Servicing the 1932 Auburn Twelve Cylinder Engine

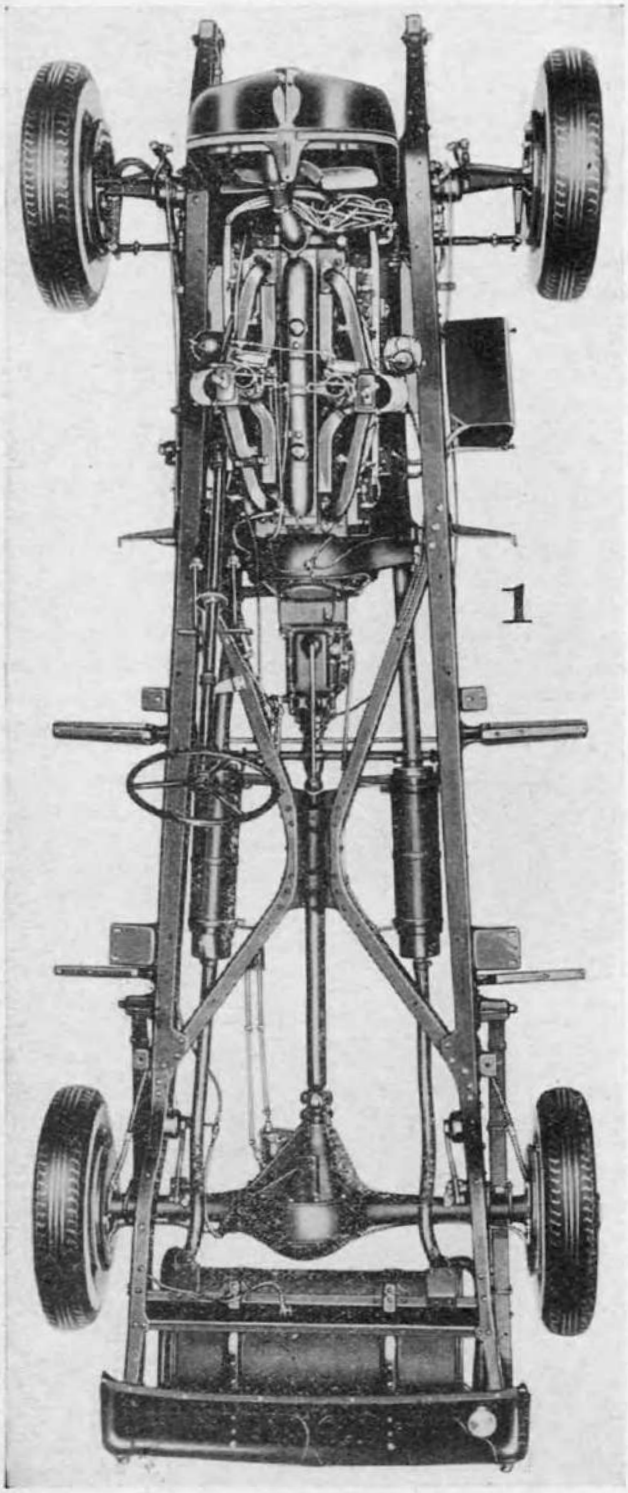

Fig. 1. Plan view of Auburn twelve-cylinder, dual ratio rear-axle car

Tolerances, Clearances and Specifications, Including the Recommended Service Routine on a New Twelve Cylinder Engine. Complete in This Issue with Wiring Diagrams

By C. T. SCHAEFER
Member S. A. E. and A. S. M. E.
Author of "The Automotive Mechanic's Handbook"

THE Auburn Model 12-160 introduced to the public early this year is powered by a Lycoming engine designated as Model "BB." This engine is an entirely new design and has many features not previously employed on vertical engines. This engine is a compact, accessible 45-degree V-type, with cylinder blocks and crankcase cast integrally. The narrow angle of the V reduces the overall width of the engine and the V-type unit also makes possible a comparatively short engine for the large piston displacement. In effect this unit is really two six-cylinder engines operating on the same crankshaft, the firing order of each bank of cylinders being 1-5-3-6-2-4.

Details of Construction

Constructional details of this engine are presented in the longitudinal cross section Fig. 3, and the cross section, Fig. 4. The cylinder head of each block is detachable, but provided with covers which contain the spark plugs. The 45-degree angle between the two banks of cylinders results in uneven firing, breaking up the regularity of the power impulses. It is claimed this irregularity is not detrimental to smoothness, but does reduce the tendency to set up torsional vibration in the crankshaft. The location of the camshaft in the center of the V with rocker shaft directly above permits operation of both banks of horizontal valves from a single camshaft. The rocker shaft and camshaft supports tie the two banks of cylinders together.

The crankshaft is mounted on four main bearings and provided with three counterweights, one weight serving each pair of crank pins. The crankshaft is also equipped with a vibration damper mounted at the front end. Exceptional rigidity of the shaft is obtained by large diameter bearings and the comparatively short throw of the shaft. Internal clearance for the reciprocating parts also provides for the re-

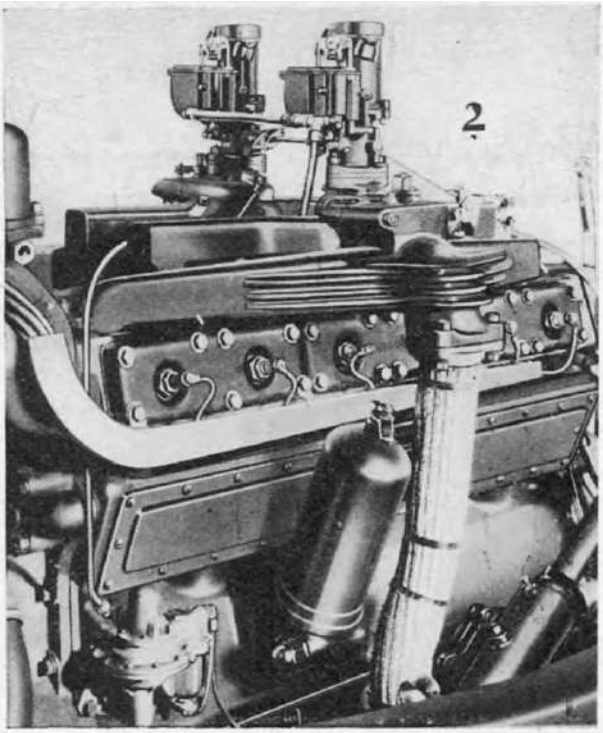

Fig. 2. View of twelve-cylinder Lycoming engine

moval of piston and connecting rod assemblies from the bottom of the engine.

An entirely original combustion chamber design has been developed having characteristics which result in increased power and efficiency without detonation, as well as better accessibility. The compression ratio is fairly high, but prmits the use of commercially standard fuel. Cylinder head covers which are in pairs, containing the spark plugs, may be removed to regrind the valves without removing the cylindr head from the block. Th cylinder heads may be removed without disturbing either the camshaft or rocker arm assembly. While each bank of cylinders has its individual head, the two heads are identical.

It will be noted the valves are mounted in the cylinder head, valve adjustment being accomplishd by removing the cover which encloses the valve mechanism. Each bank of cylinders has its individual intake and exhaust manifold. The intake manifold is of Swan design, designed for the downdraft carburetor. The exhaust manifold has a hot spot which applies heat under the center of the intake manifold runner. The fuel pump is a plunger type with double outlet to accommodate the two carburetors. It is driven by an eccentric on the oil pump shaft and mounted on a pad at the left front side of the crankcase. The pump is

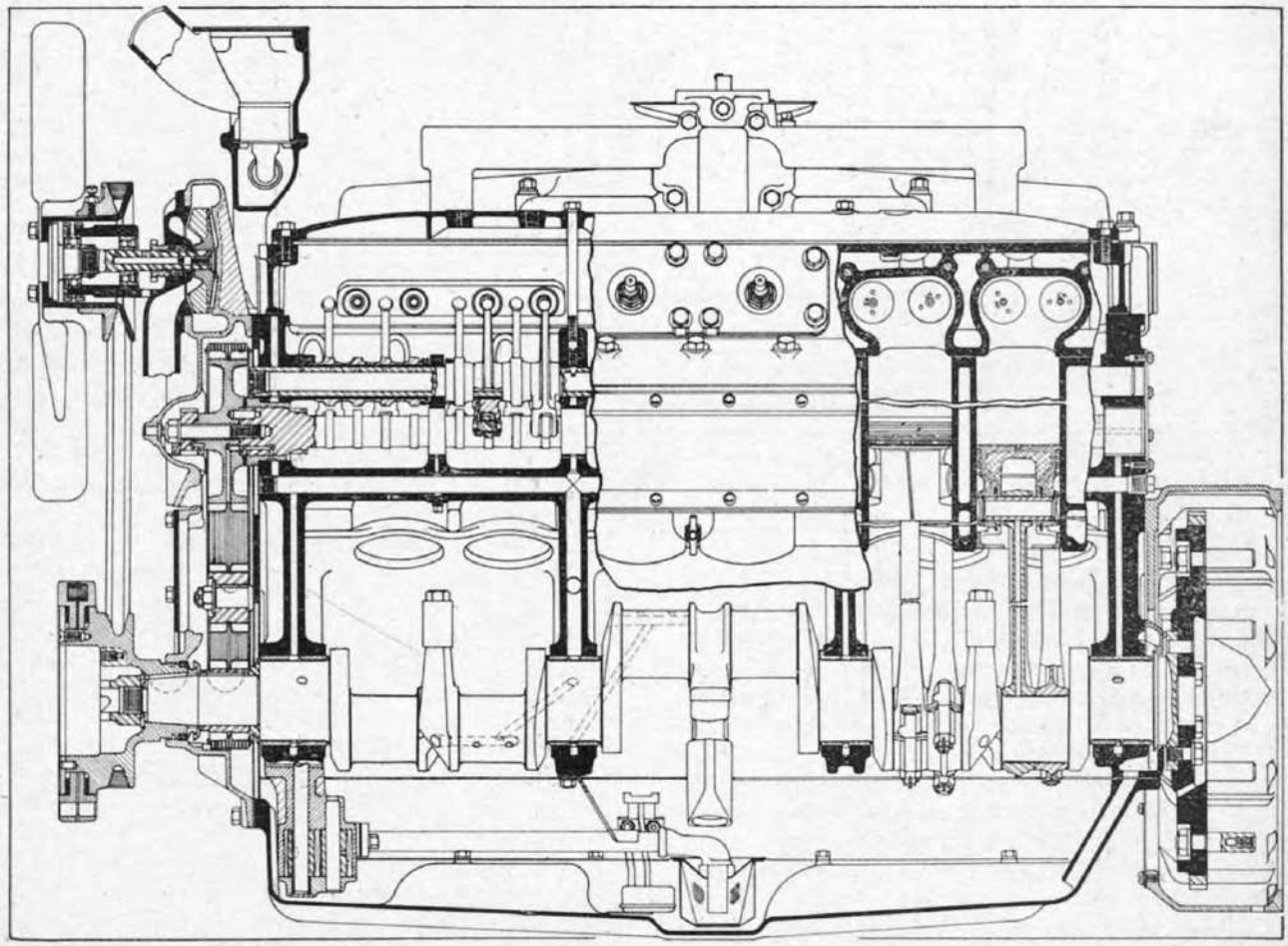

Fig. 3. Longitudinal cross section view of the Lycoming model "BB" twelve-cylinder engine, as employed in the Auburn chassis

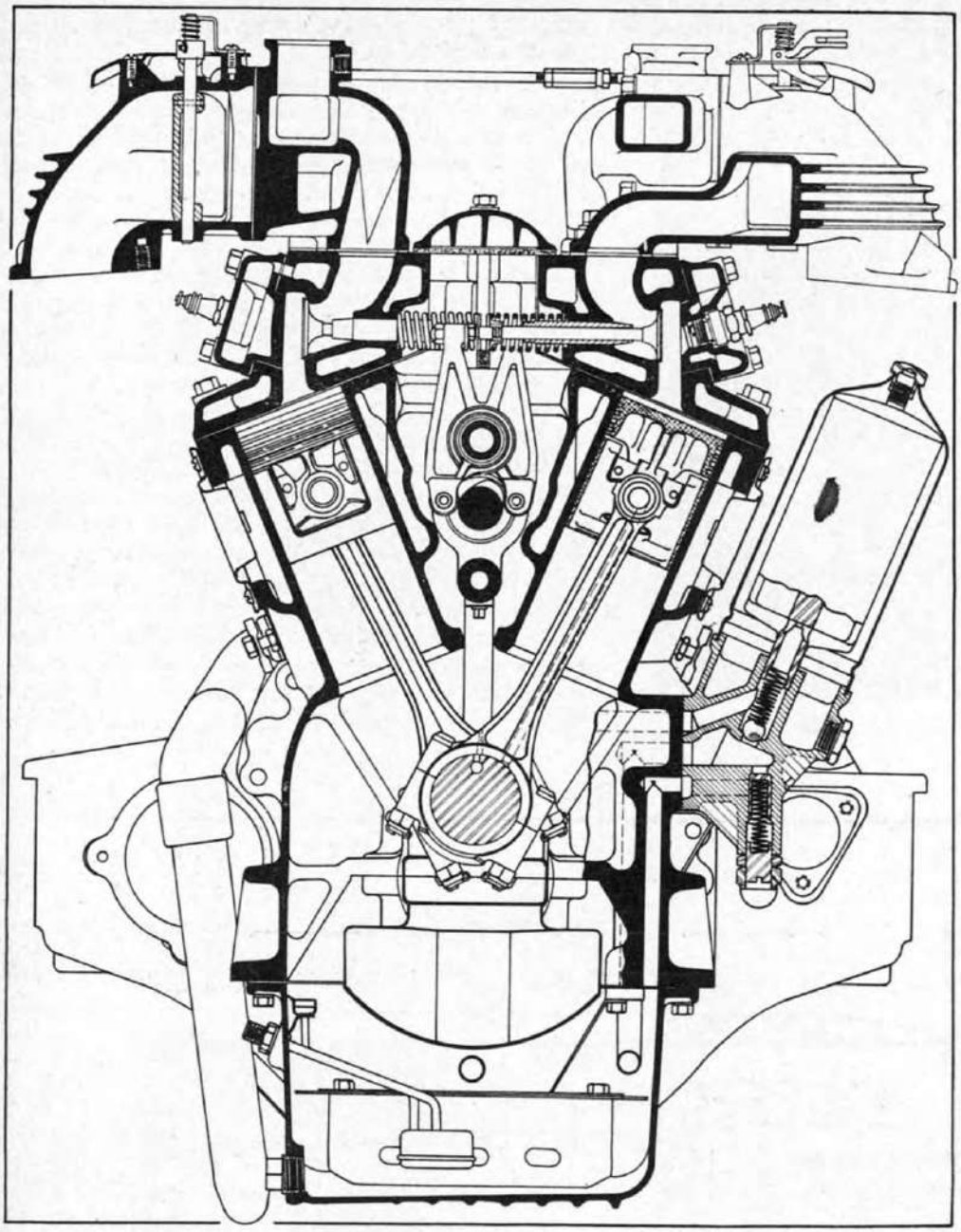

Fig. 4. Cross section of the engine showing pistons, connecting rods and valve mechanism

located in the fan blast to reduce the possibility of vapor lock.

Engine Lubrication

The oil pump is a gear type, driven from a helical gear on the camshaft directly behind the front bearing of this shaft as shown in Fig. 3. The oil enters the pump through a large strainer and pipe lead from the center of the crankcase as shown in Fig. 3, and is pumped into the full-flow filter as shown in Fig. 4. The oil filter also contains the oil pressure relief valve which is provided with an external adjustment. The filter also contains a by-pass valve which permits the oil to go directly from the pump to the main oil line in the event the oil filter becomes clogged through neglect to keep it clean.

The main oil line from the pump is a longitudinally drilled passage just beneath the camshaft which supplies oil under pressure to the main bearings, camshaft bearings, rocker shaft tube and oil pump drive shaft bearings. The crankshaft is drilled to feed oil to the connecting rod bearings. Oil is forced intermittently to the piston pin bearings through rifle drilled connecting rods. Oil jets drilled in the rod also provide a properly timed spray of oil to the cylinder walls. From the front camshaft bearing drilled passages through the shaft and sprocket lead out to feed oil on the inside of the front end chain. Oil from the hollow rocker shaft is fed out into the valve rocker bearing. The rocker arm is also drilled to provide oil under pressure to the valve tappet rollers. The spray from the samshaft and rocker bearings lubricates the valve stems and the complete valve mechanism.

The distributor is driven through helical gears at the front end of the camshaft, a sectional view of this

drive being shown in Fig. 6. An adjustable coupling is provided on the driveshaft at the base of the distributor. Distributor rotation is clockwise when viewed from top. The automatic spark advance starts at 600 rpm. and is 20 degrees maximum at 3200 rpm. Two breakers are used, the fixed breaker operating the right bank of cylinders.

Pistons, Pins and Rings

Pistons are of the strut type, aluminum alloy and should be assembled to the cylinder with sufficient clearance so that a .0015-in. feeler is easily pulled out, while a feeler .0025-in. cannot be withdrawn. Feelers should be gripped with forefinger and thumb and pistons should not be so tightly fitted that the smaller feeler can be pulled by gripping feeler with pliers. Pistons and connecting rods are balanced or weighed in sets to close tolerances to insure proper balance of reciprocating parts and it is necessary to maintain this balance when making replacements.

The piston pin has a floating mounting in both piston and rod and is retained in the piston by means of snap rings. The pin should be fitted to a clearance of .0006-in. Pistons should be heated to 160 to 180 degrees in order to remove and refit pins. Pins must have a drive fit. This is important as expansion of the piston under operating conditions would permit a knock to take place should these tolerances be disregarded. Always check piston pin bearings for alignment when making replacements.

The aluminum alloy pistons are provided with four rings, two of which are compression rings, ⅛-in. wide. These compression rings should be fitted with .001-in. to .002-in. clearance in the piston groove. When fitting of rings is necessary, the upper side of the ring only should be dressed as the lower side must have a perfectly square seat on the groove surface. It is difficult to maintain this true seat when lapping is done on the under side of the ring. The gap in the compression rings should not be less than .006-in. The oil regulating rings are ⅛-in. and 3/16-in. wide respectively and these rings should have a clearance of .0015-in. to .003-in. in their respective grooves. The gap in the oil regulating rings may be slightly greater specifications calling for .010-in. to .018-in.

Bearings

The connecting rod bearings are babbitt spun in the rod and no adjustment is provided or permissible as rods are supplied on an exchange basis and any fitting that may be done would prevent maintaining the original factory standards in replacement since exchange rods are rebabbitted. The end clearance specified is to exist betwen the two rods on each crankpin. Rods are numbered and must be replaced in their original cylinders which bear corresponding numbers.

(*Continued on page 43*)

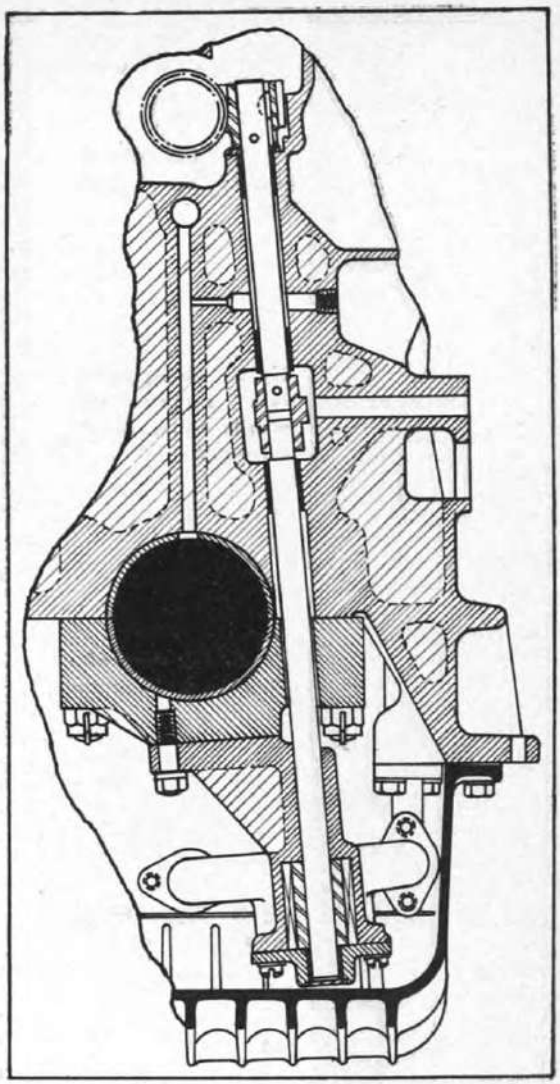

Fig. 5. Sectional view showing how oil pump is driven by helical gears from the crankshaft

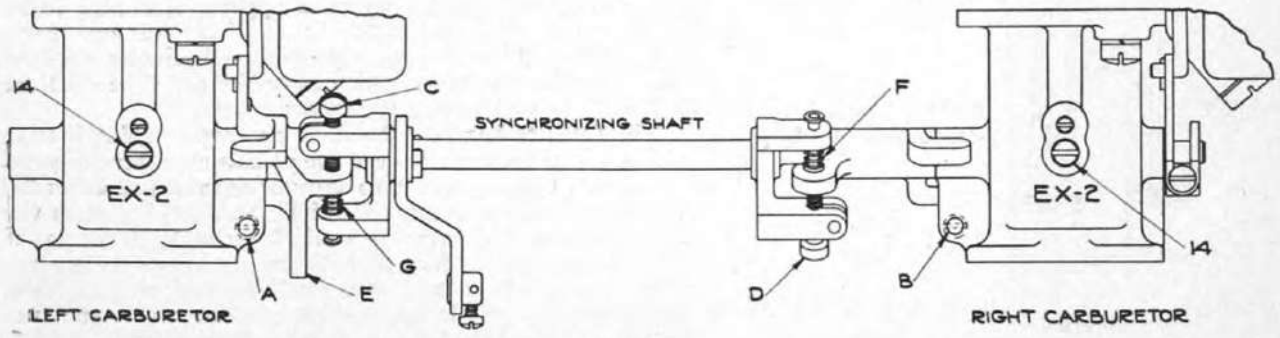

Fig. 7. Diagram showing hook-up employed to synchronize the throttles of the two carburetors employed on this twelve-cylinder engine

AUBURN 8-100 TOLERANCES

(*Continued from page 40*)

17. Cooling system, pump circulation, cellular type radiator; capacity, 19 qts. Upper hose connection, 1½" diam., length, 9"; lower hose connection, 1½" diam., length 11". Fan belt, 38° Vee, endless, width ¾"; approximate length, 46".
18. Front wheel toe-in, ⅛" plus 1/16" minus 0"; front wheel camber, 2°; caster angle, 1° min., 2° max.; king pin angle, 7°.
19. Clutch, Long model 9ABM; clutch facing, outside diam., 10", inside diam., 5½"; thickness, .137", moulded type, two required.
20. Rear axle gear and pinion clearance (back lash), .003 to .008".
21. Brakes. Midland Steeldraulic, internal expanding; clearance between lining and drum for front and rear wheels, heel and toe, .040". Brake lining length per wheel, 33¼"; width, 1¾"; thickness, 7/32", moulded type. Division of brake effort, 50 per cent front and 50per cent rear.
22. Hand brake. Same as foot brakes.
23. Tire size, 17 by 5.50, 17 by 6.00, and 17 by 6.50.
24. Tire pressure, front and rear, 35 lbs.
25. Oil capacity of transmission, 3 lbs.
26. Oil capacity of rear axle, 4 lbs.
27. Standard rear axle ratio, 4.7 to 1.
28. Gasoline tank capacity, 25 gals.

AUBURN 12-160 TOLERANCES

(*Continued from page 39*)

19. Clutch, Long model, 29AM; clutch facing outside diam., 9¾", inside diam., 6¼", thickness .130"; type, molded, four required.
20. Rear axle gear and pinion clearance (back lash), .003 to .008".
21. Brakes, Bendix two-shoe, single anchor type, hydraulic actuated; clearance between lining and drum, front and rear wheels, heel and toe, .010". Brake lining length per wheel, 29.321"; width, 2"; thickness, 3/16"; moulded type. Division of brake effort, 50% front and 50% rear.
22. Hand brake, same as service brakes.
23. Tire size, 17 by 6.00, 17 by 6.50, and 17 by 7.00.
24. Tire pressure, front and rear, 38 lbs.
25. Oil capacity of transmission, 3 qts.
26. Oil capacity of rear axle, single ratio, 4 qts; dual ratio, 7 qts.
27. Standard axle ratio, single ratio, 4 1/12 to 1; dual ratio, low, 4.55 to 1, high, 3.04 to 1.
28. Gasoline tank capacity, 25 gals.

TROUBLE HUNTING

(*Continued from page 21*)

Hoping this may be of some help to readers of the DIGEST, I remain.—*CHAS. RICHARDSON, Prop., Canmer Motor Co., Canmer, Ky.*

Misplaced Oil

DEAR EDITOR:

I am writing in regards to the Chevrolet Six burning distributor points. Have had the same trouble with one. I installed three pair of points, including condensers, battery ground cables, grounded distributor and checked wiring, but the same trouble occurred again.

I noticed every time I installed points there was considerable oil on them and distributor. So I turned a spiral groove on distributor shaft and squeezed the oil out of the felt under distributor rotor, put a dab of grease on cam. This car has run 15,000 miles and points are in good condition, and no oil on distributor.

Have also cured other cars from having point trouble by keeping oil out of distributor.—*M. HAUENSTEIN, Hinsdale, Ill.*

Ground the Distributor

DEAR TROUBLE MAN:

In answer to Chester Brewer's trouble with points on a 1929 Chevrolet.

I have had the same trouble and I cured it by grounding the distributor. Run a wire from the little screw on the opposite side of the distributor from where the switch comes in to the motor. I am sure that will cure your distributor point trouble. If not, try changing the complete switch.—*EUGENE MYERS, Myers Bros., Oil City, Pa.*

SERVICING THE AUBURN 12

(*Continued from page 17*)

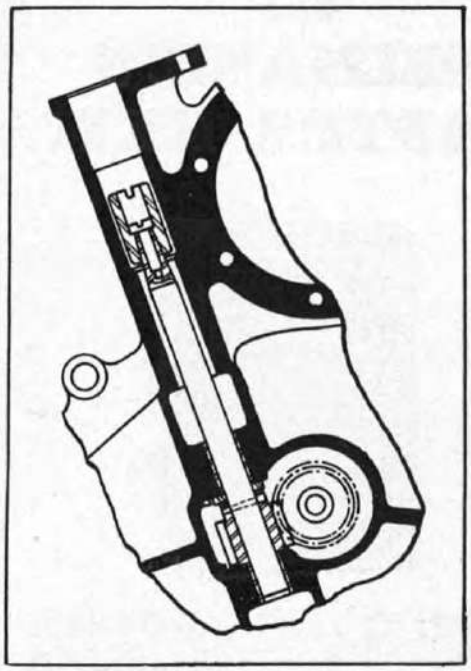

Fig. 6. Sectional view of the distributor drive

The main bearings are of the bronze back interchangeable type and not provided with sims, hence no adjustment is permissible. Bearings are supplied in under size standards for replacement purposes when reconditioning of the crankshaft is necessary. The lower half of the bearing is dowelled to the bearing cap, the upper half being provided with the oil hole through which oil is fed to the bearing from the main oil line in the crankcase. Main bearings have continuous oil grooves to provide a constant feed of lubricant to the connecting rod bearings. End thrust is taken on flanges formed integral with the upper half of the rear center main bearing. No adjustment for end thrust is provided and when this becomes excessive, this part of the bearing should be replaced.

Valve Mechanism

The camshaft is supported by seven steel back, babbitt lined bushings. Clearance between the shaft and its bushings should be .0015-in. to .003-in. The rocker shaft is 1⅛-in. in diameter and the rocker arm has a steel back, babbitt lined bushing. The roller in the rocker arm which contacts with the cam on the camshaft is bronze bushed and runs on a hardened pin. This roller is 13/16-in. in diameter and 7/16-in. wide and must be concentric and have a true bearing on the cam as flat spots or eccentricity would result in valve noise.

The valve guides are pressed into the cylinder head and in making replacements it is necessary to check end of guide in relation to valve seat and position the replacement guide accordingly. Valves may be reground by removing the inspection cover plate at the center of the engine directly over the valve stems which will give access to remove the springs. Remov-

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ing the cylinder head covers which are in pairs will give access to head of the valve and permit reconditioning valves without disturbing other parts of the engine. Both valves have a thirty degree seat which necessitates the use of 15 degree and 70 or 75 degree cutters when seat reconditioning is necessary. The adjusting screw for adjusting valve stem clearance is located in the end of the rocker arm and the adjustment should be such as to provide .010-in. clearance at the end of the valve stem.

The rocker shaft is a continuous shaft running the full length of the engine and is prevented from rotating by dowel or cone-pointed set screws which are threaded into the same holes into which the bolts holding the center inspection plate enter. Rocker arms are positioned on this shaft to alternately operate the valves of opposite cylinders. Springs are used as spacers between the shaft supports to space the rocker arms.

The front end drive is by means of a silent chain which also drives the generator. The sprocket ratio is such as to drive the generator at 1.19 times crankshaft speed. This chain is manually adjusted by means of a three-bolt flange on the generator.

Engine Cooling System

The cooling system includes a centrifugal type pump having a double outlet. The pump is belt driven from the crankshaft, the drive pulley also supporting the vibration damper. The pump is mounted on the front of the engine in such position that the shaft extending through the front end of the pump carries the fan. This shaft is mounted on ball bearings, the construction employed being depicted in Fig. 3. The two outlets from the pump lead respectvely to the right and left banks of the cylinder block. As water enters the front of the block it is carried through a distributing chamber and discharged evenly throughout the length of the block. The fan belt adjustment is incorporated in the fan pulley which is made in two parts, locked with a set screw. To adjust fan belt loosen set screw and then screw the fan pulley adjusting flange on hub which will reduce the width of the belt groove and force out the belt in the groove, thus taking up the excessive slack and establishing proper tension in the belt.

Carburetor

The carburetors which are of the down draft type are of Stromberg make and designated as Model Ex-2." This is a single barrel instrument, a carburetor being mounted on each bank of cylinder. In order to obtain steady idling, smooth acceleration and satisfactory all-round performance, both throttle valve openings must be exactly the same. To accomplish this, a synchronizing shaft connects the throttle stem of the left carburetor to the throttle stem of the right carburetor. This shaft has ball joints at both ends to compensate for possible variations caused by heat and misalignment.

The throttle stem of the left carburetor is rigidly pinned to throttle lever *E*, Fig. 7, and is operated by the accelerating rod, which in turn operates the throttle on the right carburetor by means of the synchronizing shaft. By means of springs *F* and *G* and adjusting screws *C* and *D* on the shaft, the throttle stem of

the right carburetor must be adjusted to open exactly the same as the throttle stem of the left carburetor. To attain this synchronization, the following procedure is recommended:

First, after allowing the engine to run until reaching normal operating temperature, turn the stop screw *A* on the left carburetor for fast idle.

Second, pull out coil wire for right bank of cylinders and unlock adjusting screw *D*.

Third, turn out stop screw *B* and adjusting screw *D* so throttle valve in right carburetor will close completely.

Fourth, idle needle valve "14" controls the gasoline mixture at low speeds. Turning it in gives a leaner mixture and out, a richer mixture. Turn the needle in and out until the engine runs smoothly for this throttle position.

Fifth, unlock adjusting screw *C*, turning it out enough so there is sufficient compression on spring *F* to keep throttle in right-hand carburetor closed.

Sixth, lock screw *C* and place wire in coil for right bank of cylinders.

Seventh, turn in stop screw *B* for fast idle and then pull out wire for left bank of cylinders.

Eighth, adjust stop screw *B* for desired speed and adjust idle needle valve "14" in right-hand carburetor. Then turn screw *D* so it just touches throttle lever. Note carefully speed of right-hand cylinders.

Ninth, place wire in coil for left bank, removing wire for right bank and note speed of left cylinders. If speeds of both banks are not the same they can now be adjusted by stop screws *A* and *B*, making sure that screw *D* touches the throttle lever at all times.

Tenth, after both banks of cylinders are turning at the same speed, lock screw *D* and the synchronization is complete.

The choke valves of both carburetors are operated by a single control placed on the dash and care must be exercised when connecting them. Place control wire through wire connectors of both choke valve levers. Then with choke valves in the wide open position, fasten wire connector clamp screws securely. Pull out choke control on dash all the way and observe whether choke valve in each carburetor closes tightly. If one does not, loosen clamp screw, set the choke valve closed and fasten the screw.

Electrical System

The electrical system is of Delco-Remy manufacture and is of the three-unit type, complete specifications being presented in connection with the wiring diagram appearing in this issue. The ignition system includes two coils each of which supplies high tension current for one bank of six cylinders. The starter is actuated by a Startix which includes a two-way switch by means of which the Startix itself can be cut out of the circuit altogether and the entire potential of the battery is therefore available to the coil. This is done so that in case the car must be started by cranking or pushing as occasionally happens in severely cold weather, the starting motor will not be drawing any current and the full energy of the current will be available for the spark in the combustion chamber.

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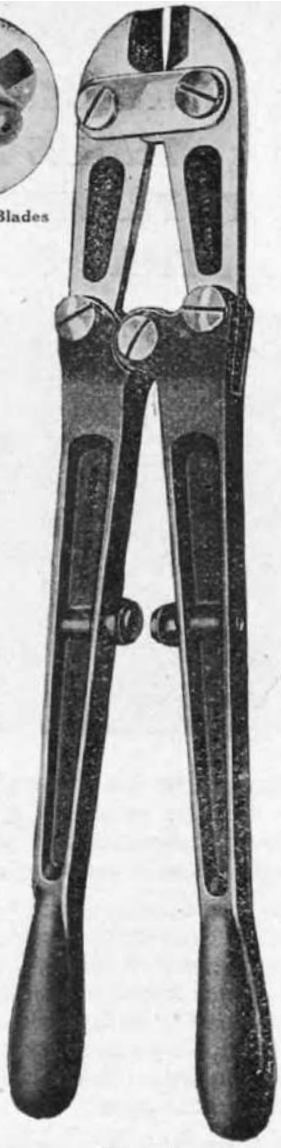

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NEARLY A MILLION IN USE

has superceded Model 8-98 which has been previously covered in this series of articles. The specifications for this model and a wiring diagram are also presented in this issue. Detail changes have been made in this model but the service instructions as presented in the February, 1932, issue, also apply to Model 8-100.

Some New Books - -

THE CHEVROLET SIX CAR AND TRUCK —Construction, Operation and Repair. By Victor W. Page.

This new book covers the construction and operation of the chassis and power plant of this popular car in such simple, non-technical language that even a novice can understand it. Many clear and distinctive drawings showing all mechanical parts, illustrate this book, and the repairman will find in it many short-cuts explained that will make repairing much easier and set him up as a Chevrolet expert. The latest syncromesh and free-wheeling transmission is explained in detail and various special tools and fixtures to facilitate work are described. Contains 450 pages; 150 illustrations, and the price is $2.00. Order through the Book Department, AUTOMOBILE DIGEST, Cincinnati, Ohio.

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We're uncovering more clever service tips than we had ever dreamed of in that "How I Fixed a Tough Job" contest." Don't hold out—let's have your story, too. Read details of this $500 prize contest on page 38 of this issue.

D-R ELECTRICAL EQUIPMENT

(*Continued from page 25*)

Adjusting the Current Regulator

1. (A) Connect the negative wire of an accurate reading ammeter to the ammeter binding post on the apparatus box. Connect lead which was connected to this post to positive terminal of ammeter.

(B) While adjusting current regulator the circuit through the contact points of the voltage regulator must be kept closed as when adjusting cutout relay. (See item 3 under cutout relay adjustments.)

(C) Adjust current regulator unit to maximum specified output given for the generator. Loosen lock screw *LS* on current regulator and turn eccentric screw *ES* to the right to decrease the output and to the left to increase the output. See Fig. 3.

(D) On third brush current controlled generators the output is increased by moving the third brush in the direction of armature rotation and in the reverse direction to decrease the output. It is also necessary to have the voltage regulator contacts bridged as specified for adjusting cutout relay. Output should be set at value specified for the generator that is being adjusted.

2. (A) With the armature held down against the core there should be a point opening between the contacts of .012—.015 inches. When gauging the points for correct opening do not move the upper contact from the natural position or the correct setting will not be obtained.

(B) After the point opening has been adjusted to the proper limits tighten the contact screw lock nut assuring no changing in position of contact screw while the regulator is in operation.

(C) The spring holding the upper contact should rise slightly above the fibre insulator when the points are together and at rest so as to insure a wiping action on the points when they are in operation.

The voltage regulator limits and regulates the generator voltage so that it is varied in accordance with the battery requirements. When the battery is low the charging rate is high and when the battery becomes fully charged the charging rate "tapers off" to a minimum.

Adjusting the Voltage Regulator

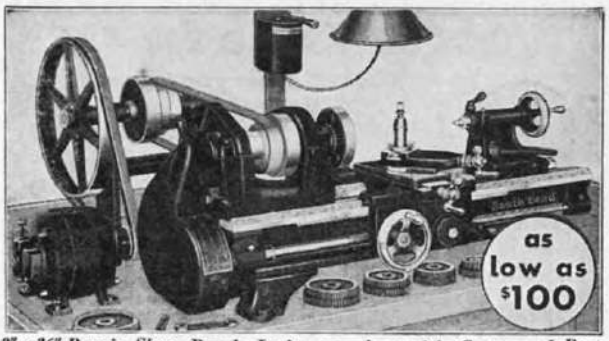
Adjustments to this unit can be made in the following manner:

1. (A) Open the battery circuit by disconnecting the ammeter lead from the ammeter binding post on the apparatus box.

(B) Connect the negative wire of the voltmeter to the ammeter binding post on the apparatus box and the positive wire to the ground.

2. (A) Increase the speed of the engine and adjust the voltage to 14.75—15 volts by loosening the adjusting plate lock screw, *LS*, Fig. 3, and turning the eccentric adjusting screw *ES* to increase or decrease the spring tension. Increasing the spring tension increases the voltage reading.

(B) If an open circuit setting of 14.75—15 volts causes overcharging of the battery this condition can be remedied by decreasing the finish rate of charge.



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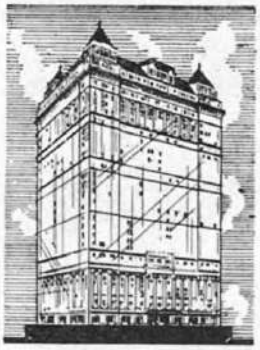

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