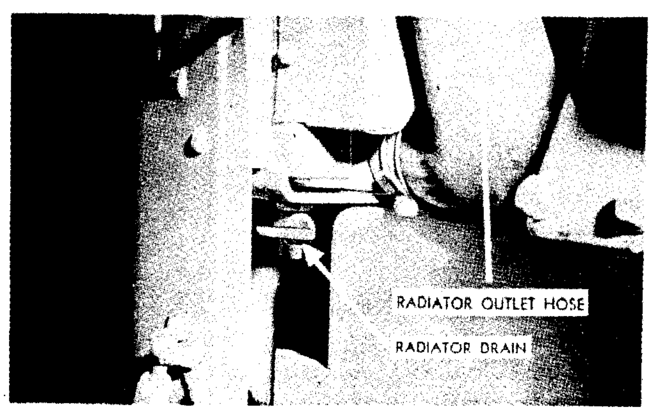


Figure 25 — Water Drain Cock

5. Fill Crankcase with oil shown in chart on page 14.

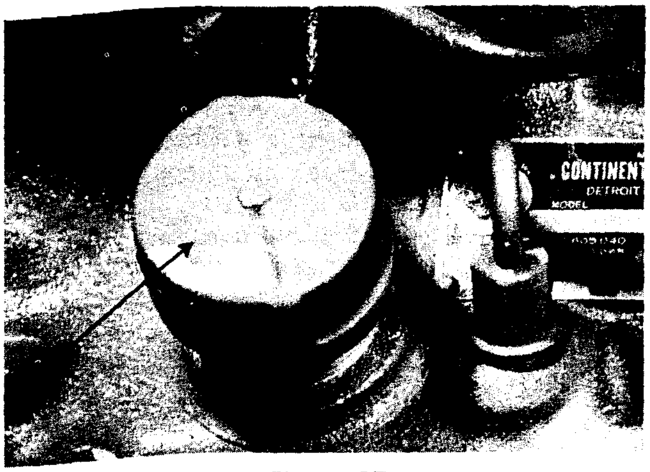


Figure 27

6. **Fill Radiator with Clean Water** — during freezing weather, use a sufficient amount of anti-freeze to protect the system for the lowest anticipated temperature — refer to Section V.

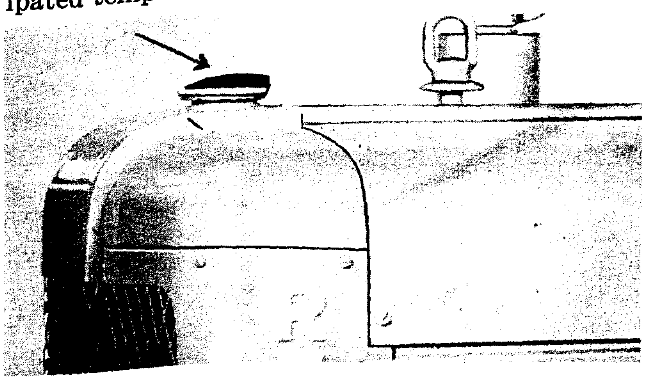


Figure 28

7. FILL GASOLINE TANK FULL — **All new engines are shipped with a treated tank which should be completely diluted with a full tank of gasoline to eliminate any tendency to clog.**

Be sure that the container used for filling is clean and free from dirt. Replace cap securely.

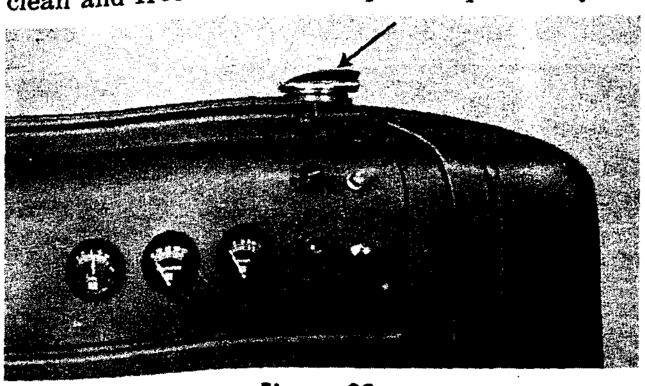


Figure 29

8. **Engine Accessories** — see that all points re quiring lubrication are properly supplied.

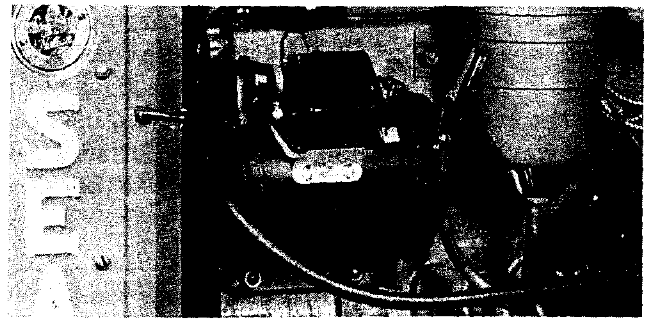


Figure 30

9. **Electrical Connections** — check storage battery terminals and all electrical connections. Check each spark plug wire for tightness.

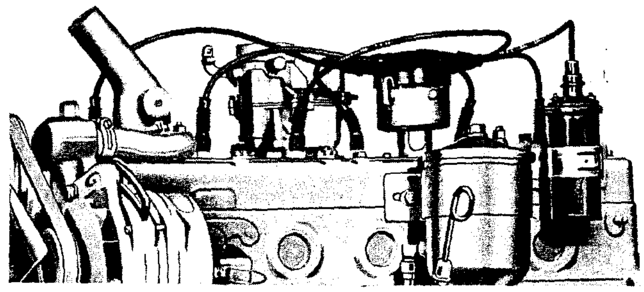


Figure 31

10. RADIATOR COOLANT CAPSULE — The radiator coolant capsule, which comes with the engine, is a water conditioner and anti rust inhibitor to protect the cooling system. **Remove cellophane wrapper before using.**

STARTING THE ENGINE

Normally check daily preventive maintenance schedule before starting. — (See Section IV).

1. **Safety Control Switch** — (If supplied)

Turn Manual control knob with arrow pointing toward "on" position. When oil pressure builds up to normal, control knob will automatically release and arrow will point to "run" position.

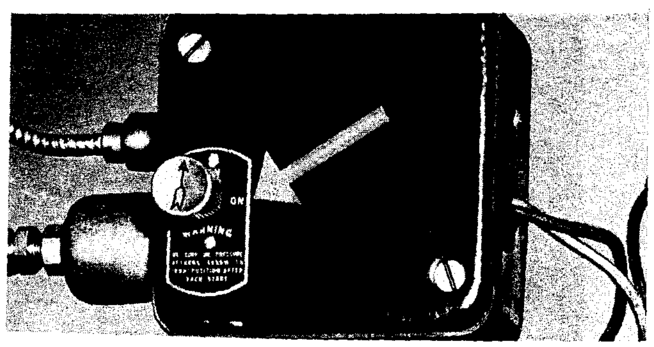


Figure 32 — Safety Switch

2. **Disengage Power Take-Off** — (if equipped) Starting engine under load throws overload on starter and battery.

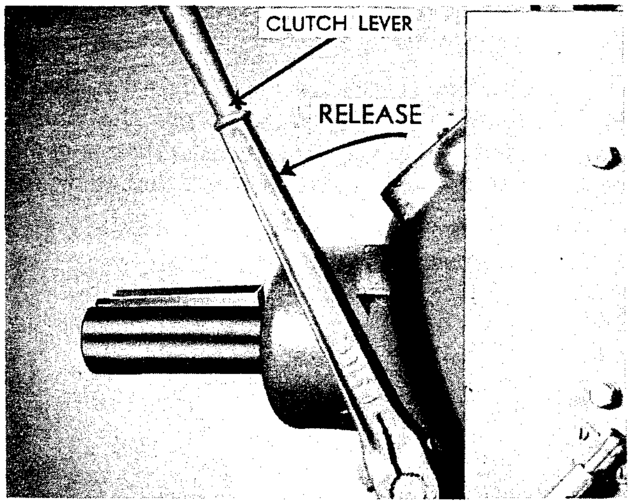


Figure 33 — Power Take-off

3. **Open throttle Control about 1/3 open**
4. **Turn on Ignition Switch**
5. **Pull Out Choke** (if manually operated) But avoid flooding the engine. Operate the engine without choking as soon after starting as possible.
6. **Push Starter Button In** Keep on until engine starts; but not longer than 15 seconds at a time.

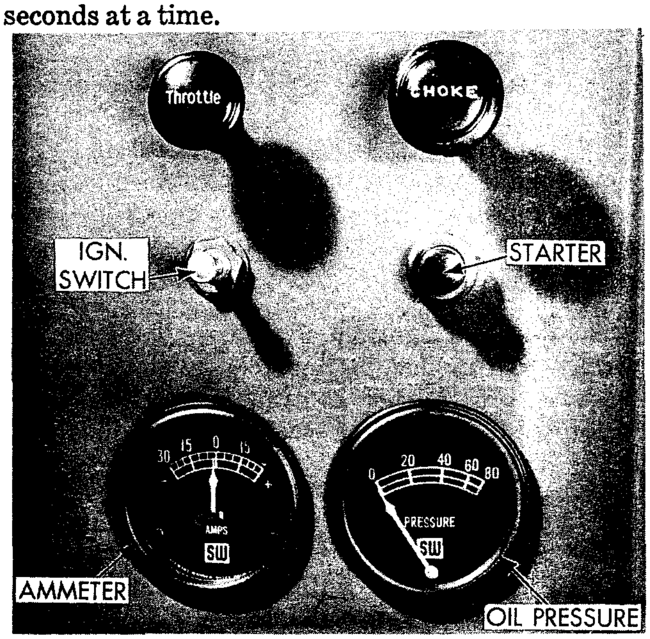


Figure 34 — Instrument Panel

7. **Warm-up Before Applying Load** Idle the engine about 700 R.P.M. for a few minutes to circulate and warm oil — then increase the speed to approximately half throttle until the engine water reaches 100° F. This procedure will prolong the engine life.

8. **Check Oil Pressure**

MODEL	OIL PRESSURE
N Series	20-30#
F Series (with F400L00223 oil pressure relief spring)	20-30#
F Series (with 10EL00230 oil pressure relief spring)	30-40#
Y-M Series	30-40#
B Series	40-50#

*Refer to pages 5 & 6 for additional oil pressure information.

Figure 35 — Oil Pressure Chart
(Other pressures available for special Applications)

9. **Check Water Temperature**

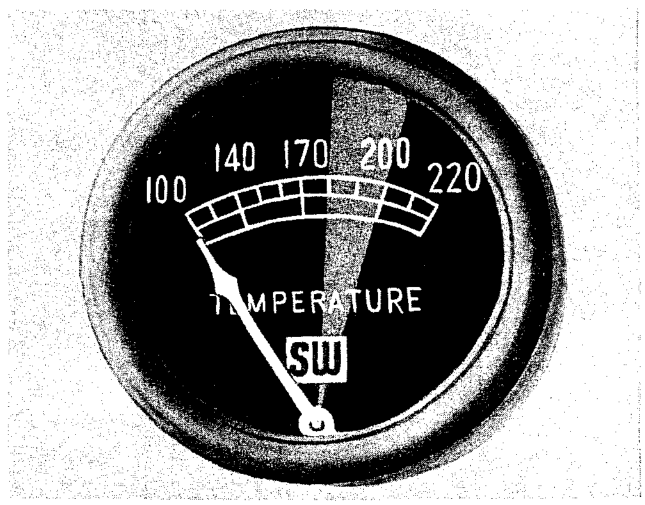


Figure 36 — Water Temperature Gauge

10. **Check ignition timing**

CAUTION:

After starting new engine — run it at idle for 5 minutes, then stop engine and recheck oil level in crankcase — then bring oil level to high mark on dipstick.

IMPORTANT!

Breaking in a new or rebuilt engine — for peak performance and economical operation, the following adjustments should be made at end of first 50 hrs. operation.

1) Torque down cylinder head studs to specifications.

2) Adjust valve tappets to specified clearances.

3) Adjust idle mixture and idle speed to 400-600 R.P.M.

SPEED CONTROL

The throttle control is used to close the carburetor butterfly valve to limit engine speed below governed speed.

Engines are provided with a mechanical or velocity governor set to maintain the load and speed specified when the engine is ordered. If individual requirements necessitate a change of governed speed — reset governor as outlined under "Governor adjustment", but do not exceed manufacturers recommended maximum speed, since this has been worked out with the end product requirements in mind.

When extended periods occur between the applications of load, it is recommended that the engine be throttled down to minimum idling speed or, if the intervals are unusually long, that it be shut down.

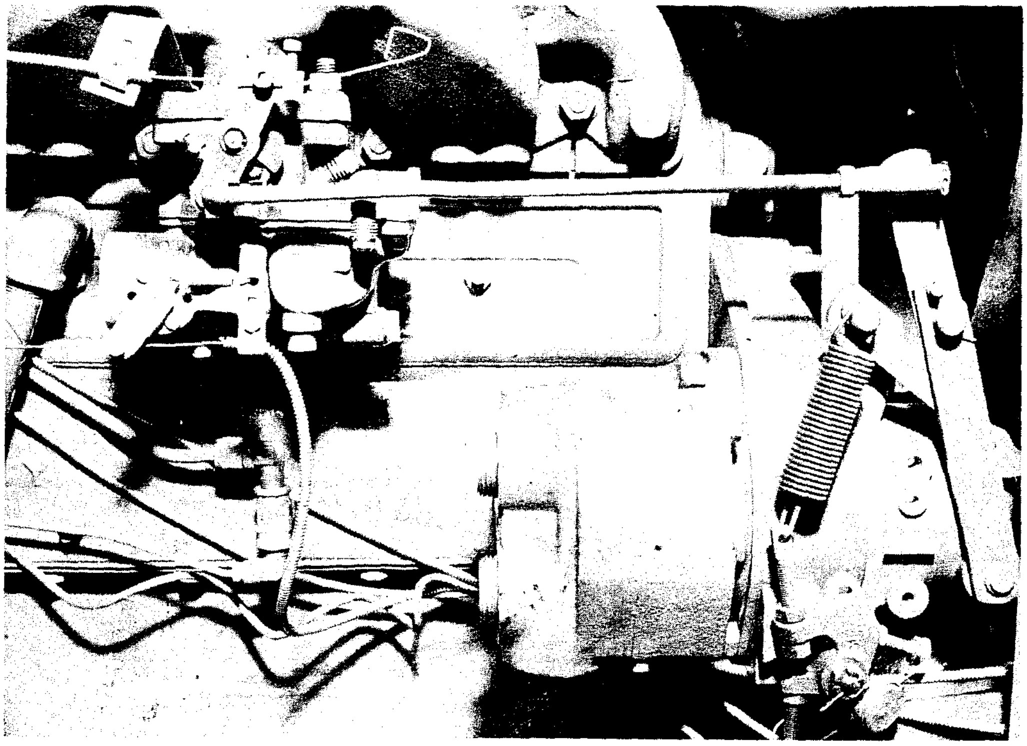


Figure 37 — Throttle Lever
(This may vary with the application.)

STOPPING THE ENGINE

1. **Disengage Power Take-Off**

2. **Reduce engine Speed to Idle** — If hot, run engine at idle (400-600) for several minutes to cool.

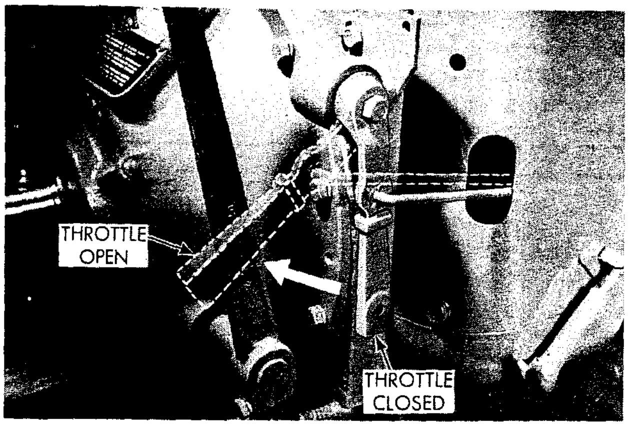


Figure 37A — Hand Throttle Control

3. **Turn Off Ignition Switch** — if engine continues to run due to high combustion chamber temperatures, either continue idling to further cool or shut off fuel supply.

> **CAUTION:**
> **NEVER PULL OUT CHOKE WHEN STOPPING ENGINE — BECAUSE RAW GASOLINE WILL WASH LUBRICANT FROM CYLINDER WALLS.**

10 OPERATING PRECAUTIONS

1. **Oil Pressure** — should be up to recommended pressure at operating speed and over 7 pounds at idle (400-600 R.P.M.)

2. **Ammeter** — should register "Charging" at all times engine is running. (A voltage regulator, if used, may limit it to a very low reading).

3. **Water temperature** — Normal operation 178 to 205° F. A pressure cap determines higher temperatures. Overheating is detected by loss of coolant. **"Frequent Readings of Gauge should become a Habit."**

4. **Muffler Restriction** — should not exceed 20" water or 1½" Mercury. Inspect mufflers periodically for restrictions to prevent burned valves.

5. **Clean and Service Air Cleaner** — as recommended to maintain its efficiency. The rapidity that dirt collects in the oil cup indicates how often the air cleaner should be serviced.

6. **When engine is Over-Heated** — do not add water — allow engine to cool so as to prevent cracking the cylinder head.

7. **Engine Load Indication** — a manifold vacuum of 6 inches of Mercury indicates the recommended maximum continuous full load operation and a vacuum of 18-20 inches of Mercury indicates normal idling vacuum. Between full load and idling, vacuum gauge readings may be used to approximate the percent. Any reading below 6" HG indicates engine is overloaded for continuous duty.

8. **Avoid Cold-Sludge Condensation** — by protecting unit to maintain crank case temperature over 135° F.

9. **Idling engine** — slow engine down to low idle (600 RPM) for about 5 minutes after each operating period before stopping. Too rapid cooling down may cause distortion. **Do not run at low idle for prolonged periods.**

10. **Follow Preventive Maintenance Schedules Recommended** — This will avoid troubles which might cause expensive breakdowns and maintain your engine for dependable and economical operation.

COLD WEATHER OPERATION

The oil used during cold weather should have a cold test below the lowest anticipated temperatures that will be encountered during its use. The new multigrade lubricating oils 5W-20 and 10W-30 are ideal for cold starting with its reduced initial drag until warmed up, when it assumes the characteristics of the heavier oil.

Sludge formation at low temperatures is a close second to dirt in causing engine damage and wear. This is formed by the piston combustion gases mixing with the fine oil mist in the crankcase and condensing on a cold surface. This condensation forms both a sulphuric and sulphurous acid which combines with the oil to become a highly injurious sludge. This dew point is about 135° F. — when crankcase temperatures are higher, the contaminated gases remain in gaseous form and the engine operates clean as long as breather system is kept clean — however temperatures below this will result in injurious sludge formation. It is vitally important therefore to maintain oil and crankcase temperatures above 135° F., as shown on the following chart:

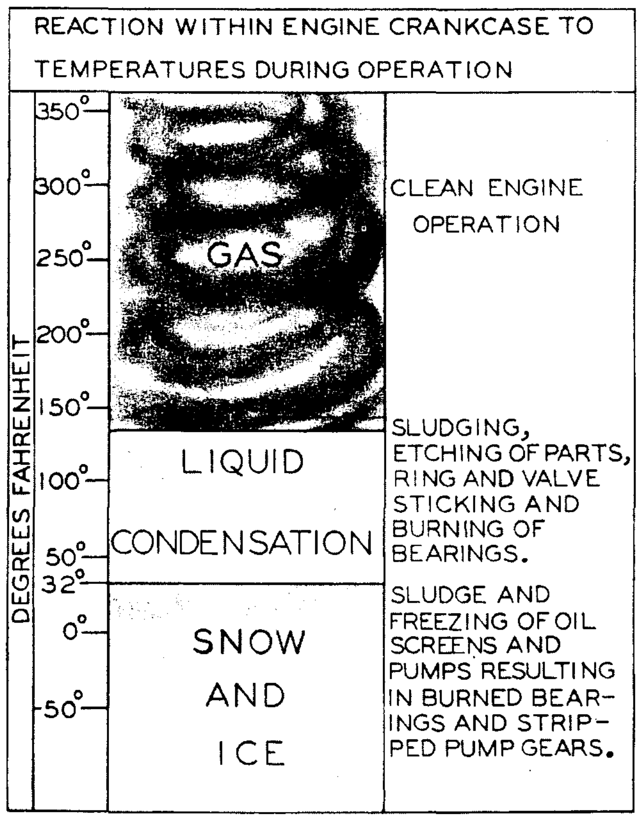


Figure 38

When sludging conditions prevail, the oil should be examined daily and changed as it may freeze, or clog the inlet strainer and cause bearing failures.

High Altitude Operation — High Altitude operation reduces the power output approximately 3½% for every 1000 feet of altitude above sea level.

High Temperature Operation—for every 10° above 60° F. carburetor air temperature — a power loss of 1% results.

PREPARATION OF ENGINE FOR SEASONAL STORAGE

CAUTION

Before starting the processing, engine must be cooled down to the surrounding temperature, since oil will adhere much better to cold metal surfaces.

1. **Drain Oil from Oil Pan** — and replace drain plug.
2. **Refill Oil Pan** — with high grade SAE 30 or 40 engine oil to ½ its normal capacity.
3. **Start up Engine** — and run at above 600 R.P.M. for 2 minutes to complete oil distribution on all surfaces — **Do Not Run Longer Than 2 Minutes.**
4. **Stop Engine**—Remove all Spark Plugs.
5. **Pour 3 Ounces of SAE 30 or 40 Engine Oil** — into each Spark Plug Hole.
6. **With Ignition Cut Off — Crank engine with Starter** — for at least a dozen revolutions to distribute this oil over the cylinder walls and valve mechanism.
7. **Drain Oil from Pan and Reassemble Plug.**
8. **Drain Cooling System and Close Drain Cocks.**
9. **Drain All Gasoline** — from tank, lines and carburetor bowl.
10. **Replace All Spark Plugs.**
11. **Seal Air Cleaner Inlet — exhaust outlet — Crankcase Breather Tube** — with weather proof masking tape.
12. **Check Oil Filler Cap — Gas Tank Cap** and **Radiator Cap** to make certain they are securely in place.

Note: If Mil-L21260 No. 30 oil is available, substitute in Steps 2 and 5 above.

SHORT TERM STORAGE

(Instructions below should be adhered to every 90 days on outside storage and every 6 months on inside storage.)

If the shut down period is to be over 30 days duration, the following instructions should be adhered to:

1. Stop engine, remove spark plugs.
2. Pour 3 ounces clean engine oil in each spark plug hole.
3. With ignition cut off, crank engine with starter at least a dozen revolutions to distribute this oil over the cylinder walls and valve mechanism.
4. Replace all spark plugs.
5. Remove drain plug from carburetor bowl, and drain gasoline.
6. Replace drain plugs.

CAUTION: Gasoline evaporates if left in carburetor for long periods. This evaporation of gasoline will leave a gum and varnish coating over jets and moving parts; when engine is started up again, you may have flooding or poor operation from carburetor.

SECTION IV
PREVENTIVE MAINTENANCE

In order to obtain maximum efficiency from your gasoline engine, a definite maintenance program should be set-up and followed. Haphazard maintenance will only lead to faulty engine performance and shorten engine life.

All moving parts in the engine are subject to wear; however, wear **can be retarded** by careful operation and a planned maintenance program.

In general, gasoline engine operation demands careful attention to the cleanliness of **air, fuel** and **oil** and maintaining operating temperatures of 180°-200° F.

The following pages, covering DAILY, 50-250 and 500 hour maintenance, have been worked out with our field service division as "Minimum Requirements" to keep your engine in dependable operating condition.

DAILY
PREVENTIVE MAINTENANCE SCHEDULE

1. OVERALL VISUAL INSPECTION OF ENGINE

Look for evidence of fluid leaks on floor, cylinder head and block, indicating loose fuel, oil or water connections — **tighten if found.**

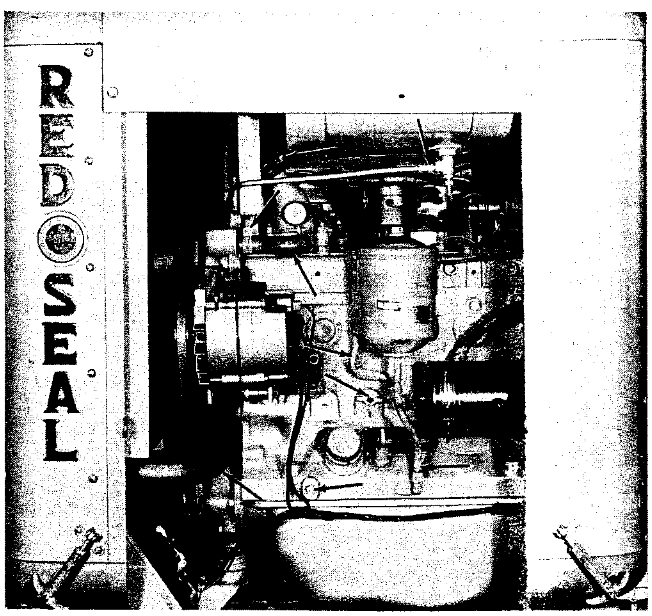


Figure 39 — Check for Possible Leakage

2. CHECK OIL LEVEL OF ENGINE

The dipstick indicates the high and low oil level in the crankcase—make allowance for additional oil drainage back into oil pan if engine has not been stopped 15 minutes. The most efficient oil level is between the two dipstick levels.

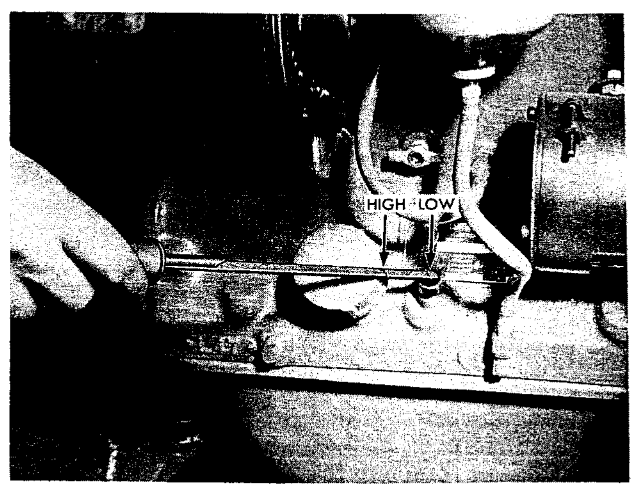


Figure 40 — Check Oil Level of Engine

> *Do not add oil until oil level approaches the low mark — then add only enough to bring it to high level — NEVER above.*
>
> *Do not operate the engine with oil below low level mark.*

3. CHECK RADIATOR

Fill radiator with clean water or anti-freeze to normal level maintained due to expansion when heated. Visually inspect fan and belt for condition and adjustment.

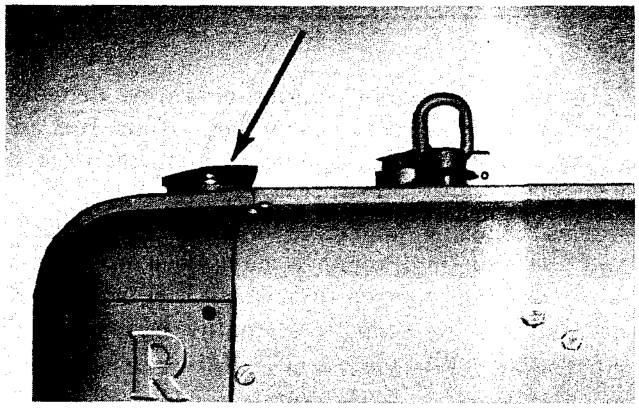


Figure 41

4. FILL FUEL TANK

Should be done at end of day's operation to prevent condensation forming in tank. Clean filler cap and area around spout before filling to prevent entrance of dust into fuel system.

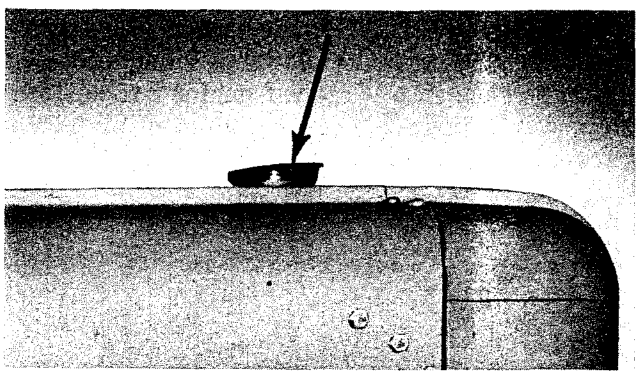


Figure 42

5. CHECK AIR CLEANER

Oil Bath Air Cleaner

Inspect daily or more often in extremely dusty conditions. Change oil and clean cup when oil becomes thick or 1/6 inch of dirt collects in bottom of cup. Always refill cup to **exact** oil level as indicated on the cup. Use SAE 20 oil in summer and SAE 10 oil or lighter in winter. Inspect all hoses. clamps and connections between air cleaner and engine. Tighten loose clamps and replace damaged hoses promptly.

Dry Type Air Cleaner

Under normal conditions, dry-type filters should be serviced every 50 hours of operation. **Extreme**

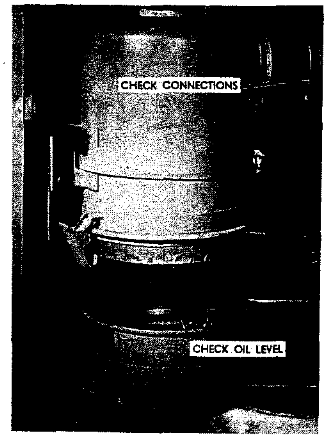


Figure 43 — Oil Bath Air Cleaner

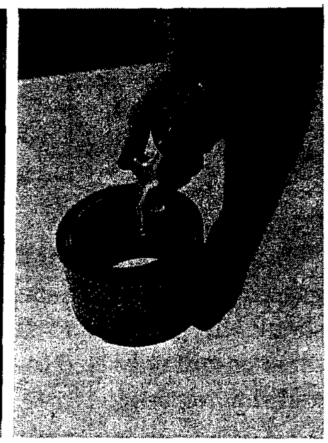


Figure 43-A — Dry-Type Air Cleaner

conditions will require daily cleaning. Cartridge can be cleaned best by blowing compressed air from inside out. Do not apply air closer than 2 inches and don't use more than 50 pounds pressure. Do not damage gasket surface or bend outer screen. Cleaning can only be done a few times as the element will finally clog and restrict air flow. The cartridge must then be replaced.

6. CHECK OIL PRESSURE*

Note oil pressure gauge which should indicate the following pressure range at full throttle and a minimum of 7 pounds pressure at idling speed (400-600 R.P.M.):

MODEL	OIL PRESSURE
N Series	20-30#
F Series (with F400L00223 oil pressure relief spring)	20-30#
F Series (with 10EL00230 oil pressure relief spring)	30-40#
Y-M Series	30-40#
B Series	40-50#

*Refer to pages 5 & 6 for additional oil pressure information.

Figure 44 — Operating Oil Pressures

*Standard Engines: on some special customer specifications, this may change.

7. NOTE ANY UNUSUAL NOISE

Operators familiar with daily engine operation soon become alert to any noise not normally present. This is very valuable in correcting defects in the early stages and preventing expensive repairs or delays.

EVERY 50 HOURS

1. REPEAT DAILY OPERATIONS OUTLINED

Follow previous instructions.

2. CHANGE CRANKCASE OIL

Engine life is dependent upon clean oil being circulated to all moving parts; therefore, the frequency of oil changes and oil filter replacement is very important and should be made at regular, scheduled periods.

The schedule for changing oil is directly dependent upon the operational environment: an extremely clean operation could go 150 hours while a dirty operation (foundry or cement factory) could be 50 hours **or less.**

Replace the oil filter element every 150 hours unless extremely unfavorable operating conditions indicate that filter replacements should be made at every oil change period.

Thoroughly clean the filter, cover and sealing surfaces before replacing new element and gasket.

3. SERVICE AIR CLEANER

If oil-bath air cleaner is used, remove bottom half of air cleaner — clean thoroughly and fill with engine oil to oil level mark on cup, avoid overfilling. Replace cup and check all connections to manifold. Be sure that no unfiltered air can enter the engine intake manifold.

If a dry type air cleaner is used, clean element with compressed air.

(See Daily Instructions)

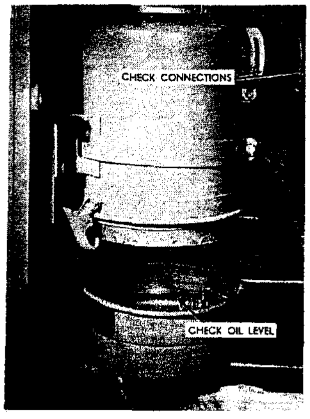
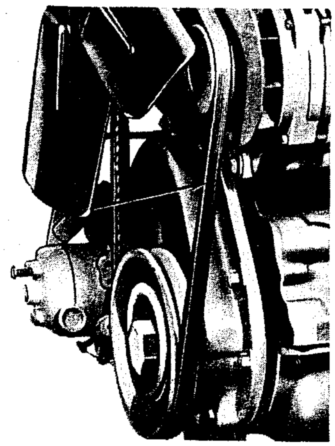


Figure 46 — Air Cleaner

4. CHECK FAN BELT TENSION



Inspect wear condition of fan belt; note alignment and check belt tension which should allow not over 1/2″ deflection on long span on narrow belts. (On wide belts the deflection should be between 3/4″-1″.)

Figure 47 — Fan Belt Tension

5. CHECK BATTERY

Check specific gravity of each cell — which should be at least 1.250. Add distilled water, if required, to raise level 3/8″ above the separators.

Particular attention should be given battery during cold weather. The cranking power of a fully charged battery @ 80° F. is reduced 60% @ 0° F. — yet the power required to crank the engine is 2½ times greater @ 0° F. than @ 80° F.

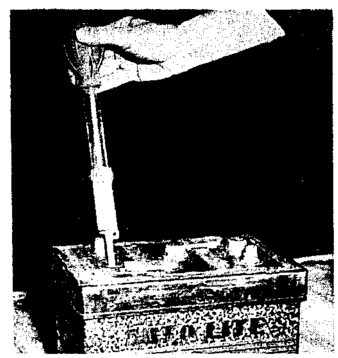


Figure 48 — Checking Battery

6. LUBRICATE GENERATOR AND STARTER

Apply 3-5 drops of engine oil to each cup on the generator and if required on the starter (Many starters have sealed bearings).

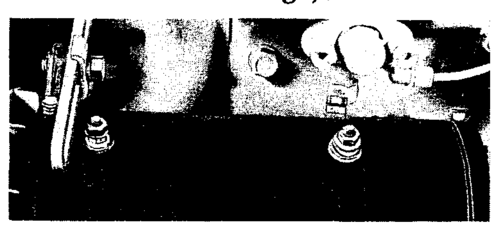


Figure 49 — Generator Lubrication

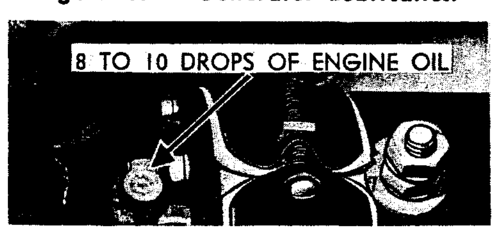


Figure 50 — Starter Lubrication Point

7. LUBRICATE POWER TAKE OFF

Using grease gun, lubricate the clutch throwout bearing and output shaft bearing with approved ball bearing grease.

Operations requiring frequent de-clutching should be lubricated daily.

Figure 51

8. TORQUE DOWN CYLINDER HEAD TO SPECIFICATIONS IN MANUAL.
9. ADJUST IDLE MIXTURE AND IDLE SPEED TO 400-600 R. P. M. REPEAT AGAIN AT THE END OF 500 HOURS

EVERY 250 HOURS

1. REPEAT DAILY AND 50-HOUR SCHEDULES

Follow previous instructions.

2. CLEAN EXTERIOR OF ENGINE

Use steam if available, otherwise any good commercial engine cleaner to wash down the engine.

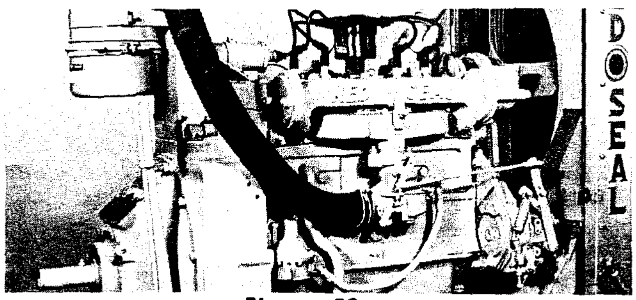


Figure 52

3. CHECK GOVERNOR CONTROL

Clean and lubricate all governor linkage to insure free operation of governor. Free-up any joints that may be binding or rods or levers that may be twisted. Check for full throttle opening.

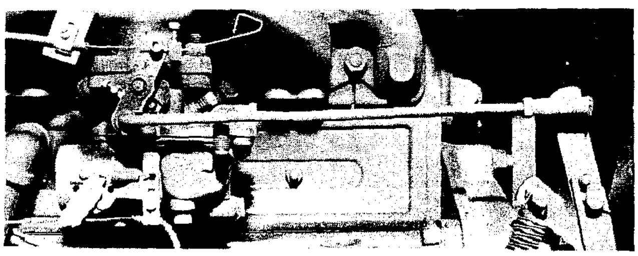


Figure 53

4. CLEAN SPARK PLUGS

Clean depressions around plugs before removing them — then clean and re-set point gap to .025 on standard plugs and .035 on resistor plugs.

Install spark plugs (18mm) and tighten to 35 ft. lbs. torque.

Figure 54

5. CHECK DISTRIBUTOR

Clean distributor cap inside and outside with solvent without removing wires and blow off with compressed air — inspect cap and rotor for cracks.

Examine contact surfaces of points — replace if burned or pitted and adjust to .020 gap.

Lubricate distributor cam sparingly.

Check distributor clamp bolts and if found loose — retiming the engine is necessary.

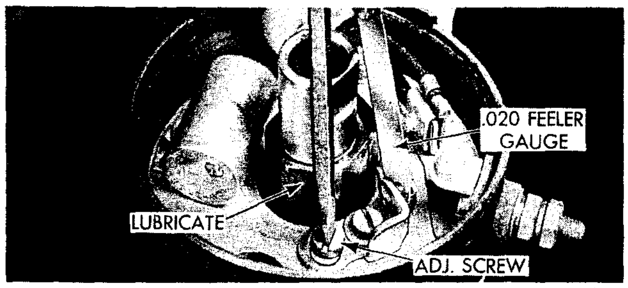


Figure 55

6. INSPECT IGNITION WIRES AND CONNECTIONS

Examine ignition wires for breaks in insulation, chafing and loose connections. Replace if defective.

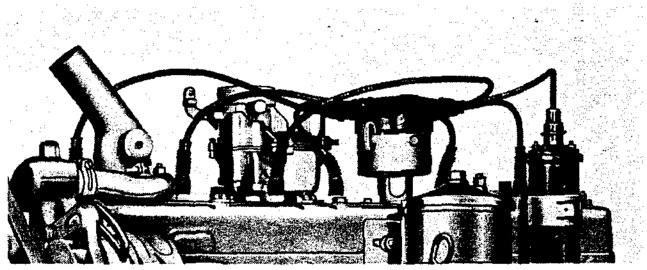


Figure 56

7 *IF DRY REPLACEABLE ELEMENT AIR CLEANER IS USED, REPLACE ELEMENT.*

EVERY 500 HOURS

1. REPEAT DAILY — 50 HOUR AND 250 HOUR SCHEDULES

2. COOLING SYSTEM

Clean radiator core by blowing out with compressed air.

Inspect radiator mounting.

Inspect water pump and connections for leaks.

Check fan and accessory drive belts.

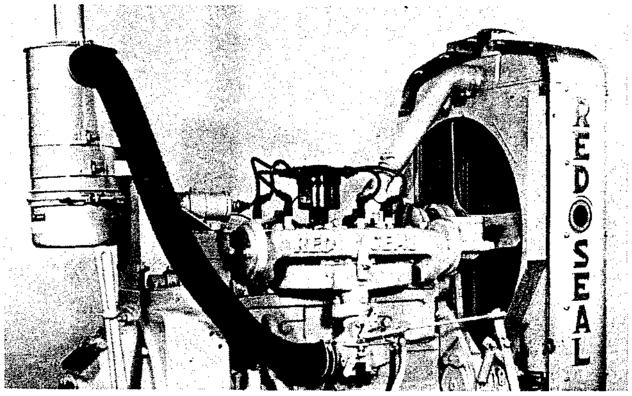


Figure 57

3. ADJUST VALVE TAPPET CLEARANCE

Check and adjust intake and exhaust valve tappets to following clearances at idling speed and running temperature:

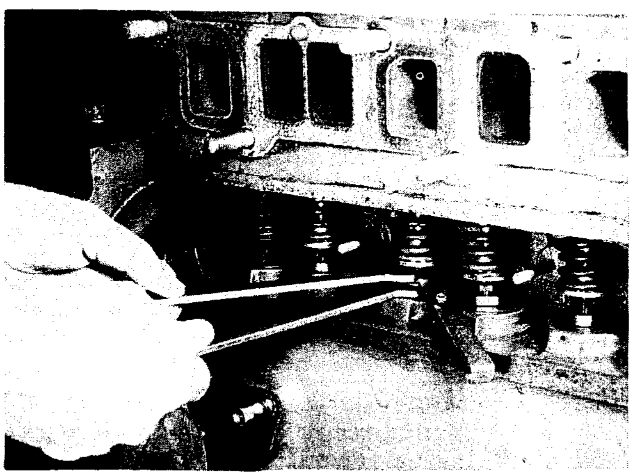


Figure 58 — Adjusting Valve Tappet Clearance

MODEL	INTAKE	EXHAUST
Y112, F135, F163	.012	.020
F227, F245	.012	.020
M330, M363	.017	.020
B427	.017	.022

Please check your engine nameplate for the correct setting.

NOTE: Tappet settings for previous models are listed on pages 5 & 6.

4. CARBURETOR

Clean exterior and check mounting to manifold.

Adjust carburetor air adjustment for even running and adjust idle speed to 400-600 R.P.M. minimum.

Inspect throttle and choke linkage for free operation.

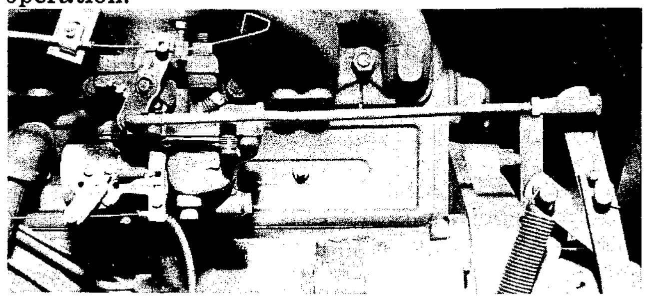


Figure 59 — Carburetor

5. FUEL PUMP

Clean Filter bowl and screen.

Inspect mounting and gasket.

Check all connections for leaks.

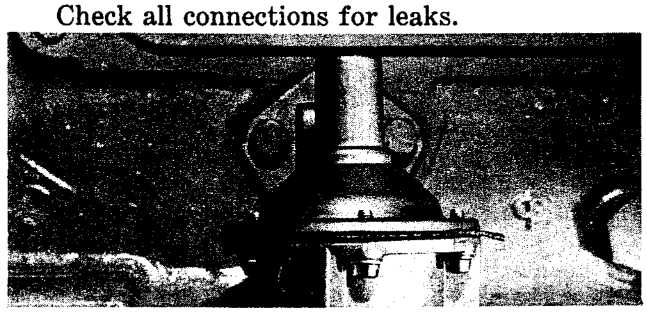


Figure 60 — Fuel Pump Mounting

6. MAGNETO (when equipped)

Spark test with engine operating by checking firing with each high tension cable held about 1/16″ away from spark plug terminal.

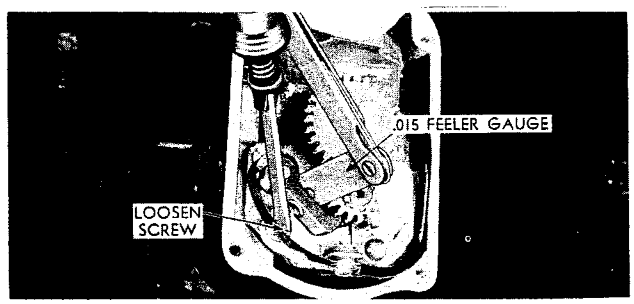


Figure 61

Remove end cap and examine carbon brushes for free-movement and inspect breaker points for wear and gap. Gap should be .015.

7. SAFETY AND THERMAL CONTROLS

Inspect control wires and connections.

Examine armored capillary tubing on water temperature element for visual damage that may cause faulty operation.

8. ADJUST IDLE MIXTURES AND IDLE SPEED TO 400-600 R. P. M.

SECTION V
COOLING SYSTEM

The function of the cooling system is to prevent the temperatures in the combustion chamber, which may reach as high as 4000° F., from damaging the engine and at the same time keep the operating temperatures within safe limits.

Maintaining the cooling system efficiency is important, as engine temperatures must be brought up to and maintained within satisfactory range for efficient operation; however, must be kept from overheating, in order to prevent damage to valves, pistons and bearings.

CONTINENTAL L-HEAD COOLING SYSTEM

With the exception of some "N" and a few "Y" engine specifications, all Continental L-Head engines have the cooling water force-circulated by a water pump and use a thermostat and by-pass system to control the temperature range.

Some of the "N" and a few of the "Y" specifications circulate the cooling water using the Thermo-Syphon system — which requires no water pump or thermostat — but circulates the water from the resulting liquid expansion when heated and contraction during cooling.

The coolant from the water pump is first directed in the block against the exhaust valve seats and into passages connecting the cylinder head. This method provides the coldest water reaching the parts subjected to the highest temperatures.

The cylinder walls, in turn, are cooled their full length by convection currents only, which keeps the cylinder barrels at a more uniform temperature and thereby reduces crankcase oil dilution and sludge formation.

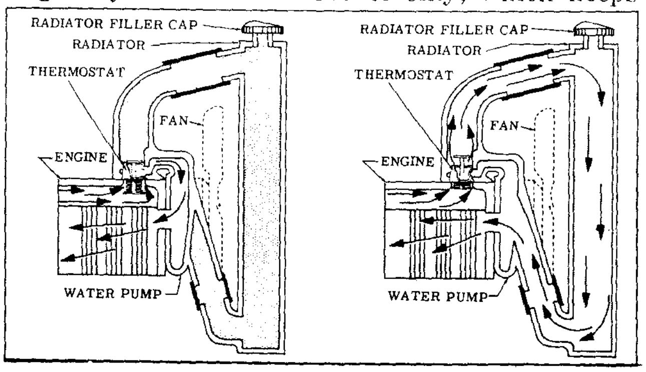


Figure 62 — Thermostat Flow Control
Thermostat Closed, Water Re-Circulating through Engine ONLY
Thermostat Open, Water Circulating through BOTH Engine and Radiator

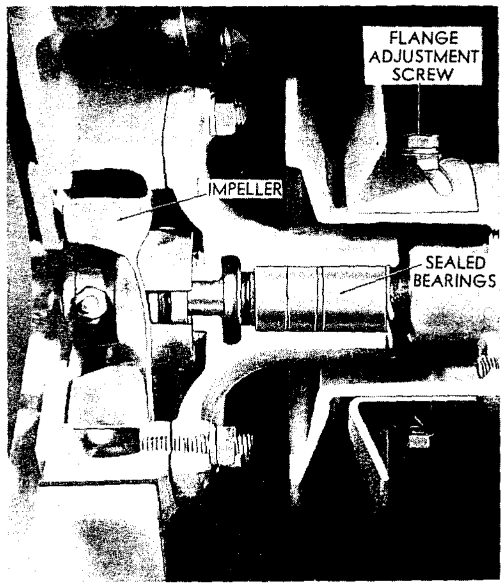


Figure 63 — Water Pump

Upon leaving the cylinder head, the water enters the thermostat housing, in which is mounted the by-pass type thermostat, which controls the opening to the radiator or heat exchanger. Upon being discharged from the thermostat housing, the water enters the radiator or heat exchanger, depending upon the application, where it is cooled before re-entry into the engine.

Continental L-Head gasoline engines operate most efficiently with water temperatures of 180°-200° F. and a thermostat and by-pass system is generally used to control these temperatures.

The thermostat valve remains closed and only allows the water to recirculate within the engine itself until normal operating temperatures are reached. This provides for both rapid and even temperature increase of all engine parts during the warm-up period. When desired temperature is reached, the thermostat valve opens and allows the water to circulate through both the engine and radiator.

IMPORTANT

Present thermostats begin to open at 180° F. and are fully open at 202° F. Operation of engines in this temperature range is not harmful. However, temperature gauges are not always exactly accurate and may sometimes indicate higher than actual temperature. This can lead operators to believe engines are overheating when they are actually operating normally.

Overheating is always accompanied by loss of coolant water. In case of doubt, this should be checked.

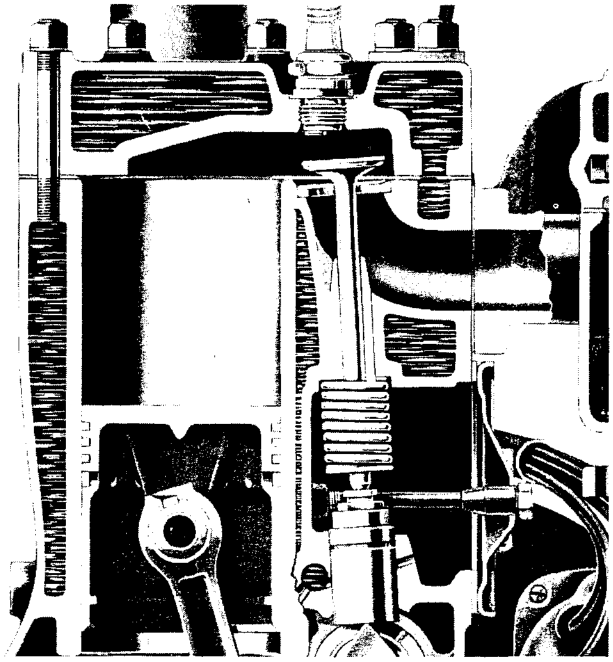


Figure 64 — Sectional View Showing Water Passages in head and block

EXPANSION OF WATER

Water has always been the most commonly used coolant for internal combustion engines because it has excellent heat transfer ability and is readily obtained everywhere. Like all liquids it expands when heated, the rate of expansion being ¼ pint per gallon when the temperature is raised from 40° to 180° F.

For example: If a 4 gallon cooling system is filled completely full of water at 40° F, 1 pint will be lost through the radiator overflow pipe by the time the water temperature reaches 180° F.

WATER FILTERS

In some areas, the chemical content of the water is such, that even the best of rust inhibitors will not protect the cooling system from the formation of rust and scale.

There are instances where this corrosive element has eaten holes through cast iron parts such as water pump impellers and bodies. This condition is caused by electrolysis taking place in the parts involved.

Where these conditions exist, water filters, such as those made by the Perry Co. and the Fram Corp., should be incorporated in the assembly to remove these troublesome elements and offset the electrolytic action.

EFFECT OF ALTITUDE ON COOLING

Water boils at 212° F under atmospheric pressure at sea level. This pressure becomes less at higher altitudes and the reduced pressure causes water and other liquids to boil at a lower temperature. The following chart shows the effect on boiling point of water and anti-freeze solution:

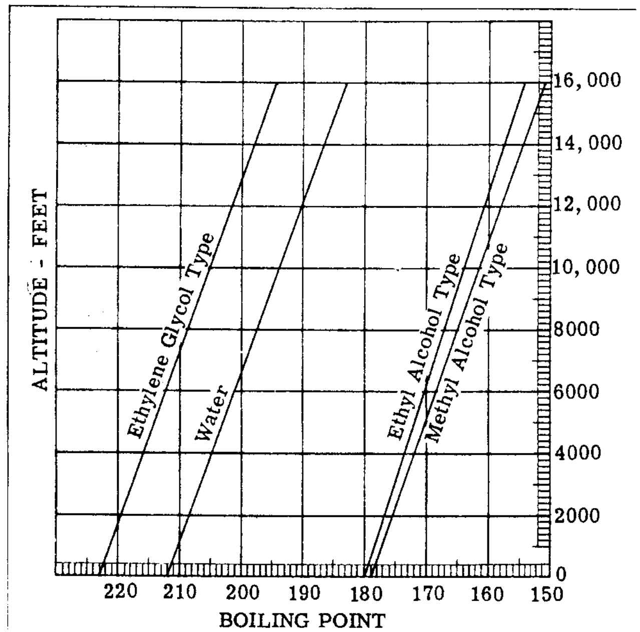


Figure 65 — Effect of Altitude on Boiling Point of Coolant

ANTI-FREEZES

Water freezes at 32° F., forms solid ice and expands about 9% in volume — which causes tremendous pressure and serious damage when allowed to freeze inside the cooling system.

When operating temperatures are below 32° F. an anti-freeze liquid must be added which will lower the freezing point a safe margin below the anticipated temperature of outside air.

TYPES OF ANTI-FREEZE	OPERATING TEMPERATURE RANGE		
	32° to 10° F	+10° to —10° F	—10° to —30° F
PLAIN ALCOHOL — (evaporates easily)	Not Recommended w/180° Thermostat		
METHYL ALCOHOL COMPOUNDS	Not Recommended w/180° Thermostat		
ETHYLENE GLYCOL (permanent type) — When there are no leaks add water only to make up for evaporation	1 to 4	2 to 5	1 to 1

NOTE: While the above list includes three types of generally used Anti-Freeze, the Ethylene Glycol or Permanent Type will be found to be the most desirable and likewise the most economical because of the temperatures desirable to maintain for efficient operation.

CORROSION INHIBITORS

Water forms rust due to its natural tendency to combine chemically with iron and air in the system. Rust inhibitors for water are inexpensive, simple to use and make cleaning and flushing necessary only after long periods of operation.

The most commonly used is either a 3% addition of soluble oil or commercial corrosion inhibitor that is readily available at low cost. The addition of corrosion inhibitor is not necessary if an anti-freeze containing a rust inhibitor is used.

RADIATOR

The radiator or heat exchanger consists of a series of copper tubes through which the cooling water is circulated. In standard radiator design fins are connected to the copper tubes to give an extended surface through which heat can be dissipated. It is important that these tubes be kept clean on the inside and the fins free of dirt on the outside so that maximum heat transfer can take place in the radiator.

Blowing out between the fins of the radiator, using compressed air, in a direction opposite to that of the fan circulated air, will serve to keep the cooling surfaces of the core free of dirt and other particles.

Every 500 hours of operation the radiator and cooling system should be well cleaned and flushed with clean water. (See Radiator Drain.)

Figure 66 — Radiator Drain

Wherever possible, only soft clean water should be used in the cooling system. Hard water will cause scale to form in the radiator and the engine water jackets and cause poor heat transfer. Where the use of hard water cannot be avoided an approved water softener can be used.

CLEANING COOLING SYSTEM

Deposits of sludge, scale and rust on the cooling surfaces prevent normal heat transfer from the metal surfaces to the water and in time render the cooling system ineffective to properly maintain normal operating temperatures. The appearance of rust in the radiator or coolant is a warning that the corrosion inhibitor has lost its effectiveness and should be cleaned before adding fresh coolant.

Dependable cleaning compounds should be used. Follow the procedure recommended by the supplier. This is of prime importance because different cleaners vary in concentration and chemical compositions. After cleaning and flushing, the system should be filled with an approved anti-freeze compound containing a rust and corrosion inhibitor or water with a corrosion inhibitor.

REVERSE FLOW FLUSHING

Whenever a cooling system is badly rust-clogged as indicated by overflow loss or abnormally high operating temperatures, corrective cleaning by reverse flow flushing will most effectively remove the heavy deposits of sludge, rust and scale. The reverse flow flushing should be performed immediately after draining the cleaning solution and it is advisable to flush the radiator first, allowing the engine to cool as much as possible.

Reverse flush the radiator, as follows:

1. Disconnect the hoses at the engine.
2. Put radiator cap on tight.
3. Clamp the flushing gun in the lower hose with a hose clamp.

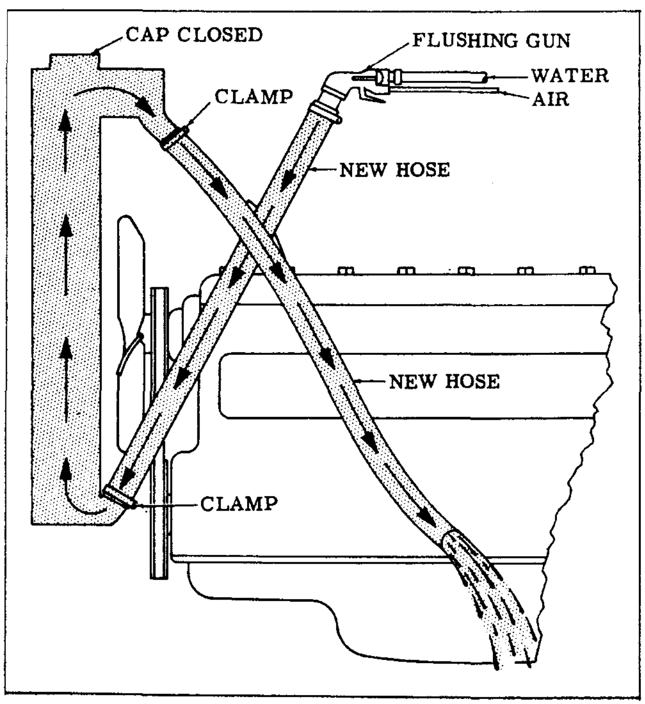


Figure 67 — Reverse Flushing Radiator

4. Turn on the water and let it fill the radiator.
5. Apply air pressure gradually, to avoid radiator damage.
6. Shut off the air, again fill the radiator with water and apply air pressure — repeat until the flushing stream runs out clear.
7. Clean and inspect radiator cap.

To Reverse flush the engine water Jacket

1. Remove the thermostat.
2. Clamp the flushing gun in the upper hose.
3. Partly close the water pump opening to fill the engine jacket with water before applying the air.
4. Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and blowing it out with air (80# pressure) until the flushing stream is clear.

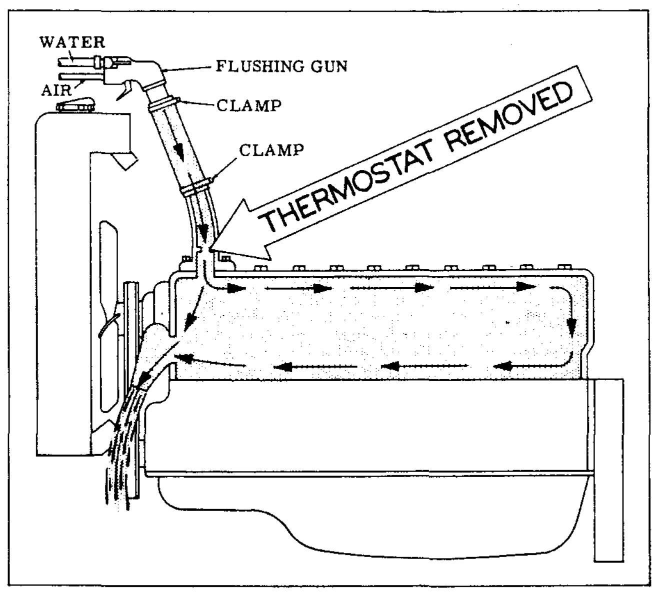


Figure 68 — Reverse Flushing Engine

TESTING THERMOSTAT

Remove Water Pump Header as shown in illustration. Before testing, clean and examine the bellows for rupture or distortion. If the valve can be pulled or pushed off its seat with only a slight effort when cold or it does not seat properly, the unit is defective and should be replaced.

The thermostatic operation can be checked in the following method:

1. Hang thermostat by its frame in a container of water so that it does not touch the bottom.
2. Heat the water and check temperature with a thermometer.

3. If the valve does not start to open at temperatures of 180°-200° F. or if it opens well before the 180° point is reached the thermostat should be replaced.

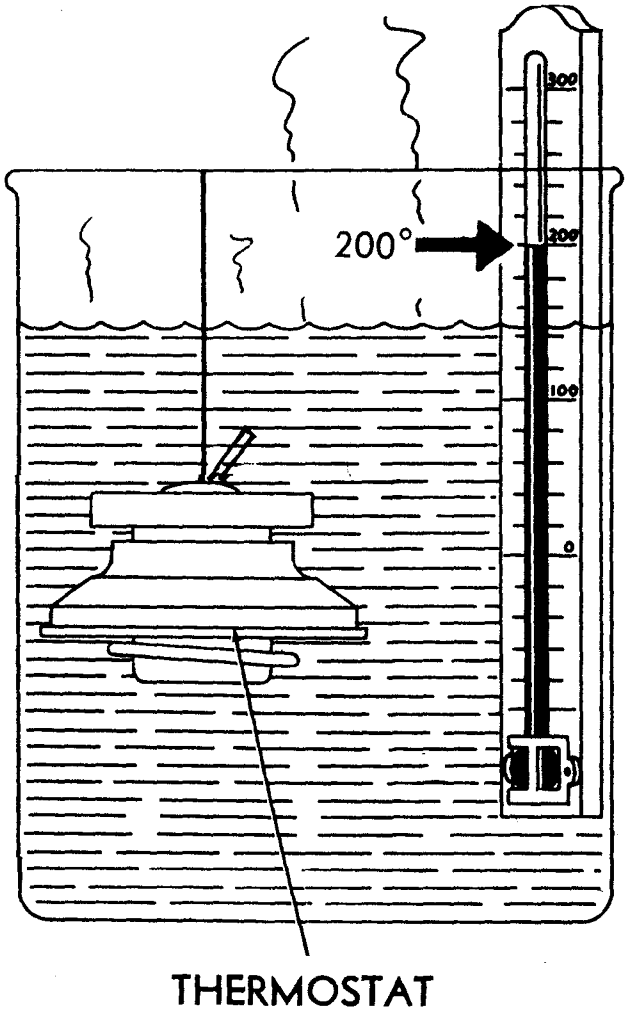


Figure 69 — Checking Thermostat

When replacing the thermostat in the water outlet elbow, be sure seal is in place, and seal **seat** as well as the **counterbore** is clean.

Assemble new gasket to pump body or spacer. Thermostat flange must seat in counterbore with gasket sealing contact between it and the pump body.

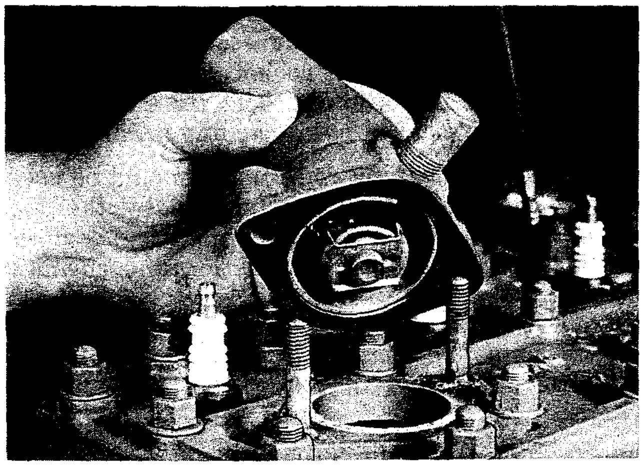


Figure 70 — Replacing Thermostat

RADIATOR PRESSURE CAP

Many operations use a pressure cap on the radiator to prevent overflow loss of water during normal operation. This spring loaded valve in the cap closes the outlet to the overflow pipe of the radiator and thus seals the system, so that pressure developing within the system raises the boiling point of the coolant and allows higher temperatures without overflow loss from boiling. Most pressure valves open at 4½ or 7 pounds, allowing steam and water to pass out the overflow pipe, however, the boiling point of the coolant at this pressure is 224°F or 230°F at sea level. When a pressure cap is used an air tight cooling system is necessary with particular attention to tight connections and a radiator designed to withstand the extra pressure.

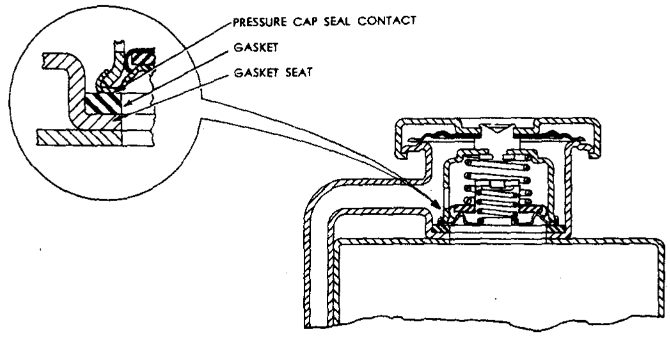


Figure 71 —

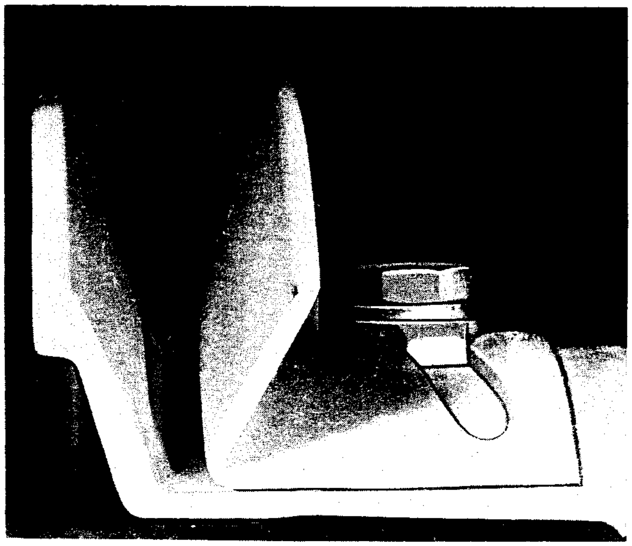


Figure 72 — Fan Belt Adjusting Flange

FAN BELT TENSION

When tightening fan belts, loosen the generator adjusting bolts and pull out on the generator by hand until the belt is just snug. **Under no circumstances should a pry bar be used on the generator to obtain fan belt tension** or damage to the bearings will result. Some engines have an adjustable fan pulley flange for belt adjustment.

When adjusted correctly the fan belt should have between ¾″ to 1″ deflection on the long side. (On narrow belts this should not exceed ½″.)

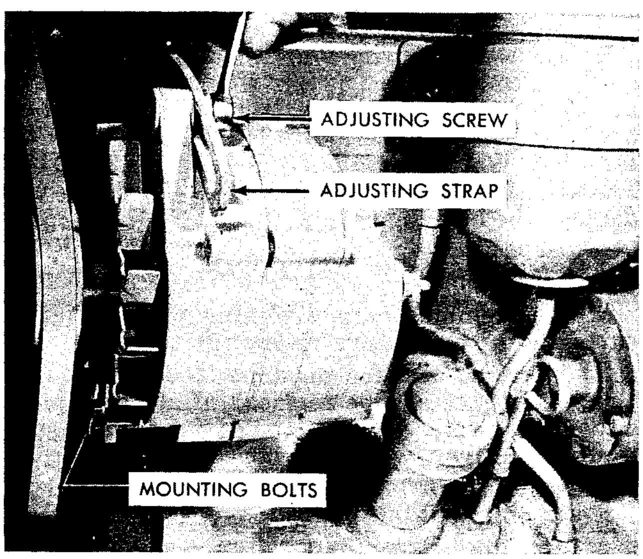


Figure 73 — Adjusting Fan Belt Tension

CYLINDER BLOCK WATER DRAINS

When the cooling system is to be completely drained, there are one or two drain plugs on the right hand side of the cylinder block depending upon engine models, which drain all cooling water which might be trapped in the base of the block.

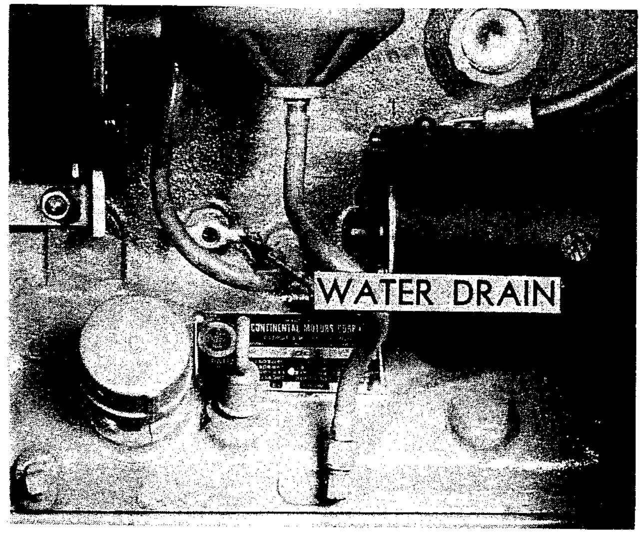


Figure 74 — Water Drain

CAUTION: OVERHEATED ENGINE

Never pour cold water or cold anti-freeze into the radiator of an overheated engine. Allow the engine to cool and avoid the danger of cracking the cylinder head or block. Keep engine running while adding water.

WATER PUMP

The water pump is located in the front of the cylinder block and is driven by the fan belt from the crankshaft pulley. The inlet of the water pump is connected to the lower radiator connection and the outlet flow from the pump is through integral passages cast in the block.

No lubrication of the pump is required except on the M and B series as the bearings are of the permanently sealed type and are packed with special lubricant for the life of the bearing.

The water pump requires no attention other than bearing replacement when they show excessive looseness or if a water leak develops which shows a damaged or badly worn seal that needs replacement.

COOLING SYSTEM PROTECTOR PELLET

All Continental engines are shipped with a cooling system protector pellet in the water outlet header. The pellet should be allowed to dissolve in the cooling system.

This pellet will dissolve in the cooling water with proven results as a rust inhibitor and water conditioner. It can be used with all types of anti-freeze.

ENGINE HOUSE VENTILATION

Engines operating inside buildings must be adequately ventilated to supply sufficient air *to cool the engine — provide air to mix with the fuel* and in addition, *to carry the heated air from the building.*

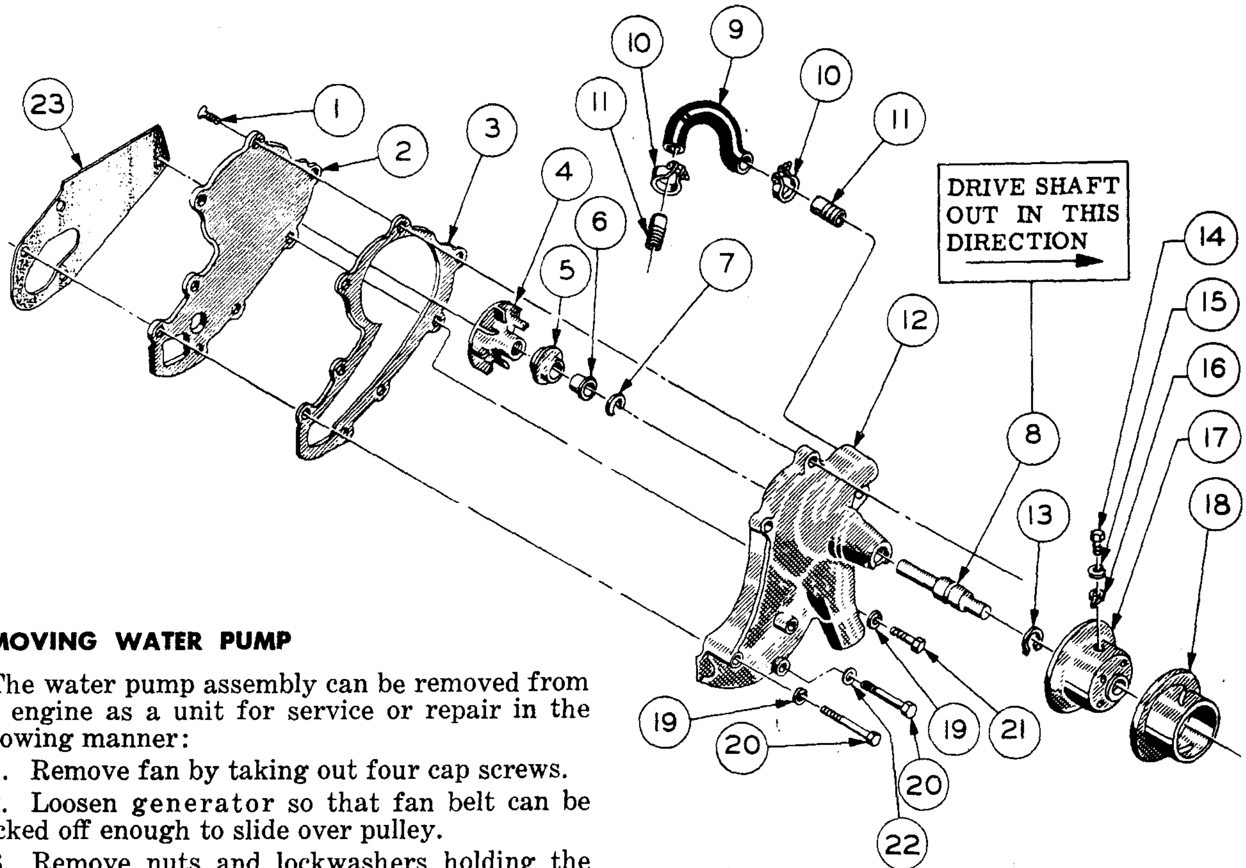


Figure 76 — Disassembling Water Pump

REMOVING WATER PUMP

The water pump assembly can be removed from the engine as a unit for service or repair in the following manner:

1. Remove fan by taking out four cap screws.
2. Loosen generator so that fan belt can be slacked off enough to slide over pulley.
3. Remove nuts and lockwashers holding the pump body to the front of the block and remove the pump assembly.

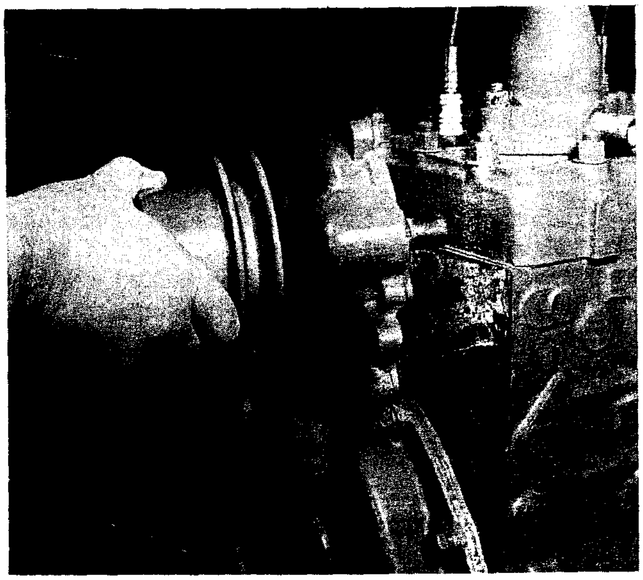


Figure 75 — Removing Water Pump

DISASSEMBLY OF WATER PUMP

When replacement of any internal parts becomes necessary, **disassembly must be in the following sequence in order to prevent damage to the pump.**

1. Before removing pump use puller to remove fan hub (17) from shaft.
2. Remove cap screws attaching pump to engine (20) (21).
3. Remove countersunk screws (1) holding cover (2) removing cover and gasket.
4. Use puller to remove impeller (4) taking precautions to prevent damage to the casting.
5. Remove seal (5) and water shedder (6).
6. Remove lock ring (13) holding bearing and shaft assembly in body after which shaft (8) can be forced out **through the front** with an arbor press or lead hammer. **DO NOT ATTEMPT TO DRIVE WATER PUMP SHAFT (8) OUT THROUGH REAR OF HOUSING. To do so will damage the housing beyond repair.**

REASSEMBLY AND INSTALLATION

1. Reassemble pump, replacing worn or failed parts and reverse above instructions.

Seal contact surface must be smooth and flat. The bushing should be replaced, if scored or cut, but may be refaced and polished for further use, if not excessively worn or grooved.

A light film of lubricant applied to the face of the seal will facilitate seating and sealing.

2. Use thick soapsuds on both the seal and shaft when assembling in order to prevent damage to the seal.
3. Mount pump assembly on block using a new housing gasket.
4. Install fan belt and adjust belt tension to have ¾″ to 1″ deflection on long side. (On narrow belts this should not exceed ½″.) Pull out the generator or alternator by hand, as bearing damage will result with a pry bar; in some cases this may be adjusted by the adjustable fan pulley.

SECTION VI
FUEL SYSTEM

The basic purpose of the fuel system is to store, convey, mix fuel with air, then vaporize and introduce the mixture into the engine.

Fuel is stored in the gasoline tank; it is filtered and flows through the fuel supply line to the carburetor — either by gravity or under pressure of a fuel pump. The carburetor mixes the fuel with proper proportions of air and at the same time breaks it into very fine spray particles. This atomized spray changes to vapor, by absorbing heat as it travels through the intake manifold to the combustion chamber. Fuel must be vaporized since it will not burn well as a liquid.

GRAVITY FUEL SYSTEM

This is the most simple fuel system and is generally used on power units as it eliminates the need of a fuel pump — it only requires the fuel tank located higher than the carburetor.

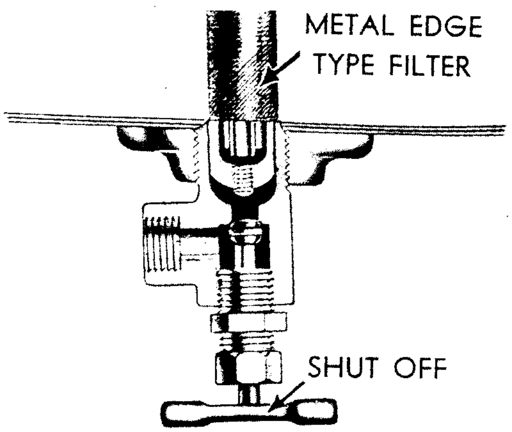


Figure 77 — Edge Type Filter

All power units with fuel tank have a combination shut-off valve and an efficient metal edge type filter. This filter prevents all foreign particles and water from entering the carburetor.

With reasonable care in filling the tank with clean fuel, this filter will require only seasonal cleaning of both the filter and tank.

CAUTION:
IT IS RECOMMENDED THAT THIS VALVE BE KEPT IN THE CLOSED POSITION EXCEPT WHEN UNIT IS IN OPERATION.

MECHANICAL FUEL PUMP

The Mechanical Fuel Pump is generally used when the fuel supply is below the level of the carburetor. They are of several models dependent upon the diaphragm diameter and assembly arrangement with fuel strainer bowl, air dome and manual primer.

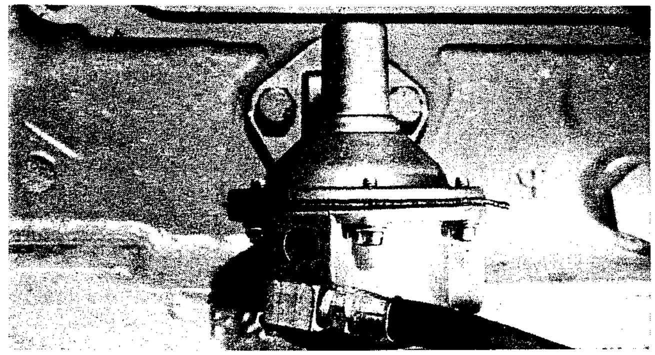


Figure 78 — Fuel Pump

This mechanical fuel pump mounts on the cylinder block pad and is driven by an eccentric on the engine camshaft contacting the fuel pump rocker arm.

Constant fuel pressure is maintained by an air dome and a pulsating diaphragm operated and controlled by linkage which adjusts itself to pressure demands.

Fuel Pump Tests — The fuel pressure may be measured by installing the pressure gauge between the fuel pump and carburetor.

The AC fuel pump size and static pressures @ 1800 R.P.M for the L-Head engines are.

ENGINE MODEL	DIAPHRAGM DIAMETER	FUEL PRESSURE	MAX. LIFT
N	3¼	1½ - 2¾#	10′
Y	3¼	2 - 2¾#	10′
F	3¼	1½ - 2¼#	10′
M	3⅞	3 - 4½#	10′
B	3⅞	3 - 4½#	10′

When pressures are below the range, pump should be disassembled and reconditioned with the special overhaul kits available.

Maintenance — Fuel pump trouble is of only two kinds — either the pump is supplying too little gas or, in rare cases, too much.

If the pump is supplying too little gas, the engine either will not run or it will cough and falter. If too much gas — it will not idle smoothly or you will see gasoline dripping from the carburetor.

If the engine is getting too little gas — the trouble may be in the pump, fuel line or the gas tank. First, be sure there is gas in the tank, then disconnect the pump to carburetor line at the pump or carburetor, and turn the engine over a few times with the ignition off. If gas spurts from the pump or open end of the line — the pump, gasoline and tank are OK.

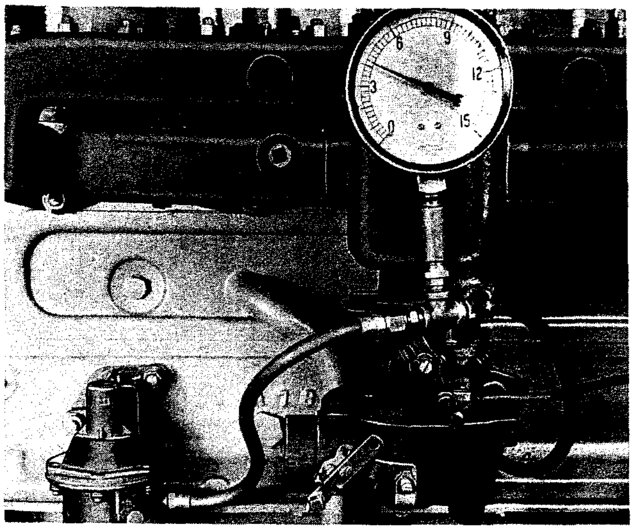


Figure 79 — Checking Fuel Pressure

If there is little or no Flow—check the following:

1. Look for leaky bowl gasket or line connections — tighten them.
2. Remove and clean with solvent the gas strainer or screen inside the pump bowl.
3. Look for clogged fuel line — Blow out with compressed air.
4. Make sure that all pump cover screws and external plugs are tight.
5. Inspect flexible fuel line for deterioration, leaks, chafing, kinks or cracks. If none of these items restore proper flow — remove the pump for replacement or overhaul.

If getting too much gas — an oversupply of gasoline is generally caused by trouble other than the fuel pump — so first check the following:

1. Defective Automatic Choke.
2. Excessive use of hand choke.
3. Loosely connected fuel line, or loose carburetor assembly screws.
4. Punctured carburetor float.
5. Defective carburetor needle valve.
6. Improper carburetor adjustment.

If none of these items corrects flooding, remove the fuel pump for replacement or overhaul.

ELECTRIC FUEL PUMP

Many L-Head engines use electric fuel pumps operated from the storage battery supply. The pump should be mounted close to the fuel tank so as to provide fuel pressure at all points along the fuel line and so eliminate vapor lock.

The electric fuel pump is energized in the ignition circuit — which assures quick filling of the carburetor and fuel lines to effect easy starting.

When fuel pump trouble is suspected, disconnect the fuel line at the carburetor and turn on the ignition switch. Pump fuel into a small container, then place your finger on the outlet side of the fuel line. If the pump stops or ticks very infrequently, the pump and fuel line connections are satisfactory. Remove your finger from the outlet side of the fuel line and if ample fuel flows — the pump is satisfactory.

If fuel does not flow and all connections are tight, the pump should be replaced or repaired. Always be sure of a good ground and check for faulty flexible fuel lines and poor electrical connections.

CARBURETOR

Continental L-Head gasoline engines normally use various models of Zenith and Marvel-Schebler carburetors — of both the updraft and downdraft types.

The carburetor mixes fuel with air and meters the mixture into the engine as the power is demanded. Most carburetors incorporate the following systems to provide the flexibility and sensitive requirements of varying loads and conditions:

1 — **Float System** — Controls the level and supply of fuel.

2 — **Idle or Low Speed** — Furnishes the proper mixture for the engine idle, light load and slow speeds, until the main metering system functions.

3 — **Main Metering System** — Controls the fuel mixture from part throttle operation to wide open throttle.

4 — **Power or Economizer System** — Provides a richer mixture for maximum power and high speed operation. This system ceases to function when the manifold vacuum is above 6″ Hg.

5 — **Compensating System** — Provides a mixture which decreases in richness as the air speed increases.

6 — **Choke System** — Delivers additional fuel to the manifold for cold engine starting.

ZENITH CARBURETOR

The Zenith 62 Series carburetor shown below has the following three adjustments:

1 — **Main Adjustment Screw** — Determines the amount of fuel which may be obtained for high speed operations.

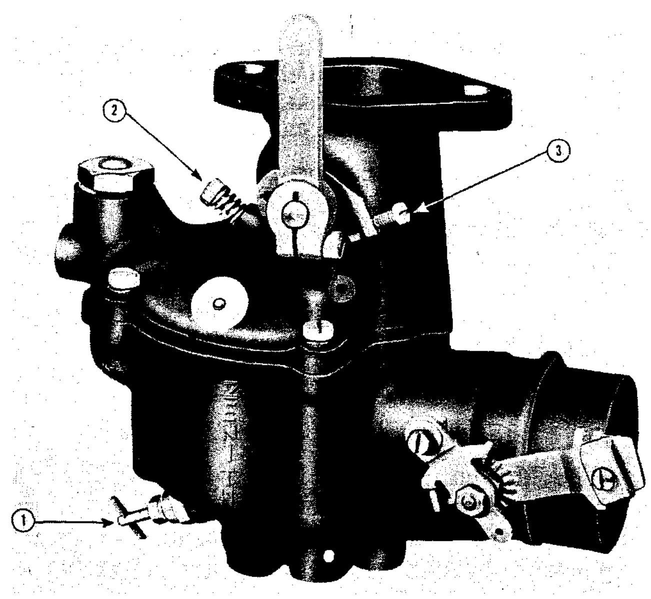


Figure 80 — Zenith 62 Series Carburetor

To set this adjustment, open the throttle to about ¼ open. Turn the adjustment clockwise, shutting off the fuel until the engine speed decreases or begins to miss due to lean mixture. Now open the adjustment until the engine reaches its maximum speed and runs smoothly without missing.

2 — **Idle Mixture Adjustment Needle**—Controls the amount of air admitted to the idling system, which functions only at low speeds.

Turning the screw clockwise cuts off the air, making the mixture richer — while unscrewing it admits more air making the mixture leaner. The idling adjustment needle should be set for the smoothest running of the engine; or, if a vacuum gauge can be attached to the manifold, set the adjustment for highest manifold vacuum.

3 — **Idle Speed Adjustment Screw** — controls the idling speed — which should be 400-600 R.P.M. for most industrial applications.

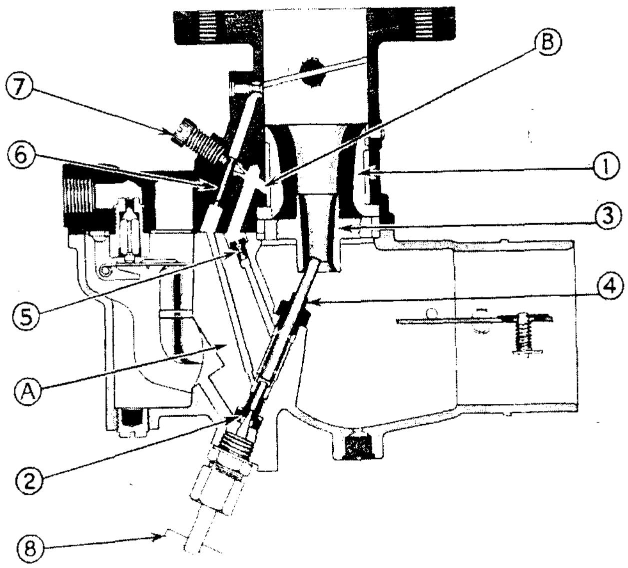


Figure 81 — Sectional View of a Zenith Carburetor

No. 1. Venturi
No. 2. Main Jet (High Speed)
No. 3. Secondary Venturi
No. 4. Main Discharge Jet
No. 5. Well Vent
No. 6. Idling Jet
No. 7. Idle Adjusting Needle
No. 8. Main Jet Adjustment
A — Main Jet Channel
B — Idle Channel

MARVEL-SCHEBLER CARBURETOR

(Model TSX)

The Model TSX carburetor without power adjustment has the following two adjustments.

Preliminary Adjustments

1 — Set throttle stop screw "A" so that throttle disc is open slightly.

2 — Make certain that gasoline supply to carburetor is open.

3 — Set throttle control lever to ⅓ open position.

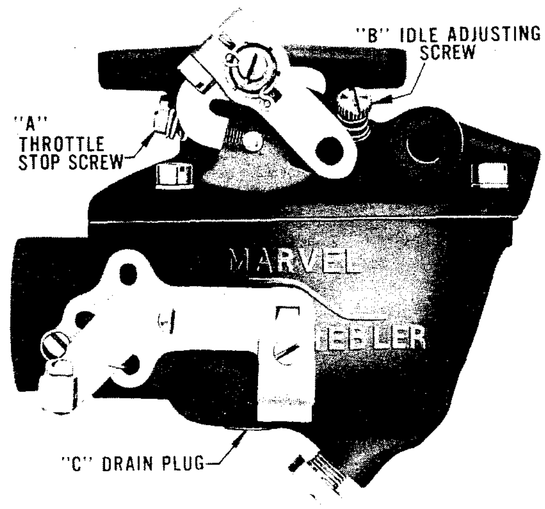


Figure 82 — Marvel-Schebler TSX Carburetor

4 — Close choke valve by means of choke control button.

5 — Start engine and partially release choke.

6 — After engine is up to operating temperature throughout, see that choke is returned to wide open position.

Low Speed or Idle Adjustment

1 — Set throttle or governor control lever in slow idle position.

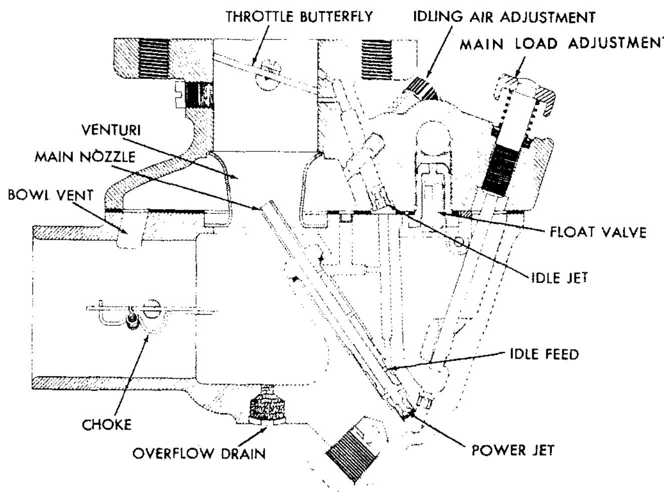


Figure 83 — Sectional View of the Marvel-Schebler Carburetor

2 — Adjust throttle stop screw "A" for correct engine idle speed (normally 400-600 RPM).

3 — Turn idle adjusting screw "B" **in,** or clockwise, until engine begins to falter or roll from richness, then turn screw "B" out, or counterclockwise, until the engine runs smoothly.

NOTE: *IT IS BETTER TO HAVE THIS ADJUSTMENT SLIGHTLY TOO RICH THAN TOO LEAN.*

CARBURETOR CHOKES

Manually Operated Choke — is operated by a flexible cable control from the instrument panel or rear house panel. While this is the most simple

It is very important not to paint over the powdered bronze overflow drain plug shown in figure 83. This has to remain porous to drain off excess gasoline from over choking. If this plug is sealed, gas can back up into the air cleaner hose and create a fire hazard.

type, it is most important that the operator have the choke valve in wide open position when engine operating temperature is reached.

ZENITH ELECTRIC CHOKE CONTROL

Is made as part of the carburetor assembly. It is directly connected to the choke shaft and automatically controls the opening during the entire engine operation.

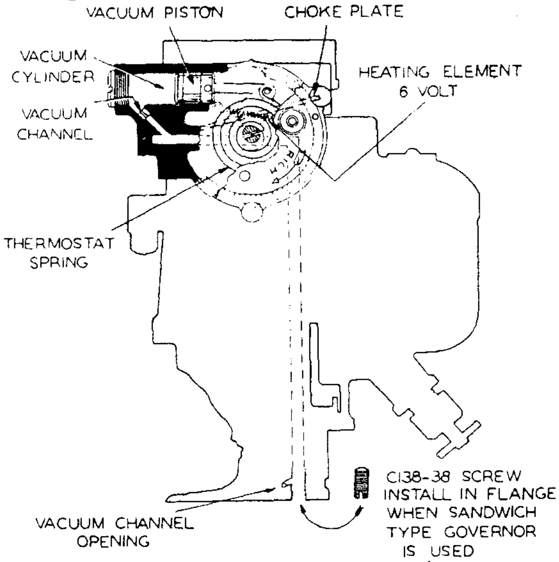


Figure 84 — Zenith Electric Choke

Manifold vacuum is used to open the choke shaft partially after the initial firing of the engine, and heat is used on the thermostat spring to control the amount of opening during the warming up period. This heat is provided by an electric element in the thermostat chamber. Fast idling during the warm-up period is also provided by a throttle advance mechanism which is actuated from the choke shaft.

The heating element which is energized when the ignition is "on" gradually warms the thermostat, decreasing its resistance to the pull of the vacuum piston, which gradually causes the choke to open and moves the throttle advance to the warm idle position.

All units are initially set with the thermostat 15 notches rich for 70° F. ambient temperature. Temperature corrections can be made by allowing one notch on the cover for each 5 degrees variation — making certain that the choke valve is fully open when operating temperatures are reached.

SISSON AUTOMATIC CHOKE

Uses an electro-magnet and a thermostat to automatically close the carburetor choke valve for cold starting and regulates its degree of opening as the engine warms.

The unit is mounted on the exhaust manifold and a small rod connects it to the carburetor choke lever. The electro-magnet is energized by the starter circuit which pulls an armature lever down, closing the choke valve.

As soon as the engine starts, the electro-magnet circuit is broken and then the thermostat provides automatic adjusting of the choke valve during the warming-up period.

The carburetor choke lever should be adjusted so that when the carburetor choke valve is closed tight, there will be .015" to .020" clearance between the automatic choke lever and the field pole that serves as a stop. This measurement is taken at "A" and must be made with thermostatic control "B" pushed down as far as it will go.

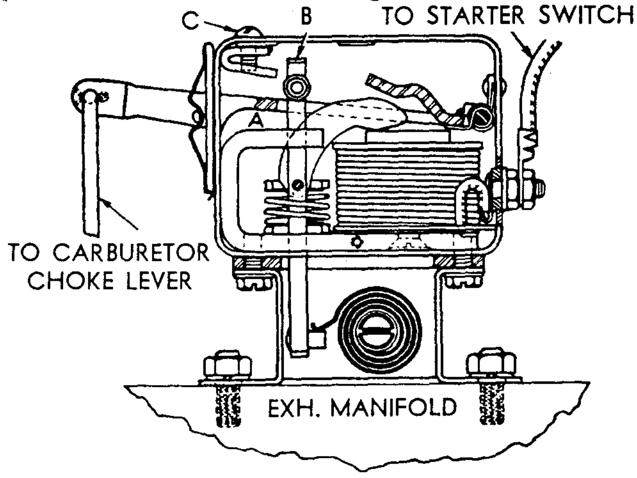


Figure 85 — Sisson Automatic Choke

> *CAUTION: Do not oil the Sisson automatic choke under any circumstance.*

Carburetor Service — In general any change in carburetor action will usually come gradually, therefore, if the carburetor operated satisfactorily when last used, it can reasonably be assumed that some other part of the engine is at fault — which should be corrected before disturbing the carburetor.

Dirt is the main enemy of good carburetion as it fills up the minute air and gasoline passages and accelerates the wear of delicate parts.

Never use a wire to clean out restrictions in jets as this will destroy the accurate calibrations of these parts — **always use compressed air.** The jets are made of brass to prevent rust and corrosion and a wire would cut or ream the hole in the jet and ruin it.

Maintaining correct fuel level in the carburetor bowl is important — as the fuel flow through the jets is naturally affected by the amount of fuel in the bowl.

After a carburetor has been in service for some time, the holes in the jets and the float valve and seat become worn from the constant flow of fuel through them and should be overhauled by a competent carburetor service station.

Do not experiment with other size jets or any so-called fuel-saving gadgets as your arrangement has been thoroughly tested on a dynamometer program.

GOVERNORS

The governor is a device which controls engine speed — either keeping it operating at a constant speed or preventing it from exceeding a predetermined speed. It promotes engine operation economy and eliminates needless engine failures.

Continental L-Head engines use many types of velocity and centrifugal governors — however the majority use centrifugal (Mechanical) governors.

VELOCITY GOVERNORS

Velocity Governors — are generally used to prevent engine speed from exceeding a predetermined maximum. The governor is mounted between the carburetor and manifold flanges. In its most simple form, it consists of a main body, which contains a throttle shaft, a throttle valve and a main governor spring. The main governor spring is attached by linkage to the governor shaft and the spring force holds the throttle valve open.

When the engine is started, air flows through the carburetor throat and the governor throat. The velocity of the air creates a pressure above the throttle valve. When this pressure exceeds the force exerted by the spring, the throttle will move toward a closed position. The adjusting screw varies the spring tension.

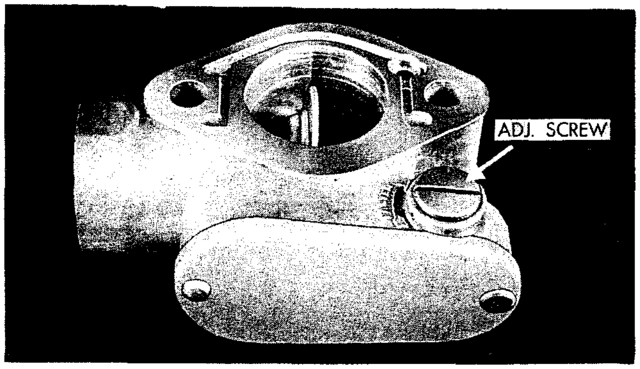


Figure 86 — Hoof Velocity Governor

When this closing action of the valve exactly balances the spring, governing action takes place and maximum speed is fixed at this point.

When load is applied — the engine speed tends to drop — the velocity of the gas through the manifold and the pressure against the governing valve is reduced and the spring opens the valve to feed more gasoline to the engine to handle the increased load demand. Thus an almost constant speed is maintained whether the engine is running with or without load.

CHECKING AND ADJUSTING GOVERNOR LINKAGE

The following is a step by step procedure to follow in checking and adjusting the governor linkage:

1 — With the engine stopped and spring tension about normal, the governor should hold the throttle in the open position. The governor to carburetor control rod should be adjusted in length so the throttle stop lever is $\frac{1}{64}$ to $\frac{1}{32}$ off the stop pin.

2 — Make certain that all linkage is free with spring at operating tension disconnect the governor spring and check movement of levers and rods.

3 — The hinged lever governor eliminates the need for a spring loaded throttle lever on the carburetor. As the carburetor lever is forced to idle position by the speed control lever, this in turn pivots the top half of the governor arm forward, slowing the engine to idle. (See Figure 87.)

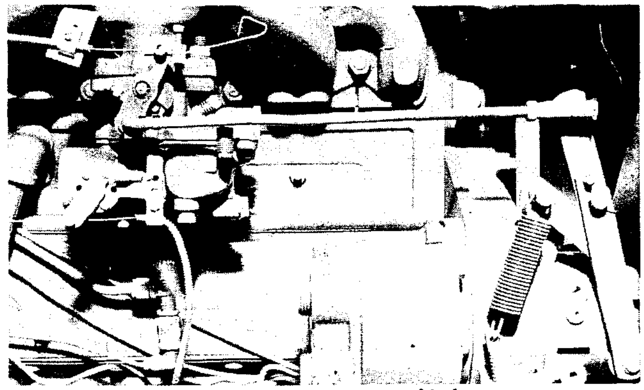


Figure 87 — Governor Linkage

CONTINENTAL GOVERNORS

The **Continental Governor** — is used on most industrial units requiring normal industrial speed regulation. These governors differ from conventional centrifugal governors mainly in that round steel balls are used as the motivating force producer instead of masses of weight.

When the governor is driven at increasing speeds by the engine through the governor gear, the hardened steel balls, move outward, forcing the conical upper race, fork base, fork and lever assembly toward a closed throttle position.

An externally mounted spring imposes tension on the lever assembly toward the open throttle position. As the engine speed increases, the centrifugal force created by the balls will increase until a balanced condition between the governor force and the spring force exists and the governing lever remains stationary — holding a constant engine R.P.M.

Adjustment — The desired engine speed is obtained by increasing or decreasing the governor spring tension.

WARNING!
Disconnect Fan before making Governor adjustments

CONSTANT SPEED GOVERNOR

1 — **Start the engine.** While it is warming up, back out surge adjusting screw "C" (Figure 88) so it will have no effect.

2 — **With engine warmed up,** adjust idle speed approximately 150 R.P.M. higher than the required speed under load, by turning screw "B" in or out, thus either increasing or decreasing pull on the spring.
Lock screw "A" should be backed out so as not to interfere with the adjustment.

3 — **Apply the desired load,** and readjust screw "B" in order to obtain the required speed under load.
Release load and note R.P.M. at which engine settles out.
Again apply load, and observe the drop in R.P.M. before governor opens throttle to compensate.

4 — **The range of a governor's action** is indicated by the differential between R.P.M. **under load** and that **under no load.**
This can be varied and the sensitivity of governor changed by changing the length of screw "E".

5 — **To broaden the range of the governor** and produce a more stable action, lengthen screw "E" and compensate for this change by turning screw "B" in to restore speed. Lengthening screw "E" changes pull on spring to more nearly the arc of the lever action, thus having the effect of increasing the spring rate.

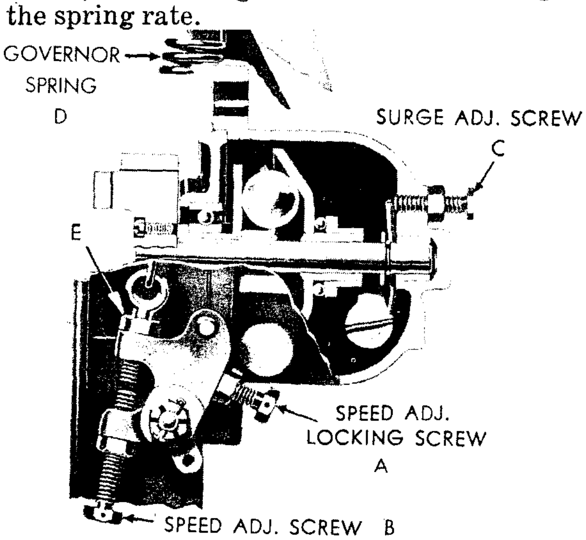


Figure 88 — Governor

6 — **To narrow the range** and increase the sensitivity of the governor, reverse procedure outlined in 5. (Changing the length of screw "E" has the same effect as using a stronger or weaker spring.)

7 — **With the governor adjusted for desired performance,** release the load and allow engine to run at governed speed, no load. If a surge is noted, turn surge adjusting screw "C" in or clockwise until surge is eliminated. Do not turn in further than necessary as it may make it difficult to get a low enough slow idle.
Alternate method if a tachometer is used: have engine running at high idle (governed speed) no load. Turn surge adjusting screw in until R.P.M. increases 10-20 R.P.M. and lock. If linkage and carburetor are all properly adjusted, surge will be gone.

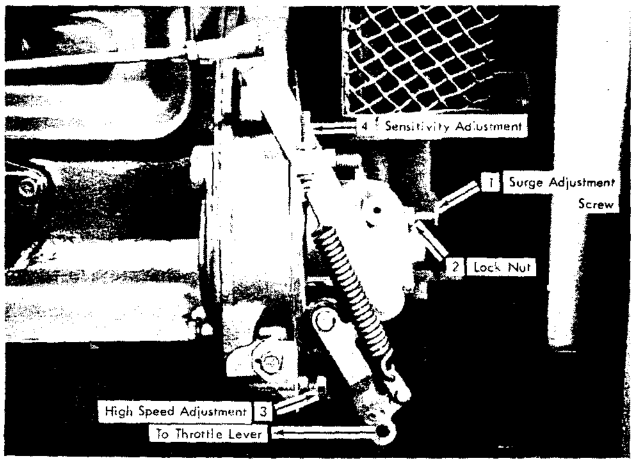
8 — When governor adjustment is completed, tighten locking screw "A", which locks the cam in position. Then make sure that all lock nuts are tight, in order to maintain the adjustment.

VARIABLE SPEED GOVERNOR

1 — **Back Out Surge Screw "1"** — until only 3-4 threads hold — then lock with lock nut "2".

2 — **Start Engine and Idle** — until warmed to operating temperature.

3 — **Set Specified High Idle No-Load Speed** — by moving throttle to required position and adjusting high speed screw "3".



Variable-Speed Governor

4 — **Check Regulation** — by applying and removing engine load.
(1) **If regulation is too broad** — increase spring tension with sensitivity screw "4" and readjust high speed screw "3" throttle stop to obtain high idle speed.
(2) **If regulation is too narrow** — decrease spring tension with sensitivity screw "4" and readjust high speed screw "3" throttle stop to obtain desired high idle speed.
(3) **If governor surges under load** — decrease spring tension with sensitivity screw "4" and readjust throttle lever position to desired high idle speed.
(4) **Repeat above steps as required** — until desired performance is obtained. When adjustment is complete, lock all lock nuts to maintain settings.

Surge Screw "1" — **is used to remove a no-load surge only**

If governor surges at no-load, turn surge screw in a turn at a time until the surge is removed. Do not turn in far enough to increase the no-load speed more than a few RPM, if at all.

Maintenance — The slotted driver, in which the balls move, is pinned to the governor shaft; the two races are free floating on the shaft. When the engine is running at a fixed speed all parts go around with the governor shaft and the thrust is taken on the thrust bearing between conical shaped race and fork base. When a change in speed, due to change in load, takes place, the relative speed between the balls and races is changed. Consequently, wear is distributed over the entire operating surface of the races and balls. Since the surfaces are hardened, little or no wear other than a polish should ever take place on these parts.

The driver must always be tight to the shaft. The races must be free on the shaft.

In assembly of the governor a space of .0 :o .006 is provided between the driver and the flat race This is to assure freedom for movement of the flat . When servicing the governor, make sure that both s revolve freely on the shaft.

When the balls are "in", that is in the bc m of the driver slots, the space between the top of e conical shaped race bushing and hairpin clip should .230-.240. Use .010 spacer washers to obtain required sp .

The governor shaft is pressed into gear secured with screw that is partially in the shaft and rtially in gear.

Lubrication is supplied the governor by spl from the front end gear train through holes provided the governor base. Like all mechanical governors, must have ample lubrication for its functioning. Make the governor parts are being well supplied with oil.

HINGED LEVER GOVERNOR

The Continental hinged lever governors are sically the same as other Continental Governors, except e governor arm is in two parts. Pivoted on a pivot bolt. it is spring loaded to hold the arm in a straight position except when low idle is desired. (Figure 88A.)

When carburetor lever is forced to idle position by speed control lever, this in turn pivots top half of governor arm forward.

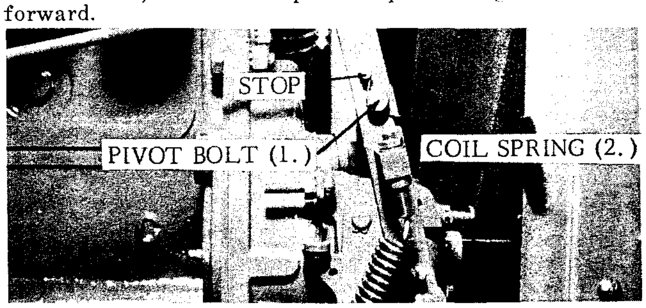


Figure 88A

On older models, a small coil spring loaded throttle lever and shaft on carburetor was used to get idle position. (Figure 88B.)

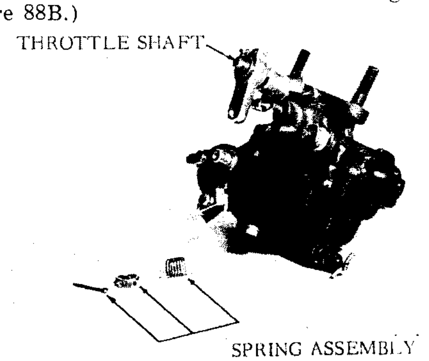


Figure 88B

Should a hinged lever governor be used with a spring loaded throttle lever, the cotter key (Figure 88C) should be removed and coil spring wound up as tight as possible, counter clockwise, by turning serrated nut (Figure 88D) until it lines up with nearest hole in nut and carburetor shaft and then reinstall cotter key. This governor can be supplied as constant speed or variable speed.

Governor adjustments are the same as previously explained under Governor adjustments.

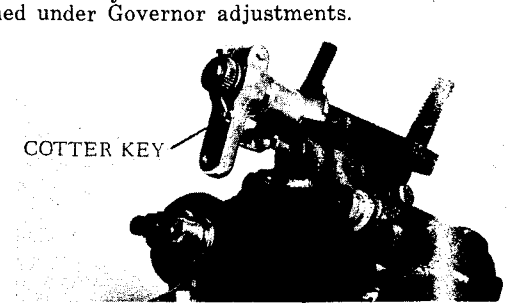


Figure 88C

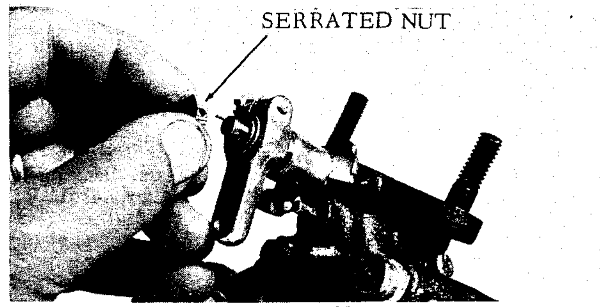


Figure 88D

PIERCE GOVERNORS

Pierce Centrifugal Governors — are used for many close generator applications and also as tailshaft governors on torque converter installations.

Governors for engines driving generators are of the constant speed type — which provide close regulation at a fixed speed to prevent excessive frequency variation. Close regulation with a single spring and weights is possible only in a short range of engine speeds — not exceeding 400 R.P.M. The reason for this is that the forces of the governor spring and weights do not increase and decrease at the same rate.

Operation (See Fig. 90) — Pierce governors operate as follows:

The governor shaft (10) is driven by gears (1). The shaft is mounted on a heavy-duty radial ball bearing (3) to minimize friction and wear. On the main shaft is a spider (4) which supports two governor weights (6). The weight noses (2) rest against a hardened thrust sleeve (14) with thrust bearing (8).

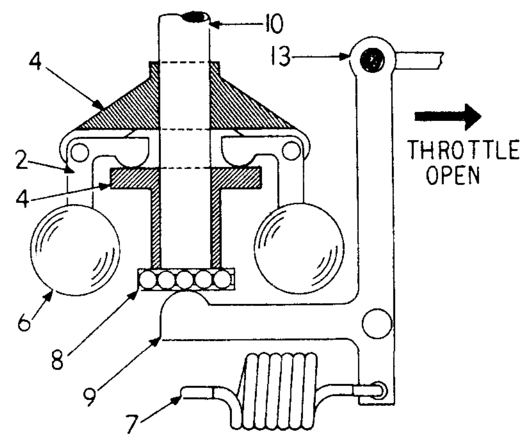


Figure 89 — Schematic Drawing of a Pierce Centrigugal Governor

In operation, the governor shaft turns with the engine. As the shaft rotates, the centrifugal energy developed in

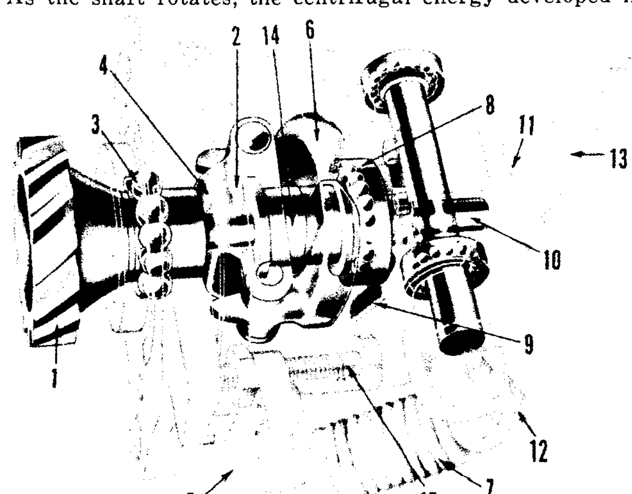


Figure 90 — Sectional Drawing of a Pierce Centrifugal Governor

the weights (6) causes them to swing outward on their pivots — this energy is opposed by the governor spring (7). The tension of this spring is the means of setting the governor to act at a predetermined speed.

When the engine is not running, the governor spring holds the throttle valve wide open.

When the engine is started, the weights swing out, moving the thrust sleeve (14) along the driveshaft. This movement is transmitted through the thrust bearing (8) to the rocker yoke (9) on the throttle lever shaft. This movement, in turn, moves the governor control lever (13) toward the closed throttle position. The weights continue to move out until the weight force and spring force are in balance — when the throttle will be in position to maintain the governed R.P.M.

Adjustment

1 — The speed of the Governor is regulated by adjusting screw (15).

2 — **Sensitivity** of the governor can be regulated, by auxiliary adjusting screw (12). Surging or hunting under load conditions can usually be eliminated by broadening the regulation with this adjusting screw.

3 — **No Load Surge** — is eliminated by means of the bumper screw (11) at no load-open throttle position.

CAM GEAR GOVERNOR

Some L-head engines use the Continental designed "built-in" cam gear driven governor. Sealed, dust proof and engine lubricated, it is compact and easily adjusted. The control shaft floats on two needle bearings to remove friction for closer, more accurate control through the whole power range.

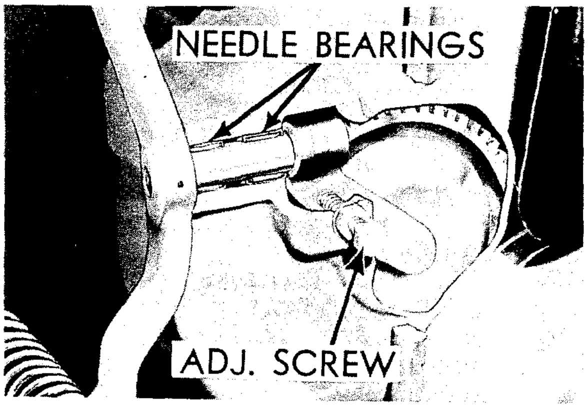


Figure 91 — Cam Gear Governor

This governor is a variable speed type and has no speed adjustment other than amount of travel the control rod is moved. Control rod movement is determined by accelerator pedal or hand control linkages. Idle surge adjusting screw should be adjusted **in** just enough to eliminate any tendency of engine to surge.

TAILSHAFT GOVERNORS

Many industrial applications with torque converter drives want to maintain a constant output shaft speed under varying load conditions. This requires the governor to be driven by the output shaft where it can sense output shaft speed variations rather than engine speed.

Tailshaft governors are of the long range type which provide regulation over a wide range of speeds and can be set up to maintain any desired speed in that range.

The tailshaft governor is mounted on the torque converter and is gear-driven. This type governor has two operating levers — one of which is the throttle lever to set the desired output shaft speed and the other lever is connected directly to and operates the carburetor throttle control lever by a mechanical linkage. This linkage, preferably should be a short, straight rod with ball joints at each end or if the linkage is long — walled tubing should be used — so that weight and friction of the linkage is reduced to an absolute minimum.

The torque converter governor, being driven by the output shaft, senses only output shaft speed and controls the engine throttle accordingly. It is therefore very important that the engine be protected, with an overspeed device which will sense engine speed and limit that speed to a

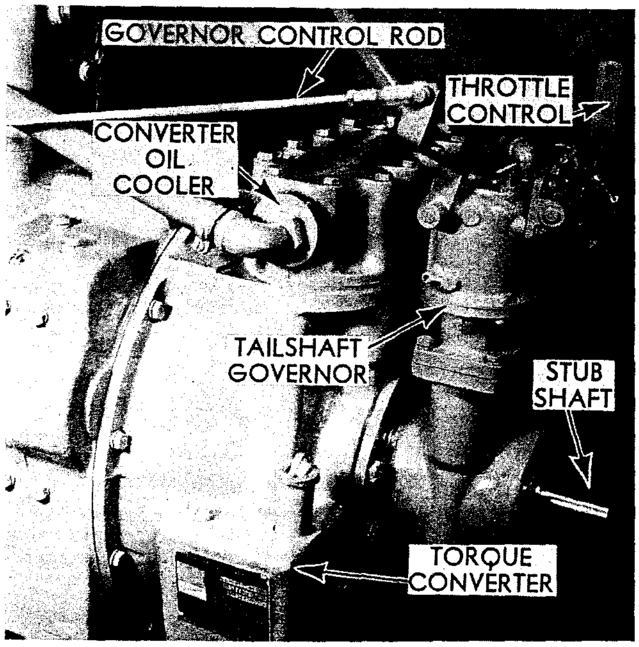


Figure 92 — Tailshaft Governor

safe maximum. This protection may be obtained with a mechanical, electrical or velocity type governor whichever may be the most simple arrangement.

Adjustments — include the following:

(A) **High Idle Speed** — Limits maximum engine speed, follow manufacturers recommendations.

(B) **Low Idle Speed** — Limits engine idling speed — 400-600 R.P.M.

(C) **Sensitivity Adjustment** — will eliminate surging or hunting by broadening regulation.

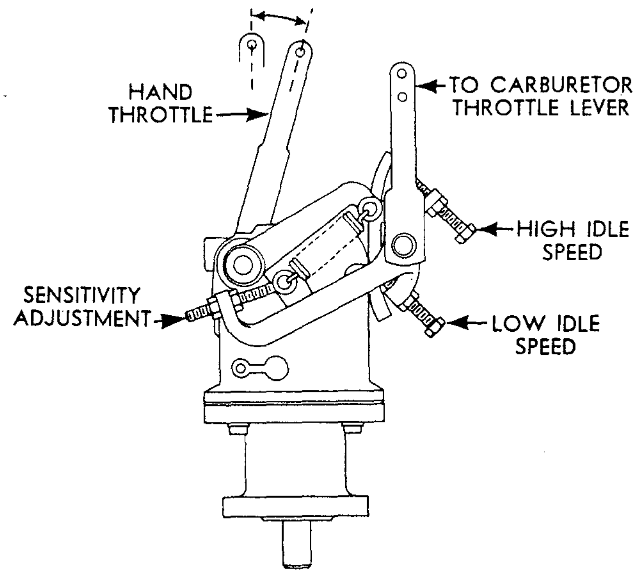


Figure 92A — Tailshaft Governor Adjustments

The hook-up of governor lever to carburetor lever should be done in the following manner:

1. Make sure carburetor shaft does not stick nor bind.
2. With governor lever in its normal position under spring tension, with engine shut off, with carburetor lever in **wide open** throttle position, a rod of exact length to connect the two levers is inserted.
3. Make sure that there is no bind or sticking in the assembly of rods and levers. **THIS IS IMPORTANT.**

IMPORTANT:

Pressure lubricated line must be connected to the torque converter or supply with an orifice.

Governor control linkage must be absolutely free to obtain correct governor operation.

SECTION VII
IGNITION

Continental L-Head engines are equipped with either battery ignition or magneto ignition. Both systems consist of an induction coil; breaker points, with a condenser connected across the points to absorb any arcing, and a distributor which connects to each spark plug. The main difference is that the battery-ignition system requires a storage battery and the magneto system uses the engine to supply energy to rotate a permanent magnet armature.

The ignition system has the job of producing and delivering high voltage surges of about 20,000 volts **to the correct spark plug, at the correct intervals** and with the **correct timing to the engine.** Each high voltage surge produces a spark at the spark plug gap to which it is delivered, so that the mixture of air and fuel in the cylinder is ignited.

BATTERY-IGNITION SYSTEM

This battery-ignition circuit consists of the battery, ammeter, ignition-switch, ignition coil, distributor, spark plugs and low and high tension wiring.

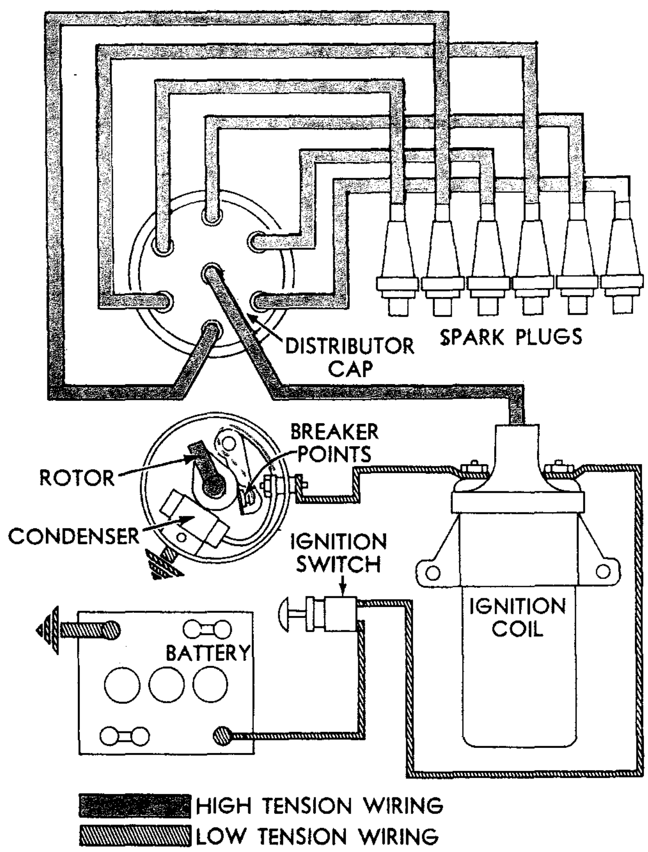


Figure 93 — Schematic drawing of battery ignition system

These parts can be divided into separate circuits consisting of a low tension circuit carrying battery voltage and a high tension spark circuit of about 20,000 volts.

The low tension primary circuit consists of the battery, ammeter, ignition switch, primary winding of the ignition coil, distributor contacts and condenser, and the primary wiring.

The secondary high tension circuit includes the coil secondary winding, distributor cap and rotor, spark plugs, and high tension wiring.

IGNITION SYSTEM COMPONENTS

The **Battery** supplies the voltage for producing a current flow through the ignition circuit.

The **Ammeter** indicates the amount and direction of current flow.

The **Ignition Switch** is an "Off" and "On" switch and the **Breaker Contacts** function as an intermittent switch. Current flows only when both switches are closed and returns by the ground through the engine or frame. The resistance of the primary winding of the ignition coil restricts the primary current flow.

The **Ignition Coil** consists of two windings, a primary winding and a secondary winding and is a transformer to increase the voltage high enough to jump a spark gap at a spark plug.

The **Condenser** momentarily provides a place for the current to flow until the distributor contacts are safely separated in order to reduce arcing.

The **Distributor** interrupts the primary winding current in the ignition coil and distributes the high tension current to the correct spark plug at the correct time.

The **Spark Plugs** provide a spark gap in the combustion chamber. The compressed air and fuel mixture is ignited when the high voltage jumps across this gap.

The **Low Tension Primary Wiring** conducts battery current through the ignition coil and contacts.

The **High Tension Secondary Wiring** conducts the high voltage, produced by the ignition coil, to the distributor and from the distributor to the spark plugs.

Operation — A primary current flows from the battery, through the ammeter and ignition switch to the coil primary winding, then to ground through the distributor contacts.

When the contacts open, the current tends to continue flowing across the contact gap. The condenser, which is connected across the contacts, momentarily absorbs this current and in doing so hastens the collapse of the magnetic field produced by the current in the coil primary winding.

This collapsing field induces a very high voltage in the secondary winding which is carried by the high tension wire to the center terminal of the distributor cap. The rotor connects this center terminal to one of the cap terminals which in turn is connected to the proper spark plug.

The spark produced by this high tension current ignites the fuel in that cylinder. This process is repeated for every power stroke of the engine and at high speeds, an impulse may be required as often as 300 times per second.

Ignition Coil — The function of the ignition coil is to transform the low voltage supplied by the battery into the high voltage to jump the spark plug gap.

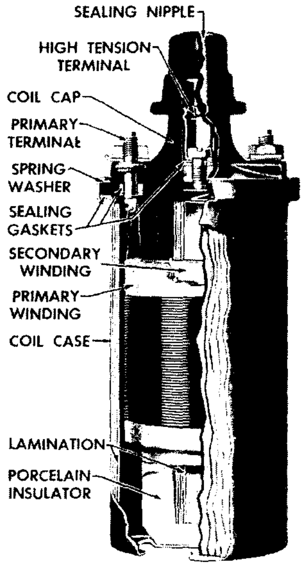


Figure 94 — Cutaway View of an ignition coil

An ignition coil has two windings wound on a soft iron core; the primary winding which consists of a comparatively few turns of heavy wire, and the secondary winding of many thousand turns of very fine wire. The primary winding is wound around the outside of the secondary winding. A soft iron shell encloses the outside of both windings and serves to complete the magnetic circuit.

Ignition coils do not normally require any service except keeping all terminals and connections clean and tight. The coil should be kept reasonably clean; however, it must not be subjected to steam cleaning or similar cleaning methods that may cause moisture to enter the coil.

Ignition coils can be tested for grounded windings by placing one test point on a clean part of the metal container and touching the other point to the primary and high voltage terminals. If tiny sparks appear at the points of contact, the windings are grounded.

If the coil is further suspected of being faulty, remove and check its operation on a coil tester and replace it if inoperative. Most coil testers compare the operation of the coil being tested with one known to be in good condition. This test should be made with the coils at room temperature and then warming the coils five minutes by connecting th primary to a battery of the same voltage rating a the coils. Recheck the comparison test to see if th expansion due to heating has caused some defec to appear.

Distributor — The distributor conducts and interrupts the current through the primary windin of the ignition coil at the correct time and distributes the high tension voltage to the correct spar plug.

There are two separate electrical circuits in distributor. The breaker contacts and condense are in the primary circuit and carry low voltag current — while the cap and rotor are in the secondary circuit and carry the high voltage spark current.

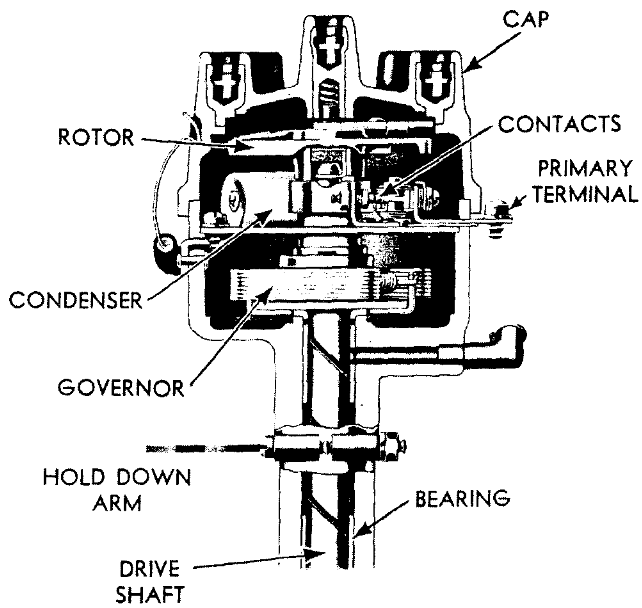


Figure 95 — Cutaway View of a distributor

The **breaker contacts** are mounted on a plate in the top part of the distributor housing. The grounded contact is stationary and the insulated contact is mounted on a breaker arm which is actuated by a cam near the top of the distributor shaft.

The **rotor** is mounted above the cam and turns with it to make a connection between the cap center contact and the various side contacts.

Continental L-Head engines have distributors equipped with a centrifugal governor which varies the timing by advancing the breaker cam as the engine speed increases. This mechanism consists of weighted levers which revolve with the distributor rotor and act against a set of springs. As the speed of rotation increases, the weights are moved out and the timing is advanced. With this arrangement it is possible to have a retarded spark for idling and obtain a gradual advance in spark timing as the engine speed is increased.