OPERATOR'S MANUAL

"L" HEAD

ENGINES and POWER UNITS

4 cylinder

6 cylinder

SEAMAN MOTORS, INC.
MILWAUKEE 3, WISCONSIN

Continental Motors Corporation
Factories: Detroit and Muskegon — Offices: Muskegon, Michigan

Printed in U.S.A

IMX6132

"L" HEAD MODELS

Model	Cyl.	Bore	Stroke	Displ.
N-50	4	2 1/8	3 1/2	50
62	4	2 3/8	3 1/2	62
Y- 69	4	2 1/2	3 1/2	69
91	4	2 7/8	3 1/2	91
112	4	3 3/16	3 1/2	112
Y-4069	4	2 1/2	3 1/2	69
4091	4	2 7/8	3 1/2	91
4112	4	3 3/16	3 1/2	112
F-124	4	3	4 3/8	124
140	4	3 3/16	4 3/8	140
162	4	3 7/16	4 3/8	162
F-4124	4	3	4 3/8	124
4140	4	3 3/16	4 3/8	140
4162	4	3 7/16	4 3/8	162
F-186	6	3	4 3/8	186
209	6	3 3/16	4 3/8	209
226	6	3 5/16	4 3/8	226
F-6186	6	3	4 3/8	186
6209	6	3 3/16	4 3/8	209
6226	6	3 5/16	4 3/8	226
M-271	6	3 5/8	4 3/8	271
290	6	3 3/4	4 3/8	190
330	6	4	4 3/8	330
M-6271	6	3 5/8	4 3/8	271
6290	6	3 3/4	4 3/8	290
6330	6	4	4 3/8	330
B-371	6	4 1/8	4 5/8	371
427	6	4 5/16	4 7/8	427
B-6371	6	4 1/8	4 5/8	371
6427	6	4 5/16	4 7/8	427

WHEN ORDERING SPARE PARTS BE SURE TO SPECIFY THE FOLLOWING INFORMATION WHICH CAN BE FOUND ON THE ENGINE NAMEPLATE ON THE SIDE OPPOSITE THE MANIFOLD:

ENGINE MODEL

ENGINE SERIAL NUMBER

SPECIFICATION NUMBER—When indicated

Your cooperation in giving the above data will be of material assistance in filling your orders promptly and correctly.

INDEX

FOREWORD

The CONTINENTAL Engine is produced by one of the largest manufacturers of internal combustion engines in the world. All Engines are thoroughly tested before leaving the Continental factory. Notwithstanding this, some attention is required on your part. To simply fill the gasoline tank, radiator and replenish the oil supply is not enough, if you are to obtain the fullest measure of satisfaction from its performance. The amount of attention required is small, but IMPORTANT.

When, through wear or accident, new parts are required, make certain that only those of GENUINE CONTINENTAL manufacture are used. Unauthorized dealers in spare parts now exist in large numbers but their product in no way measures up to the standard in material and workmanship established by Continental.

In this book you are given all information required to operate your engine successfully. Extensive repairs or rebuilding should be undertaken only by a mechanic fully capable of doing such work.

INSTRUCTIONS

Operating Details

Certain distinct steps must be taken to prepare a Continental Engine for service. By following these closely the operator will obtain best results.

1. Inspect bolts holding down the Engine to make certain that they are firmly set.
2. Open Carburetor Feed Valve by turning handle from right to left (counter-clockwise) as far as it will go.
3. Close Water Drain Cock in lower Radiator Connection on side of block.
4. Examine Oil Drain Plug to make sure that it is tightly closed.
5. Fill Oil Reservoir through Filler located on side of Crankcase to "full" level as marked on Bayonet Gauge located on filler side, in center of Block. Be sure that the container used for filling is absolutely clean and free from grit.
6. Fill Radiator with clean water.
7. Fill Gasoline Tank. Be sure that the container used for filling the Tank is absolutely CLEAN and free from dirt. Replace Cap securely.
8. Open Throttle Control slightly.
9. Turn Ignition Switch to "on" position.
10. Pull out Choke.
11. Where Clutch is used, same must be disengaged to relieve the operator of unnecessary effort and permit the engine to get up speed before applying load.
12. Push starter engaging mechanism until motor starts.
13. Immediately after starting engine, push Choke Button in. Should the engine stop after pushing back the choke button, it indicates that the engine is not warm enough to operate on normal adjustment. After starting engine as before, push choke button part way in. The manipulation of the choke is dependent entirely upon the temperature of the engine. The colder the engine the more choking will be necessary. A warm engine requires little or no choking. NEVER RUN AFTER WARMING PERIOD WITH CHOKE BUTTON PULLED OUT. When starting engine, permit it to warm up before applying load. This especially is true during cold weather and where the engine is operating in the open. Another precaution during extremely cold weather is to partially cover the radiator.

CAUTION:

14. The first time the engine is started, run it at idle for 5 minutes, no longer, then stop engine and recheck oil level in crankcase. (Do not check oil level while engine is running.) Oil level may be found low due to the fact that considerable oil is required to fill the oil passages. Or it may be found high if dip stick was not removed for venting air during the initial filling. Bring oil level to high mark on dip stick.
15. It will be found that in service the Engine will, or will not require throttling, depending upon whether the speed desired comes below or equals that for which the Governor has been set. Where extended periods occur between the applications of load it is recommended that engine be throttled down to minimum idling

speed or, if the intervals are unusually long, that it be shut down entirely.
16. Engines are provided with a Mechanical Governor set to maintain load and speed specified when engine was ordered. It may be necessary to reset Governor to meet requirements of the individual installations. The details of the Governor and its resetting when necessary are outlined under "Governor Adjustment."

LUBRICATION RECOMMENDATIONS

General: Engine design, the service it performs and the prevailing atmospheric temperatures in which it operates, are factors which determine the body and character of the lubricating oil required to assure maximum performance with minimum costs for supplies, adjustments, repairs and replacements. These engines which are used in both motor vehicles and for industrial purposes encompass a wide field of operating conditions hence, the lubricating oil recommendations set forth herein are established to meet the requirements of the several classifications and types of service, seasonal operating conditions considered.

Engine Service: The kind of engine service to be performed influences the type of oil best suited for your particular operation. Therefore, before replenishing or refilling the crankcase reservoir determine from the following explanation the type and grade of oil to be used, servicing practices considered.

Types of Lubricating Oils: As a progressive move for the benefit of all concerned the American Petroleum Institute recently formulated commercial expressions to classify the types of oil as concerns general chemistry composition only, namely:

Regular Grade: These are straight mineral oils without additives and are suitable for service where engine loads and oil temperatures are moderate and where crankcase oil change periods are regular and frequent.

Premium Grade: These are straight mineral oils of the higher quality type which contain Stabilizing Inhibitors that retard oil oxidation as well as bearing corrosion. They are preferred in engine service where engine loads are often severe, where oil temperatures are reasonably high and where crankcase oil change period is regular but less frequent.

Heavy Duty Grade: These are very high grade mineral oils to which have been added Stabilizing Inhibitors which further retard oil oxidation also hard alloy engine bearing corrosion and to which have also been added Dispersive Detergent compounds which keep the solid contaminates from combustion in a finely divided state whereby they remain in suspension within the engine oil and are removed when the crankcase oil is changed. These oils should be used in all engines performing Heavy Duty Service where severe loads are accomodated for periods of considerable time even though crankcase oil changes are regular and frequent.

Oil Character: This is identified in several ways familiar to the petroleum chemist. The yardstick most familiar to those operating engines is that of Viscosity Index. This is a measure of the amount of the oil body changes with change in temperature; ratings are established from 0 to 100; the higher the rating the better is the oil for automotive engine service. High Viscosity Index oils do not thicken up so much at low temperature thereby assuring easier cold starting also prompt oil circulation; neither do they thin out so much at the higher operating temperatures, which characteristic contributes to longer engine life and lower oil consumption.

Oil Body: This is Laboratory measured in Seconds/Viscosity/Temperature; the heavier the oil, the greater its Seconds Number. The yardstick most familiar to those who operate engines is the Society of Automotive Engineers Grading System expressed in SAE Numbers. As concerns engine oils these range as 10W 20W-30-40-50-60-70; the most popular grades used in the Automotive Engine services are the first four mentioned; the lighter bodied oils are used chiefly during the colder seasons of year.

Grade Recommendations: See chart on Page 20.

Quality Oils: The use of high Grade, high Viscosity Index Oils (Minimum 95) such as Socony-Vacuum Oil Company Mobiloils and Delvac 900 Series oils are recommended. Socony-Vacuum's several oils conforming to the types and grades stipulated herein are as follows:

Premium Grade: Mobiloil AF (SAE 40); Mobiloil A (SAE 30); Mobiloil Arctic (SAE 20W); Mobiloil Arctic Special (SAE 10W).
Heavy Duty Grade: Delvac 940 (SAE 40); Delvac 930 (SAE 30); Delvac 920 (SAE 20W); Delvac 910 (SAE 10W).

New Engines—Reconditioned Engines: The crankshaft to bearing clearances and those clearances between pistons, piston rings and cylinders (also other moving component parts) are very small in new engines and in engines which have been reconditioned with new and newly machined parts. To assure adequate oil distribution to these closely fit surfaces during the first week or 50 hours of engine operation, the use of a light bodied oil is desirable. When this engine run-in is performed during the warmer months of the year an SAE 10W or SAE 20W should be used.

Oil Change Frequency: Good oil; oil of the proper body and character for the service being performed; oil kept free from the several forms of contamination, assures minimum engine wear and replacement of parts. The frequency with which the oil should be changed is contingent upon (1) the quality of the oil being used (2) the severity of engine operation (3) the mechanical condition of the engine (4) the rate and kind of contamination from engine operation or the surrounding elements and circumstances. Generally speaking, good average draining frequencies are: Industrial Engines every 50 hours of operation; Motor Vehicles from 1500 to 2000 miles of operations.

CAUTION: Do not overfill the crankcase. An excess of oil does not improve lubrication. It causes high oil consumption, smoking and carbon deposit. Fill to the proper level, never letting it come below the "low" mark on the bayonet gauge.

DO NOT FLUSH CRANKCASE WITH KEROSENE

The reason for this is that some of the kerosene may be trapped and will remain to thin out the new oil, reducing its lubricating qualities. Some operators unwisely put kerosene in the crankcase after draining out 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 its branch leads into the engine bearings thereby washing away the protective oil film. Do **not** put kerosene into the crankcase. The best method is to drain the oil when the engine is thoroughly heated. This will carry off most of the sediment.

Oil Bath Air Cleaners—Oil Filters: These devices contribute materially to less engine parts wear and to lowered engine oil contamination; they progressively reduce or remove contamination by solids which otherwise would reach the metal rubbing surfaces of the engine interior. As these devices remove the dirt from the incoming air or solids liberated by fuel combustion, they progressively become less effective with use in their power to clean. The Air Cleaners should be frequently cleaned and their reservoir oil renewed also the oil filter elements should be renewed from time to time, as dictated by the service conditions under which they operate.

Cooling Fan Bearing: This is of the anti-friction type bearing. Those pumps having a low pressure fitting are lubricated by hand gun using a heat resisting, short fibre grease of No. 2 NLGI consistency such as Socony-Vacuum's Mobilgrease No. 5. The water pump is mounted integral with the Cooling Fan Shaft. The pump seal is water lubricated from the engine cooling system.

Accessories: The oil cups attached to the Ignition Distributor, Electric Generator and Starting Motor should receive a few drops of engine oil each 100 hours of operation.

Air Compressors: Where Air Compressors are in use and where they are lubricated separately from the engine system, the same type and grade of oil as used in the engine may be used in the compressor crankcase reservoir.

OIL PRESSURE

(See Chart on Page 21)

POWER TAKE-OFF

When Power Take-Off is used it should be lubricated through the Zerk Fitting provided for that purpose following the instructions on the plate attached to the unit.

Where clutch is used follow the direction on manufacturer's plate attached to unit. Where, in insolated cases, this plate is omitted, the following should be observed.

IMPORTANT: If clutch does not pull, heats, or operating lever jumps out, the clutch must be adjusted.

ADJUSTMENT: Remove hand hole plate, turn clutch until adjusting lock pin can be reached. Pull adjusting pin out and turn adjusting yoke to right or clockwise, until operating lever requires a distinct pressure to engage. A new clutch requires several adjustments until friction discs are worn in.

LUBRICATION: Lubricate clutch throw-out collar and ball bearings once a day before starting.

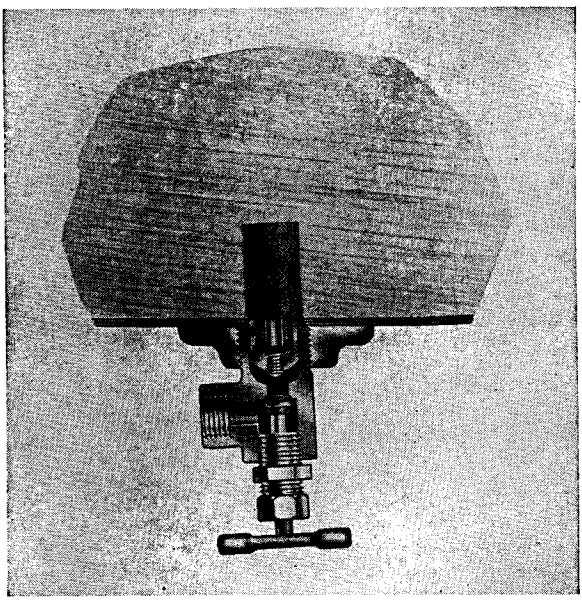


Figure 1

Combination Gasoline Shut Off Valve and Edge Type Filter

This semi-permanent unit, assembled in all overhead mounted gas tanks, filters out all foreign particles and prevents any water that may get into tank from entering the carburetor.

Using reasonable care in filling tank, with emphasis on CLEAN CONTAINERS, the filter should not require any attention whatsoever. If the engine ever requires an overhaul job, however, it is an excellent idea to have the gas tank and filter cleaned at the same time.

COOLING

If the water is permitted to drain or evaporate down to an insufficient amount, serious over-heating will take place. Moderately soft water is most desirable; if not obtainable we recommend that the system be drained every two weeks and flushed with clear running water.

Never use kerosene for cooling purposes in place of water, as its vapor is highly inflammable, increasing the fire risk to a prohibitive extent.

In cold weather, a suitable anti-freeze should be used. ANTI-FREEZE solutions come in 3 general types and may be used in the following proportions by volume to withstand the temperatures indicated: for example, 1 qt. of Alcohol to 3 qts. of water for 10° F.

	32° to 10°F	+10° to -10°F	-10° to -30°F
PLAIN ALCOHOL—(evaporates easily)—Check with Hydrometer and replenish often—If spilled on paint wash thoroughly immediately.	1 to 3	4 to 9	5 to 8
METHYL ALCOHOL COMPOUNDS—such as Zerone, Norway, etc. (evaporates less easily)—Check and replenish occasionally.	1 to 4	2 to 5	1 to 1
ETHYLENE GLYCOL—such as Prestone, Zerex, Peak, and GM (permanent type)—When there are no leaks add water **only** to make up for evaporation.	1 to 4	2 to 5	1 to 1

TROUBLE SHOOTING GUIDE

A good rule to follow in locating engine trouble is to never make more than one adjustment at a time. Stop and think how the motor operates, and figure out the probable cause of any irregular operation. Then locate the trouble by a process of elimination. Remember that the cause usually is a SIMPLE ONE, rather than a mysterious and complicated one. The following outline will be helpful in locating ordinary engine troubles:

ENGINE IS CRANKED AT NORMAL SPEED BUT ENGINE WILL NOT START

(This also covers hard starting and slow starting. Possible causes will be covered under (A) Improper Carburetion, (B) Electrical Difficulties, (C) Poor Compression, (D) Wrong timing).

A. IMPROPER CARBURETION

1. Out of fuel: tank empty?
2. Is fuel reaching the carburetor?
   First disconnect line from fuel tank to carburetor, and see if gasoline flows out freely. This line may be clogged with dirt.
3. Is fuel reaching the cylinders?
   The choke may not be closing tightly. The carburetor may be out of adjustment, float level too low, or the jets may be clogged with dirt or gum.
4. Engine flooded?
   If the spark plugs are wet, this indicates flooding, caused by using the choke too long.
5. Air leaks at intake manifold or governor gaskets.
6. Poor grade fuel in combination with cold weather. In very cold weather, heating the oil will help.

B. ELECTRICAL DIFFICULTIES

1. Primary Circuit:
   Faulty or shorted ignition switch.
   Corroded, dirty or loose connections.
   Weak, leaky or grounded condenser.
   Magneto points pitted or fused.
   Magneto points set to wrong gap.
   Breaker arm sticking.
   Hinge bushing tight on pin.

2. Secondary Circuit:
   Corroded, dirty or loose connections.
   Pay particular attention to high tension wire from coil to distributor, and all wires in distributor cap.
   Wet wires.
   Moisture or carbon on spark plug.
   Cracked insulation, leaks and shorts.
   Cracked distributor cap.
   Carbon contact inside distributor cap broken or missing.
   Rotor contact spring broken.
   Improper gap on spark plugs.
   Fouled or cracked spark plugs.
   Magneto wired to wrong plugs.

C. POOR COMPRESSION

A rough-and-ready check for compression is to remove a spark plug and place your thumb over the spark plug hole, then crank the engine. Accurate method is to use a compression gauge. Do not expect all cylinders to show the same compression pressure, but a decided difference will indicate improperly seating valves, worn rings, worn cylinder, or leaky gasket. After taking an initial reading, seal the piston with a teaspoonful of engine oil poured through spark plug hole, and take a second reading; if pressure does not increase this will indicate that improperly seating valves are at fault. Poor compression may be caused by any of the following:

1. Loose head.
2. Damaged cylinder head gasket.
3. Poorly seating valves.
4. Broken valve springs.
5. Valves holding open due to insufficient tappet clearance.
6. Valves sticking open due to carbon and gum on stems or in guides.
7. Badly worn, broken or stuck piston rings.
8. Cylinder scored.

D. WRONG TIMING

Remove No. 1 spark plug, put your thumb over the spark plug hole and test for compression stroke, cranking the engine over by hand. Then set piston on top dead center of the compression stroke. T.D.C. mark on flywheel will line up with pointer in bell housing, the breaker points in distributor should be just starting to open.

TROUBLE SHOOTING
(Continued)

Lack of Power

1. Faulty compression.
2. Incorrect timing.
3. Poor carburetion.
4. Restriction in air supply to carburetor caused by dirt in flame arrester screen, or choke valve not completely opening.
5. Throttle control linked up so that throttle valve is not fully opening.
6. Dirt in sediment bowl of fuel pump.
7. Dirt in fuel lines or carburetor jets.
8. Air leak in fuel pump or fuel line.
9. Air leak in manifold gasket or at governor gaskets.
10. High engine temperature, caused by worn water pump or clogged water jackets.
11. Vent of gasoline tank not open.
12. Pre-ignition, caused by carbon deposits.
13. Engine misalignment.

Rough, Uneven Idling

1. Improper adjustment of carburetor.
   Idling jet air passage clogged.
2. Air leaks in intake manifold or carburetor.
   Loose manifold nuts.
   Damaged gasket at manifold.
3. Faulty ignition.
4. Spark plug difficulties.
5. Uneven compression.
6. Water leak at cylinder head gasket or manifold.

Missing at High Speed

1. Spark plug troubles.
2. Broken insulation on high-tension wires.
3. Faulty breaker-points.
4. Fuel obstruction, indicated by back-firing.
5. Incorrect tappet clearance.

Missing at All Speeds

1. Blown head gasket.
2. Sticking valves, broken valve spring.
3. Fouled spark plug, broken insulation.
4. "Leaky" high tension wiring.
5. Pitted or fused breaker points.
6. Incorrect breaker-point gap.
7. Incorrect valve tappet clearance.
8. Punctured condenser.
9. Gasket leak at intake manifold or governor.

Crankshaft Knocks

These are usually detected as dull, heavy, metallic knocks which increase in frequency as the speed and load on the engine is increased. The most common crankshaft knock is that caused by excessive clearance at one or more main bearings. This is most audible when engine is pulling hard, on acceleration, or when engine is cold. By alternately shorting out each spark plug, the approximate location of the loose bearing can usually be determined. Excessive crankshaft end play causes a sharper noise or rap which occurs at irregular intervals. In bad cases this can generally be detected by releasing and engaging the clutch. Causes of crankshaft knocks include the following:

1. Excessive bearing clearance.
2. Excessive end play.
3. Eccentric or out-of-round journals.
4. Sprung crankshaft.
5. Insufficient oil supply.
6. Low oil pressure.
7. Badly diluted oil.
8. Loose Flywheel.

Connecting Rod Noises

Connecting rod noises are usually a light pound or knock of much less intensity than main bearing knocks. The noise is usually evident with the engine idling and becomes louder when engine speed is slightly increased. Connecting rod noise can best be located by shorting out one spark plug at a time. These noises should not be confused with piston or piston pin noises. Possible causes are as follows:

1. Excessive bearing clearance on crank pin.
2. Insufficient oil supply.
3. Low oil pressure.

4. Badly diluted oil.
5. Misaligned connecting rods.
6. Out-of-round or tapered crank pin journal.

Piston Noises

The most common piston noise is "slap," due to the piston rocking from side to side in the cylinder. Piston-slap usually causes a hollow, muffled bell-like sound, or a click. Slight piston noises that occur with a cold engine and disappear after the engine is warm, do not warrant replacement. Piston-slap is most audible when driving the engine at low speed under load.

Piston and ring noises can be located by putting a spoonful of heavy engine oil (S.A.E. 50) into the suspected cylinder through the spark plug hole. Crank the engine over by hand for several revolutions with the ignition off, until the oil has worked down past the piston rings. Replace the spark plug, start the engine, and determine if the noise still exists.

Piston Pin Noises

The most common piston pin noise is the result of excessive piston pin clearance. This is characterized by a sharp, metallic double knock, generally audible with the engine idling. Possible causes:

1. Excessive piston pin clearance in piston boss.
2. Excessive piston pin clearance in bushing.
3. Bushing loose in connecting rod.

Valve and Tappet Noises

Noisy valve action has a characteristic clicking noise occurring usually at regular intervals. The frequency of valve action noise is generally less than other engine noises, because the valves are operated by the camshaft running at one-half of crankshaft speed. If one or two of the valves or tappets are causing the noise, the clicking sound will be intermittent, but if the condition exists with a majority of the valves, the noise may be continuous.

The common cause of valve action noise is that of excessive clearance between tappet and valve stem. Instructions for valve tappet adjustment are covered in detail on page 13. Possible causes of valve and tappet noises:

1. Excessive tappet clearance.
2. Threads stripped on adjusting screw.
3. Broken valve springs.
4. Excessive valve stem to guide clearance.

Spark Knock and Fuel Knock

Included under this heading are Pre-ignition and Detonation. Pre-ignition is caused by an incandescent particle of carbon or metal in the combustion chamber, which fires the mixture prematurely, while the piston is still rising. Detonation is caused by fuel of improper octane value, which burns too rapidly, throwing a sudden and abnormally high pressure against the piston. The two have a similar sound, a metallic ringing knock which is often described as a "ping." This is usually heard when the engine is accelerated rapidly, or overheated. Causes:

1. Carbon deposits in combustion chamber.
2. Ignition timed too early.
3. Faulty spark plugs.
4. Carbon on spark plugs or burned porcelain.
5. Hot valves resulting from:
   Insufficient tappet clearance.
   Improper seating.
6. Excessive engine temperature, caused by faulty water circulation.
7. Low octane fuel.

8. Old or stale fuel.
9. Extremely lean carburetor mixture.

NOTE: Continental Engines of current manufacture are calibrated to produce rated engine power, maximum smoothness and economy when using gasoline of 75 ASTM, Motor Method, Octane Value. Gasolines of slightly lower or higher Octane Values may be satisfactorly used in these engines by making minor engine adjustments and by changing Ignition Spark Plug timing for the fuel to be used. For specific instructions on these adjustments write Continental Engine Service Department, giving full information on the fuel to be used.

Vibration Originating At Engine

The most common sources of vibration originating in or on the engine, as distinguished from causes originating outside the engine (covered below) are as follows:

1. Misfiring.
2. Misalignment of engine.
3. Bent or off-center coupling.
4. Engine loose on bed.

Uncommon Engine Noises

The following possible causes of engine noise are more rare, but should be considered and checked in locating foreign sounds:

1. Flywheel loose on crankshaft.
2. Crankshaft pulley loose on flywheel.
3. Loose exhaust pipe at manifold connection.
4. Loose engine accessories, such as generator, water pump, etc.

Backfiring at Carburetor

Engine back-firing through the carburetor when starting cold is many times unavoidable as it is the result of imperfect air-gasoline mixture, which will automatically correct itself after the engine reaches normal operating temperatures. The "reason why" of back-firing in this case is late burning of the mixture in the cylinder, due to improper ratio of fuel to air, igniting the incoming charge and causing an explosion in the intake manifold and carburetor. Thus lean mixtures and retarded spark are the commonest cause of back-firing. Continued back-firing after the engine is warm should be corrected by checking the following possible causes:

1. Excessively lean fuel-mixture.
2. Late ignition timing.
3. Improperly seating valves, especially intake.
4. Obstruction in fuel line.
5. Dirt or water in sediment bowl.
6. Intake manifold air leaks.
7. Poor grade of fuel.
8. Secondary wires crossed in distributor cap.
9. Faulty spark plugs.

Abnormal Oil Consumption

1. Piston rings stuck, worn or broken.
2. Piston rings improperly fitted.
3. Scored or worn cylinder bore.
4. Out-of-round cylinder bore.
5. Excessive bearing clearances.
6. Excessive oil pressure.
7. Oil level too high.
8. Oil leaks at seals and gaskets.
9. Overheating.

Before deciding that worn piston rings or worn cylinders are the cause of high oil consumption, don't overlook the possibility of oil leaks. Give attention particularly to the oil seals. Slow leaks can be located by spreading a paper under the engine.

If plugs foul up persistently, and if the exhaust is smoking, this indicates that the engine may be pumping oil, either past the pistons or along the valve stems. Another cause of fouled plugs is too high an oil level, causing crankshaft to dip and splash excessive oil.

Remember that it is normal for an engine to consume and burn a certain amount of oil, the quantity depending on the speed of operation.

Low Oil Pressure

Complete absence of oil pressure is sure sign of a broken oil pump or lack of oil. (Normal oil pressures are listed on page 21.) Possible causes of low oil pressure:

1. Incorrect grade of oil.
2. Badly diluted engine oil.
3. Oil relief valve not properly seating.
   Look for dirt on seat of valve.
4. Clogged oil cooler.
5. Air leak in oil pump suction line.
6. Sludge on oil pick-up screen.
7. Worn or damaged pump gears.
8. Inaccurate oil pressure gauge.

High Oil Pressure

Oil pressure should not exceed recommended pressures on page 21, except momentarily when the engine is started up cold. Abnormally high oil pressure is not desirable because it increases oil consumption. Possible causes of high oil pressure:

1. Engine oil too heavy.
2. Relief valve not opening (It may be stuck).
3. Obstruction in distributing line.
4. Inaccurate oil pressure gauge.

Fouled Spark Plugs

1. Worn piston rings.
2. Worn cylinders.
3. Excess piston clearance.
4. Rich mixture.
5. Gap too narrow, causes missing at idle.

Burned Spark Plugs

1. Lean mixture.
2. Late ignition timing.
3. Engine overheated, due to worn water pump, obstructions, etc.
4. Low octane fuel.
5. Badly leaking valves.

Hard Starting

1. Magneto points burned or corroded.
2. Points improperly adjusted.
3. Wrong gap in spark plugs.
4. Spark plug wires loose and corroded in Magneto cap.
5. Loose connections in primary circuit.
6. Defective condenser.
7. Choke not fully closing.

Back Firing

1. Crossed plug wires.
   See "Backfiring at Carburetor" for other causes.

Missing At High Speed—Under Load

1. Incorrect gap in spark plugs.
2. Defective spark plugs.
3. Defective coil.

Pre-Ignition

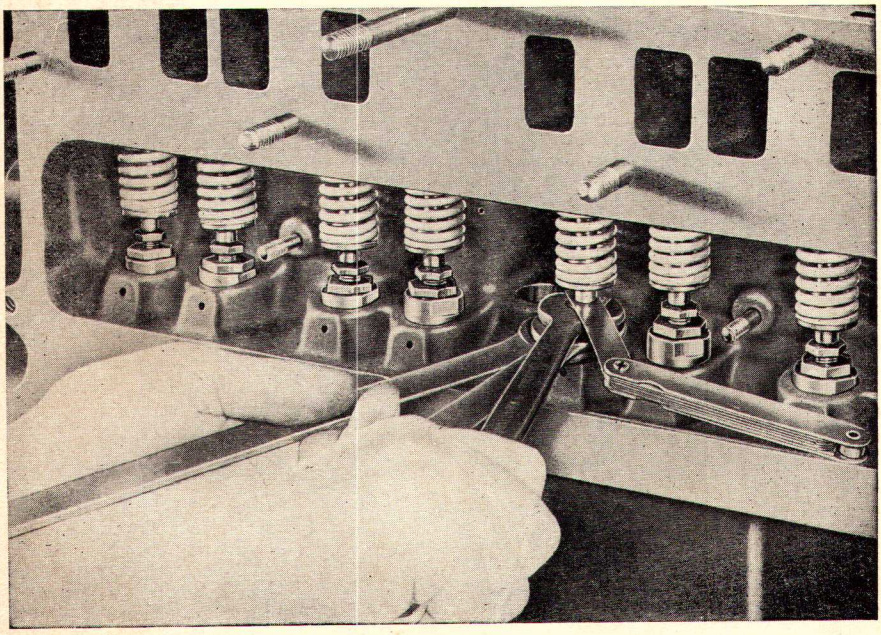
1. Carbon deposits.
2. Overheating.
3. Ignition timing set too early.

ADJUSTING TAPPETS

The correct clearance between the tappet and the valve stem is very important. This should be set according to the chart on page 20. Three wrenches and a feeler gauge will be required to make the necessary adjustment.

When the adjustment has been correctly made the feeler gauge will pass between the tappet and valve freely.

It is recommended that the tappets be adjusted with the machine running at idle speed whenever possible. If it is not possible to make the adjustment with the engine running, it will be necessary to crank the engine until both valves are closed and the piston is on Top Dead Center on the compression stroke. As a final check start the engine and be sure the correct feeler gauge will pass between the tappets and valves.



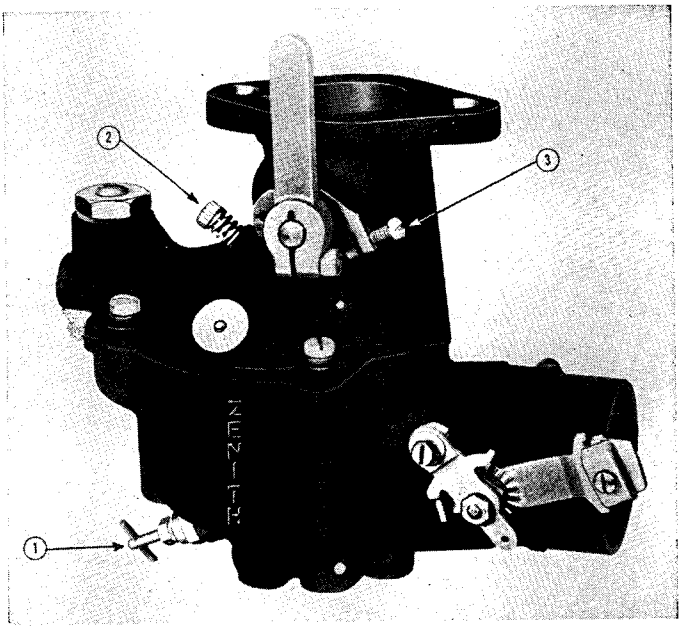


Figure 2

Zenith 62 Series Carburetor

The main adjustment screw (1) determines the amount of fuel which may be obtained for high speed operations. To set this adjustment, open the throttle to approximately ¼ open. Turn the adjustment clockwise, shutting off the fuel until the engine speed decreases or begins to miss due to too lean mixture. Now open the adjustment until the engine reaches its maximum speed and runs smoothly without missing.

The idle mixture adjustment needle (2) controls the amount of air admitted to the idling system (which functions only at low speeds). Turning the needle (2) clockwise cuts off air, making the mixture richer while unscrewing it admits more air making the mixture leaner. The idle adjusting needle should be set for smoothest running of the engine. or. if a vacuum gauge can be attached to the manifold, set the adjustment for highest manifold vacuum. This point will coincide with the smooth running of the engine.

The idle speed adjustment screw (3) controls the required idling speed.

Adjustment Instructions For

MODEL TSX MARVEL SCHEBLER CARBURETOR

Without Power Adjustment

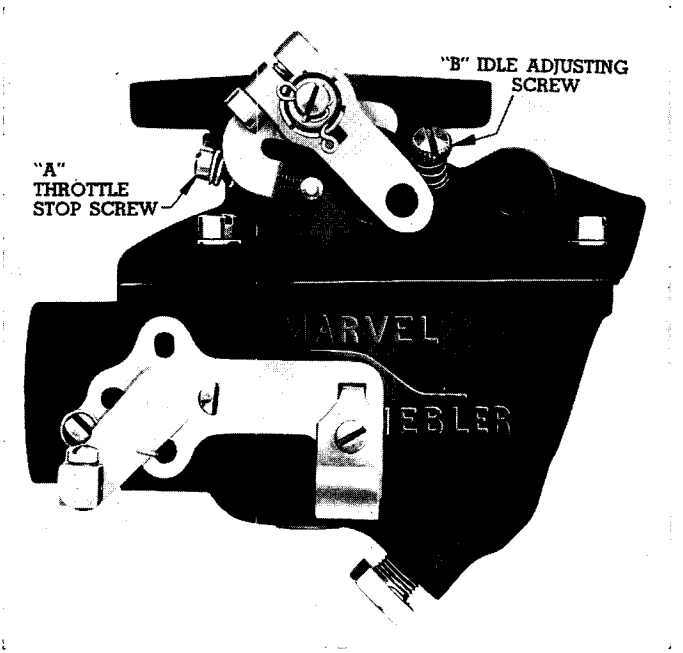


Figure 3

Preliminary Carburetor Adjustments

Set throttle stop screw "A" so that throttle disc is open slightly. Make certain that gasoline supply to carburetor is open. Set throttle control lever to one-third open position. Close choker fly by means of choke control button. Start engine and partially release choke. After the engine has been run sufficiently to bring it up to operating temperature throughout, see that choke is returned to wide open position.

Low Speed Adjustment

Set the throttle or governor control lever in slow idle position and adjust throttle stop screw "A" for the correct engine idle speed. (On a new, stiff engine this speed must be slightly higher than required for a thoroughly run-in engine.) Turn idle adjusting screw "B" in. or clockwise. until engine begins to falter or roll from richness, then turn screw "B" out. or counter-clockwise, until the engine runs smoothly.

Note: It is better that this adjustment be slightly too rich than too lean.

GOVERNOR
(Centrifugal Flyball Type)

In this type of governor two forces are utilized to gain the regulation desired. The first is the centrifugal force created by the balls which tends to close the throttle as the speed of the engine increases. The second force is that of the spring. This force is constant and tends to hold the throttle in wide open position at all times. When these forces are in equilibrium, the engine is operating at the predetermined governor speed.

If load is applied, the engine slows down and decreases the centrifugal force of the balls. The spring force, then being the greater, opens the throttle and returns the engine to the governed speed.

If the load is thrown off, the engine gains RPM and causes the weight force to exceed the spring force. This excess of force closes the throttle and brings the engine back to the governed speed.

REPLACEMENT OF PARTS

Check all bearings for roughness of wear. Replace all rough or worn bearings.

Check the yoke for wear where it contacts the thrust bearing and for signs of fracture.

Use new oil seal when reassembling.

If there are worn parts in the assembly consisting of spider shaft, balls spider, diaphragm, diaphragm bearing or the drive gear, it is necessary to replace the entire assembly. Oil all bearings before reassembling.

OPERATION AND SERVICE OF NOVI GOVERNORS ON CONTINENTAL ENGINES

Novi Governors differ from conventional centrifugal governors principally in that round steel balls are used as the motivating force producer in the Novi, instead of masses of weight.

The balls move "out" and "in" radially from the governor shaft on two hardened steel races. One race is a flat surface, the other conical in shape. As the balls move "in" and "out" they tend to raise or lower the conical shaped race, the motion of which is transferred through a fork or finger to the governing lever on the outside of the governor housing.

The force created by the balls in their centrifugal movement on the governing lever is opposed by a spring, one end of which is hooked to the governing lever, the other end of which is hooked to the speed adjusting screw lever.

To increase engine speed, tension of spring is increased and to lower speed the tension is decreased. To increase the spring tension, turn screw "A" out or in a counterclockwise direction after loosening the locknut. Then loosen locknut on Screw "B" and turn in or in a clockwise direction. To decrease the spring tension, reverse the above procedure. After making the adjustment, be certain to tighten the two locknuts.

Should governor surge at no load speed, screw Bumper Screw "C" in until surge is eliminated. Don't run Bumper Screw in far enough to increase speed.

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 .004 to .006 is provided between the driver and the flat race. This is to assure freedom for movement of the flat race. When servicing the governor, make sure that both races revolve freely on the shaft.

When the balls are "in", that is in the bottom of the driver slots, the space between the top of the conical shaped race bushing and hair pin clip should be .230-.240. Use .010 spacer washers to obtain required space.

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

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

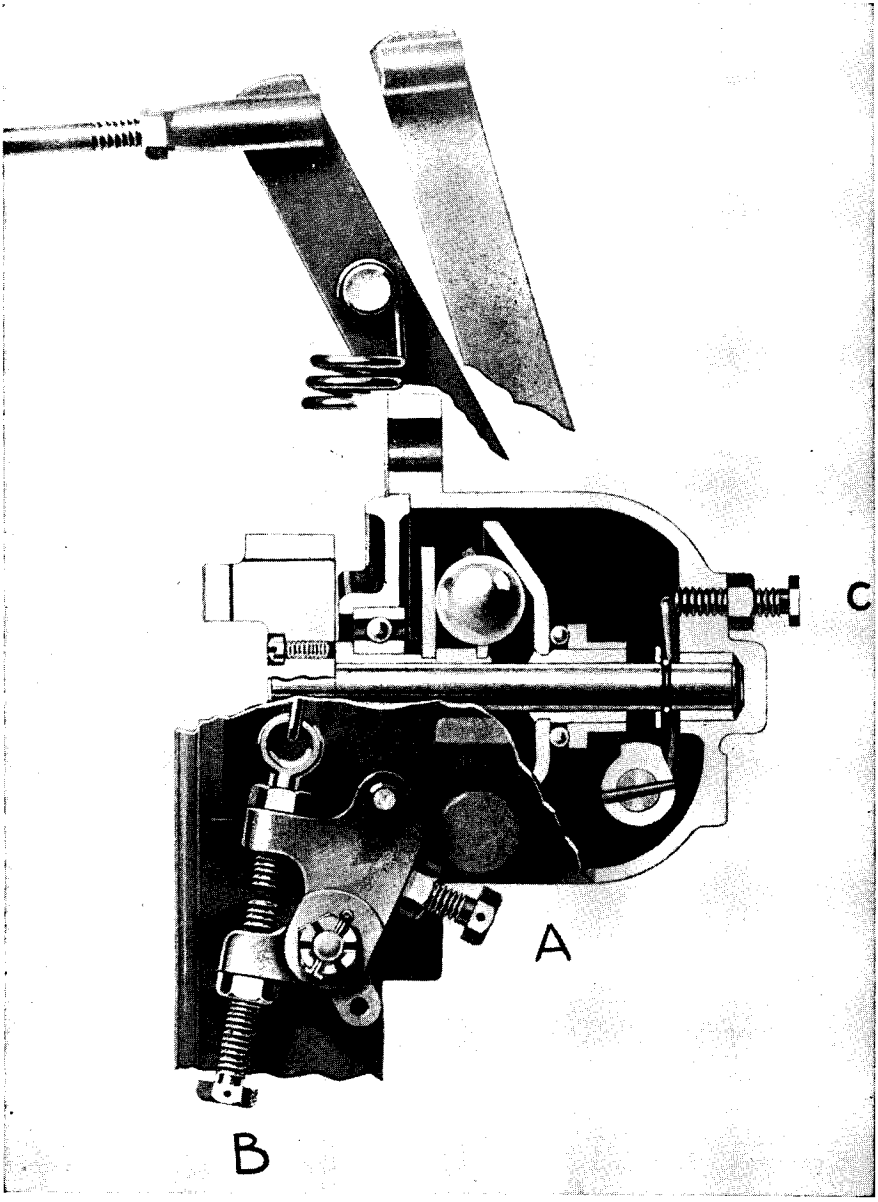
The hook-up of governor lever to carburetor lever should be done in the following manner:

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 nor sticking in the assembly of rods and levers. **This is very important.**

GOVERNOR ADJUSTMENT INSTRUCTIONS (NOVI)



NOVI GOVERNOR

LOCATING IGNITION TROUBLE

If you suspect ignition trouble when engine does not start (provided the battery is well charged and starting motor is functioning), or if the engine is running irregularly, the following routine is a good short method of locating the trouble:

1. Disconnect the high-tension wires to spark plugs, one cylinder at a time, and hold the end of the wire about ¼" from the cylinder head, then trip the starter relay switch (use the emergency switch under screw cap at end of solenoid) and observe if you get a good spark. This may also be done by shorting across with a screw-driver, without disconnecting wire to the plug.

2. If spark is good then the trouble is in the spark plug, which may be cracked or fouled. Remedy: install new plug. Gap should be .025.

3. If spark is weak, or missing altogether, check the coil.

4. Pull the high tension wire that leads to the coil out of the distributor cap and hold end of wire ¼" from cylinder head, then test again for spark.

5. If you get a weak spark or no spark here, trouble is indicated in the coil or distributor. Examine the high tension wire, also the primary wire leading from distributor to coil.

6. The distributor compartment cover should be removed, care being taken not to damage the gasket attached to the cover side of the joint. The interior should be thoroughly cleaned and the air inlet and outlet passages opened. Examine the high tension lead brush; replace if noticeably worn or damaged. This brush should move freely in its holder and should have a slight spring pressure.

7. Remove the distributor cap and check the breaker points; these should be examined for evidences of pitting or pyramiding. A small tungsten file or fine stone may be used to resurface the points. If points are worn or badly pitted, they should be replaced. Points are to be adjusted to have a .020 inch gap at full separation. Adjustment is made by loosening the round head locking screw at the upper end of the stationary point bracket, then turning the eccentric head adjusting screw until the gap is obtained, and locking the assembly by tightening the round head screw.

8. If you do not get a satisfactory spark from the coil after distributor has been checked, trouble is indicated in the coil.

9. Check the high tension wires from distributor to spark plugs. These wires must be dry as surface moisture will cause a short.

DISTRIBUTOR MAINTENANCE

1. Check Breaker Arm Hinge: Make sure the breaker arm moves freely on its hinge, and apply a drop of light oil as covered under "Lubrication." Moisture or oil under certain conditions may cause swelling of the fiber bushing in breaker arm hinge, producing irregular running at high speeds. Remedy is to ream the bushing very slightly.

2. Adjust breaker points: If the points are burned or pitted they should either be replaced or dressed down with a fine-cut stone or point file. File must be clean and sharp. Never use emery cloth to clean contact points. After filing, check the breaker point gap and reset to .020. The breaker arm must be resting on the high point of the cam during this operation.

When replacing contacts be sure they are aligned and that they make contact near the center. Bend the stationary arm to secure proper alignment. Do not bend the breaker arm.

TAPPET SETTINGS

MODEL	INT.	EXH.	MODEL	INT.	EXH.
N50-N62 N56-	.012 .015	.012 .015	F186 F6186 F6209 F209 F6226 F226	.014	.014
Y4069 Y69 Y4091 Y91	.012	.012			
Y4112 Y112	.012	.012	M6271 M271 M6290 M290 M6330 M330	.017	.020
F4124 F124 F4140 F140 F4162 F162	.014	.014			
			B6371 B371 B6427 B427	.017	.022

"L" HEAD ENGINE LUBRICATING OIL RECOMMENDATIONS

Engine Series	When Temperatures Are		
	Over 50°F	50°F to 20°F	20°F to 0°F
N50	SAE 30	SAE 20W	SAE 10W
N62	SAE 30	SAE 20W	SAE 10W
Y69	SAE 30	SAE 20W	SAE 10W
Y91	SAE 30	SAE 20W	SAE 10W
Y112	SAE 30	SAE 20W	SAE 10W
Y4069	SAE 30	SAE 20W	SAE 10W
Y4091	SAE 30	SAE 20W	SAE 10W
Y4112	SAE 30	SAE 20W	SAE 10W
F124	SAE 30	SAE 20W	SAE 10W
F140	SAE 30	SAE 20W	SAE 10W
F162	SAE 30	SAE 20W	SAE 10W
F4124	SAE 30	SAE 20W	SAE 10W
F4140	SAE 30	SAE 20W	SAE 10W
F4162	SAE 30	SAE 20W	SAE 10W
F186	SAE 30	SAE 20W	SAE 10W
F209	SAE 30	SAE 20W	SAE 10W
F226	SAE 30	SAE 20W	SAE 10W
F6186	SAE 30	SAE 20W	SAE 10W
F6209	SAE 30	SAE 20W	SAE 10W
F6226	SAE 30	SAE 20W	SAE 10W
M271	SAE 40	SAE 30	SAE 10W
M290	SAE 40	SAE 30	SAE 10W
M330	SAE 40	SAE 30	SAE 10W
M6271	SAE 40	SAE 30	SAE 10W
M6290	SAE 40	SAE 30	SAE 10W
M6330	SAE 40	SAE 30	SAE 10W
B427	SAE 40	SAE 30	SAE 10W
B6371	SAE 40	SAE 30	SAE 10W
B6427	SAE 40	SAE 30	SAE 10W

OIL AND WATER CAPACITY
OIL PRESSURE DATA

Model	Oil Capacity in Qts.		Oil Pressure* (1800 RPM)	Water Capacity (Qts.)	
	Pan	Filter		Engine	Engine & Radiator
N-50	3½	½	20-30		11
N-62	3½	½	20-30		11
Y69	3½	½	30-40		14
Y91	3½	½	30-40		15
Y112	3½	½	30-40		15
Y4069	3½	½	30-40	3¾	
Y4091	3½	½	30-40	3¾	
Y4112	3½	½	30-40	3¾	
F124	4	½	20-30		14
F140	4	½	20-30		14
F162	4	½	20-30		15
F4124	4	½	30-40	5	
F4140	4	½	30-40	5	
F4162	4	½	30-40	5	
F186	5	½	20-30		17
F209	5	½	20-30		17
F226	5	½	20-30		17
F6186	5	½	30-40	6½	
F6209	5	½	30-40	6½	
F6226	5	½	30-40	6½	
M271	7	1	30-40		31
M290	7	1	30-40		31
M330	7	1	30-40		33
M6271	7	1	40-50	13½	
M6290	7	1	40-50	13½	
M6330	7	1	40-50	13½	
B371	8	1	30-40		36
B6371	8	1	40-50	16	
B6427	8	1	40-50	16	
B427	8	1	40-50		36

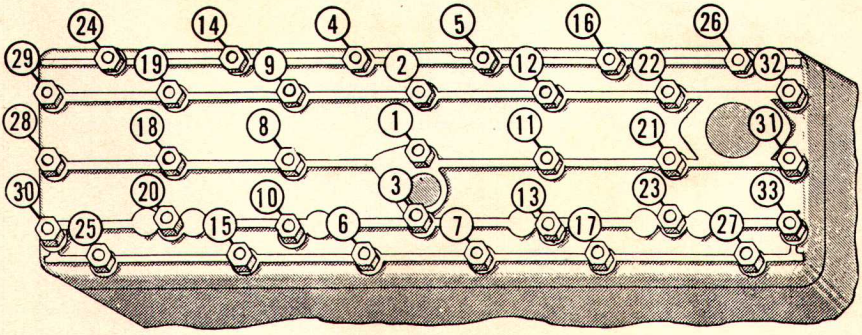
*Pressure at low idle RPM will be lower than these figures; this is satisfactory as long as pressure does not fall below 5#.

TORQUE WRENCH DATA

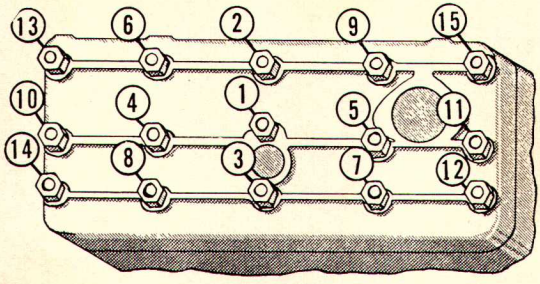
Size	Limit in Foot Pounds Torque
Cylinder Heads	
3/8	35- 40
7/16	70- 75
1/2	100-110
9/16	130-140
5/8	145-155
Main Bearing Caps & Connecting Rods	
5/16	20- 25
3/8	35- 40
7/16	70- 75
1/2	85- 95
9/16	100-110
Flywheels	
5/16	20- 25
3/8	35- 40
7/16	70- 75
1/2	85- 95
9/16	100-110
5/8	145-155

Size	Limit in Foot Pounds Torque
Manifolds	
5/16	15- 20
3/8	25- 30
7/16	50- 55
1/2	80- 90
9/16	100-110
5/8	130-140
Gear Covers, Water Pumps, Front & Rear End Plates, Oil Pans	
5/16	15- 20
3/8	25- 30
7/16	50- 55
1/2	80- 90
Flywheel Housings	
5/16	15- 20
3/8	25- 30
7/16	50- 55
1/2	80- 90
9/16	115-125

CYLINDER HEAD TIGHTENING SEQUENCE



6 Cylinder Engines



4 Cylinder Engines

To prevent distortion of cylinder and head castings, tighten cylinder head stud nuts or screws in order of above designations.

WHEN ORDERING SPARE PARTS BE SURE TO SPECIFY THE FOLLOWING INFORMATION WHICH CAN BE FOUND ON THE ENGINE NAMEPLATE ON THE SIDE OPPOSITE THE MANIFOLD:

ENGINE MODEL
ENGINE SERIAL NUMBER
SPECIFICATION NUMBER—When indicated

Your cooperation in giving the above data will be of material assistance in filling your orders promptly and correctly.

WARRANTY

for

Red Seal

Transportation and Industrial Engines

The Continental Motors Corporation warrants each new engine manufactured by same to be free from defects in material and workmanship on the basis of installations and applications as herein defined.

1. BUS and TRUCK EQUIPMENT - Six months from date of shipment but not to exceed ninety days or 15,000 miles of service.
2. RAIL CARS and LOCOMOTIVES - Six months from date of shipment but not to exceed ninety days or 15,000 miles of service.
3. AGRICULTURAL EQUIPMENT - Six months from date of shipment but not to exceed ninety days of service.
4. INDUSTRIAL and OIL FIELD EQUIPMENT - Six months from date of shipment but not to exceed ninety days of service.
5. MARINE EQUIPMENT - One year from date of shipment.
6. FIRE EQUIPMENT - One year from date of shipment.

The obligation under this Warranty, statutory or otherwise, is limited to the replacement or repair at the Manufacturer's factory, or at a point designated by the Manufacturer, of such part as shall be found by the Manufacturer, upon inspection at such point, to have been defective in material or workmanship.

This Warranty does not obligate the Manufacturer to bear the cost of labor or transportation charges in connection with the replacement or repair of defective parts, nor shall it apply to an engine upon which repairs or alterations have been made unless authorized by the Manufacturer.

The Manufacturer makes no Warranty in respect to trade accessories, such being subject to the Warranties of their respective manufacturers.

The Manufacturer shall in no event be liable for consequential damages or contingent liabilities arising out of the failure of any engine or parts to operate properly.

No express, implied or statutory Warranty other than herein set forth is made or authorized to be made by the Manufacturer.

Before consideration can be given to requests for adjustments covering field service and alleged defective material, the Buyer shall furnish CONTINENTAL MOTORS CORPORATION with the following data:

Owner's name and address	Information as to the nature of the trouble
Engine Model	Date actually placed in service
Serial Number	Accumulated days or miles of service

Continental Motors Corporation

MUSKEGON, MICHIGAN