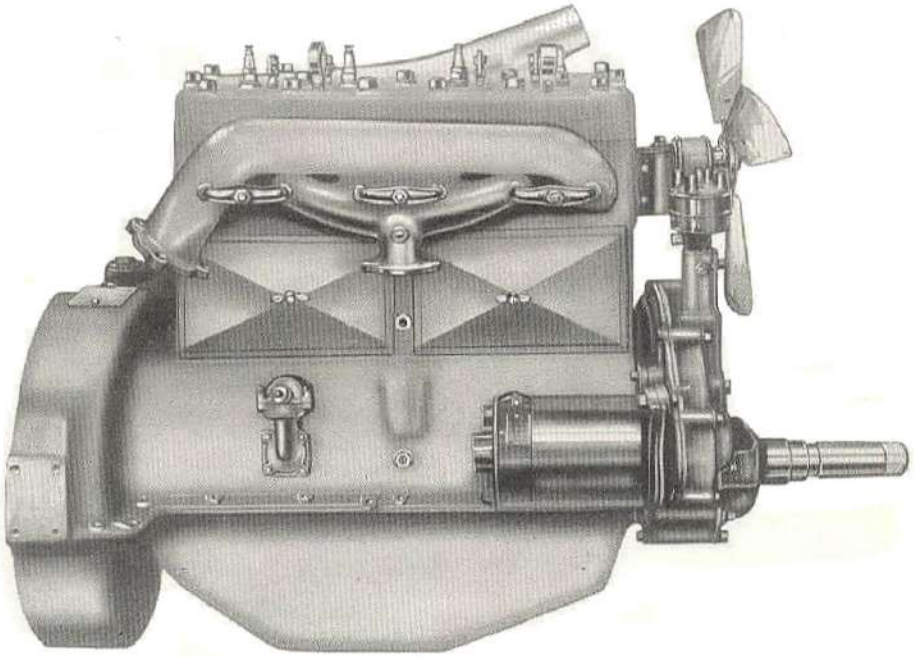
INSTRUCTIONS for the Care and Operation of the

Lycoming Model "C" Series Four Cylinder Engine



LYCOMING MANUFACTURING CO.

WILLIAMSPORT, PENNA.

General Description
Lycoming Model "C" Four Cylinder

CYLINDERS: Special grade gray iron cast en bloc; integral water jacket; water circulation around barrels and large water passages around valves. All blocks are subjected to a high water pressure to insure against leaks.

CYLINDER HEADS: Close grain gray iron; detachable, permitting easy access to valves and pistons; large water passages around spark plug bosses and over combustion chambers. Attached to cylinder by 18-1/2" studs closely and equally spaced.

CRANKCASE: Upper half; close grain iron; thoroughly ribbed to give maximum strength and rigidity; upper half flywheel housing integral. Oil reservoir, or lower half, pressed steel with cork gaskets used to insure oil tight union.

PISTONS: Lycoming design; cast iron; reinforced at open end and around piston pin bosses; remarkably light in weight; accurately ground and fitted with four individually cast rings.

PISTON PINS: Made of case hardened steel, drilled hollow, hardened, accurately ground and held stationary in rod by a special locking device.

CONNECTING RODS: Drop forging, designed especially for light weight; 30-40 carbon steel; "I" beam section; double heat treated to insure strength, refinement, and toughness of material. Lower ends ground to guarantee perfect seat of bearing metal.

BEARINGS: Bronze back, babbitt lined, main and connecting rod bearings are used.

VALVES: Cast iron heads electrically welded to steel stems. Silchrome exhaust valve supplied at option of purchaser. All valves, whether intake or exhaust are interchangeable.

VALVE TAPPETS: Mushroom type; fitted with hardened steel adjusting screws and lock nuts.

GEARS: The camshaft and generator are driven through cast iron and steel gears respectively with 1" face. Composition crankshaft and generator gears can be furnished upon request.

When magneto or water pump is employed the drive is made through a cast iron idler gear to either a composition or steel accessory shaft drive gear.

CAMSHAFT: Drop forging; cams integral. All bearings surfaces and cams are hardened and ground accurately to size. Every cam is tested with a sceleroscope for hardness.

FLYWHEEL: Cast iron completely machined and perfectly balanced; provided with teeth for starting motor.

IGNITION: The model "C" engine is designed for either battery or magneto ignition. Where battery ignition is used the distributor drive shaft is mounted in the gear case and driven from the camshaft through two spiral cut gears.

When magneto ignition is employed, the magneto is mounted on the right side of the crankcase, opposite generator, looking at the motor from the front and driven from the crank shaft through an idler gear.

LUBRICATION: Full force feed. Entire lubricating system contained in upper half of crankcase. Pressure controlled by opening and closing of throttle and not by speed of motor, thereby insuring maximum pressure when motor is under load.

COOLING SYSTEM: Thermo-syphon or centrifugal water pump optional to purchaser. Fan mounted on adjustable bracket and driven by a 1-1/4" flat belt from crankshaft.

OIL PUMP: Gear type mounted in upper half of crankcase and extending into oil reservoir. The lower end of the pump is always immersed in oil and requires no priming. The construction permits oil reservoir to be removed without interfering with any part of lubricating system.

INTAKE MANIFOLD: Integral with exhaust; designed to completely vaporize gases and give equal distribution.

Instructions for Care and Operation Lycoming Model "C" Series Four Cylinder

PISTONS: The pistons are readily removable without removing cylinder head. Drain off the oil. (It is not necessary to drain the water system unless you intend removing the cylinder head). Remove all cap screws attaching the oil pan to the crankcase and gear case. With a hand crank, turn the crankshaft until either 1 and 4 or 2 and 3 pistons are on lower dead center. Remove the cotter pins, nuts, and take the caps off the two lowest rods first. With the starting crank, turn the crankshaft until the piston will slide by between the throws. Then reassemble the caps immediately to the respective rods from which they were removed.

FITTING PISTONS: Cast iron and slit skirt lynite pistons (used in the 3-5/8" and 3-11/16" engines) are fitted at the factory to a shim .0027 in thickness and not less than 1-1/2" wide. The slit skirt lynite piston must be assembled to the cylinder barrel with the slit side to the water inlet side of the block opposite the valve side.

A number of "C4" 4 x 5 engines are fitted with special design aluminum alloy pistons which require no clearance when fitting. These pistons are a push fit in the barrels but care should be taken in not having them fit too tightly.

CONNECTING RODS: The connecting rod caps must be replaced in exactly their original position. For example: No. 1 rod and cap have a figure "1" stamped on the side of the rod and also on the cap. This number must be on the same side.

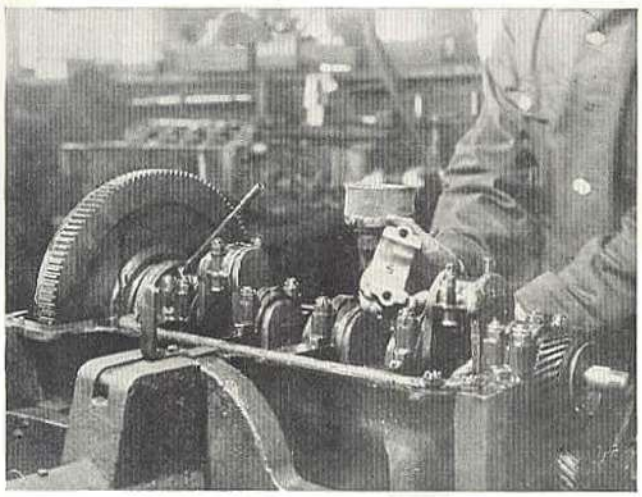


Fig. No. 3—Removing Connecting Rods. Hold rod in position when backing off nuts and removing cap.

The connecting rod bearings, both upper and lower halves, are anchored in the rods and caps by two No. 12-28 x 7/16" flat head brass machine screws. No shims are used. The clearance between the bearing and the shaft is set at the factory .0015. This clearance is checked by using a piece of paper .0015" thick and 1-1/8" square. The paper is assembled between the shaft and bearing and the nuts are drawn up tightly. The rod with the paper in place should support its own weight on the shaft, but it should be possible to move it with very little pressure.

The connecting rod bearing total side clearance is from .004" to .006". Never exceed this clearance or the danger of over oiling will result.

Adjustment should be made when wear of .004" or more has taken place. The work of adjusting the connecting rod bearings should be undertaken only by an expert mechanic in a properly equipped service station. Adjustment can be made by filing off the face of the cap. Care must be taken in filing, to see that the surface is kept straight.

A loose connecting rod bearing is usually most noticeable on a hard pull and an experienced mechanic can usually determine which bearing is giving the difficulty by listening closely or by removing the oil pan and noting any looseness in the cap. Pressing against the cap and rocking the crankshaft at the same time will usually enable the mechanic to determine which bearing is in need of adjustment.

GRINDING VALVES: It is necessary to regrind the valves in their seats whenever they become sufficiently pitted or scored to cause loss of compression. To remove the valves, drain the water and remove the cylinder head as described in the paragraph relating to the cylinder head and gasket.

Remove the valve cover plate from the side of the engine and with a suitable valve lifter, raise the valve springs and take out the valve spring seat supports. Be careful that the supports do not drop through the oil holes in the cylinder into the crankcase. Remove the valve spring seats and springs, then lift out the valves.

When grinding, it is advisable to place under the head of the valve a spring of sufficient tension to hold the valve away from its seat when not under pressure from the grinding tool.

Valve grinding compound may be purchased from any accessory store and is usually sold in combination tins containing both fine and coarse grades. A little of the coarse grade should be placed on the valve and with an oscillating movement of the valve it should be worked into the seat. Always bear lightly on the valve and be careful not to make more than 1/8 to 1/2 a revolution of the valve before reversing its direction of motion, otherwise grooves in the valve face will result. When all pits and black spots have disappeared and the valve presents a dull, silvery appearance, finish the grinding with a fine compound. The valve face should have a uniform surface, free from grooves and pits, but should not necessarily have a polish. The valve acquires a glassy polish while in use. Each valve should be ground and returned to the seat from which it was removed.

An excellent test to determine whether a perfect seat has been ground is as follows: With a soft lead pencil, mark lines across the face of the valve head, spacing them approximately 1/8" apart around its entire face. Then replace the valve and make a quarter rotation backward and forward. All lead pencil marks should be broken. If any are not, continue grinding until such time as all pencil lines are broken, which indicates that the valve is seating perfectly on its entire surface. Remember that all of the pencil lines are not to be completely erased but should be broken at one point on the seat where the valve comes in contact with the seat in the cylinder block.

After regrinding, make certain that every trace of grinding compound is removed as well as cloth or other material used to prevent the grinding compound from reaching the cylinder bores.

CYLINDER BLOCK: The cylinder block is made detachable to promote accessibility and to facilitate repair work.

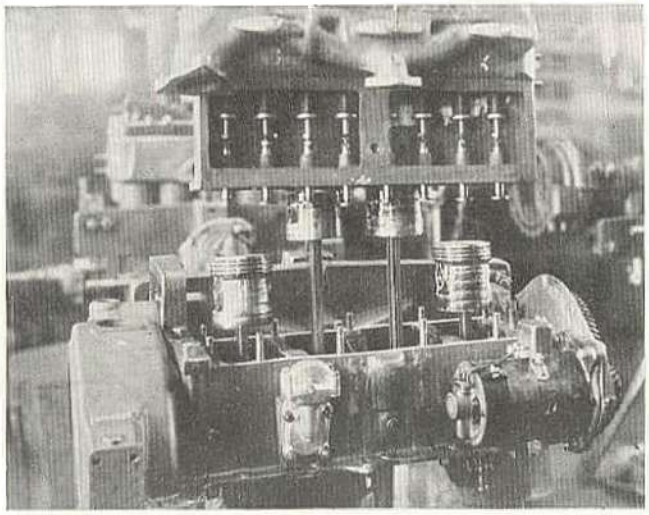


Fig. No. 1—Removing Cylinder Block. Rods Nos. 2 and 3 in uppermost position to avoid possibility of bending.

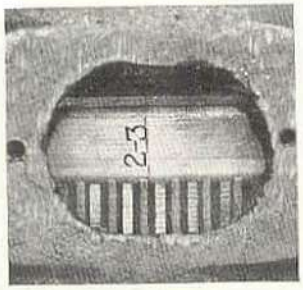


Fig. No. 2-A

Fig. No. 2-B

Flywheel Timing marks: A, used when removing and replacing Cylinder Block; B, used when timing engine.

When removing, turn the crankshaft until marks 2-3 D. C. on the flywheel align with the center mark on the housing. This operation will bring pistons 2 and 3 on top dead center, largely avoiding the possibility of bending the rods when the block is lifted off.

When replacing the cylinder, it is very important that all cylinder base stud nuts be drawn down as tightly as possible. A loose cylinder will cause a dull heavy knock or pound very similar to a knock caused by a loose main bearing. When attempting to locate a motor knock it is well to see that these nuts, especially the ones at the extreme front and rear ends of the cylinder block, are drawn down tightly.

PISTON PIN: After removing the connecting rod and piston as directed above, test the pin for looseness in the piston bosses. The pin is held in the connecting rod by means of a bolt which passes through the sawed end of the rod and engages in a notch in the piston pin, clamping the pin tightly and preventing it from turning in the rod. A loose pin will cause a knock, in which case replacement is necessary.

It is very important when reaming the bearings in the piston pin bosses to see that the holes are reamed smoothly and are in perfect alignment so that the pin will fit properly.

Lynite pistons with floating piston pins were used in a number of model "C" engines. Where floating pins are used, the connecting rods are assembled with bronze bushings for the piston pins and the bearing taken in both the rod and piston. The pins in this case are held in place by retaining rings which fit into recesses cut in the piston bosses.

To remove pin, compress the hooked ring with a pair of pliers; remove it from the recess and push the pin out. When fitting new pin to piston, first place the piston in hot water for several minutes. The heat will expand the piston pin hole, after which the pin should be inserted. When a new pin is assembled and the rod is held by the piston, its free end will, with a slight push, fall of its own weight. Before installing in engine the rod assembly should be checked for squareness.

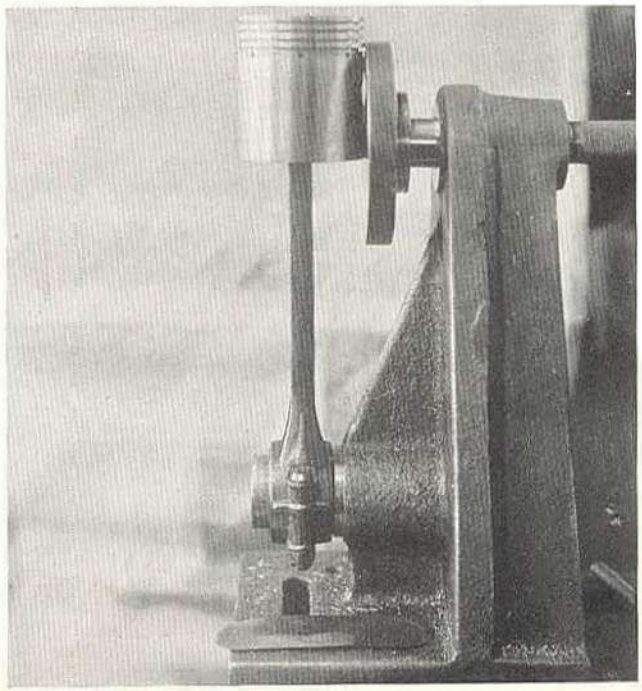


Fig. No. 11—Connecting rods should be checked for alignment before reassembling.

PISTON RINGS: When the piston rings become worn to any extent, immediate replacement should be made.

In fitting new rings to pistons, they should have about .0015" side clearance between the ring and the piston groove. The gaps between the ends should be from .006" to .010".

MAIN BEARINGS: The main crankshaft bearings are of the bronze back babbitt lined type. No shims are used and adjustment is secured by filing off the faces of the caps the same as described under connecting rods.

The proper clearance between the crankshaft bearing surfaces and the bearings is from .0015 to .002. This clearance can be checked in the same manner as described in the paragraph on connecting rods. A side clearance of from .0015" to .0025" is allowed between the bearing flange and the fillet on the crankshaft. Use a feeler gauge to check this clearance when installing new bearings.

Never fit main bearings so tightly that the crankshaft cannot be turned freely by hand with the piece of paper .0015" assembled between the bearing and shaft. This insures the proper amount of oil film. Adjustment should be made after wear of .003" or more has taken place or only at comparatively long intervals.

However, overheating or overloading a new engine, due to operation without a sufficient quantity of oil or with an inferior oil, is sure to cause loosening of the bearings by the melting of a small portion of the facing.

A loose bearing always causes in an engine a knock of a magnitude depending upon the degree of looseness. It is readily discernible to any person in the immediate vicinity, and ignorance of its existence is inexcusable. Proper attention must be given immediately or the wrecking of the entire engine may result. A loose or burned-out bearing will pound the crankshaft out of round, necessitating replacement. Pounding will crystalize the connecting rod cap bolts, resulting in their failure and generally the smashing of both halves of the crankcase, camshaft, piston, and cylinder block. When adjustment of connecting rod or crankshaft bearings is required, it is our suggestion that the work be done in a properly equipped service station. This class of work is for an experienced mechanic only.

We cannot too strongly impress on the inexperienced owner the necessity of having an expert mechanic do all the work on adjustment and replacement of main or crankshaft bearings. In the great majority of cases there is no necessity for having to replace main bearings, as they will outlive the car if proper attention is given to lubrication and necessary adjustment for looseness.

CYLINDER HEAD AND GASKET: To remove the cylinder head, proceed as follows: Drain the water; disconnect the upper hose; disconnect the spark plug wires; disconnect the cable tube brackets; remove the cylinder head stud nuts and plate washers. With a soft lead hammer or block of wood, tap cylinder head on lugs provided at each end until the head is loose and can be lifted easily. The gasket is not shellaced in place and no shellac should be used when reassembling.

The method of replacement of the gasket and head is as important as the method of removing them. Place the gasket in position on the studs with the brass side down or next to the top surface of the cylinder block and press it down carefully, making sure that no foreign matter is adhering to it or to the surface of the cylinder block. Replace the washers and tighten down the nuts in the center of the head first, working both ways towards the ends. This is important, and will insure freedom from strains in the cylinder head casting.

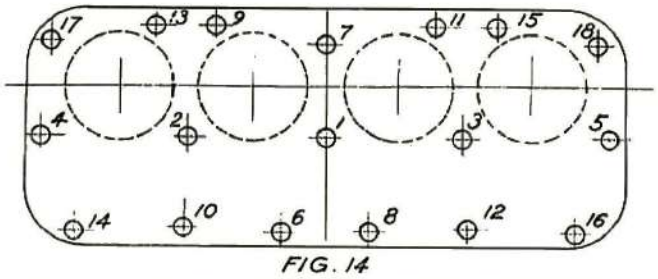


FIG. 14

Fig. No. 4—Tighten cylinder head nuts in order shown.

CAMSHAFT: The camshaft is carried on four bronze bearings pressed in the crankcase, each held in place with a 5/16" dog point headless set screw extending through the crankcase wall beneath the cylinder block. Under normal conditions, they will not require attention during the life of the car. The clearance between the shaft and bearings is .002" to .0025".

The end play of the camshaft is taken up by a coil spring and plunger in the front of the shaft which holds the camshaft back against the thrust face. The take-up is automatic. No adjustment is necessary.

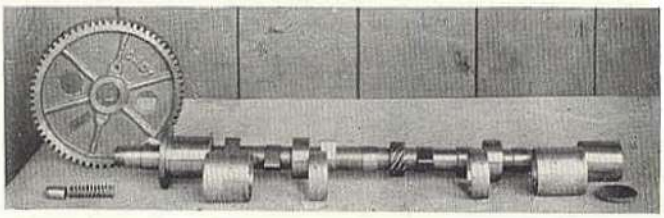


Fig. No. 6—Camshaft with Gear, bushings and thrust button removed. Note expansion plug for rear bushing and position of oil holes in bushings.

VALVE ADJUSTMENT: It is important that sufficient clearance be had between the end of the valve and the head of the adjusting screw on the tappet, to insure the proper fitting of the valve in its seat. The clearance should not be less than .004" and not more than .006" when the motor is warm.

The clearance is readily adjusted by removing the valve cover plates and adjusting the screw on the top of the tappet with suitable wrenches.

VALVE AND VALVE TIMING: Both the intake and exhaust valves are the same size which renders them interchangeable. The firing order is 1, 3, 4, 2 and the valve timing is as follows:

Intake opens on Top Dead Center.

Intake closes 35 degrees after Top Dead Center.

Exhaust opens 42 degrees before Bottom Dead Center.

Exhaust closes 5 degrees after Top Dead Center.

When checking the valve timing, the clearance between the valve stem and the tappet must be exactly .008". This clearance should then be reset to not less than .004" or more than .006" for

quietness. A change in the valve timing is possible only by removing the cam or crankshaft gear.

In resetting the camshaft, the gears on the camshaft and crankshaft should be lined up so that the prick punch mark on the crankshaft gear is between the two prick punch marks on the camshaft gear. With the gears in this position, the top dead center mark for No. 1 and No. 4 on the flywheel will be in line with the dead center mark on the crankcase.

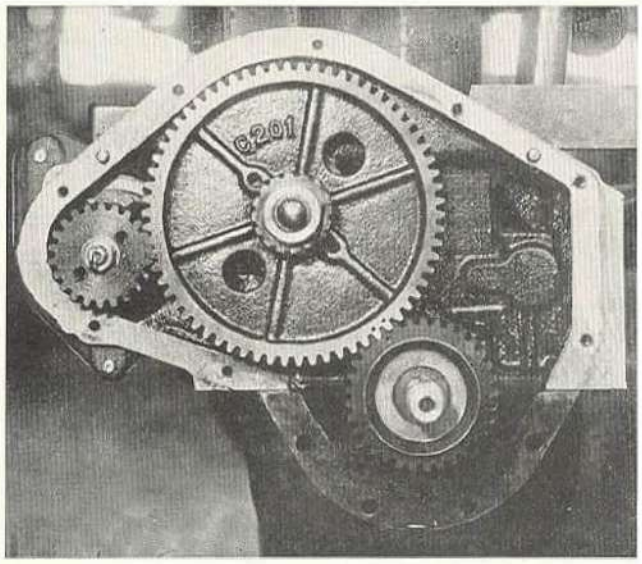


Fig. No. 7—Timing gears exposed showing punch marks on Cam and Crankshaft Gears to facilitate timing.

IGNITION TIMING: If the ignition units have for any reason been displaced, to retime proceed as follows: With the cam and crankshaft gears in their respective positions and with the marks 1 and 4 D. C. on the flywheel in line with the center marks on the crankcase, and with both inlet and exhaust valves closed and distributor arm pointing to No. 1 terminal, retard spark lever fully and adjust breaker mechanism so that the points just begin to separate. This operation should be performed with all ignition linkage connected. If breaker points do not separate or are separated too far when gear case is in position, pull the gear case off, with timer assembled and linkage connected, turn the timer shaft backward or forward until points will separate at proper time. In this position replace the gear case assembly.

OIL CIRCULATION: The oil is drawn from the reservoir through the strainer and is pumped into a distributor tube located on the left side of the crankcase and cast integral with it. From there it is forced through drilled passages in the crankcase webs to the main and camshaft bearings. From the main bearings the oil is forced through drilled passages in the crankshaft to the connecting rod bearings.

Oil is forced to the timing gears through a drilled passage in the crankcase leading from the camshaft front bearing. Four holes in the camshaft thrust flange register with passages in the

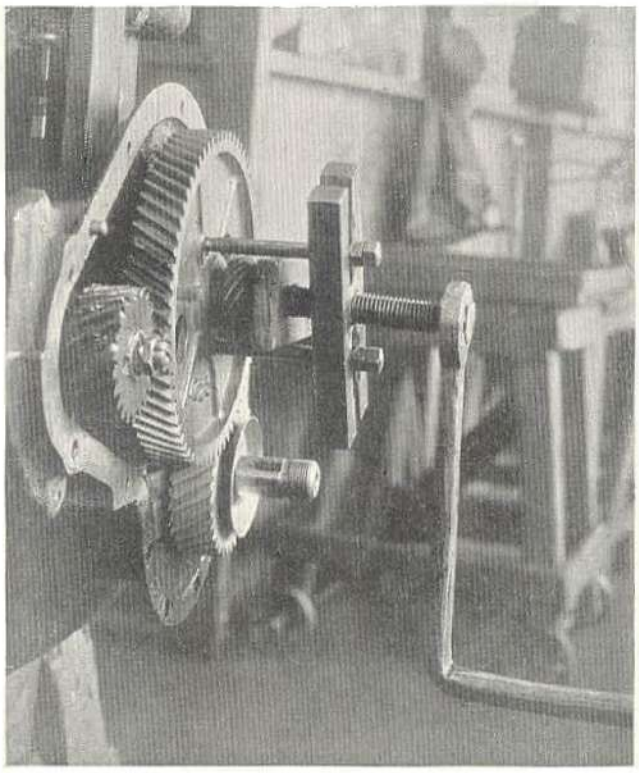


Fig. No. 12—Factory tool for removing timing gears. It is adjustable and can be constructed by the average mechanic.

front bearing so that at every revolution of the shaft four shots of oil are supplied to the gears.

The surplus oil from the front end drains back into the oil reservoir. The cylinder walls, piston pin bearings and valve operating mechanism are oiled by spray thrown from the connecting rod bearings. The valve stems are lubricated by oil spray through cored holes in the cylinder base.

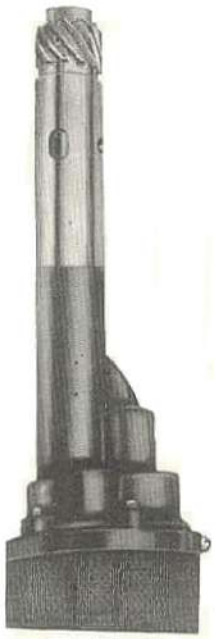


Fig. No. 8 Model "C" Oil Pump Assembly.

OIL SUPPLY: Oil is poured through the filler tube on the side of the crankcase. Keep filled between the two marks located on the oil gauge tube which encloses the oil gauge indicator. Do not carry oil above the high mark nor let the supply go below the low mark.

The oil should be drained from the reservoir and replaced with a fresh supply every 500 miles unless a test shows the oil used has lost its lubricating qualities before that time, in which case more frequent draining is required.

To drain, remove 3/4" pipe plug located in the bottom of the oil reservoir.

OIL PUMP: The oil pump is located on the left side and fits into a hole in the crankcase. It is held in place by a 3/8" set screw extending through from the outside of the engine. The pump is operated by a shaft on which

is assembled a spiral gear of bronze which engages with a spiral gear on the camshaft.

It may be removed for cleaning by removing the oil reservoir and backing out the 3/8" set screw which holds it in position.

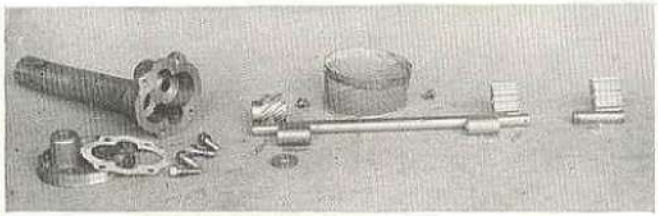


Fig. No. 9—Oil Pump with completely disassembled and component parts placed in proper order of assembly.

OIL PRESSURE REGULATOR: The oil pressure is controlled by a regulator attached to the crankcase on the valve side of the engine below and to the left of the intake manifold. It is connected to the throttle by levers so arranged that when the throttle is opened the oil pressure is increased and when the throttle is closed the oil pressure is reduced. The pressure is controlled by a spring with tension on a steel ball. Any excess pressure causes the ball to rise. The surplus oil passes through the regulator body into the crankcase and is returned to the oil reservoir. The pressure of the spring on the ball which regulates the oil pressure is controlled by a cam which is operated by the levers connected to the throttle.

Adjustment of the pressure is secured by changing the position of the regulator camshaft with reference to the lever which connects to the throttle. To adjust pressure, loosen the lever which is clamped to the regulator camshaft. Turn the camshaft with a screw driver to the right to increase, and to the left to reduce the oil pressure. The pressure will vary somewhat depending on the viscosity or thickness of the oil.

When the motor is idling and with the oil in good condition, the oil pressure should be from five to ten pounds on the indicator. When the motor is cold, the pressure will be high until the oil becomes warm and thins down. With hot oil, the pressure may drop to two pounds, but it should never go below two pounds at five miles per hour. The maximum pressure with the throttle wide open should be from forty to fifty pounds.

During extremely cold weather the oil may show excessive pressure due to congealing in the oil passages which will prevent free circulation. By running the motor slowly with the spark retarded for a few minutes, the oil will warm up and become thinner. Never race the engine before the oil has become warmed up sufficiently to lubricate the pistons properly. Failure of the gauge to show pressure is an indication that something is wrong, lack of oil or a clogged strainer. The motor should be stopped immediately and the cause determined.

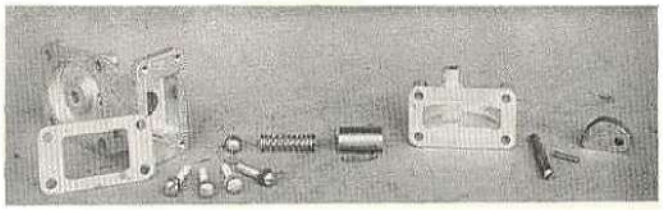


Fig. No. 10—Oil Pressure Regulator. Completely disassembled and component parts in proper order of assembly.

COMPRESSION: Compression in all cylinders should be equal. Weakness or loss of compression is probably due to imperfectly seated valves which may be caused by insufficient clearance between the valve stems and tappets or by the sticking of the stems and tappets in their guides.

The use of a poor or improper grade of lubricating oil, or running with a too rich mixture, may cause carbon deposits to collect on the valve seats and prevent the valves from seating properly. If the compression varies greatly between the various cylinders, it will result in a loss of power and the cause should be determined and remedied. It frequently happens that valves are held open by insufficient clearance between the valve stem and the tappet adjusting screw. Where this occurs the valves become burnt and warped and are usually unfit for further service.

GENERATOR MOUNTING: The generator is attached to the front end of the crankcase by three studs and driven by a gear which meshes with the camshaft gear. To remove, back off the generator stud nuts and pull the generator straight back. When reassembling, be sure that about .003 backlash is given between the teeth of the generator gear and the teeth of the camshaft gear.

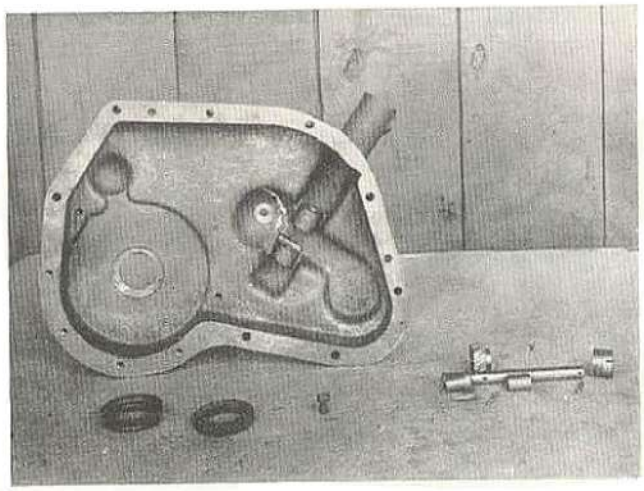


Fig. No. 13—The Timer-Distributor (Ignition Unit) Assembly Disassembled and the component parts in proper order for assembly.

CARBON: If the motor knocks easily under load and does not seem to develop its normal amount of power, it is generally an indication that there is carbon in the cylinders. The carbon can readily be cleaned by removing the cylinder head. Before replacing the cylinder head, be sure that the surfaces of the cylinder block, head, and gasket are clean.

General Specifications

TYPE—Four cylinders, enblock, four cycle, detachable vertical "L" head.

Model	Bore	Stroke	Piston Displacement	S. A. E. H. P. Rating	H. P. Developed
CT	3-3/4"	5"	220.9	22.50	43 @ 2200
C4	4"	5"	251.3	25.60	44 @ 2000

FIRING ORDER—1, 3, 4, 2.

BELL HOUSING FLANGE—SAE No. 3 or SAE No. 5 (optional).

COOLING—Thermo-Syphon.

Note—Models CT and C4 engine furnished with centrifugal water pump if desired.

IGNITION—Engines designed for either battery or magneto ignition.

GENERATOR MOUNTING—SAE No. 2 Flange.

STARTING MOTOR MOUNTING—SAE No. 1 flange outboard type.

FLYWHEEL—Furnished to suit any standard make of clutch.

INTAKE—SAE 1" vertical carburetor.

LUBRICATION—Gear pump, full force feed.

SUSPENSION—Three point.

Detail and Dimensional Specifications

CAMSHAFT—Four bearing, .15-.25 carbon steel, cams integral.

CAMSHAFT DIAMETER—1-1/8".

CAMSHAFT BEARINGS—

	Diameter	Length
Front	2-1/32"	2-1/8"
2nd Inter.	2"	7/8"
3rd Inter.	1-31/32"	7/8"
Rear	1-15/16"	2"

CONNECTING ROD—"I" Beam section, .30-.40 carbon steel. Length (center to center) 11-15/16".

CONNECTING ROD BEARINGS — Diameter, 2-1/8"; length, 1-13/16".

CONNECTING ROD BOLTS—Nickel steel 7/16" —two per rod.

CRANKSHAFT—Five bearing, .40-.50 carbon steel.

Bearings	Diameter	Length
Front	2-1/8"	2-11/16"
1st Inter.	2-1/8"	1-5/16"
Center	2-1/8"	1-13/16"
2nd Inter.	2-1/8"	1-5/16"
Rear	2-1/8"	2-11/16"

PISTON—Length 4-1/8".

PISTON RINGS—Four per piston.

PISTON PIN—Diameter 1-1/8".

VALVES—Effective working diam. 1-5/8".

VALVE LIFT—5/16".