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 crystallize 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 necessary, we suggest that the work be done in a perfectly equipped Service Station and by an experienced mechanic.

We urge upon inexperienced owners 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 toward the ends. This is imporant and will insure freedom from strains in the cylinder head casting.

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 hold the camshaft back against the thrust face. The take-up is automatic. No adjustment is necessary.

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 top of tappet with suitable wrenches.

VALVE AND VALVE TIMING: Both the intake and exhaust valves

are the same size and they are therefore 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 crankshaft.

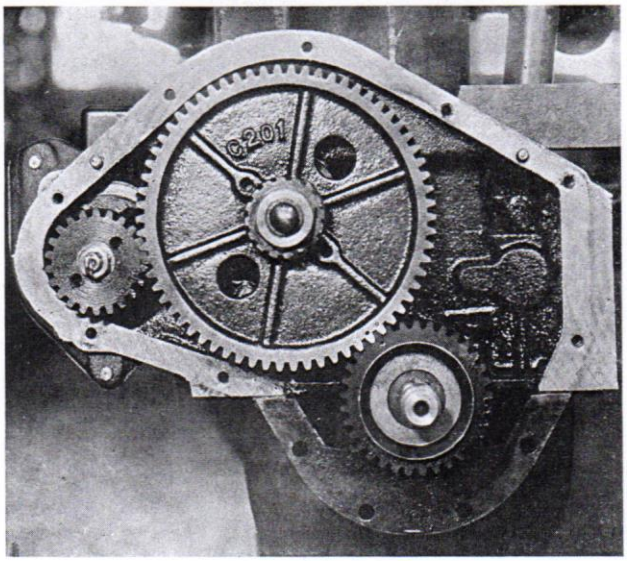


Fig. No. 4—Timing gears exposed, showing punch marks on Cam and Crankshaft Gears to facilitate timing.

IGNITION TIMING: In order to check or reset the ignition timing bring the marks 1 and 4 D. C. on the flywheel in line with the center marks on the crankcase, with both inlet and exhaust valve closed on No. 1 cylinder. Remove the lock nut on top of the distributor rotor shaft, loosen up the cam on rotor shaft and reset so that the breaker points just begin to open with the distributor arm pointing to No. 1 terminal. This setting should be made with the spark lever in the fully retarded position. Be sure that the distributor itself is locked in the distributor

housing and that all ignition linkage is connected during this operation.

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 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.

OIL SUPPLY: Oil is poured through the filler tube on the side of 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 changing is required.

To drain, remove 3/4″ pipe plug located in bottom of 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.

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 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 motor before the oil has become warmed up enough to give proper lubrication to the pistons.

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.

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 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.

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 out by removing the cylinder head. Before replacing the cylinder head, be sure that the surfaces of the cylinder block, head, and gasket are clean.

HOW TO AVOID SLUDGE FORMATION: "Sludge" is an emulsion of oil, water and impurities which accumulate most frequently in cool running engines. Water vapor constitutes a large percentage of the exhaust gas in normal combustion.

Unless the piston seating is absolutely perfect, a small portion of this burned gas passes into the crankcase. If the crankcase is normally hot, the water vapor will pass off through the breather without condensing. In a cold crankcase, it will condense. The water may settle to the bottom of the case, or may be continually circulated and mixed with the used oil. In either case, sludge is apt to form from the agitation of the oil, water, and the finely divided matter always present in used oil.

In Winter this difficulty is aggravated from the fact that crankcase temperatures are lower and condensation is more rapid. The danger is increased from the fact that the condensed water may freeze and completely stop the oil circulation.

If the water has not been thoroughly mixed with the oil, this freezing may be localized at the low point in the crankcase. If there is a sufficient quantity, the oil circulation may be blocked with ice.

If the water is kept in constant agitation, it may freeze in crystalline form throughout the whole body of the oil, with the apparent result of thickening the oil so that it will not circulate.

This difficulty is most evident at extremely low temperatures and can only be avoided by the use of adequate means to keep the engine and crankcase normally warm.

Sludge formation can be controlled by careful attention to the following details:

1. Drain the oil at specified intervals—or oftener if the service consists of short intermittent runs in which the engine does not reach its normal temperatures. This will prevent the accumulation of too much water.
2. Use a suitable radiator cover or shield in Winter. By keeping the engine normally warm the condensation of water vapor in the crankcase will be avoided.
3. Clean the oil screen regularly.
4. If traces of sludge are noted, when the crankcase is drained, remove the oil pan and clean it thoroughly with a lintless cloth. Sludge tends to increase when once started.

GENERAL SPECIFICATIONS

TYPE—Four cylinders, enbloc, four cycle, detachable Vertical "L" head.

Bore	Stroke	Piston Displacement	S. A. E. H. P. Rating	H. P. Developed
3-5/8″	5″	206.	21.03	42@2300

FIRING ORDER—1, 3, 4, 2.
COOLING—Thermo-Syphon.
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 diameter 1-5/8″.
VALVE LIFT—5/16″.

COOLING SYSTEM

Auburn 4-44 Models are equipped with a thermo-syphon cooling system of ample capacity, by which cool water is circulated around the cylinders and valves in jackets. The water enters jackets at bottom, passes upward, absorbing heat from the engine, thence outward into top of radiator from whence it circulates downward through numerous small tubes in the radiator core. By the time it reaches the bottom of core it is quite cool and thus passes back into the cylinder jackets again.

To insure perfect operation and circulation, the water level in radiator should be kept above inlet in upper tank.

We recommend the use of soft water whenever possible. Occasion-

ally the old water should be drawn off and the system refilled with fresh water.

To drain the water, open drain cock at lower part of radiator which can be reached with a screw driver through small hole in lower radiator shell.

During freezing temperatures it is necessary to use anti-freeze solutions with the water in the radiator of a proportion and strength sufficient to keep the water from freezing. It is advisable to test the resistance of the system at frequent intervals during the period of cold weather, as most anti-freeze solutions have a tendency to evaporate, and it will be found necessary to add a further supply from time to time.

The best all-around solution is a mixture of denatured alcohol and water.

When alcohol is added, care must be taken not to spill it on the hood, as it will ruin the lacquer finish.

Do not pour cold water into an empty or partly empty radiator while the engine is hot, as this practice might cause serious damage to the engine.

Capacity of the cooling system, 21 quarts.

GASOLINE SYSTEM

The 4-44 Gasoline supply tank holds approximately 18 gallons. The drain plug at bottom of tank should be removed occasionally and the water and sediment drained out. Dirt which accumulates in bottom of tank may be drawn into feed lines and carburetor, and cause trouble.

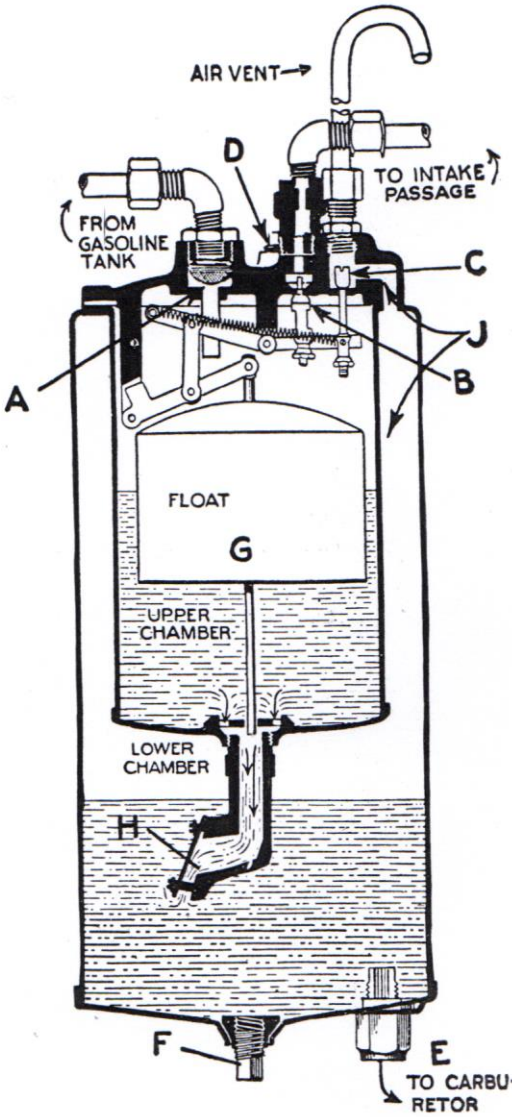
The flow of gasoline from main supply tank to the carburetor is controlled by a vacuum system.

VACUUM TANK

VACUUM TANK: The vacuum system provides a steady flow of gasoline from the supply tank to the carburetor with the supply tank located at a lower level than the carburetor.

The pumping action of the pistons in the engine creates a high vacuum or suction in the intake manifold, and by piping this suction to the tank, the gasoline is drawn up into it. As the tank is always installed at a point higher than the carburetor, the gasoline gravitates to the carburetor.

The vacuum tank has two separate units, the upper or inner chamber, and a lower or outer chamber. The upper chamber has four openings at the top.



REFERENCE LETTER APPLICATIONS

A=Gasoline inlet.

B=Suction or vacuum valve that opens and closes connection to engine intake passage or manifold.

C=Atmospheric valve that permits or prevents an atmospheric pressure condition in "upper chamber."

D=Plug giving access to tank for wetting valves with gasoline when dry, washing dirt or sediment from flapper valve **H**, and for temporary removal while driving to service station in case of trouble due to leaky float.

E=Outlet to carburetor, connection extending upward into "lower chamber" so as to form a pocket in which sediment and water may collect.

F=Plug in opening for pet cock for drawing off any sediment or water that may collect in lower chamber.

G=Float with guiding stem.

H=Flapper valve of upper chamber outlet, held closed by suction whenever the valve **B** is open, but it opens whenever the valve **B** is closed and atmospheric valve **C** is open.

J=Passage between inner and outer shells leading to air vent that keeps the lower chamber under atmospheric pressure at all times and thus insures a free flow of fuel to carburetor by gravity. In case the fuel supply tank should be higher than vacuum tank, as when descending some steep declivity, the air vent, because of its height above vacuum tank, serves to prevent an overflow of gasoline.

1—The gasoline inlet "A" which is connected to the supply tank and through which the gasoline is drawn.

2—The vacuum inlet "B" which is connected to the intake manifold.

3—The air opening "C."

4—The opening "D" into which a plug is screwed. The lower chamber has two outlets at the bottom. "E" is connected to the carburetor, and "F" is a plug in opening for pet-cock for draining or cleaning tank. Gasoline can be drawn here for priming or cleaning purposes.