Servicing the 6-cylinder
TERRAPLANE ENGINE
Presenting complete service instructions for the 1934 Models "K" and "KU"

The Terraplane cars are built in several models known as the Standard and the DeLuxe, there being two chassis in the line for 1934. Model "K" has a 112-inch wheelbase and model "KU" has a 116-inch wheelbase. With the exception of several major and minor details and the power out of the engine, the construction of both chassis is practically identical. On the longer wheelbase chassis, the brake linings are wider, tire equipment varies, but each model retains the Terraplane principle of unit chassis and body construction.

The principal variation in the engines of these two models is in the compression ratio, the model "KT" having a 5.75 to 1 ratio, while model "KU" has a 6.25 to 1 ratio, the maximum power for these engines being 80 and 85 hp respectively at 3600 revolutions per minute. Each model is equipped optionally with a 7 to 1 compression ratio in which case the maximum power is 89% at the same speed. Engines with standard compression ratios are equipped with a cast iron cylinder head, while the DeLuxe models are equipped with a composite aluminum and cast iron cylinder head. Engines are mounted in the chassis on rubber front and rear, providing a 3-point suspension.

Cylinders

Details of the engine design are shown in the sectional view, Fig. 1. The cylinder bore has been increased 1/16" over the previous model while the stroke has been increased ¼" and the increase in power is claimed to be more than ten per cent over the previous model. The cylinders and crankcase are integral and made from chrome alloy. Standard reconditioning tolerances apply, reconditioning working limits being .0005" ; maximum allowable taper .0015" and maximum allowable out-of-round .002". Owing to the use of aluminum pistons, carbon should be removed by scraping. Cylinder head gaskets on these models are of steel with an asbestos filler and standard precautions on pulling down the head bolts apply. At the rear of the engine, two arms project from the frame against the transmission case. This is a live rubber mounting which dampens transmission movement and vibration, being adjustable to vary the dampening action in accordance with each owner's requirements.

Pistons, Pins and Rings

The piston and rod assemblies are removed through the head of the block as the crankshaft is fully counter weighted and there is not sufficient clearance for removal of these assemblies from below. The pistons are of "Lo-Ex" silicon aluminum alloy, "T" slotted to. compensate for expansion and cam-ground to give full bearing on the cylinder wall. Pistons are fitted to the cylinders with a clearance of .016" at the top, .001" to .0015" at the top of the skirt and .0005" to .001" at the bottom of the skirt. The weight of the piston is 9.6 oz., the length 3A" and the piston pin center is located 1+1" from the top of the piston.

Pistons are fitted with four rings located in grooves 2," deep above the piston pin center. The rings have a straight cut joint and the practice of lining up the ring gaps and pinning the rings in the piston grooves as adopted on the previous model is continued. The two upper rings are plain compression rings while the two lower rings are oil control rings, one narrow and one wide. Ring gaps should be fitted to .009" to .011" with ring located in cylinder bore and parallel to the cylinder axis. Rings should be fitted to piston grooves so that after pinning they will move freely in grooves when piston is shaken.

The piston pin mounting is of the full floating type, pin being retained against endwise movement by means of snap rings located in grooves in the piston pin bosses. The piston pin should be fitted to the bronze bushing in the upper end of the rod with a clearance of .0003" at room temperature. It is fitted to the piston with the same clearance, but piston should be heated to 200 degrees Fahrenheit. This clearance leaves the pin tight when piston is cold and provides a snug fit when piston is heated to this temperature. Pistons should always be heated for removal and replacement of pins to avoid distortion. Pistons must be balanced for weight variation not to exceed 1/4 oz. for the complete set of six pistons. When assembled, the rods and pistons are selected so that assemblies cannot vary over IA oz. in weight and this standard should also be adhered to in maintenance.

Crankshaft Bearings

Connecting rods are steel forgings of I-beam section with the crankpin bearing spun in the lower end. This babbitt metal is less than .812" in thickness so there is no interference with heat flow from the bearing. Bearings are fitted to the crankpin with a radial clearance of .001" and an end clearance of .006" to .010". Bearings are adjustable by means of laminated shims located at each side between cap and rod. Alignment of rod and piston assembly is also important and this should be accurately checked before assembling to the cylinder.

The crankshaft is a heavy forging being equipped with eight counterweights which are integral with the crank cheeks. Full compensation, together with three main bearings and a rubber type torsional dampener mounted on the front end of the shaft, insures free running of the crankshaft under all operating conditions. The rubber working member of the torsional dampener is fully enclosed requiring no adjustment. The main bearings are bronze-backed babbitt-lined and removable, both halves being prevented from rotating by means of dowel screws. All main bearings are provided with .001" radial clearance and with shims for adjustment. The end thrust specified is .006" to .012" and taken on the flanges of the center main bearing, front and rear bearings having clearance endwise Main bearings are

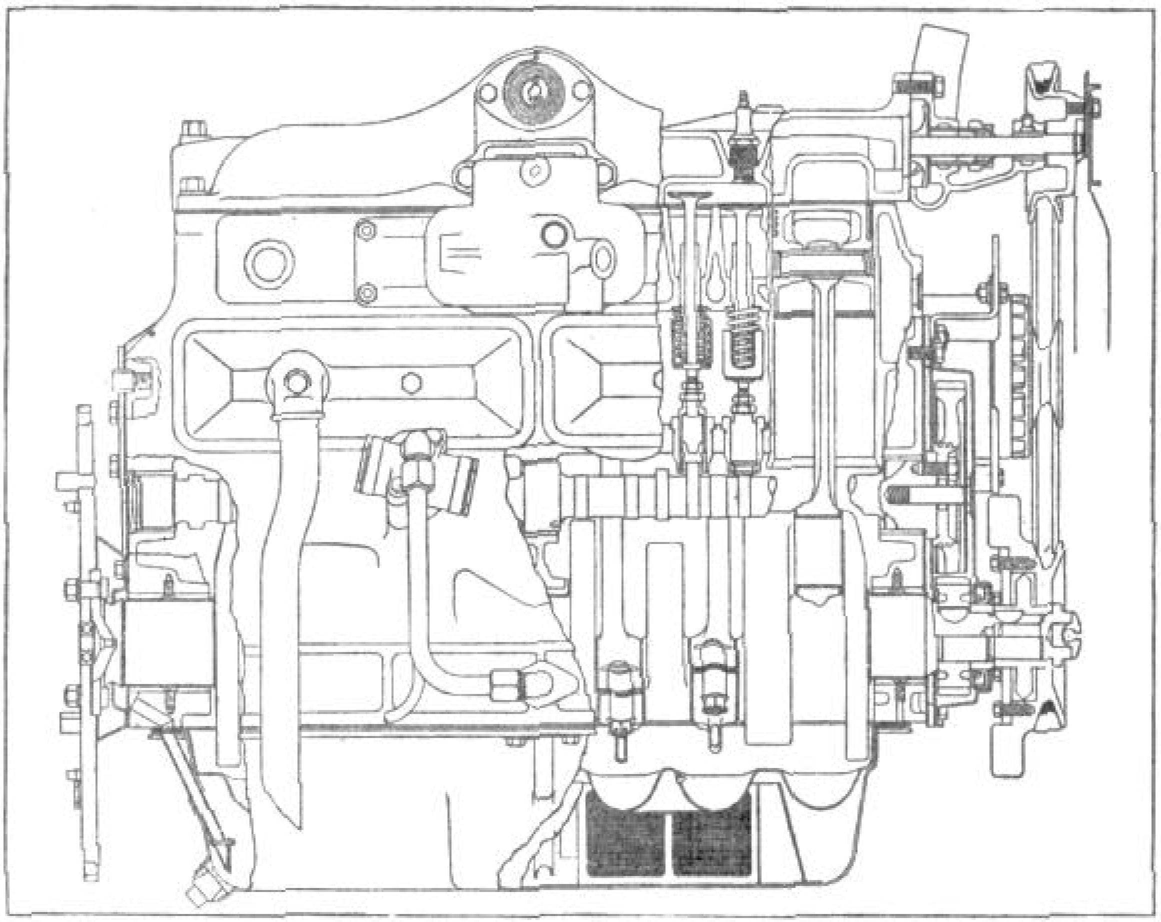


Fig. 1. Sectional view of the 1934 Terraplane engine

Main bearings are larger and the crankshaft is heavier and more rigid.

The flywheel is located on the conventional flange at the rear end of the shaft and held in position by bolts with special heads which lock against a shoulder on the flange to prevent turning when drawing home the nuts. The flywheel has 107 teeth which are wide. An oil thrower is integral with the rear end of the shaft enclosed by an oil seal, while the bearing cap is provided with a drain which communicates with the drain pipe located in the oil pan. A special oil seal is also located at the front end of the shaft on a spacer between the crankshaft and the combination vibration dampener and fan drive pulley.

Valves and Valve Mechanism

The cast alloy camshaft introduced on the previous model is continued. This is an Electric Furnace alloy with hard-ring and cam surfaces. The camshaft is mounted on three bearings, which are removable and provided with a radial clearance of .0015". Bearings are stepped in diameter to permit removal of the shaft through the front end of the case. End play is taken by a spring-loaded plunger bearing against a hardened steel button on the timing gear case. The camshaft is driven from the crankshaft by means of gears, the crankshaft gear being of steel and keyed to the crankshaft, while the camshaft gear is a G. E. Bakelite composition type located on a flange and bolted to the camshaft.

The intake valves are of Silicon steel, while the exhaust valves are Silicon Chrome steel; all valves being located in removable guides which are pressed into the block. The valve lift is 11/32"; valve stem diameter 5/16" and intake valve stems are fitted with a clearance of .0015" to .003", exhaust .003" to .005" in the valve guides. The valve springs are mounted in cages to prevent valve spring flutter and shimmy at high speed. They are held in position by being located between the spring and the valve spring retainer. They are designed to provide definite dampening action through frictional contact with the coils of the spring and should not be bent or altered in any manner. If any doubt exists as to their ability to control spring action this would warrant replacement.

The tappets which are of novel design are mounted in removable guides. These tappets have a large radius parallel to the cam surface which is claimed to be equivalent to a 3" roller which permits a longer dwell in wide open position and more rapid opening and closing of the valve. Tappets are provided with the conventional adjustment and clearance adjustment should be made with engine at normal operating temperature. The intake valve tappets should be adjusted to an operating clearance of .006" and the exhaust valve tappets .008". The tappet clearance for checking the valve timing should be .010" for both valves with engine cold. Tappets should have a good bearing in their guide and if either or both parts are worn, they should be replaced.

Engine Timing

The valve timing of the Terraplane engine is as follows : The intake valve opens 10 degrees - 40 minutes before top dead center and closes 60 degrees past bottom center. The exhaust valve opens 50 degrees before bottom center and closes 18 degrees - 44 minutes past top dead center. Since there are 107 teeth in the flywheel gear, the intake valve will open at 3 teeth before top dead center. The tipper dead center position is stamped on the flywheel face. A further means of establishing

establishing valve timing is provided in the marking of the timing gears. The tooth on the crankshaft gear with punch mark on front face should mesh between the punch marked teeth on the camshaft gear.

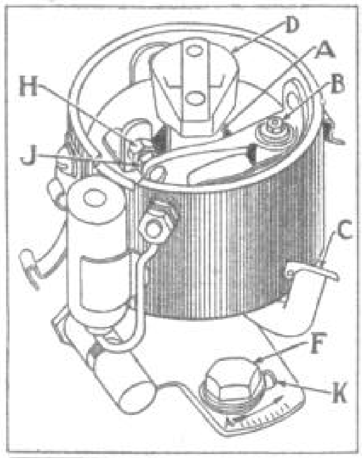
The distributor is mounted on the right side of the crankcase and driven by gears from the camshaft. The breaker is of the single arm type operated by a six-lobe cam, construction of the breaker being shown in Fig. 2. The breaker points should be adjusted to .020" maximum opening, with points clean and set squarely on each other. If the points become pitted it is necessary to remove them and grind smooth or replace with new ones. Grinding requires a special machine to insure proper seating. Filing or honing will remove oxidization but, due to the hardness of the tungsten alloy used, this method is not practical for removing deep pits.

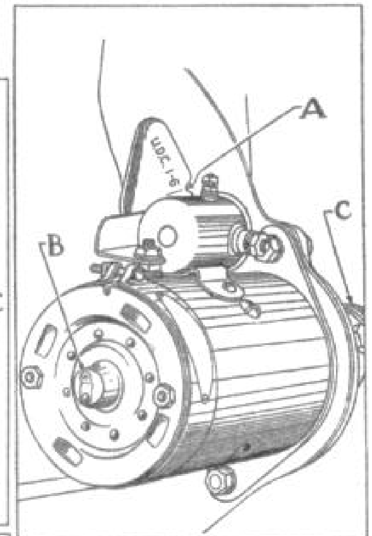
The ignition is timed with breaker points starting to open with piston on top dead center. This position is indicated by the "UDC 1-6" mark on the face of the flywheel as shown in Fig. 3. Since the piston in a four-stroke-cycle engine may be completing the exhaust stroke or completing the compression stroke and ready for the power stroke, when it is at upper dead center (UDC), it is necessary to determine the stroke as well as the piston position. This can be done by removing the spark plug from number one cylinder and with finger over the opening, crank engine slowly, using the hand crank. Air pressure indicates that piston is coming up on the compression stroke. On this stroke, continue cranking slowly until the mark "UDC 1-6" is directly in line with the pointer on timing inspection hole in rear support plate of engine as indicated at A in Fig. 3.

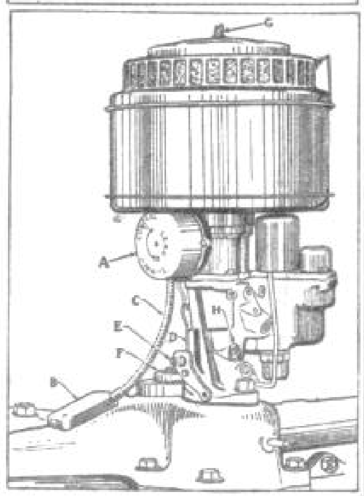
With engine in this position, rotor arm D, Fig. 2, should be in the position in the illustration. When the distributor cap is put in place, the metal strip on the rotor arm should be directly under the terminal to which number one spark plug wire is attached. Referring to Fig. 2, loosen the clamp screw F. and turn the distributor until the fiber block A of the breaker arm is on the highest point of the cam. Measure the gap between the points with feeler gauge. This gap should be exactly .020". Adjustment of gap is accomplished by loosening the lock-nut H, and turning adjusting screw J. Always tighten the lock-nut and recheck gap after adjusting.

Turn the distributor housing clockwise to the limit of the slot in the clamping plate K. Remove the center cable from the distributor cap and place the bare end about " from the intake manifold. With ignition turned on, turn the distributor body counter-clockwise slowly just until a spark jumps from the high tension wire to the intake manifold. Tighten screw F, replace central cable in distributor cap and clamp cap on distributor.

The foregoing operations give dead center timing. This, however, due to variations in fuel characteristics (octane rating), is only approximately correct. To get the correct setting, the car should be driven until the engine has reached its normal operating temperature. Allow the car to slow down to 8 miles per hour in high gear on a level, hard-surfaced road, then depress accelerator rapidly to the limit of its travel. As the car accelerates from 10 to 15 miles per hour a slight spark knock should develop. If a knock is not heard loosen loosen distributor clamp screw F, Fig. 2, and turn distributor counter-clockwise one graduation of the clamping plate K, and repeat the acceleration test. Repeat this operation until the knock is heard. The higher the octane rating of the gasoline being used the greater the advance required to get maximum performance and fuel economy. However, the timing should not be set ahead of the 3/4" advance mark.







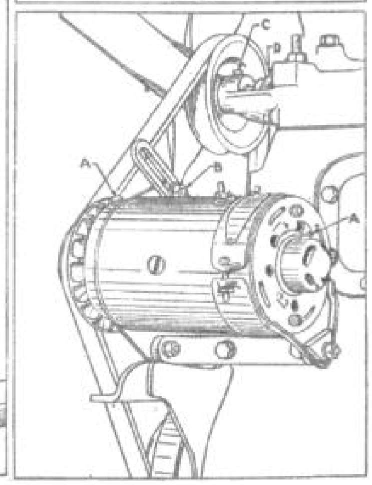


Fig. 2. (upper left). Details of the ignition distributor involved in checking and setting the ignition timing

Fig. 3. (upper right). Showing location of inspection hole in engine support for ignition timing

Fig. 4. (lower left). External view of carburetor showing climatic control and location of adjustment

Fig. 5. (lower right). Generator mounting and means provided for adjusting fan belt tension

Carburetor

The carburetor is a Carter downdraft type with Climatic Control (self-controlled choke), automatic heat control, and accelerating pump. The choke valve, the mechanism for which is contained in the insulated housing A, Fig. 4, is fully closed when the engine is cold at average air temperatures (75 degrees F). Hot air drawn off the exhaust manifold through the stove B and tube C enters the control housing, giving accurate positioning of the choke for all starting and operating conditions. When the choke is closed the bar D is dropped behind the throttle stop screw E to increase the idling speed during the warm-up period. This, however, cannot drop into position until the throttle has been opened. The heat control valve F is automatic in operation, supplying the correct amount of heat to the intake manifold under all operating conditions.

Do not attempt to adjust the carburetor alone, but give the engine a general tuning, performing all of the following operations in the order given:

(Cont'd)

Carburetor *(Cont'd)*

1 - Clean spark plugs and adjust gaps to .022

2 - Clean breaker points and adjust to .020" maximum opening.

3 - Check battery and ignition wiring, being sure all distributor wires are pressed down in their sockets and insulation is in good condition.

4 - Set ignition as outlined above.

5 - Turn carburetor idling screw H, Fig. 4, into its seat and back out exactly one turn.

6 - Start engine.

7 - When engine has reached normal operating temperature, adjust valve tappets to clearance specified above.

8 - Set carburetor throttle stop screw E so that engine idles at a speed equivalent to 8 miles per hour in high gear.

9 - Adjust carburetor idling screw H for smooth engine idling. The final adjustment should be from 1/2 to 1 turn of the screw from its full in position.

10 - Road test car for final ignition timing as described above.

The high speed is a fixed jet and properly calibrated to meet the requirements of the engine. The air cleaner and carburetor silencer consists of a sound-absorbing chamber, on top of which is mounted a filter unit. The filter unit should be removed and washed in gasoline every 2,000 miles and re-oiled by dipping in SAE No. 50 engine oil. Drain the excess oil before replacing. The removal of the wing nut G, Fig. 4, permits removal of the air cleaner element.

Miscellaneous Service Items

The water pump is built in a unit with the fan and mounted on the cylinder head as shown in Fig. 1. The generator is mounted on a swinging bracket on the side of the crankcase and both fan and generator are driven by a V-belt. This belt must be kept sufficiently tight to prevent slippage on the pulleys. If belt is adjusted too tightly, rapid wear of fan and generator bearings will result. To adjust fan belt tension, loosen lock-nut B, Fig. 5, and swing the generator away from the engine until a slight pull is felt on the belt, then tighten the lock-nut.

Lubrication of both fan and generator is necessary and a few drops of light oil should be put in' the oil cups A and C every 1.000 miles. The water pump packing gland nut D should be drawn up only finger tight. Do not use a wrench to tighten this packing gland nut. If leakage occurs after tightening or if the nut goes to the bottom of the thread, additional packing should be added:

The generator is of the ventilated type and the maximum output is controlled by a third brush. Adjustment requires the use of an accurate ammeter and voltmeter as third brush regulation is used in combination with voltage regulation. The maximum output is 22 amperes cold. The output regulator is mounted on the engine side of the body dash and reduces the output from 22 amperes to 10 amperes when the battery is fully charged, reverting to the higher rate should the battery become partially discharged. This regulation is permanently built into the generator and no adjustment is necessary. The generator field fuse is contained in the knurled cup extending from the bottom of the generator. Replacement should be made only with a 7-1/2 amp., 25 volt fuse.

The starting motor is controlled by a push button switch on the instrument panel through a solenoid switch mounted on: top of the starting motor. The switch can be operated manually by removing the cap on the rear of the switch and pushing the plunger in.