1909

INSTRUCTIONS

MODEL L

THOMAS 6-40 FLYER

Instructions for the Care and Operation of the Thomas 6-40 Flyer

Model "L"—1909

E. R. Thomas Motor Company

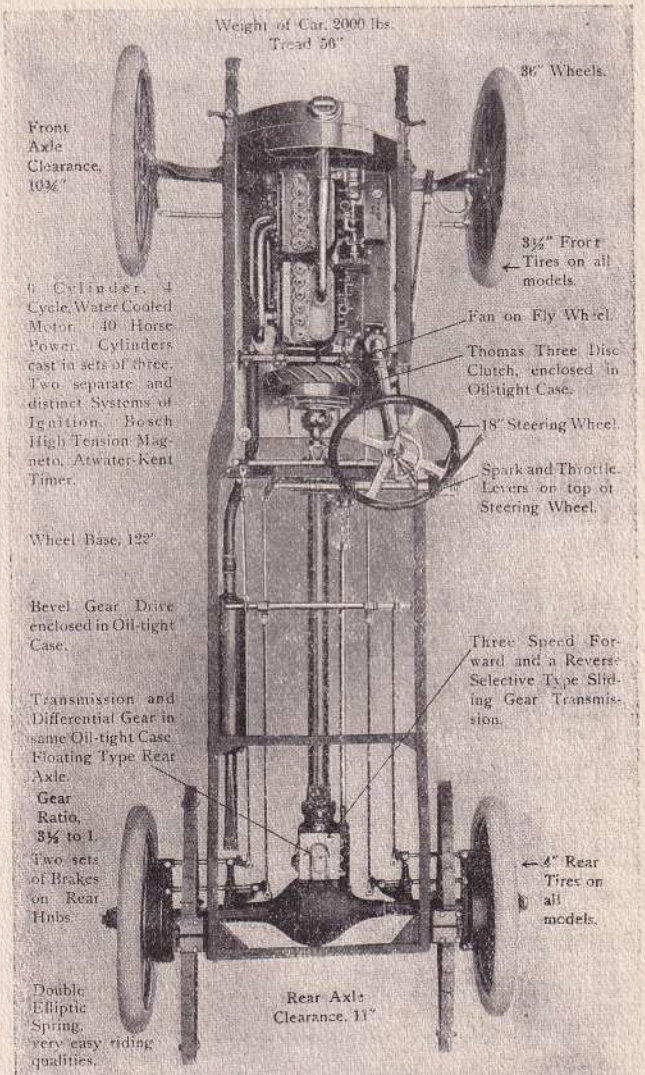
Buffalo, New York

Member Association Licensed Automobile Manufacturers

DON'T
Tamper With Your Car

When car leaves factory it is properly adjusted to give the best results. These adjustments should not be changed except where it is absolutely necessary. Finally, remember that all parts of the car must be properly lubricated if satisfactory results are to be obtained.

CONTENTS



Chassis of Thomas 6 Cylinder, 40 Horse Power Flyer

INTRODUCTION

IT is assumed that the reader is more or less familiar with the general principles of the gasoline engine and its adaptation to motor car use. However, a few introductory words along this line may not be out of place.

Gasoline is vaporized and mixed with air in proper proportions to form an explosive mixture by means of a device known as a carburetor. The mixture thus formed is led into the cylinders of the engine through the inlet valves, which mechanically open and close at the proper time. This charge, once in the cylinders, is compressed and then fired by means of an electric spark and the energy due to the resulting explosion is transmitted by means of transmission, drive shaft, etc., to the rear wheels.

The "*Thomas*" engine, in common with most automobile motors is of the four cycle type, by which is meant that the cycle of its operation is divided into four parts or stages, i. e.

First. The explosive charge is drawn into the cylinders through the carburetor and inlet valve by the downward or suction stroke of the piston.

Second. The charge is compressed preparatory to the explosion by the upward stroke of the piston at the end of which the explosion takes place.

Third. The downward or power stroke of the piston is induced by the expansion of the exploded gases. At the end of this movement the exhaust valve opens and the burned gases escape.

Fourth. The upward stroke of the piston forces the remaining gases through the exhaust valve and the cycle is complete.

For satisfactory results it is necessary that the owner familiarize himself with the various operating parts of the motor with which he must come in daily contact. A careful reading of this book together with a thorough examination of the car will tend to make everything clear. In case any point is obscure, a letter written to us concerning it will be immediately answered with full and complete information.

Controlling Levers and Switches

The controlling levers are seven in number, two being located on top of the steering wheels, two on the side of the car and three are placed at the feet of the operator.

No. 1. *Throttle lever*—the longer lever on top of the steering wheel.

No. 2. *Spark lever*—the shorter.

No. 3. *Change gear lever*—the inside hand lever on the side of the car.

No. 4. *Emergency brake lever*—the outside hand lever.

No. 5. *Clutch lever*—the left hand foot lever.

No. 6. *Foot brake lever*—the right hand foot lever.

No. 7. *Accelerator* or *foot throttle*—bottom lever placed between the two foot levers.

The throttle lever controls the amount of explosive mixture admitted to the motor cylinders. It is closed when at the end of the quadrant nearest the operator and wide open when at the opposite end.

The spark lever controls the time at which the spark ignites the charge in the cylinder. When the lever is nearest the operator, the spark is retarded, i. e., the charge is ignited after the piston has reached its highest point and has begun its downward stroke. When pushed away from the operator, the spark is advanced, i. e., the explosion of the charge is made to occur before the piston has fully completed its upward stroke.

A certain appreciable time is required for the total combustion of the explosive mixture after it is compressed and fired. The combustion being more of a slow burning than a true explosion. This time remains practically the same for all speeds of the motor, hence at high speeds the charge must be fired somewhat before the end of the upward stroke of the piston, in order to get the maximum power from the motor. At slow speeds firing must occur after the piston has started on its downward stroke in order that the motor may run smoothly. Hence, the spark must be advanced at high speeds and retarded at low speeds, or in other words *the higher the speed the greater the advance.*

However, if the spark is advanced too far for any given speed, a perceptible knock will be heard in the motor, this is a sign that power is being lost and the spark should be retarded until this ceases. Always drive with the spark as high as possible and control car with throttle. Under these conditions best results will be obtained from the motor and less gasoline will be consumed.

The spark lever must always be in the retarded position (at

near end of quadrant or a few notches up) when the motor is being cranked.

The change gear lever controls the different speeds of the car. Its normal or neutral position is in the center of the H slot and it is operated by first moving it at right angles to the car and then pushing it into desired leg of the slot. The inside forward position of the lever is the reverse and the inside back position is the first or low speed. The outside forward position is the second or intermediate speed and the outside back position is the third or high speed.

The emergency brake lever controls the action of the external band brakes on the rear wheels. These brakes are released when the lever is in its most forward position and are applied by pulling lever back towards the operator. These brakes should always be applied when the car is standing, for by so doing accidents may be avoided. Never try to start car until the emergency brake is released and the lever as far forward as possible.

The clutch lever controls the action of the clutch which is normally held in by a powerful coil spring. To release clutch, press the lever as far forward as it will go. This lever also operates the clutch brake, whose office is to bring the revolving parts of the clutch to a stop immediately the clutch is released and thus make gear changing easy for even the novice.

The foot brake lever controls the action of the internal hand brakes on the rear wheels. To apply this brake, merely press on the lever until the desired braking effect is obtained.

The accelerator or foot throttle is inter-connected with the throttle lever mechanism so that the amount of explosive mixture admitted to the cylinders of the motor may be controlled by foot as well as by hand. This will be found a great convenience in driving as the hand throttle may be set for a given speed on the level and any rough places or small grades overcome by merely pressing the foot throttle, thus leaving the hands free to guide the car.

In addition to the above a muffler cut-out lever is placed in the front floor board immediately under the driver's feet. This operates a cut-out valve in the exhaust pipe, which allows the exhaust to pass into the air without first passing through the muffler. In this manner the back pressure of the muffler is eliminated and somewhat more power is realized. The cut-out is also handy as an indicator to the condition of the motor.

The switches are two in number, one on the Atwater-Kent spark generator and one on the front of the dash. To use the first switch, a small switch plug must be inserted in the hole provided for it on the

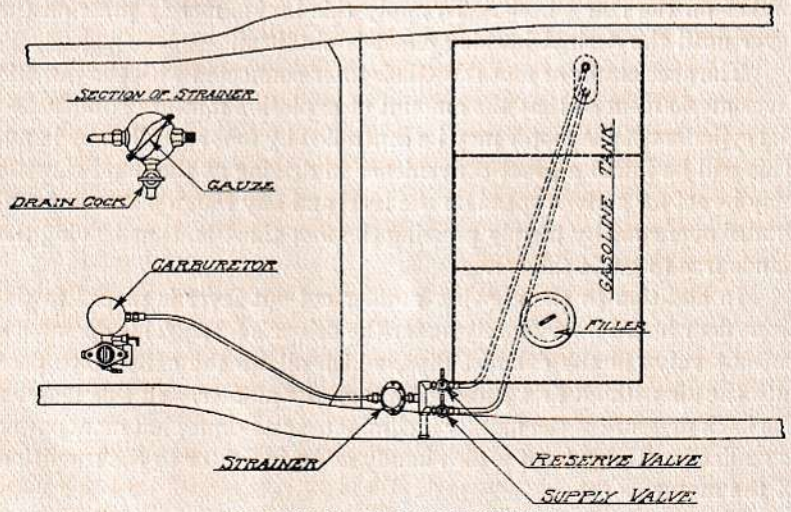
side of the switch, then moving the lever to the positions as marked, throws the battery ignition system on or off.

The switch on the dash has a removable lever by means of which the magneto ignition system is controlled. Placing this lever so as to make the contact through the center switch point, short circuits the magneto and thus throws off the magneto ignition system. Placing the levers on either of the outside points allows the magneto to operate and thus throws on the magneto ignition system.

Gasoline System

This is shown diagramatically in Cut No. 2. The fifteen gallon gasoline tank is located under the front seat of the car with filler under the left cushion. The carburetor is connected to the tank by means of copper tubing through a double controlling valve and spherical strainer.

Under ordinary conditions the gasoline should be drawn through the supply side of the double gasoline valve and the reserve valve should be closed. The supply valve is connected to the tank through a small tube which rises about 1½ to 2 inches above the bottom of the tank. Hence, when the gasoline level in the tank falls below the top of the tube, the supply to the carburetor is cut off, and the engine ceases to run. This warns the operator that his supply of fuel is almost exhausted, but by opening the reserve valve sufficient gasoline is available to run to the nearest source of supply.



CUT NO. 2. GASOLINE SYSTEM

When filling tank always see that the supply valve is open (handle lengthwise with the car) and reserve valve closed (handle crosswise

with car) then the many annoyances due to the exhaustion of the gasoline supply without warning will be obviated.

The gasoline strainer is placed in the gasoline line to insure the absolute cleanliness and purity of the gasoline delivered to the carburetor. From time to time dirty water, etc., which collects in this strainer should be drawn off through the drain cock at the bottom and at least once a season strainer should be taken apart and cleaned.

Carburetor

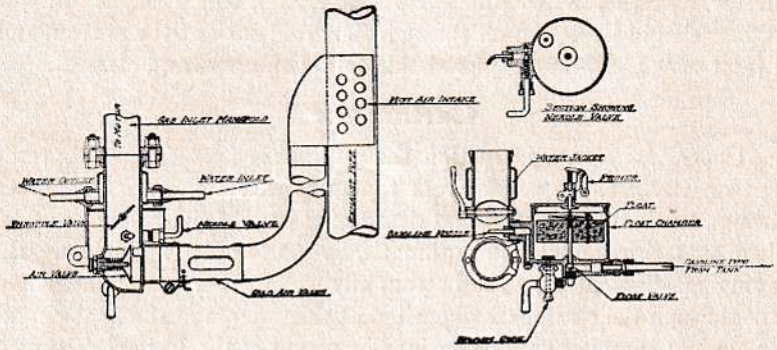
Cut No. 3 shows in section the automatic float feed carburetor used on the car. Gasoline from the tank enters the float chamber through the ball float valve, and rises to the level of the gasoline nozzle, when float rises and valve automatically shuts off the gasoline. By having gasoline enter by the bottom any sediment or water which may pass through the strainer is deposited at the bottom of the float chamber. Float chamber may be drained by means of the drain cock, shown in illustration, and for cleaning or adjustment of the gasoline level, the top may be removed. The gasoline level is adjusted by varying the position of the float on the valve stem. This is easily accomplished by means of the spring clip, attached to the float.

Air enters the carburetor through the hot air intake, which envelopes the exhaust pipe or through the cold air valve, the temperature of the air being regulated by adjusting this valve. The suction of the motor opens the air valve and the entering air passes the gasoline nozzle and vaporizes the gasoline which it draws from the float chamber. The amount of gasoline fed through the nozzle is regulated by the needle valve and the air is controlled by adjusting the tension on the spring placed back of the air valve. The throttle valve controls the amount of gaseous mixture admitted to the cylinder of the motor and by properly adjusting the tension on the air valve spring and the gasoline needle valve, a constant mixture will be supplied to the motor at all speeds or openings of the throttle.

The carburetor is water-jacketed as shown, the water flow being controlled by a cock placed in the piping, directly under the valve chamber of the motor. The water jacket in connection with the hot air intake and cold air adjusting valve assures smooth running of the car the year around.

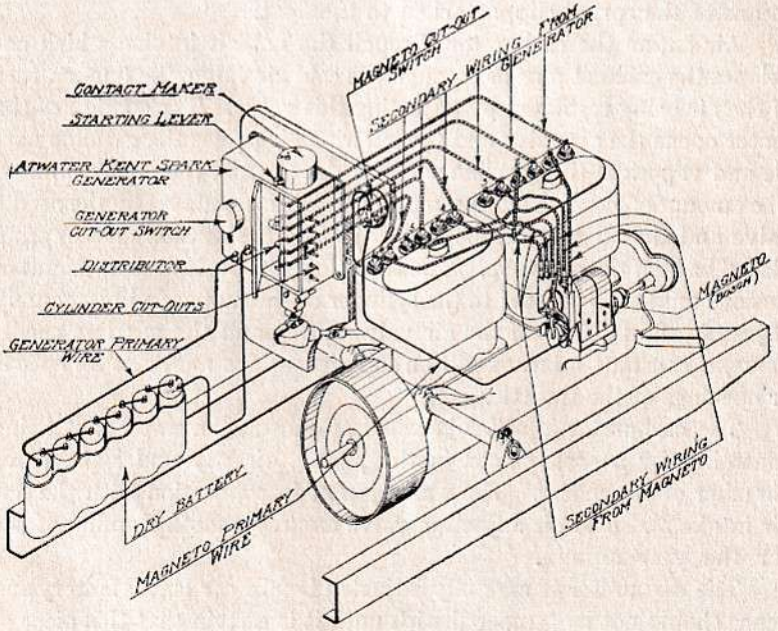
The carburetor is carefully adjusted before car leaves factory and hence should not be tampered with until it is certain that this piece of mechanism is causing trouble. Experience only can determine the proper adjustment of the carburetor. Occasionally the gasoline nozzle becomes clogged with dirt. When this happens the float chamber

must be unscrewed from the body of the carburetor, after which the nozzle may be removed and cleaned. Then replace nozzle and float chamber and readjust the carburetor, if engine still refuses to perform properly.



CUT NO. 3. CARBURETOR

Ignition System



CUT NO. 4

Two complete and entirely separate systems of ignition are employed on this car in combination with two sets of spark plugs.

An Atwater-Kent spark generator is used to furnish a spark from dry cells for starting the motor or for use in emergencies, while a Bosch magneto supplies the spark for regular use.

Cut No. 4 shows both of these systems, properly mounted and connected up, also the two switches by which they are controlled.

Atwater-Kent Spark Generator

This device is placed on the dash board, being driven by a shaft universally connected to the rear end of the pump shaft. It consists of a single coil, contained in left half of case, a distributor and a mechanical contact maker. The contact maker which is placed on top of the generator case, is shown with cover removed in cut No. 5. The shaft A has six notches milled in it and as it revolves the snapper B is forced against I, which in turn moves K and the primary circuit through the coil is completed by the platinum contacts at that point.

Further movement of that shaft allows the snapper B to drop into the next milled slot and the primary circuit through the coil is instantaneously broken. This making and breaking the current induces in the secondary circuit of the coil a high tension current, which will jump any small gap, such as the gap at the points of the spark plug. A condenser is connected in parallel with the contact maker.

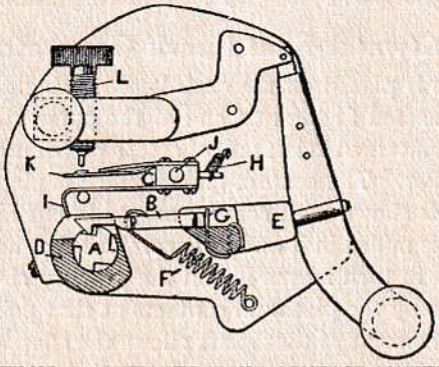
As there are six notches milled in the shaft, six sparks are obtained for each revolution of the shaft, and these are distributed to the spark plugs by means of the distributor, the operation of which may be plainly seen by opening the door on the right of the generator.

At the base of the distributor shaft is a small set screw, loosening this frees the distributor shaft so that it may be rotated and the position at which the spark occurs, advanced or retarded to the proper points. This shaft is also connected through a spiral with the mechanism in the case under the generator so that the spark can be controlled by the spark lever on the steering wheel.

The batteries, for the operation of the generator are placed under the left end of the front seat, six cells of any good battery being used for the purpose. The generator is so economical of current that the batteries may be used until they test less than 2 amperes, but it is advisable to change them when they fall below 3 amperes.

Once properly adjusted, there is but one adjustment that needs attention from time to time. This is the platinum-tipped screw on the contact maker. These contacts are intended normally to be apart and should be screwed only close enough to get good explosions without missing. The platinum will gradually be eaten off of the contact screw and adjustment will be necessary about once in 500 to 1000 miles.

These contacts will never pit and it is not necessary to file them. Sometimes, when the battery is nearly exhausted and new ones cannot be conveniently obtained, this screw can be adjusted very close so as to get a good spark, until such time as replacements can be made. A



CUT NO. 5. ATWATER-KENT CONTACT MAKER

close adjustment gives a hotter spark and uses more battery, while an adjustment with some distance between the contacts gives a lighter spark and uses less battery.

Cylinder cut-outs are arranged on the side of the generator. These short circuit the secondary current to the ground, thus preventing it from reaching the spark plug, and are very handy when trouble is to be located. For starting on the spark, a starting lever is provided on the contact maker. A quick tap on this lever makes and breaks the circuit just as the contact maker does mechanically, thus producing a high tension current which is led to the proper cylinder by the distributor.

Adjustment of Generator on Motor

The spark generator should be adjusted so that for one-third advance, ignition takes place on center. The point at which the spark occurs may be readily determined by listening for the click of the contact maker.

With engine turned over so that No. 1 cylinder is compressing, open the firing cock and turn fly wheel in the direction of rotation of the engine, until the point on the back of the fly wheel marked "1-6 Center" is directly opposite the timing indicator. Now move the spark lever on the steering column about one-third up the quadrant and then loosen the screw at the bottom of the distributor shaft and turn shaft, in direction of rotation, until No. 1 distributor wing has almost reached the contact point. Then turn slowly until contact maker clicks and at that point tighten the screw, thus fixing the position of the distributor.

The Bosch Magneto

This is a self-contained igniter mounted on the base of the motor and gear driven through a coupling. The rotation of a so-called shuttle armature, between the poles of two pairs of very strong steel magnets causes an electric current to be induced in its windings, which current is a so-called alternating current that attains a maximum intensity twice each revolution.

The tension of the current is increased by short circuiting the primary current through a contact maker at the proper moment, and then opening it. At the moment the circuit is opened or interrupted, an arc flame is formed at the spark plug which effects the explosion. As the arc can only be obtained for a definite position of the armature, and as the ignition must take place for a definite position of the motor piston, the armature of the magneto is gear driven from the motor shaft. Further, as the car has six cylinders and only two sparks can be obtained per revolution of the armature, the magneto is geared to run 1½ times the motor speed in order to get the six sparks per two revolutions of the motor, which are necessary.

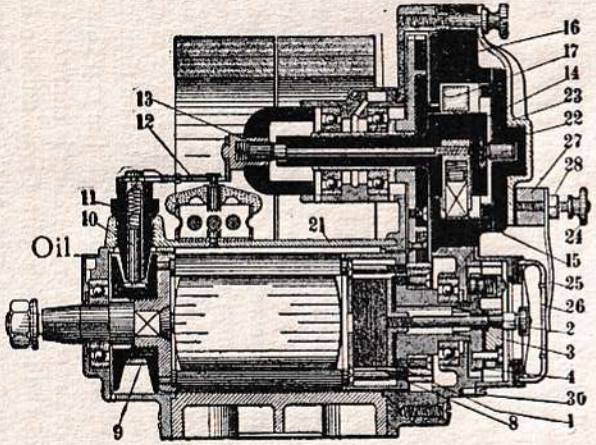
The armature is wound in two parts, one, the primary winding consisting of a few turns of heavy wire and the other, the secondary winding, consisting of many turns of fine wire.

Referring to Cut No. 6. The end of the primary winding is connected to the brass disc 1. Into the hub of this disc is screwed the fastening screw 2, which serves, in the first place for securing in place the contact maker, that is fitted into the rear end of the armature shaft and positively driven by a key. In the second, for conducting the primary current to the platinum screw block 3, of the contact maker. Screw 2 and contact piece 3 are insulated from the interrupter disc 4, which is metalically connected with armature core. In the contact piece 3 is arranged the platinum tipped screw 5. Pressed against this screw by means of spring clips is the contact maker lever 7, which is connected to the armature core, and therefore, with the beginning of the primary winding. The primary winding is therefore, short circuited as long as No. 7 is in contact with platinum screw 5. The circuit is interrupted twice each revolution when the lever is moved off the screw, by means of the fibre rollers 19 mounted on the timing lever 20. A condenser 8 is connected in parallel with the gap thus formed.

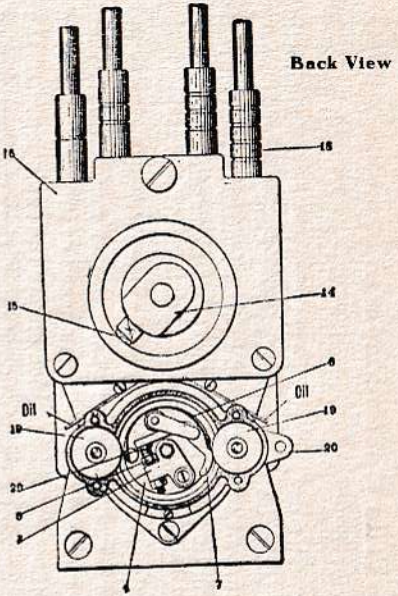
The beginning of the secondary winding is connected to the end of the primary, so that the latter is a direct continuation of the former. The end of the secondary winding is led to the contact ring 9, on which runs the carbon brush 10, which is insulated from the magneto frame by

1. Brass plate.
2. Contact-breaker screw.
3. Platinum screw block.
4. Contact-breaker disc.
5. Long platinum screw.
6. Contact-breaker spring.
7. Contact-breaker lever.
8. Condenser.
9. Slip ring.
10. Carbon brush.
11. Carbon holder.
12. Connecting bridge.

Longitudinal Section



Back View



13. Contact carbon.
14. Rotating distributor piece.
15. Distributor carbon.
16. Distributor disc.
17. Metallic segments.
18. Contact plug.
19. Fibre roller.
20. Timing lever.
21. Dust cover.
22. Cover.
23. Triangular clamp.
24. Nut for switch wire (short circuit).
25. Spring for fastening brass cap.
26. Brass cap.
27. Brass block for fastening spring of brass cap.
28. Fixing bolt.
29. Short platinum screw.
30. Stop screw for timing lever.

CUT NO. 6. BOSCH MAGNETO

means of the brush holder 11. From the brush 10 the secondary current is conducted through the connecting bridge 12, in which is mounted a central spring pressed carbon brush 13, through the rotating distributor piece 14, which carries a contact carbon 15, to the distributor disc 16.

The driving disc which turns the distributor brush 15, is geared from the armature shaft at such a ration that the contact brush rotates at the speed of the cam-shaft of the motor.

In the distributor disc 16 are embedded six metal segments 17, and during the rotation of the contact carbon 15, the latter makes contact successively with individual segments, and always leads the secondary current into one of these. Connected to the segments are sockets which serve for the reception of contact plugs 18. The plugs serve as terminals for the cables leading to the spark plugs of the individual cylinders.

From the end of the secondary winding the high tension current is led through the parts just described, alternately to the spark plugs of the different cylinders and produces there the spark for the ignition of the explosive charge; then returns through the motor frame and armature core to the primary winding, which leads it back to the beginning of the secondary winding.

The variation in the time of ignition is effected by causing the interruption of the primary circuit to take place earlier or later. To this end the timing lever 20 is arranged rotatively, by which means it is possible to obtain about 27° variation on the axis of the motor.

The apparatus, in common with all ignition magnetos, gives a better spark for earlier ignition, hence, *it is more advantageous to slightly advance the spark for starting.*

The ignition system may be disconnected or rendered inoperative by permanently short circuiting the primary circuit. This is accomplished by leading an insulated wire, clamped under the nut 24, to a switch, the other pole of which is connected to the motor frame. As soon as this switch is closed, the primary circuit is permanently short circuited and the system is rendered inactive.

In order to protect the insulation of the armature and of the current carrying parts of the apparatus against dangerously excessive pressures, a safety spark gap is arranged on the dust cover 21. The current will pass through this gap in case a cable is taken off while the magneto is in operation, or if it should accidently drop off. However, the discharges should not pass through the safety gap for any length of time, and it is in such a case absolutely necessary to short circuit the primary winding as above described, and thereby switch off the ignition.

Adjustment of the Magneto on the Motor

The magneto must be adjusted on the motor, so that, for the early ignition, the armature core of the magneto occupies a vertical position. The armature position may be readily seen upon the removal of the connecting bridge 12 and the dust cover 21.

The engine is turned over until No. 1 cylinder is compressing. Then open the priming cocks of that cylinder and pull fly wheel around by hand in direction of rotation of engine, until the point on the rear of the fly wheel marked "magneto" is directly opposite the timing indicator. Then turn magneto shaft until the metal portion of the armature is midway between the fields and mesh the magneto coupling.

Now upon the removal of yoke 23 and the cover plate 22, the position occupied by the distributor carbon 15 may be seen. Then the spark plug in the cylinder by which the magneto was adjusted, is connected with the connecting plug on the segment of which the distributor carbon is resting. The next cylinder to ignite is then connected with the next segment, etc., it being kept in mind that the distributor carbon rotates in the opposite direction from the armature and the engine fires 1-3-5-6-4-2.

Method of Proceeding in Case of Faulty Ignition

In case of defective ignition, it must first of all be determined whether the fault is with the Atwater-Kent, the magneto or the plugs.

It may be pointed out that in general, in case only one cylinder misses, the fault is very likely to be with the plugs. By substituting a new plug for the one in this cylinder, that point may be cleared up.

The more common defects of spark plugs are as follows:

First. Short circuit at the spark gap, due to small metallic beads which are formed from the metal of the electrode by the intense spark and form a conducting connection between the electrodes. This defect is easily ascertained and may be remedied by removing the metallic beads.

Second. Too wide gaps between the electrodes. The normal width of gap is .02 inch. Larger or smaller gaps are detrimental to the ignition. The proper width of gap may always be obtained by bending the plug electrodes.

Third. Sooting of the plug. The parts exposed to the burning gases should be cleaned with gasoline.

To test the spark of the Atwater-Kent or the magneto, take off the secondary terminal from one of the spark plugs and watch the spark jump to the engine. Sometimes if the secondary wire of the Atwater-

Kent is held at a distance of an inch or more from the engine, there is a possibility of seeing the spark jump inside of the generator to the ground on other wires. This will not occur when the wire is replaced on the plug. By the above method the secondary cables are simultaneously tested with the generator or magneto, and special attention must be paid to ascertaining that the insulation is intact. The metal terminals at the ends of the cables must not come in contact with any metal parts of the motor or the magneto.

If the cables and plugs are in good condition, and the magneto ignition takes place irregularly, the defect must be looked for in the magneto itself. In such a case the most important thing is to make sure of the proper interruption of the primary current. Spring 25, Cut No. 6 must be moved sideways, cover 26 taken off and it must be ascertained whether screw 2 is well tightened. Next, it must be ascertained whether lever 7, in the position of rest, contacts with screw 5, and whether the lever is moved the right distance (.02 inch) off the screw when it passes over the fibre roller 19; otherwise it must be adjusted by means of screw 5. The platinum screw contacts must be examined, and any oil or dirt present removed; in case the contacts are uneven (but only then) they must be smoothed with a fine file. If, after continued use, the platinum contacts have completely worn down, the platinum screws 5 and 29 must be renewed. In addition the distributor carbon 15 must be examined, which is an easy matter after the yoke 23 and the cover plate 22 have been removed.

If the ignition fails abruptly there may be a short circuit in the cable clamped under the nut 24, which serves for turning the ignition off. This may be ascertained by removing cable from the magneto.

If thus far no defect has been discovered and it is absolutely impossible to start the motor, timing of the ignition must be verified in accordance with the previously given directions. If the timing is correct it is advisable to send the magneto to the factory, as still further disassembling serves no purpose.

If the cables and plugs of the Atwater-Kent system are in good condition, but ignition fails, the trouble must be looked for in the generator or the primary circuit.

The batteries should be tested and the battery wires, switch and ground wires, traced up and examined. If failure still occurs, examine the generator contact maker and see if it is adjusted properly. Also examine the distributor and see if the timing of the ignition is correct. If all the above fails to place the trouble, the generator should be returned to the factory for repairs.

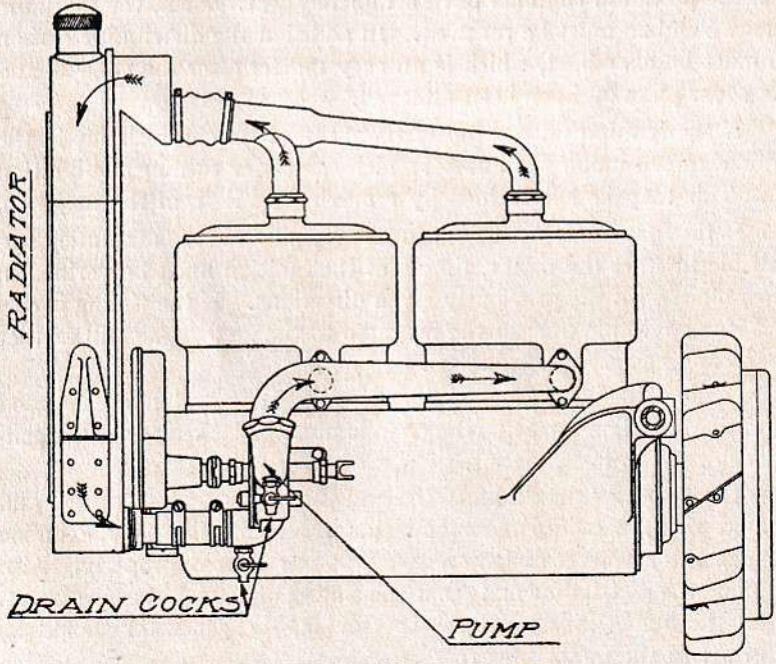
Care and Maintenance

Four or five drops of light oil should be placed in the top of the contact maker of the Atwater-Kent generator, in the tube at the base of the distributor, and in the oil cup at the bottom of the generator about every 500 miles.

All shafts of the magneto run on ball bearings which should be lubricated about every 500 miles by injecting a few drops of oil at the places stamped "Oil." All the rest of the magneto requires no lubrication, and it may be pointed out that the interrupter is designed to work without oil.

Cooling System

Cooling is accomplished through the medium of water, which is circulated through the system by a gear driven gear pump. As shown in Cut No. 7, the pump takes water from the bottom of the radiator and forces it through the cylinder jackets to the top of the radiator, whence it flows through the cooling tubes to the bottom. The water is cooled as it passes through the radiator by the natural draft, due to the motion of the car, aided by the fan blades placed on the fly wheel. An overflow pipe is provided on the back of the radiator to allow surplus water, steam or air to escape.



CUT NO 7. COOLING SYSTEM

The temperature of the circulating system at the bottom of the radiator is a good indication of the motor's condition. If the radiator is unusually hot, the excessive heat of the engine must be due to insufficient lubrication, low water, clogged water pipes or to operating the motor with throttle open ar

Never run the motor u
water, rain water being the
be used, strain it. If car i
the system by the means of
of the water pump. After
over a few times to make s

During the winter or
freezing, never allow car t
engine running. If this pr
freeze and expansion will
the water jackets of the c
mixture should be used. T
the simplest and probably
denatured alcohol, which
freezing, according to the
solution is the following: Glycerine 1½ gal., water 4 gal., wood alcohol 1 pint.

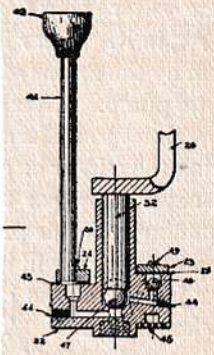
The manifolds used in this system are so large that, in case an accident renders pump inoperative it is only necessary to take off the pump cover and remove one of the pump gears in order to have a very satisfactory thermo-syphon cooling system. Arranged in this manner the car will run indefinitely if care is taken to keep the radiator full of water.

Oil and Oiling

On the motor, splash lubrication is used, the oil level in the crank case being kept approximately constant by a two-feed oiler with sight feed on dash. The oiler is bolted to the crank case and is gear driven from the motor. Cut No. 8 shows a sectional view of the oiler used. The oil is pumped from the oiler to the sight feed by one set of pumps and then returned by gravity to the oiler, where a second set forces it to the crank case. Both sets of pumps should be adjusted by means of the slotted adjusting screws, so as to feed three drops of oil per revolution of the pump, remembering that screwing down gives more oil and up less. When car leaves factory, oiler is set to feed four drops, but after a few weeks this may be reduced as above.

Only the best cylinder oil should be used in the oiler,which should be kept filled at all times. Never run engine if sight feed does not show

oil feeding, and never allow oil to get below the oiler gauge. If oiler becomes inoperative at any time and it is necessary to run car, pour about ½ pint of oil into the crank case for every five miles traveled. The oil should be poured through the vent pipes, whose caps are easily



SECTION THROUGH SECONDARY PLUNGER.

SECTION THROUGH PRIMARY PLUNGER.

CUT NO. 8. OILER

removable for this purpose. Oiling is of the utmost importance, and instructions regarding lubrication should be carefully followed in order that perfect satisfaction may be obtained from this or any car.

The following is a list of the various parts which need oil or grease periodically.

PARTS TO BE LUBRICATED	LUBRICANT	QUANTITY
Motor gear case	Grease	Monthly thru plug
Pump shaft	Light grease	One turn cup daily
Water pump	Light grease	One turn cup daily
Crank case	Cylinder oil	Drain every 1000 miles and refill
Oiler	Cylinder oil	Never let it get empty
Oiler drive gears	Grease	Monthly thru plug
Magneto	Dynamo oil	Weekly where marked oil
Magneto coupling	Machine oil	Few drops daily
Atwater-Kent generator	Machine oil	Few drops as directed under ignition system
Timer drive shaft universal joints	Machine oil	Few drops daily
Timer drive gear case	Machine oil	Few drops daily
Steering knuckles	Light grease	One turn cup daily
Cross steering tube	Light grease	One turn cup daily
Side steering tube	Grease	Pack joints yearly
Brake pedal shaft brackets	Machine oil	Few drops weekly
Clutch pedal shaft brackets	Machine oil	Few drops weekly

PARTS TO BE LUBRICATED	LUBRICANT	QUANTITY
Main drive shaft universal joint	Grease	Fill monthly
Steering gear base	Machine oil	Gun full monthly
Clutch shifting trunnion	Grease	One turn cup daily
Torsion tube trunnion	Grease	One turn cup daily
Rear brake shafts	Grease	One turn cup daily
Gear shift mechanism	Machine oil	Few drops daily
Control	Machine oil	Few drops weekly
Brake rods	Machine oil	Few drops weekly
Intermediate brake shaft	Machine oil	Few drops weekly
Transmission	Graphited grease	As directed, under rear axle
Rear axle	Grease	As directed, under rear axle
Rear wheels	Grease	As directed, under rear axle
Front wheels	Grease	As directed, under front axle bearings.

To Start Motor

1. Fill the gasoline tank, making sure that the vent hole in the cover is open and that the gasoline valve has its cocks properly set as already described.

2. Fill the oiler through the hole in the top, at end, being sure that the strainer is in place.

3. Fill the cooling system with clean water through the cap on top of radiator.

4. Place the spark lever so that it is at the late position as described.

5. Open the throttle a few notches.

6. See that change gear lever is in its neutral position in the center of the H slot.

7. Place plug in Atwater-Kent switch and throw lever to the on position. Put the magneto switch lever in place and throw it to the middle point.

8. Prime or flood the carburetor by pulling on the priming rod button which will be found under the radiator.

9. Engage the starting crank, by pushing in on it, then give a quick pull upward to the left, which action will start the motor. If motor is cold or has been standing long, several pulls will be necessary to start it.

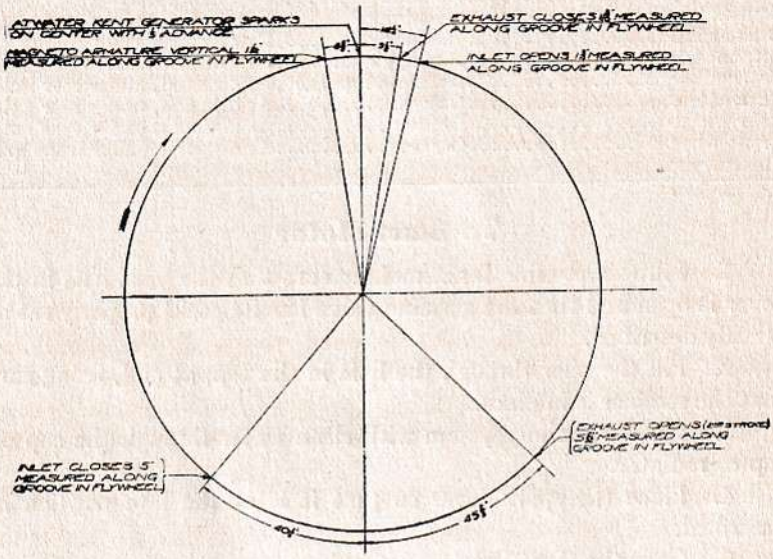
Note: Never push down on the starting crank, as in case of a back fire the operator is liable to be injured.

10. Finally, after the motor is running properly, switch off the Atwater-Kent ignition system and cut in the magneto, by moving the magneto switch lever to one of the outside points.

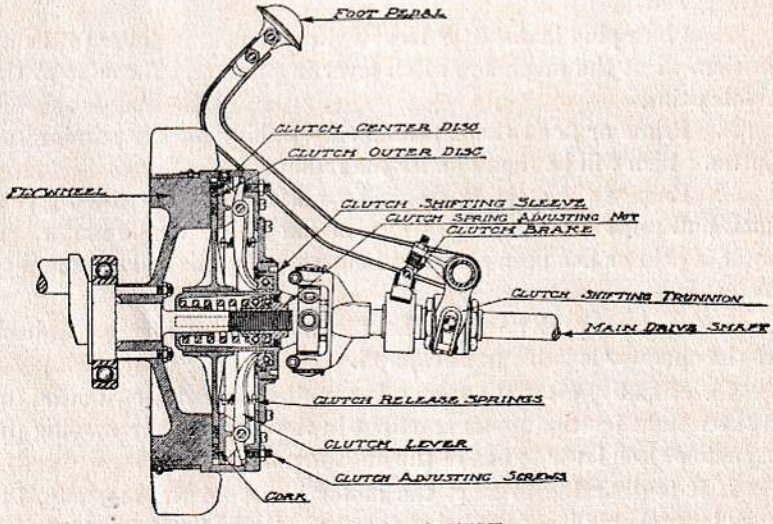
If it is desirable to start the motor direct on the magneto, the spark lever should be advanced about one-half and the magneto switch

ever moved to one of the outside points, then a very quick upward pull of the starting crank will start the motor.

If the motor is warm it can be started from the seat by merely tapping the starting lever of the Atwater-Kent, after properly placing the switch plug and lever.



CUT NO. 9. TIMING DIAGRAM



CUT NO. 10. CLUTCH

To Stop Motor

Shut off the gas entirely by bringing the throttle lever to the lower end of the quadrant, and then short circuit the magneto by throwing switch to middle point. If it is desirable that the motor start easily, it is a good plan to open the throttle just as the ignition is thrown off, then each cylinder will hold a good charge of gas and the motor should start without cranking.

Always stop the car before stopping motor. If this is done, the car will never be left standing with the gears engaged, which would be dangerous, if operator tried to start motor. When leaving car always remove Atwater-Kent switch plug and magneto switch lever.

Motor

The more important features of the motor have already been described, so under this head we will consider the care of the motor.

The lower half of the motor or crank case is a solid aluminum casting, and by removing the cylinders, the pistons, rings, crankshaft, connecting rods and bearings are open to inspection. These parts may also be examined by removing the plates on the bottom of the crank case.

Unless the very best oil is used, the motor pistons and rings will become gummed and they should be cleaned from time to time with kerosene. This may be done by injecting about a tablespoonful of kerosene into the cylinders, two or three times per week. Open the priming cocks and pour in the kerosene. It is well to do this at night and leave the motor stand until morning, when the kerosene will have disappeared.

From time to time the compression of each cylinder should be tested as follows: Be sure that neither the battery nor the magneto is in circuit. Then open the relief cocks on top of the cylinders to locate which cylinder is already under compression. Having located the cylinder, close all the cocks; raise the starting crank handle to the top center and then push downward (clockwise), thus testing the cylinder next in order. Remember that the motor fires 1-3-5-6-4-2.

If poor compression is found to be due to leaky valves, they should be ground in with powdered glass and oil, care being taken to keep the powder from getting into the cylinders.

The correct valve timing is marked on the fly wheel according to the diagram Cut No. 9 which represents the circumference of the fly wheel. To time the engine, begin with No. 1 cylinder and turn the motor over until its exhaust valve closes. At that moment the point

on the fly wheel marked Ex CL 1 & 6 should be at the tip of the timing indicator on the rear end of engine. If this is not the case, the timing should be corrected by adjusting the screw and lock nut on the valve lifter.

After the exhaust valve is timed, the inlet valve should be adjusted in the same way, then the next cylinder may be turned to and so on for all of the cylinders. The essential thing to be considered in valve timing is that the inlet valve must open at the right point and the exhaust must close at the correct time. Variation in the other events is of small consequence. As a rule valve timing should be left to the care of an expert repairman.

Clutch

The three disc, enclosed clutch used on this car is shown in section in Cut No. 10. The cast iron fly wheel forms one of the clutch discs, the center disc being of manganese bronze and the outer disc cast iron. The clutch outer disc revolves with the fly wheel and the center disc with the main drive shaft, the first being normally pressed against the center disc and that in turn against the fly wheel by the action of the clutch levers and the clutch spring.

When it is desired to release clutch, pressure is applied at the foot pedal and the whole main drive shaft is moved backward, which in turn moves the clutch shifting sleeve and removes the pressure of the spring from the clutch levers. This allows the clutch release spring to draw the plates apart and release the clutch. At the same time the clutch brake becomes operative and brings the clutch disc and main drive shaft to rest.

The ball thrust bearings shown in cut are operative only when the clutch is released, hence, the life of the clutch is indefinitely long. The clutch disc has cork inserts to make the action of the clutch smooth and easy and clutch requires practically no attention but from time to time a gun of oil should be put into it. To do this remove the brass plug in the face of the clutch. For ordinary weather we recommend one-third kerosene and two-thirds cylinder oil for use in the clutch. In cold weather it may be necessary to use more kerosene to get good results.

The clutch is adjusted by means of four clutch adjusting screws located as shown in cut. Screwing in on these tightens the clutch and vice versa. As a rule not more than one-fourth of a turn of these screws is necessary to take up the wear and care must be taken to turn each screw the same amount so as to keep the pressure in the clutch discs equalized. The clutch is properly adjusted when it leaves the

factory and if attention is paid to the above the clutch should give perfect satisfaction.

About once a month all the oil should be drawn from the clutch by taking out oil plug and turning fly wheel until hole is at the bottom. After the oil has run out, turn half way around and inject four guns of gasoline or kerosene. Then turn the wheel down again and this will rapidly run out, carrying any dirt or sediment with it. Finally, put in about one-half pint of the above mixture of kerosene and oil.

Transmission and Rear Axle

The transmission is mounted on the rear axle as shown in Cut No.1. It is of the selective sliding gear type, with three speeds forward and one reverse, all obtained by manipulating the control levers as explained. The only attention necessary to the proper working of the transmission is, that it be kept well filled with good heavy graphited grease. About every 1,000 miles the cover should be removed and the old grease washed out with gasoline and replaced with new. Adjustment is provided for on the gear shift rods, so that gear shifting mechanism may always be kept working correctly.

The rear axle is of the floating type with drive through bevel gears and a spur gear differential. The wheels may be easily removed by taking off hub caps, pulling out the drive shafts and removing the lock nut on end of axle. After this the wheel itself may be pulled or gently tapped off. Plain heavy grease should be used in the axle and the old grease should be removed every 1,000 miles as directed for transmission, by removing rear cover. This cover is held on by two cap screws, whose heads are recessed into the cover and concealed by two plugs screwed in flush with cover. The hubs should be filled with Albany grease and one filling should last almost an entire season.

Front Axle Bearings

Timken roller bearings are used on the front axle. These should at all times be adjusted so that the wheel turns freely, but without side play. The adjustment is made by removing hub cap and adjusting the castle nut which holds the bearings in place. Care must be taken to replace cotter in nut after adjustment is made. The hubs should be packed with Albany grease and one packing should last an entire season. The caps should be removed and the bearings inspected for oil at least once per month.

It is important that these front wheel bearings should be kept adjusted as not only is the wear on bearings increased by a loose adjustment but it is also dangerous.

Drive Shaft Mechanism

The drive shaft and the rear universal joint are enclosed in the torsion tube. The universal joint is non-adjustable since but little wear comes there. The front universal has means for taking up the wear, screw bushings being provided for that purpose. These screw bushings are kept from rotating by small spring actuated plungers which must be forced down with a screw driver before any attempt is made to turn bushing.

The front universal joint block is made hollow and it should be filled through a plug with a good non-fluid oil about every 500 miles. The rear universal is oiled from the transmission and needs no attention.

Brakes

There are two sets of brakes both placed on the rear wheels, which are operated by foot and hand levers as already described. These brakes are faced with "Raybestos" which is practically indestructible. Brakes may be adjusted when worn by means of turnbuckles which will be found on the brake rods.

Be sure that both brakes of a set are adjusted alike. To try this, jack up the rear wheels and try them by turning wheels after slightly setting brakes. Do not use oil on the brake bands, but see that the adjustments are always such that the bands do not drag upon the drums and thus retard the movement of the car.

Steering Gear

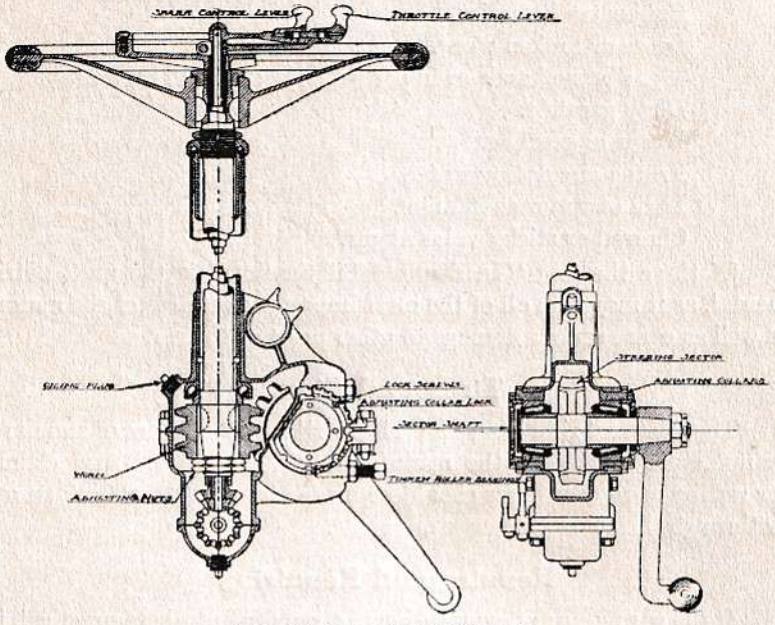
This is of the standard "Thomas" worm and sector type, with all parts encased and working in oil, oil being supplied through the plug shown in Cut No. 11. Ball bearings are provided to take the thrust of the worm and adjustment can be made for wear by means of lock nuts.

The sector shaft is carried on Timken roller bearings so mounted that when sector is in proper position the retaining collars are flush with the adjusting collars and held in place with lock screws.

In order to take up any play, due to wear, between worm and sector, the adjusting collars are so constructed as to have their outsides eccentric with the sector shaft. By disengaging the adjusting collar lock and rotating the adjusting collars, the sector is brought into closer relation with the worm, thereby taking up any backlash. The adjusting collar lock is held in place by bolts as shown and before it can be moved these bolts must be entirely removed.

It is absolutely essential to have the two eccentric collars in the same relative position. Should any adjustment be necessary at this

point, assure yourself, that each eccentric has been rotated the same number of degrees by counting the number of slots from the first to the one which the lock engages.



CUT NO. 11. STEERING GEAR

If the Motor Does Not Start

If the rules given in the paragraph entitled "To Start Motor" are rigidly observed, there should be no difficulty in starting a "Thomas" motor. Occasionally, however, especially in cold weather, it may be necessary to resort to priming. That is, injecting a small quantity of raw gasoline into the cylinders, through the priming cocks provided for that purpose in the sides of the cylinders. The gasoline for this purpose can be carried in a small oil can.

If further trouble is encountered after priming has had a fair trial and the motor refuses to run on either ignition system, investigate the gasoline system. See that gasoline piping is free and carburetor is getting fuel properly. Drain the carburetor and strainer through the valves provided.

As a last resort remove the carburetor and carefully clean as explained in section on carburetor, also go over ignition system and spark plugs, as previously explained.

The most common causes of trouble and a balky motor are as follows:

Inadequate lubrication.
Dirty spark plugs.
Exhausted batteries.
Loose or broken wires.
Tight brake bands or imperfect adjustment of same.
Dirty gasoline.
Water in gasoline.
Frozen circulating water.
Lack of water circulation.
Charred or sticky valve stems.

Of these the first "Inadequate Lubrication" is the most detrimental, as it may ruin all of the most important surfaces of the motor, as well as cause serious damage to other parts of the car.

Tires and Rims

The tries and rims used on "Thomas" motor cars are of standard manufacture and carry the manufacturer's guarantee. Any claims for repairs or replacements should be made direct to the manufacturer or through their branch houses or agents.

Repairs and Repairing

If the car requires the attention of a repairman, where practical, it should be taken to a regularly appointed "Thomas" dealer, who will be more interested and in a better position to locate the trouble than any general repair shop. Treat your car as you would your watch and don't let anybody and everybody tamper with its mechanism.

Tools, Equipment, etc.

The following is a list of the tools, equipment and extras for the car. Check off these when you receive your car, for every car when shipped is fully equipped.

One auto jack.
One auto wrench.
One cold chisel.
One $\frac{3}{16}$ x $\frac{1}{4}$ inch open end wrench.
One $\frac{5}{16}$ x $\frac{3}{8}$ inch open end wrench.
One $\frac{7}{16}$ x $\frac{1}{2}$ inch open end wrench.
One valve lifter lock nut wrench.
One valve lifter wrench.
One hub cap wrench.

Tools, Equipment, etc.—(Continued)

One magneto wrench.
One magneto switch lever.
One Atwater-Kent generator switch plug.
One 8-inch mill file.
One file handle.
One oil can.
One oil gun.
Two spark plugs.
Two spark plug gaskets.
One spark plug and valve cap socket wrench.
One tire repair kit.
One hammer.
One pair pliers.
One Wescott wrench.
One 3-inch screw driver.
One 6-inch screw driver.
One tire pump.
One tool equipment roll.
Two valves.
Two valve stem split collars.
Two valve springs.
Two valve spring seats.
One valve puller.
Six valve plug gaskets.
Assortment of washers, nuts, cotters, etc.

Extras

One horn (fitted to car).
Two oil side lamps.
One tail light.
Two head lights.
One Prestolite tank.

Brief Pointers

Do not start motor without first making sure that speed lever is in neutral position.

Do not throw in clutch when brake is on.

Look at the gasoline tank. It is annoying, to say the least, to find that the cause of a balky motor is an empty gasoline tank.

Keep tires well inflated and do not allow oil, grease or gasoline to get on them.

Do not let the car stand with engine running. Throw off the switch when standing for any length of time.

Always run with the spark advanced as far as possible and control the car by the throttle rather than the spark. If compelled to run very slowly, retard the spark and close the throttle as much as possible. Do not make a practice of running with a retarded spark and an open throttle.

Always look at your gasoline shut-off valves when filling the gasoline tank, or some day you will run out of gasoline and find no reserve to draw from.

Do not speed the car up more than six or eight miles per hour for a long distance while running on the low gear. While the car can stand such treatment for a long time, still its useful life will be much longer if it is handled carefully.

Do not throw on the brakes suddenly except in cases of emergency.

When car starts to skid on wet pavement or muddy road, throw out the clutch, and if necessary to use brakes apply them very gently. By proper attention to this rule, car may usually be kept headed in the desired direction on even the most slippery road.

Run slowly on wet asphalt. Slow down for corners and save your tires.

See that car is always properly lubricated.

Do not run on less than six cylinders. It is not necessary, and, besides, you have paid for them all. If one is suspected of not working, try to remedy it immediately. There is always a reason.

All joints in steering gear, steering connecting rods and front wheels should be kept properly adjusted, as it is injurious to the mechanism and dangerous to run with these parts poorly adjusted.

Remember that the car will not run forever without oil. It *will* run a long time, but greater satisfaction will be obtained if all parts are properly lubricated.

Keep the radiator filled or do not be surprised when the engine loses power and the cylinders begin to cut.

National Association of Automobile Manufacturers

Standard Warranty

Adopted August 12, 1902.

We warrant all goods furnished by us, for sixty days following the date of their shipment, based upon the date of invoice covering the goods, this warranty being limited to the replacement in our factory of all parts giving out under normal service in consequence of defect of material or of workmanship.

If the circumstances do not permit that the work shall be executed in our factory, this warranty is limited to the shipment, without charge, of the parts intended to replace those acknowledged to be defective.

It is, however, understood that we make no warranty whatever regarding pneumatic tires or the batteries.

We cannot accept any responsibility in connection with any of our motor cars when they have been altered or repaired outside of our factory.

We are not responsible to the purchaser of our goods for any undertakings and warranties made by our agents beyond those expressed above.

We wish it distinctly understood that we make no warranty of our goods except as stated above, but desire and expect that customers shall make a thorough examination of our goods before purchasing.

MEMORANDUM