What You Should Know About Your ESSEX

MAY, 1921

ESSEX MOTORS
DETROIT, MICH.

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Putting the Car in Service

Cooling System The radiator and cooling system holds approximately six gallons. Always use pure water unless climatic conditions necessitate the use of Anti-Freeze. In freezing weather use only alcohol solutions of the necessary strength. See page 45.

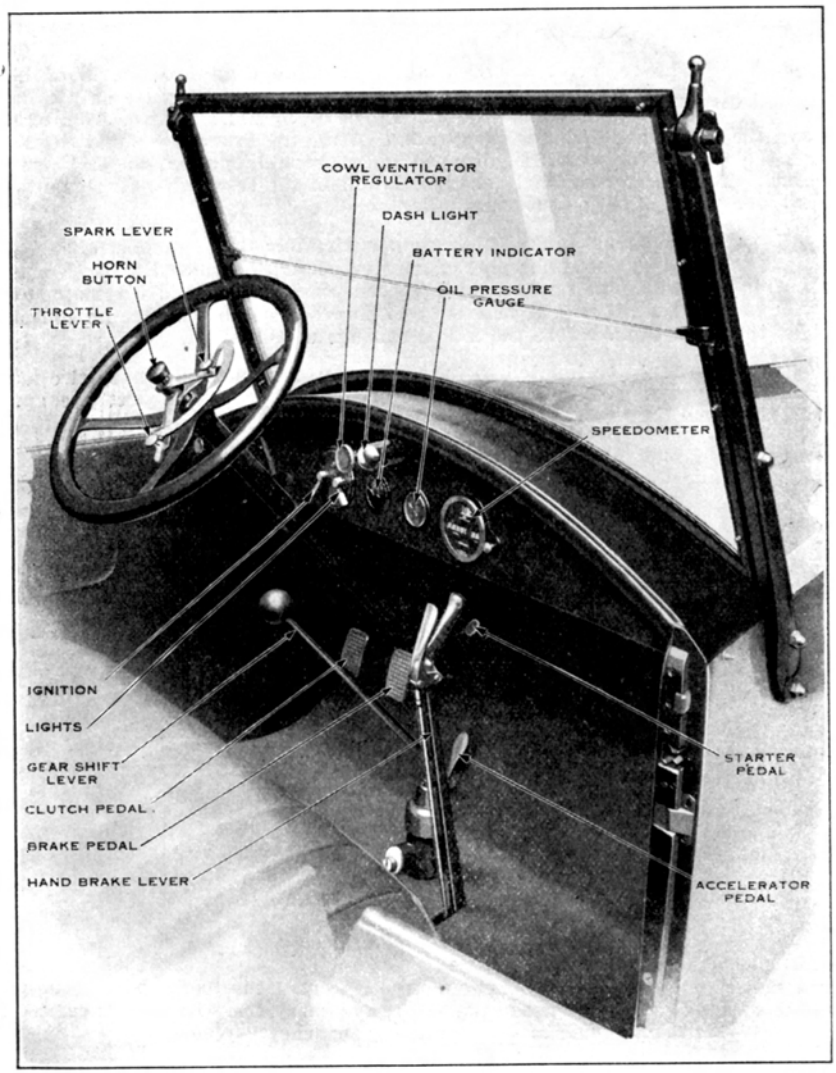
Motor Lubrication The reservoir should contain no more than five quarts of high grade medium light bodied oil. In cold weather use only a light bodied oil. Gauge the amount of oil by noting the position of the float in the oil gauge. (See cut on page 9.) After the first three hundred miles of use, the oil reservoir should be dropped and thoroughly cleaned out and new oil installed. Thereafter completely change the oil in the reservoir every month or every seven hundred to one thousand miles.

Gasoline The gasoline tank, holding approximately 12½ gallons, should be filled and about one pint of gasoline should be poured in the vacuum tank after the small pipe plug on top has been removed. Should the motor ever stop for lack of fuel, it will be necessary to pour some into the vacuum tank, as well as the main tank, before the motor can again be started.

Tires Tires should be inflated to the pressures recommended by the tire manufacturers. When checking tire pressures, always inspect the spare tire at the same time and inflate it if necessary.

Storage Battery The cells should be filled with distilled water to proper level. See page 28.

General Lubrication Too much stress cannot be laid upon the fact that thorough lubrication at all times is necessary in order to keep depreciation at a minimum. On the following pages you will find detailed instructions covering this important item, and strict adherence to these instructions will be amply repaid.



Functions of Fittings in Driver's Compartment

Instruments and Controls

Ammeter Shows whether storage battery is discharging or being charged by the generator. Should always show charge when the car is traveling over 10 miles per hour with the lights out.

Oil Pressure Gauge Simply an indication as to whether the oil pump is delivering oil or not. It should always show pressure when the motor is running. It does NOT register the quantity of oil being delivered to the motor. That is governed by an adjustment of the pump itself. See Motor Oiling System. Page 15.

Carburetor Control The left button marked "Gas" controls the amount of fuel allowed to enter the motor. The right-hand one marked "Choke" operates the air valve and is to facilitate starting only. (See cut on page 9.

Shutter Control Over the carburetor controls is located the button controlling the radiator shutter. See detail instructions on page 34.

Starter Pedal The starter pedal meshes the gears with the flywheel and makes the electrical connection which completes the cranking circuit. Never touch the starter pedal when the motor is running, or you will strip the flywheel and gears.

Clutch Pedal Clutch should always be disengaged when shifting gears.

Gear Shift Lever Controls the different transmission speeds (including reverse).

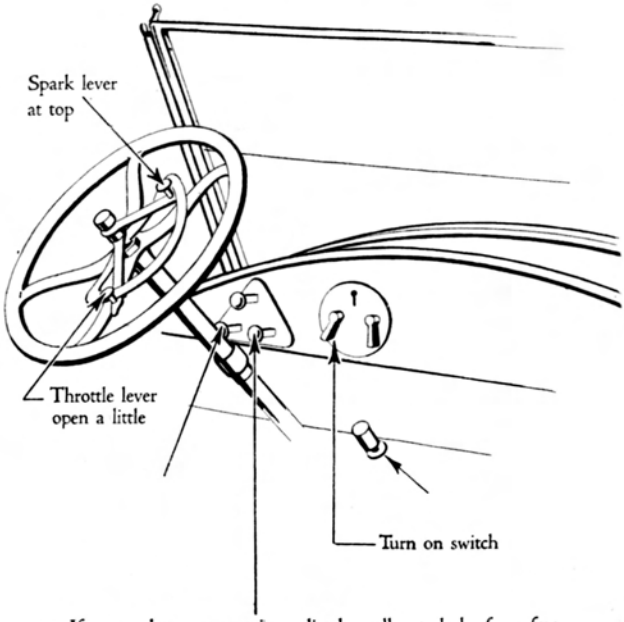
Foot Brake Sometimes called service brake. Operates the contracting bands on the rear wheels.

Emergency or Hand Brake Used as an auxiliary with the foot brake and also to set the car on grades when not in motion. It is good policy to always set the emergency brake when the car is unoccupied.

Accelerator and Hand Throttle Both operate the butterfly valve in the carburetor, thus controlling the speed and power of the motor. When the accelerator is released the valve closes instantly, but when the hand throttle is applied the valve will remain in any position set. It is better to always drive the car with the foot accelerator so that in an emergency, when the foot is removed to apply the brake, the motor is instantly throttled.

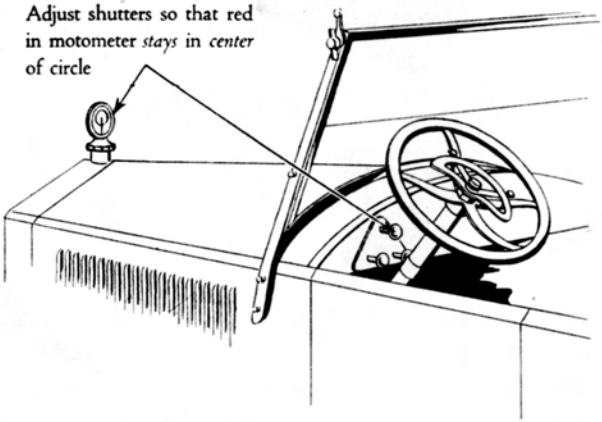
Spark Lever The distributor is advanced and retarded automatically by an automatic mechanism which adjusts the spark according to the speed of the motor. However, to obtain all around efficiency, the spark must be controlled manually to a certain extent. If the motor shows a tendency to knock on a heavy pull or upon acceleration, slightly retard the hand spark lever until the knock ceases. It is a good rule to always carry the spark advanced as far as possible without the motor exhibiting any tendency to knock.

STARTING



If motor does not start immediately, pull out choke for a few revolutions and then let it go in again

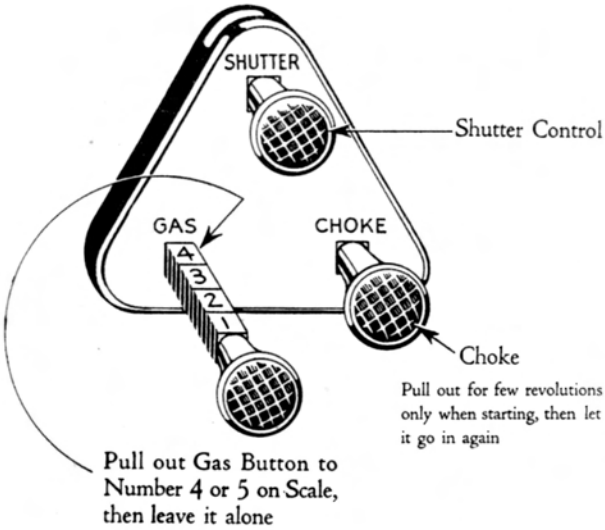
TEMPERATURE CONTROL



NOTE—When using anti-freeze mixture adjust shutters so red in motometer stays slightly below circle

Always close shutters when you stop

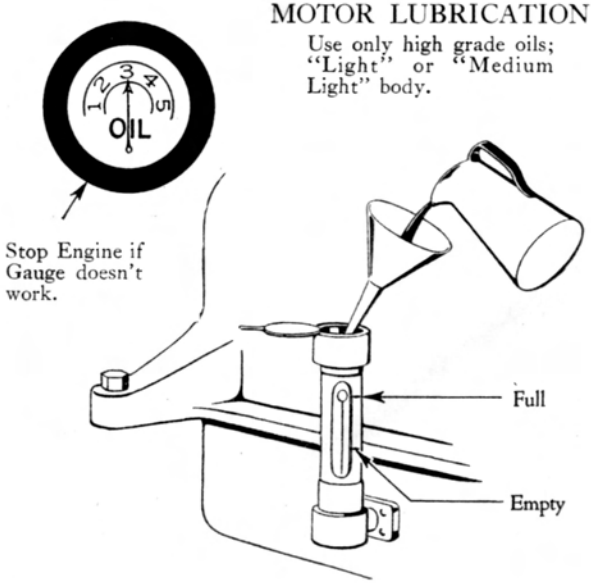
THE DASH CONTROL



In—lean. Out—rich gas mixture

MOTOR LUBRICATION

Use only high grade oils; "Light" or "Medium Light" body.



MOTOR LUBRICATION

Fill oil cup on top of motor

Oil generator every 2000 miles

Oil starter every 2000 miles

CLUTCH LUBRICATION

Refill with half pint of kerosene and oil, mixed in equal portions

Drain clutch once a year, rinse out with kerosene and refill

THE TRANSMISSION

Fill transmission every 3000 miles to level of overflow plug only

Drain once a year, flush with kerosene and refill

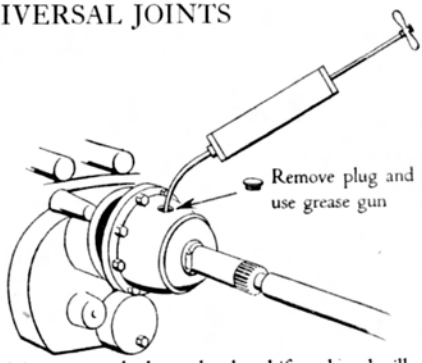
GREASE CUPS

Turn them down till grease oozes from joints

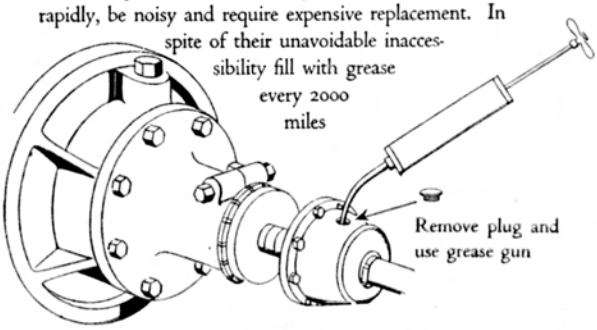
The life and quietness of the chassis depends on the attention given to all grease cups

Turn them all down once a week and avoid squeaks and rattles

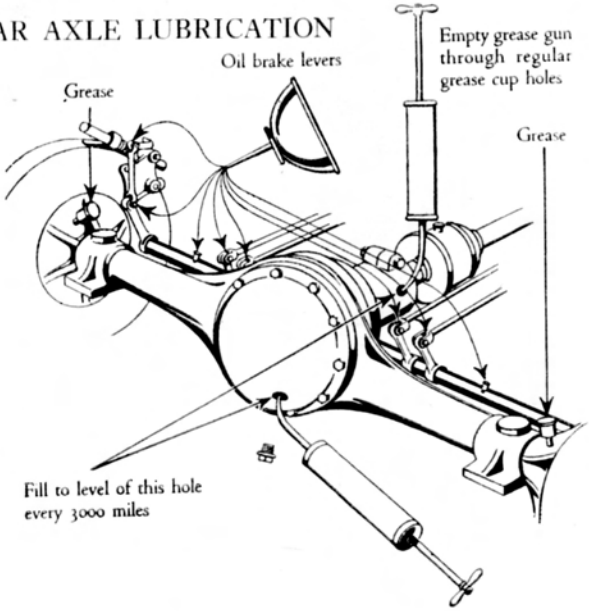
UNIVERSAL JOINTS



Universal joints are worked very hard and if neglected will wear rapidly, be noisy and require expensive replacement. In spite of their unavoidable inaccessibility fill with grease every 2000 miles



REAR AXLE LUBRICATION



What We Recommend for the Lubrication of the Essex

Motor Lubricating Oil

Use light oil in the winter and medium light in summer.	Initial filling 5 quarts.

We recommend any good standard brand of oil.

Drain and refill oil reservoir every 700 to 1,000 miles. For detailed instructions, see page 17.

Clutch

Regular lubricating oil mixed with kerosene in equal proportions.	Requires ½ pint.

Transmission

Whitmore Compound No. 7 or 600w steam cylinder oil.	Fill until compound reaches overflow plug hole in right side of transmission case.

Universal Joints

Whitmore's Compound No. 45, Whitmore's Special Universal Joint Composition or Steam Cylinder Oil 600w.	Fill joints every 2,000 miles, using grease gun.

Rear Axle

Whitmore's Compound No. 45 or 600w steam cylinder oil.	Fill until compound reaches overflow plug in rear cover.

Steering Gear

Whitmore's Compound No. 5.	Fill case.

Starter and Generator Bearings

3 in 1 Oil.	A few drops every few hundred miles.

Horn Bearings

3 in 1 Oil.	A few drops every month. See page 26.

Wheel Bearings

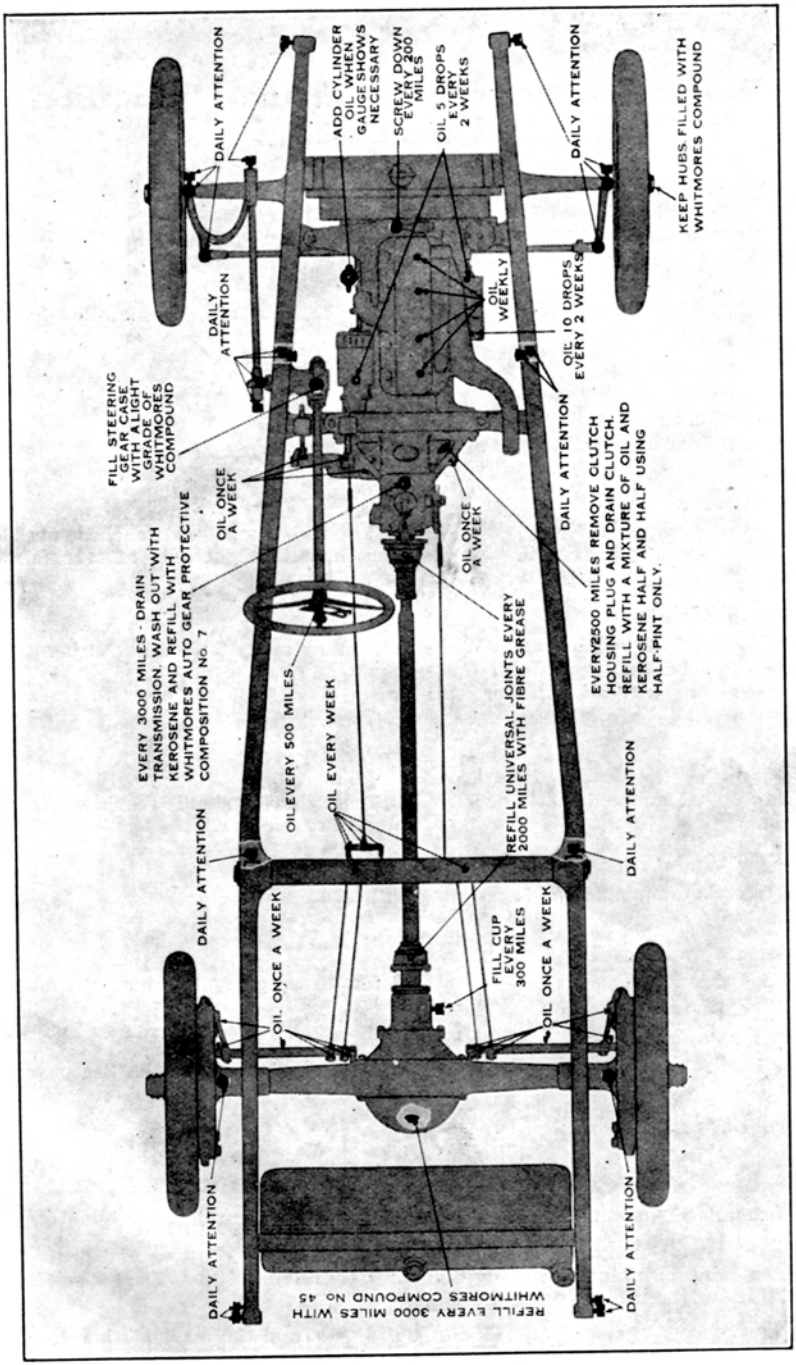
Use Yellow Cup Grease.

All Other Grease Cups

Whitmore's Compound No. 5.	Keep filled. Turn down frequently.

Whitmore's Compounds can be obtained through distributors and dealers, or from the Whitmore Manufacturing Company, Cleveland, Ohio. They specialize in small tins for the use of owner drivers.

The Compounds Nos. 7 and 45 can be drained from the transmission and rear axle and used over again after straining through No. 50 wire mesh cloth. This strainer will be supplied by the Whitmore Manufacturing Company.


DAILY ATTENTION
ADD CYLINDER OIL WHEN GAUGE SHOWS NECESSARY
SCREW DOWN EVERY 200 MILES
OIL 5 DROPS EVERY 2 WEEKS
DAILY ATTENTION
KEEP HUBS FILLED WITH WHITMORES COMPOUND
DAILY ATTENTION
OIL WEEKLY
OIL 10 DROPS EVERY 2 WEEKS
FILL STEERING GEAR CASE WITH ALIGHT GRADE OF WHITMORES COMPOUND
OIL ONCE A WEEK
DAILY ATTENTION
OIL ONCE A WEEK
EVERY 3000 MILES - DRAIN TRANSMISSION. WASH OUT WITH KEROSENE AND REFILL WITH WHITMORES AUTO GEAR PROTECTIVE COMPOSITION No. 7
EVERY 2500 MILES REMOVE CLUTCH HOUSING PLUG AND DRAIN CLUTCH. REFILL WITH A MIXTURE OF OIL AND KEROSENE HALF AND HALF USING HALF-PINT ONLY.
OIL EVERY 500 MILES
OIL EVERY WEEK
REFILL UNIVERSAL JOINTS EVERY 2000 MILES WITH FIBRE GREASE
DAILY ATTENTION
DAILY ATTENTION
OIL ONCE A WEEK
FILL CUP EVERY 300 MILES
OIL ONCE A WEEK
DAILY ATTENTION
DAILY ATTENTION
REFILL EVERY 3000 MILES WITH WHITMORES COMPOUND No. 45

Motor Oiling System

The Essex motor employs the constant level circulating splash type of lubrication. The oil is lifted by a plunger pump and distributed to all bearings and moving parts. See illustration, page 16. The oil upon reaching the connecting rod troughs is splashed by the dippers attached to the connecting rod, and the spray serves to lubricate the pistons, cylinder walls and all bearings. The oil is carried back by an arrangement of gutters and is finally returned to the reservoir where it is cooled, ready for use again. The illustration, page 15, shows clearly the route of the oil in making a complete circuit.

It will be seen by looking at the illustration, page 16, that the stroke of the oil pump, and consequently the amount of oil circulated, is controlled by an eccentric. Through a simple arrangement of levers and rods this eccentric is in turn controlled by the foot accelerator and throttle control in such a manner that the quantity of oil pumped varies directly with the demands being made upon the motor.

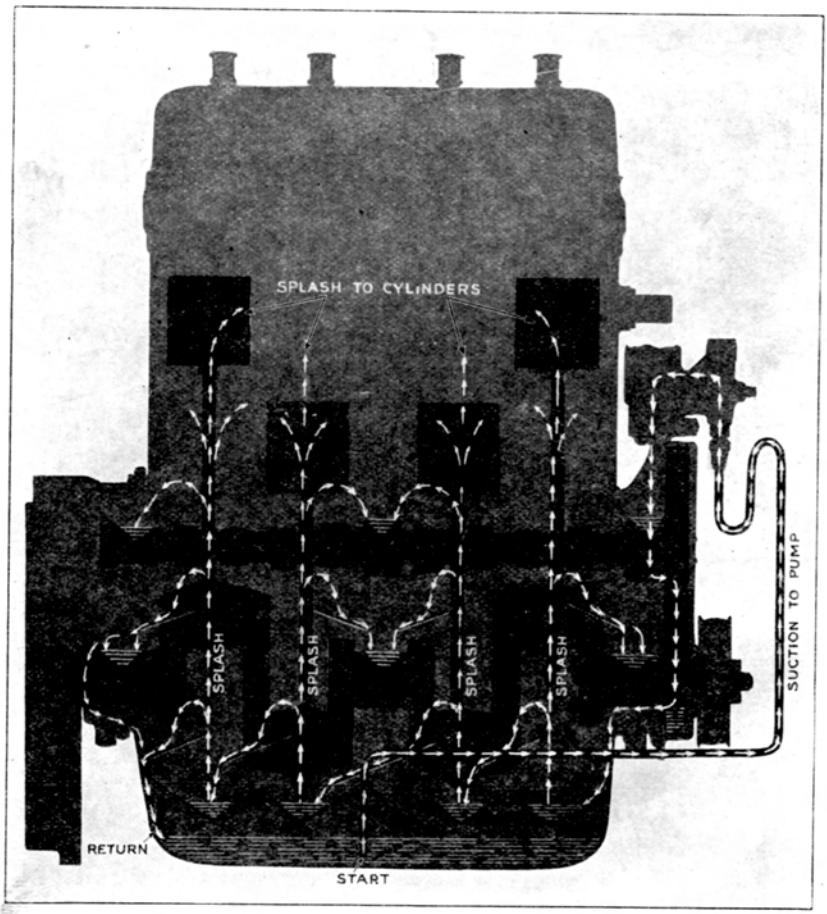
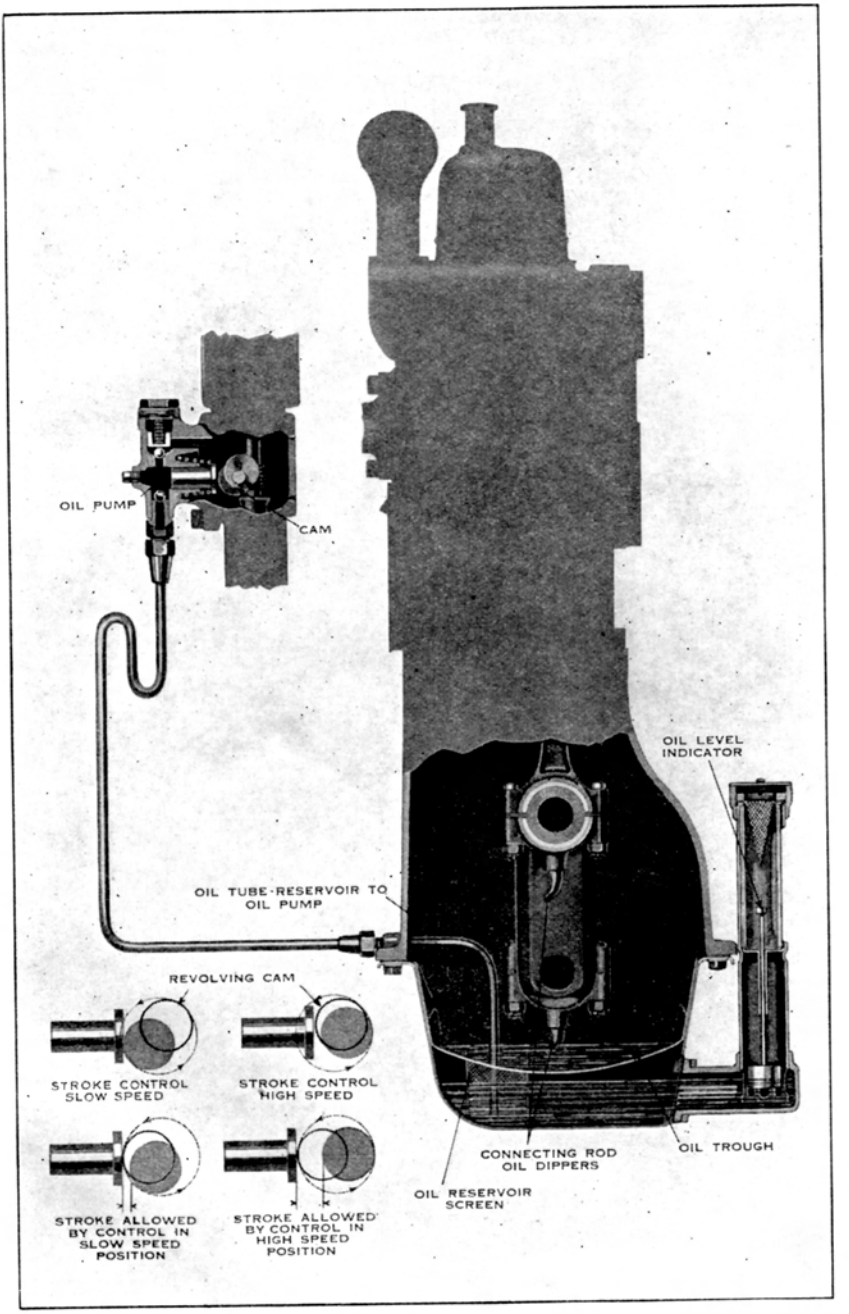


Diagram Showing Travel of Oil Through Motor



Details of Oiling System

The oil pressure gauge on the instrument board indicates whether the oil pump is functioning or not. Failure of the gauge to register indicates one or more of the following conditions existing: Lack of oil in reservoir, dirty oil,—preventing pump valves from working properly,— air leak in one of the pipe lines, faulty adjustment, or improper tension on spring located above the upper check valve. Very often irregularities are caused by small pieces of foreign material lodging under the valve seat, but the simple expedient of priming the pump will often dislodge them and restore the action.

Changing the Oil

The efficiency of the oiling system is dependent entirely upon having the necessary quantity of CLEAN HIGH GRADE OIL OF MEDIUM LIGHT BODY in the crank case. After a few hundred miles of use, lubricating oil becomes contaminated with water and gasoline to such an extent that it is almost worthless as a lubricant. Adding new clean oil to dirty diluted oil is not economy, because the efficiency of the new oil is immediately reduced in proportion.

Experience has shown us that the average owner is very negligent in keeping the oil in proper condition, and we wish to point out the absolute necessity of frequently changing the entire contents of the reservoir. If this is done every few hundred miles, the life of the motor will be increased and its operation will be quieter and more satisfactory; the small outlay necessary will be many times repaid.

To insure proper lubrication, this old oil must be drained off and replaced entirely with new. To do this, proceed as follows:

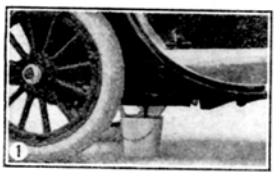


Fig 1

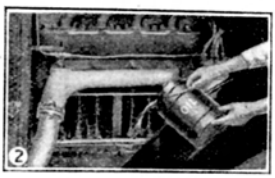


Fig 2

1. Remove the drain plug from the bottom of the oil reservoir and drain off all oil. Fig. 1.

2. Remove valve tappet cover completely and pour one quart of clean oil slowly into the tappet compartment. (Fig 2.)

Fig 3

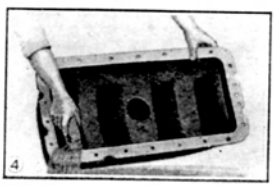
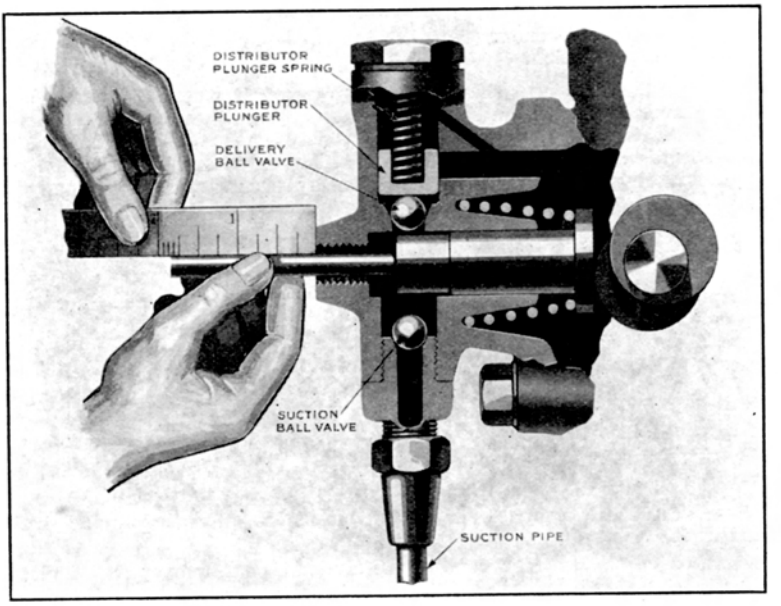


Fig 4

3. Crank motor for 30 seconds, (Fig. 3), but do not let it run on its own power. Then replace drain plug and pour one gallon of oil into reservoir.

When a new motor has been operated for about 300 miles, it is advisible to remove the oil reservoir, thoroughly clean it out (Fig 4), and then refill the system with fresh oil, using no more than five quarts. Before bolting the pan back to position, be sure and fill the dip pans in the upper trough. When tightening pan be sure and do so uniformly so as not to spring the pan and cause oil leaks.

Adjustment and Inspection The reading on the oil pressure gauge on the instrument board does not show the quantity that is being delivered to the motor. The reading on this gauge is affected by the tension on the distributor plunger spring. (See illustration, page 18.) Stretching the spring increases the tension of the distributor plunger, and consequently increases the reading of the gauge. Shortening the spring will reduce the reading on the gauge. The only way to know the amount of oil that is being delivered is to check the stroke of the oil pump itself. With the motor running idle, the stroke should not be less than 3/32". If the car is going to receive exceptionally hard driving, 1/8" stroke or a little more is allowable. The stroke can be checked as follows:

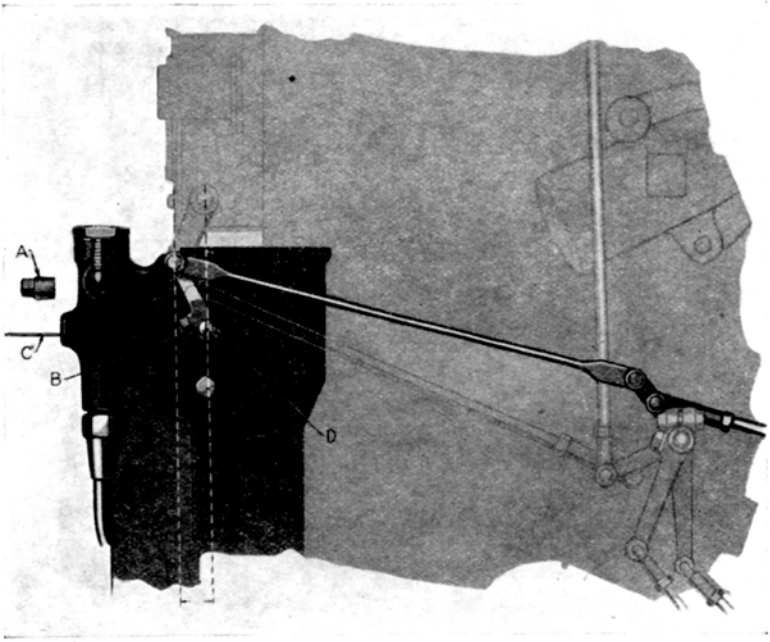


Remove the small pipe plug on the front of the pump. Start the motor and allow it to run at idling speed. Insert a straight piece of wire, so that it rests against the end of the plunger. The wire will now travel in and out with the plunger and the stroke can be accurately checked. (See illustration, page 18.)

If the stroke is more or less than the proper setting, it can be readjusted as follows:

Loosen clamp nut "B" and turn regulating shaft "D" to the right or left until the wire "C" records that the proper stroke has been attained. The clamp nut "B" may then be tightened and a little oil should be squirted into the pump with an oil can before the plug "A" is returned to place and tightened. (See illustration, page 19.)

Make sure that all the oil pump connections are thoroughly tight. Should the control shaft lever become loose on the regulating shaft, the oil pump will not work. It is also essential that no air or oil leaks exist in any of the pipe lines. If they do, the pump will stop. Keep all pipe connections carefully tightened.



How to Adjust Stroke of Oil Pump

General Care of the Motor

Running a New Motor Do not run a new motor at high speed for any length of time. During the process of limbering up and running in, it is advisable not to exceed 30 miles per hour.

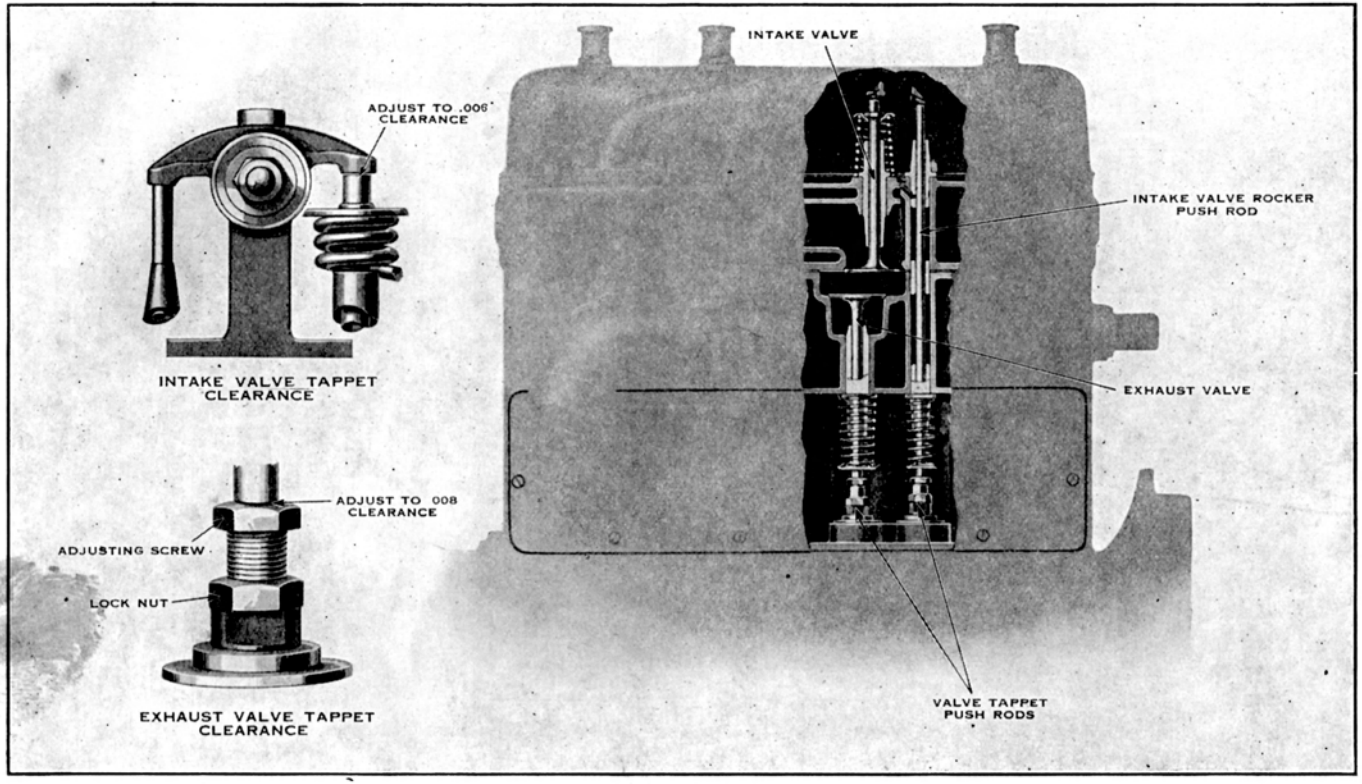
Loss of Power Loss of power may be due to dragging brakes, flat tires, improper lubrication, and similar irregularities. Be sure that these things are in order and that the car coasts or rolls easily before altering the motor adjustments in any way. The power of the motor is affected by: carburetion, loss of compression, carbon deposits, adjustment of tappets, valve and ignition timing and temperature.

Maintaining Compression Poor compression is usually caused by tappets riding because of insufficient clearance or carbonized and pitted valves. See that the inlet and exhaust valves show a clearance of .006 and .008 inches respectively when warm.

To test the compression in the cylinders, open the throttle and test each cylinder in turn with the hand crank. If the valve tappets are properly adjusted and the compressions are unequal or weak, it will be necessray to regrind the valves.

To remove cylinder head, proceed as follows:

1. Drain water from cooling system and remove upper radiator hose.
2. Remove overhead cover by taking out the two retaining cap screws.
3. Take off water manifold by removing the eight nuts and washers which hold it down.



Valve and Tappet Adjustments

4. Remove the cylinder head hold-down stud nuts and lift head straight up, being careful not to bend or strain the overhead valve stems.

Spread some valve grinding compound on the valve and replace it in the seat from which it came. This is very important. The valves are numbered to facilitate their proper return. A light spring of just sufficient height to hold the valve off its seat should be placed under the head before grinding. A screw driver or brace may be used for grinding, but if the tool is heavy, do not bear any additional pressure on the valve; otherwise, the seat may become grooved and ruined. The valve should be given about one-third of a turn back and forth for about one dozen times. Allow the spring to lift the valve off its seat, move it around a little and repeat. The operation is finished when all grooves and pits have been removed and the surface presents a frosty appearance. Before replacing cylinder head, remove all traces of carbon which has accumulated.

Carbonized Cylinders Carbon deposits may be caused entirely by too much gasoline entering the combustion chamber. The carburetor adjustment on the dash enables the operator to control the amount of fuel, and the gasoline regulating button should always be carried as close to the instrument board as possible. In order that all the fuel will be fully vaporized and consumed, the motor should be kept hot by the use of the radiator shutter. If the above does not prove effective, thoroughly inspect the carburetor. See that the packing gland nut is tight and that no dirt in the gasoline is holding the inlet valve open, thus flooding the carburetor. (See carburetor instructions on page 31.

Lubricating oil which has become diluted with gasoline will pass the pistons and cylinders easily, thus forming carbon deposits. Dilution of the oil can be minimized by running the motor hot with a lean mixture. Change the oil frequently as we recommend.

To remove carbon deposits, the head of the motor should be taken off as instructed for grinding valves.

General Inspection The following inspection should be given the motor and car periodically:

Remove spark plugs, clean them and set the points from .025 to .028 inches.

Check tappet clearences. (See page 20.)

Inspect ignition distributor. (See page 26.)

Adjust fan belt tension if necessary.

Change oil in motor. (See page 17.)

Drain water and sediment from vacuum tank.

Drain carburetor bowl.

Drain cooling system (when water is used), flush out and refill.

See that motor bolts are tight. Vibration in the motor will often be traced to loose motor bolts.

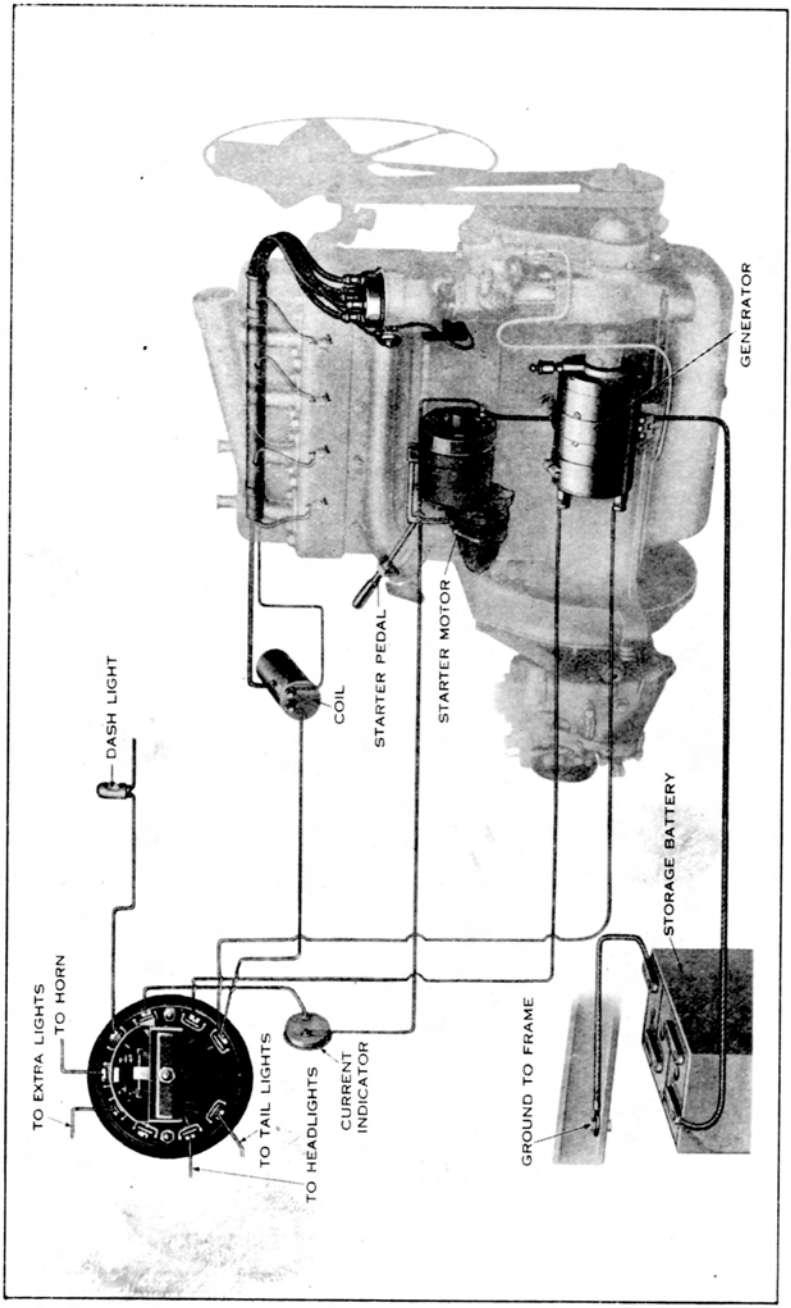
Tighten spring clips. (See page 42.)

See that spring shackles are adjusted properly. (See page 43.)

Inspect brakes. (See page 39.)

Lubricate the door hinges with a few drops of 3 in 1 Oil.

Lubricate generally. (See lubrication chart and general instructions on pages 9 to 14.)



Electric Wiring Diagram

The Electrical System

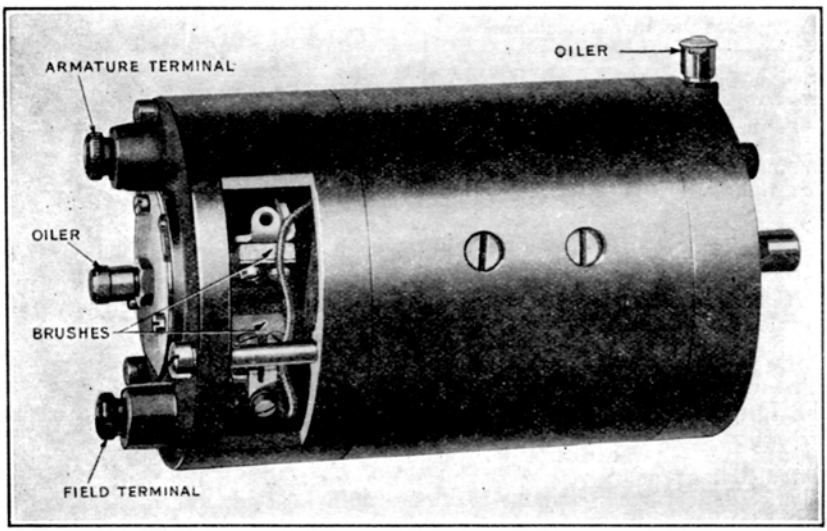
Starting Motor The starting motor is mounted on the left-hand side of the motor and is attached to the flywheel housing. When the starting button is depressed, it first meshes the starting gear with the flywheel and then brings the motor brushes in contact with the motor commutator, thus closing the circuit and causing the motor to revolve.

Lubrication and Inspection The oilers should receive a few drops of 3 in 1 Oil every few hundred miles. The starter gears should be lubricated with very light cup grease which can be inserted when the small plug has been removed on the side of the starting motor gear housing.

Keep connections clean and tight.

Do not attempt to oil the commutator or brushes.

Generator The generator supplies all the electrical energy for charging the storage battery and operating the lights, horn, ignition and starting motor. It is located on the right-hand side of the motor and is driven by a shaft extending from the front gear compartment.



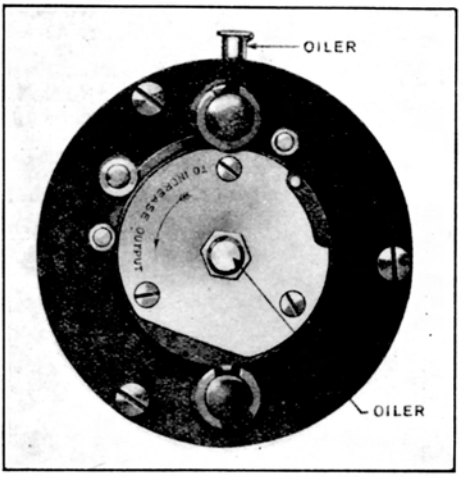
The Generator

The generator is provided with means for adjusting the charging rate, but this should not be tampered with under any circumstances, unless under ordinary operating conditions the battery fails to keep properly charged. This adjustment consists of changing the location of the third brush on the generator which automatically controls the pressure of the current in the generator fields thus regulating the output. Its action is such that the current rapidly increases up to a car speed of about twenty-five miles per hour, and when driven faster than this the current output reduces proportionally. It will be seen, therefore, that the maximum current is delivered at average driving speeds and so, when touring over long distances at a fairly high rate of speed, there is not much danger of overcharging the battery.

Frequently hydrometer readings should be taken when touring and if the battery shows indication of overheating or overcharge, it is advisible to run part of the time with the head lights turned on, thus providing an outlet for the excess current.

This third brush is regulated in the following manner: By referring to the end view of the generator, you will see that there is a bearing retaining plate provided with three screws. On this plate is marked an arrow showing the direction which the plate should be turned in order to increase the output. Turning the plate in the opposite direction will reduce the output. As it is imperative that the generator output should never exceed sixteen amperes, it is advisible to have this adjustment made by an experienced electrical mechanic who will couple up an ammeter directly off the generator and regulate the output accordingly.

Whenever the position of the third brush has been changed, it is necessary to sand it on the commutator by drawing a strip of fine sandpaper between the brush and the commutator while holding the brush down tightly.



End View of Generator Showing Details of Current Regulation

Lubrication and Inspection

The oilers should receive a few drops of 3 in 1 oil every few hundred miles.

Commutator may be cleaned by holding a piece of 00 or 000 sandpaper against it while it is revolving.

Keep generator clean and all connections clean and tight.

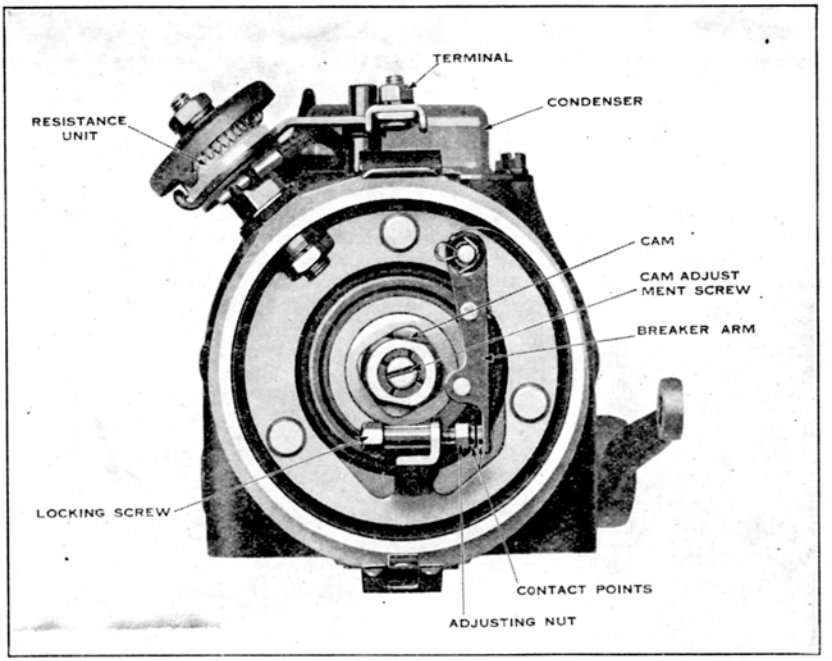
The Ignition System

The system consists of a distributor or timer, coil, condenser and a resistance unit.

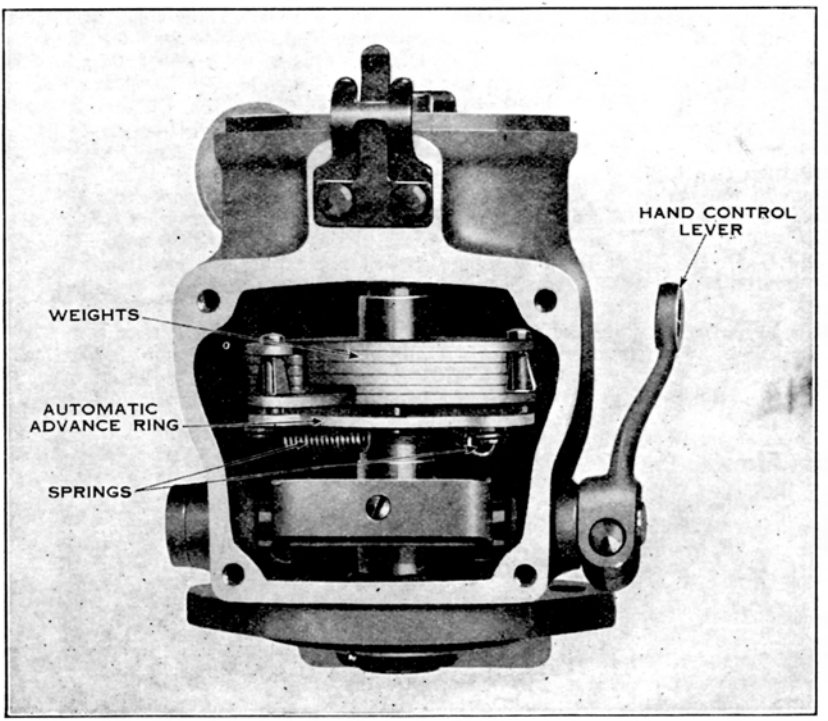
The distributor timer is driven by a vertical shaft and is located directly above the oil pump at the front end of the motor. On it is mounted the condenser and the resistance unit. The condenser is for the purpose of increasing the voltage of the high tension current and protecting the contact points in the distributor against burning. The resistance unit limits the amount of current that can pass through the system, thus protecting the coil and the wiring. A spark control governor is built in the distributor assembly, and by the action of centrifugal force it automatically advances or retards the ignition, according to the motor speed. This relieves the driver of the majority of spark lever manipulations, it being only necessary to retard the spark lever on the steering wheel quadrant when necessary, as indicated by a knocking in the motor.

Timing the Ignition

Referring to the diagram of the distributor, it will be seen that the cam which makes and breaks the contact points is adjustable. To move the cam it is necessary to loosen the screw in the center of the shaft. Before attempting to time the motor, see that the contact points are clean and set at a clearance of .018″.



Top View of Distributor Showing Contact Points



Distributor Housing Showing Details of Automatic Advance

Turn motor over slowly with hand crank until No. 1 cylinder is on compression stroke. To determine this, remove other spark plugs and turn until you feel the resistance of compression. Turn motor over very slowly until the pointer on the observation hole on the flywheel case is directly over the mark D. C. 1-4 which is stamped on the flywheel. See that the button on the rotor is directly under the contact in the distributor cap which leades to No. 1 cylinder spark plug. Loosen set screw at center of cam and turn the cam until the contact points just start to separate. When checking the result, the cam should be held on tension in the opposite direction to rotation and the back lash in the gears should then allow the points to start to separate when the cam is rocked back and forth. Then tighten the screw. Rub a very small quantity of vaseline on the track in the distributor cap, around which the contacts are spaced, and then rub off the free vaseline. Replace rotor and distributor cap.

Attention Keep contact points clean and set at a clearance of .018". Use fine sandpaper for cleaning points. The small sandpaper discs used by dentists are excellent for this purpose.

Keep distributor cap track polished with vaseline. (Use sparingly).

Do not allow oil or dirt to accumulate on the contact points.

The distributor cap and high tension wires should always be clean and dry.

The resistance unit should be kept clean and all connections tightened.

If the contact points are badly pitted, have them replaced by a competent mechanic.

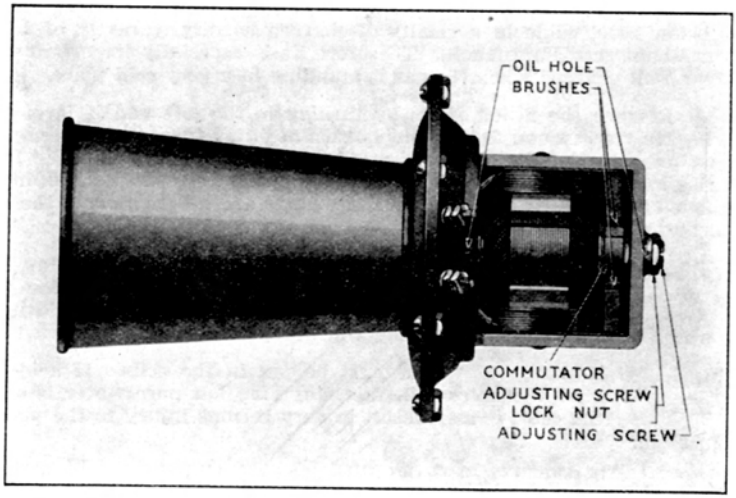
The Switch and Circuit Breaker The combination switch is located on the instrument board and controls all ignition and lighting circuits. On the back of the switch is located a circuit breaker which serves as an alarm or signal should any short circuit develop in the wiring system. Trouble of this nature instantly manifests itself in a clicking or vibrating noise at the switch. When this occurs place both levers of switch in "Off" position. Then place ignition lever in "On" position. If the circuit breaker does not vibrate, return ignition lever to "Off" and turn lighting lever to the various positions. By the process of elimination you can determine in which circuit the short or ground appears (see wiring diagram.) and it will then be necessary to follow the wire or wires out until the ignition, lights and horn function properly and the circuit breaker does not vibrate. In the Essex Delco system there are no fuses, and, consequently, after the source of the trouble has been remedied, there is nothing to replace.

The Wiring System The type of wiring employed is known as the single wire or grounded return system. The frame and metallic portions of the car serve as wire or means of completing the circuit. This simplifies the wiring system considerably. A wiring diagram is shown on page 22.

The Horn The horn contains a miniature electric motor, and when contact is made at the horn button, this motor revolves at a high rate of speed. A toothed disc is attached to the motor shaft and bears against a button on the horn diaphragm, thus producing the warning signal. The tone of the horn is dependent upon the speed at which the motor can revolve, and this is influenced by the care and attention given the device.

Lubrication Once a month remove the motor cover and drop a few drops of 3 in 1 oil (no other) in the oil holes. See illustration, page 27.)

Moisten a soft piece of cloth with 3 in 1 and hold it on the commutator while the armature is revolving. It will be necessary to have some one depress the horn button. See that the commutator is perfectly clean before returning the cover. Caution—Do not use sandpaper or any other abrasive on the commutator.



Where Horn is Lubricated and Adjusted

Adjustment The tone of the horn may be changed by loosening the adjusting screw lock nut and turning the adjusting screw to the right or left until the desired tone has been attained. Then tighten the lock nut. Do not adjust too tightly. The armature should always turn easily (when turned by the fingers).

The Storage Battery

The normal life of a storage battery can be very much shortened by neglect or abuse. Care of the battery in service can be summed up in the following rules, which, if observed with reasonable care, will result in the best service being obtained.

1. Keep the plates in each cell covered by adding pure water when necessary.
2. Take frequent hydrometer readings in order to determine that the specific gravity of the electrolyte in each cell is correct.
3. Should the hydrometer show that the gravity has fallen in the cells, then operate the car, using the lights and electric starter sparingly until the battery has become recharged. If this is not convenient, have the battery recharged at the nearest Exide Battery Service Station.
4. Keep the filling plugs tight and the tops of the battery clean.
5. Keep the battery connections tight and the terminals coated with vaseline to prevent corrosion.

Adding Water When Necessary Water must be added often enough to keep the plates covered. If the plates are exposed for any length of time they may be seriously damaged. The length of time the battery can go without the addition of water will depend upon the season of the year, the battery requiring attention more frequently in summer than in winter.

In freezing weather when necessary to add water, always do it just before running the car. The reason for this is that water, being lighter than the electrolyte, will remain on the surface and will freeze if the temperature is low enough. If the engine is run immediately after, however, the effect of the charging current will be to thoroughly mix the water with the electrolyte and the tendency to freeze will be avoided.

The electrolyte in a fully charged battery, (gravity of 1.270,) freezes at 80 degrees below zero, while in normally discharged battery, (gravity of 1.150,) it freezes at about zero Fahrenheit. Therefore, it is especially important to have the battery well charged when the car is standing in a very cold place.

To Add Water Remove the filling plugs by turning to the left and if level of electrolyte is found to be below bottom of filling tube, add water by means of a hydrometer syringe, or a very small pitcher, until the level begins to rise in the tube. After adding water, be sure to replace the filling plugs and tighten by turning to the right. If the plugs are not tightened, the electrolyte will flow out of the battery.

Kind of Water to Use The water used must be of reasonable purity, as the use of impure water, if persisted in, will injure the plates. Distilled water, which can be purchased at any drug store, or rain water collected in clean, non-metallic receptacles, is recommended.

Add Nothing But Water Nothing but water must be put in the cells. If acid of any kind, alcohol, or, in fact, anything but pure water is added to the cells, it may result in very serious injury to the plates and may ruin them.

The electrolyte consists of a mixture of pure sulphuric acid and water. Sulphuric acid does not evaporate—water does. Therefore, when the level in the battery becomes low, it means some of the water has evaporated, and for this reason it is only necessary to add water in order to restore the mixture to its former condition.

Should the contents of the battery be spilled through accident, have it refilled and recharged by an experienced battery man.

Hydrometer Syringe

Hydrometer Readings The hydrometer is an instrument used for quickly determining the specific gravity of the contents of the cells. A reading of 1.270 to 1.300 indicates that the battery is fully charged. A reading of 1.225 indicates that the battery is about one-half charged. The gravity below 1.200 indicates that the cells are nearing exhaustion.

Hydrometer readings should always be taken after the car has been run for some time and before water is added to the battery. Unless this is done, a correct reading will not be obtained. Should the gravity be 1.225 or below, it is necessary to use the lights and the electric starter very sparingly until the battery has had an opportunity to build itself up again.

If you are unable to restore it by this procedure, have it examined immediately at the nearest Exide Battery Service Station and allow them to recharge if necessary.

If the hydrometer reading of one cell should be considerably lower than the reading of the other cells in the battery, and if this continues to increase from week to week, it is an indication of trouble in that cell and it will call for expert attention at the battery service station.

If one cell continues to consume far more water than another, it may mean that the jar which holds the plates and solution is leaking, and the final result will be that the acid condition of the cell will become so low that the battery will refuse to function. This must also be corrected by an experienced battery man.

It is well to make it a practice to have your nearest Exide Battery Service Station frequently inspect the battery. You will find them willing to co-operate with you towards seeing that your battery is at all times maintained in perfect condition, and in this manner the expense of upkeep will be minimized.

If you intend to store the car, or have it inactive for some little time, the storage battery will require special attention. If the period of inactivity is not going to be more than one or two months, the battery should have distilled water added to it and should be charged until every cell reads 1.270 or slightly higher. Disconnect the cables leading to the battery and make sure that it is stored in a fairly warm building, free from dampness and dust. If the battery will be out of service for a longer period of time, it should be removed from the car, and stored with the nearest Exide Battery Service Station in order that it will receive proper care and attention necessary during the storage period.

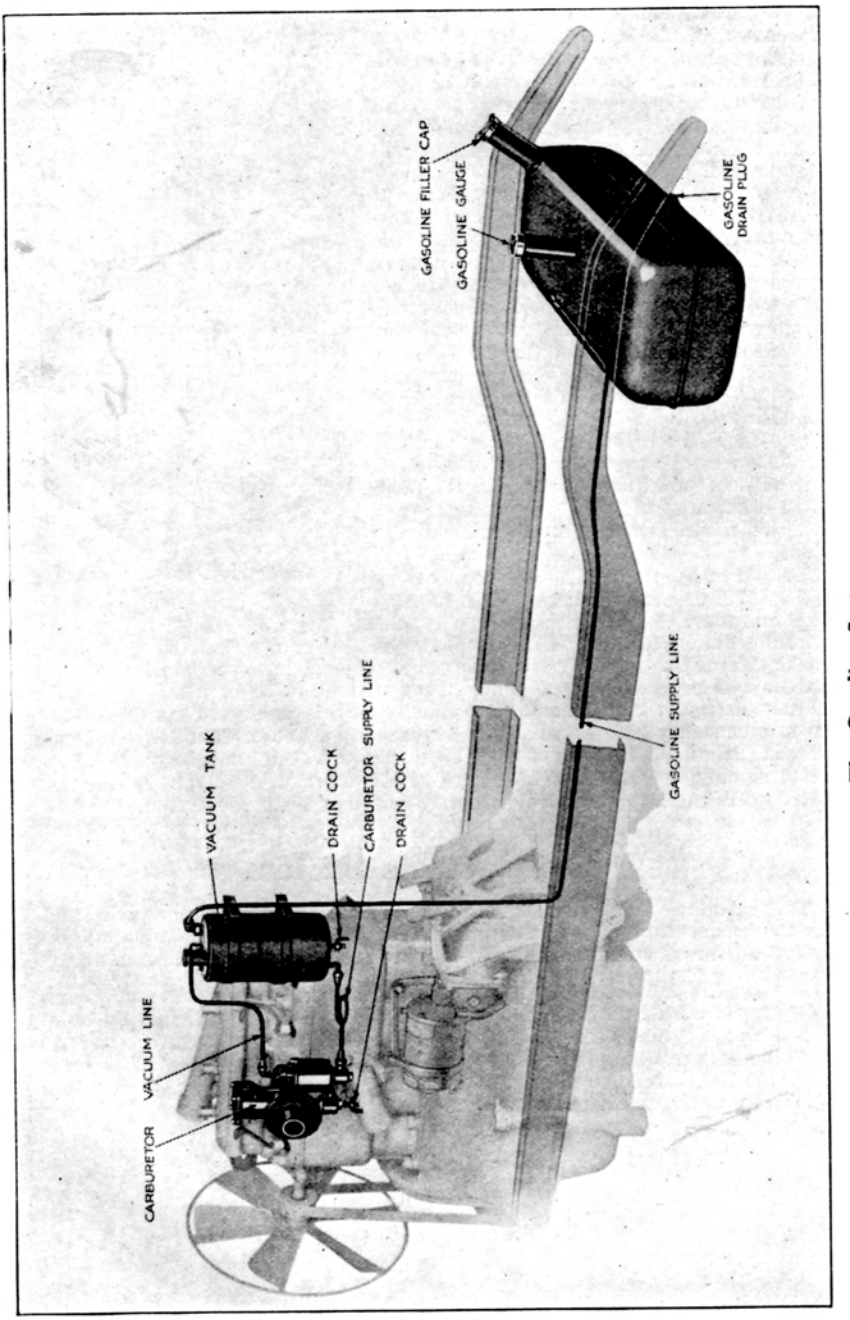
Taking Hydrometer Reading

If this is not practical, then the battery must be fully charged before the storage period and must thereafter receive a freshening charge at least every two months by running the motor until the hydrometer reading shows that the specific gravity is up to the proper point. We earnestly recommend, however, storing the battery with the service station if possible. They will place it on what is known as a trickling charge, which means that the battery is subjected continuously to a very low charging rate of current. Investigation shows that batteries may be kept charged indefinitely by this process, because the charging rate is so low that it is only sufficient to take care of the normal discharge of the battery which is continually going on whether the battery is in use or not.

The Gasoline System

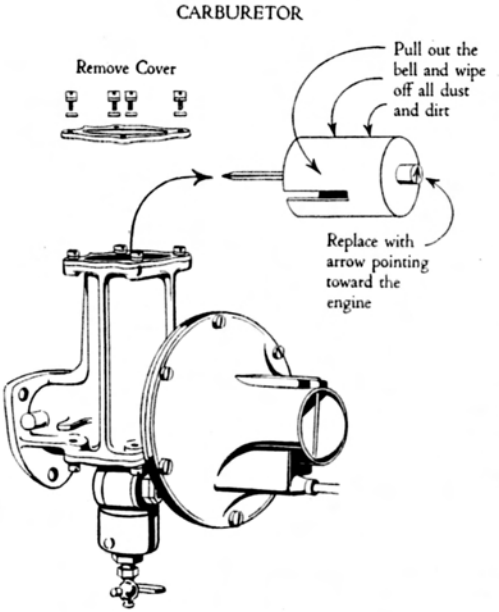
The gasoline system consists of the gasoline tank, vacuum tank, and the necessary connecting pipes. The carburetor is fed from the vacuum tank by gravity and the vacuum tank is replenished from the main gasoline tank.

The gasoline tank is supported at the rear of the car and is of ample capacity. It is equipped with a gauge which shows at a glance how much fuel is contained. When filling the tank, care should be exercised that no foreign matter enters. Should the filler cap be misplaced, it is advisable to tie a piece of cheesecloth or similar material over the filler pipe until the cap is replaced. When filling the tank, always inspect the vent holes in the gasoline gauge to see that they are not clogged.



The Gasoline System

The Carburetor



Any adjustments necessary can be made entirely with the dash controls. The air control adjustment or choke is used only for starting the motor in cold weather, or after it has been standing for any length of time. Once the motor is running, it should be operated with the choke button in and the valve wide open.

The piston can be taken out by removing the four screws and cover on top. The surface should be highly polished with whiting and oil, or jeweler's rouge, and the inner surface of the air chamber should be similarly cleaned. **Caution: Never clean the piston with crocus cloth, emery or sandpaper.** When returning piston, be sure that the grove in the metering pin points toward the motor. The arrow on top of piston will assist you to return it properly. Then carefully replace cover and tighten the four screws. (See illustration.)

To repack or tighten the packing gland nut, it is best to remove carburetor from motor. Then remove drain cock plug, float chamber and lower half of jet housing. The packing gland nut is slotted and can be removed or tightened with a screw driver, or, preferably, by a special wrench which we can supply. When repacking, use soft candle wicking. When this gland is loose the fuel cannot be accurately gauged by the gas button, and the necessity of periodic inspection is therefore apparent.

The carburetor requires no attention other than that of making sure, periodically, that the piston is clean and that the packing gland is tight. (See cut.) A sticking piston will seriously interfere with the action of the carburetor and a loose packing gland will permit excessive gasoline consumption, with its attendant troubles.

The Thermo-Syphon Cooling System

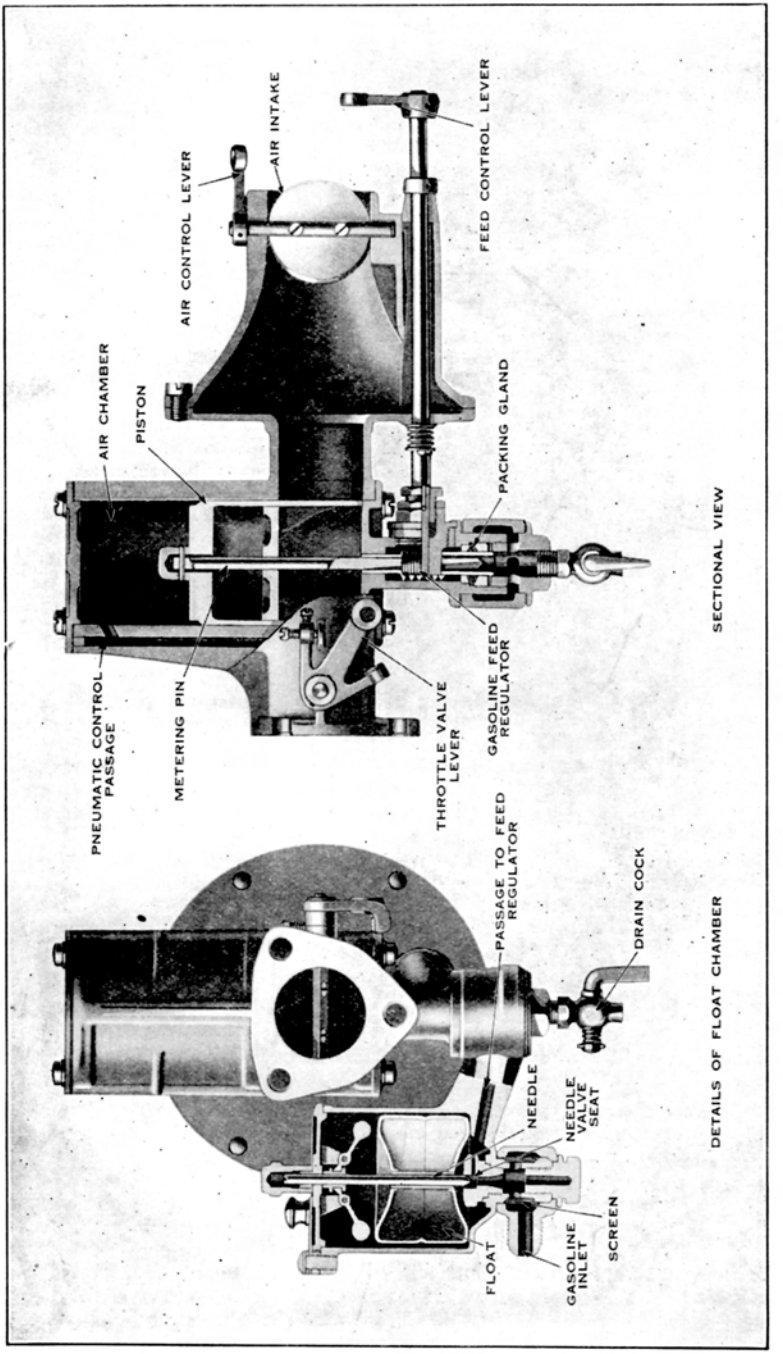
To obtain maximum results with this cooling system, the following precautions must be taken:

1. Have a thorough practical knowledge of the uses of the radiator shutter and motometer which are described elsewhere in this book.

2. The cooling system must always be filled with clear water, preferably rain or soft water.

3. Drain, flush out and refill once a month. Drain plug is in lower water connection, left hand side.

4. See that there is sufficient tension on the fan belt to prevent the fan from slipping.

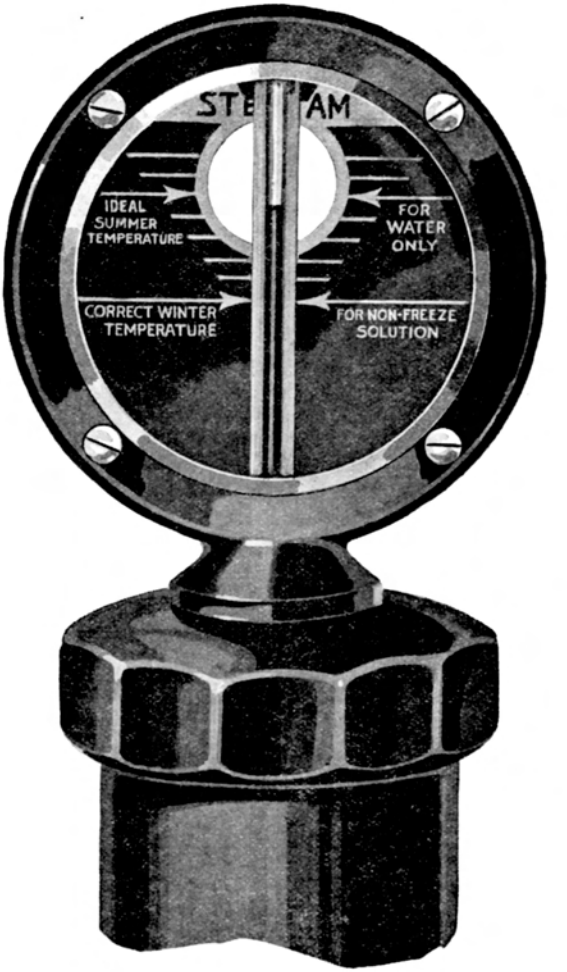


The Carburetor

5. The hose connections must not leak and should present a smooth inner surface.

6. In cold weather use only the anti-freeze solutions we recommend. (See page 45.)

7. Should you damage your radiator and use linseed meal or similar compounds to temporarily stop the leak, remember that most of this material will circulate with the water and lodge in the radiator cells and corners of the cylinder jackets, seriously retarding circulation and it should be thoroughly flushed out, and the radiator properly repaired at the earliest opportunity.



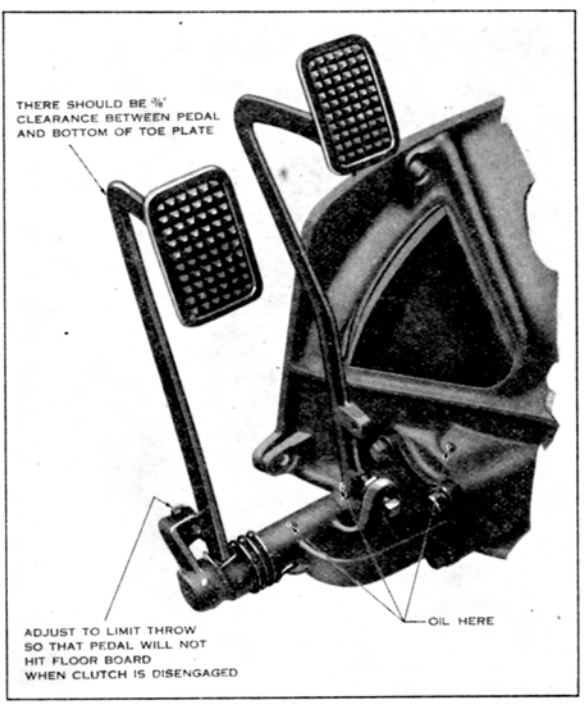
TEMPERATURE CONTROL

Always adjust the Radiator Shutter so as to maintain the red fluid in the Motometer at the points designated, according to cooling fluid being used.

Radiator Shutter

Radiator Shutter

The radiator shutter is for the purpose of properly regulating the motor temperature every month in the year. Do not infer that its purpose is merely to take the place of a conventional hood cover for winter driving. In order to thoroughly vaporize the incoming gasoline, a motor temperature of 175 to 180 degrees is necessary. This corresponds to the reading on the motometer, as shown in the illustration. Always keep the shutter closed until this reading is recorded; then open it only sufficiently to maintain this temperature. If you will do this, you will find that the motor will run upon a considerably leaner mixture and the mileage you obtain from a gallon of gasoline will be entirely satisfactory. In addition to this, keeping the motor warm and running on a lean mixture minimizes the danger of carbon deposits, fouled spark plugs and diluted crank case oil—all of which are more generally caused by running with a cold motor and a rich mixture than anything else.

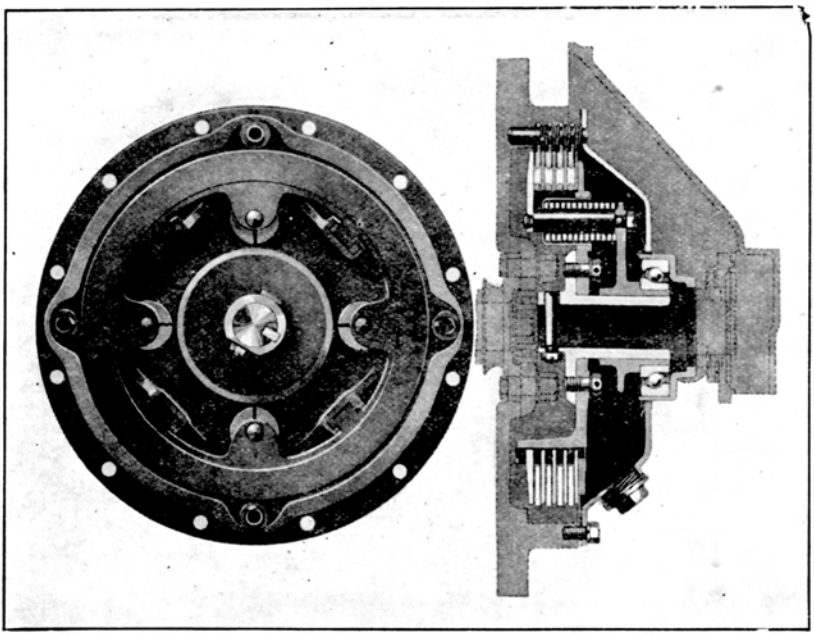


Pedal Adjustment

The Clutch

The clutch is of the multiple disc type, with cork inserts. It is fully enclosed in the flywheel and runs in what is suitably termed clutch oil. The cork inserts become saturated with this oil, and maintain the velvety action so desirable, while the friction between the corks and steel discs is sufficiently great to prevent any tendency to slip. The only care necessary is to renew the clutch oil occasionally, or adjust pedal to allow for natural wear.

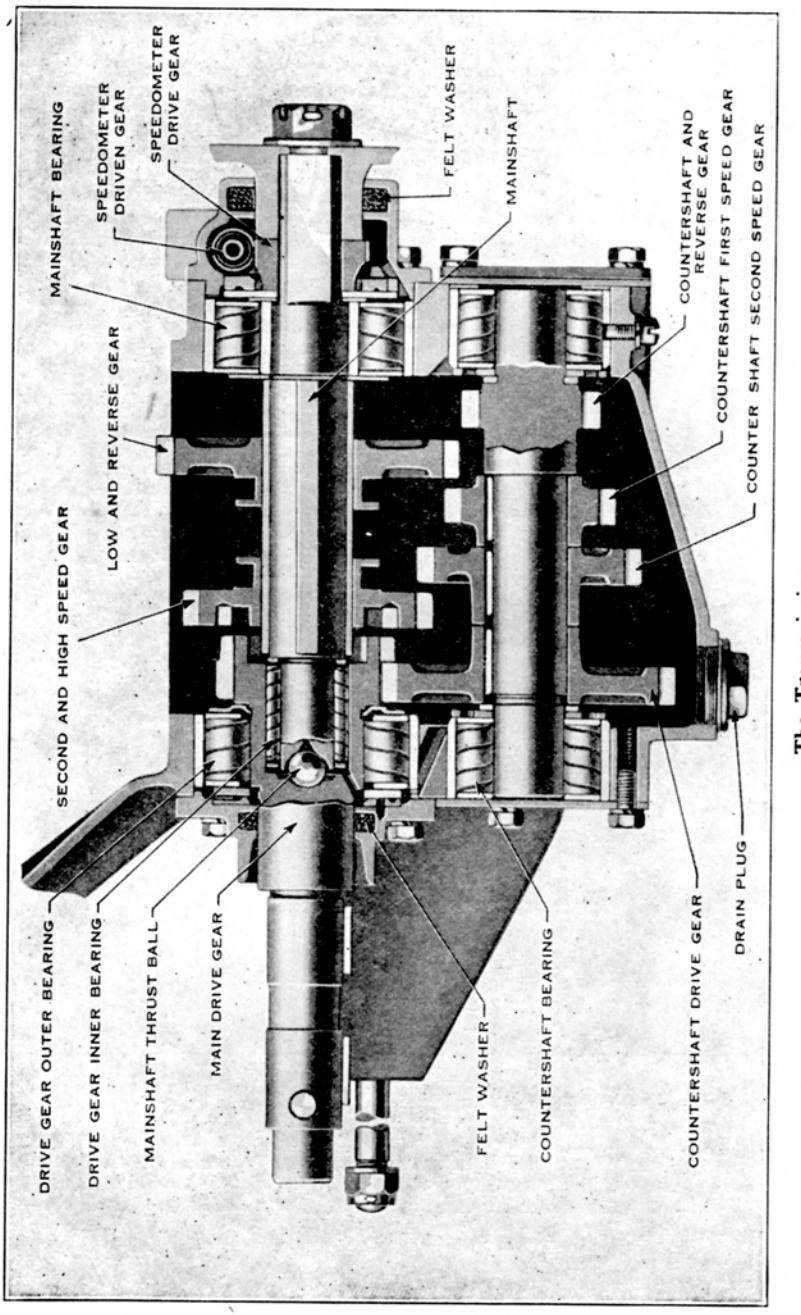
Adjustment When the clutch is fully engaged, there should be a clearance of ⅜" between the pedal and the toe board. The pedal can be adjusted by means of the small set screw and lock nut located on the stop of the clutch pedal shaft itself. Natural wear on the clutch plates will in time cause the pedal to stop farther away from the toe board than usual. When it does, it can be brought back to its original position by means of the above mentioned set screw. If the clutch is worn or abused through lack of lubrication, the corks may swell, causing the pedal to come back nearer the toe board. The pedal should never come any closer to the board than ⅜", or there will be danger of the clutch slipping when a load is placed upon it.



The Clutch

Lubrication The clutch operates in one-half pint of a mixture of kerosene and lubricating oil, in equal proportions. Once a season the old oil should be drawn off, by removing the plug in the clutch housing. The clutch should be flushed with kerosene, drained, and then filled with clutch oil of the proper proportions.

The clutch throwout bearing is lubricated from the transmission. It will receive sufficient lubrication if the transmission oil is carried no higher than the inspection drain plug located on the side of the transmission case. If the



The Transmission

lubricant is carried above this point, an excessive amount will be carried over to the clutch throwout bearing, and may find its way into the clutch itself, thus causing it to slip. The remedy for this is to immediately drain the transmission until the level is just at the inspection plug. Then drain the clutch, flushing it out thoroughly with kerosene in order to remove all traces of the transmission compound, and refill with one-half pint of regular clutch oil.

The Transmission

The transmission is provided with means of adjustment, by which ordinary wear can be compensated for when necessary.

To Adjust Main Shaft Excessive end movement in the main shaft may cause the gears to slip out of mesh when engaged, and will make the transmission noisy. To remove this end play, it is necessary to loosen the cap screws which hold the main shaft rear bearing cap in place, and take out one or more of the shims. When the cap is tightened in place, there should be no more than .004" to .007" end movement in the shaft. There should not be less than .004", or the bearing will cut, through lack of lubrication.

To Adjust Countershaft When excessive end play develops in countershaft, it can be eliminated by removing shims from behind the plate which covers the front bearing and the shaft. Never remove shims from the rear countershaft bearings.

Gears Jumping Out of Mesh This is caused by excessive end movement in shafts (See above), and may also be caused by the interlocks, which engage on the notched shifting shafts, failing to enter the notch and hold properly. The spring should be tested and replaced if weak, and the interlocks or plungers should be set so they fully engage with the notches.

Lubrication For transmission lubrication see Page 11.

Rear Axle

The rear axle requires practically no attention, except the maintaining of the proper quantity and quality of lubricant. (See Page 12.) Should adjustments to the gears be necessary to compensate for wear, or to eliminate any unusual noise, which may be caused by faulty adjustment, always proceed as follows:

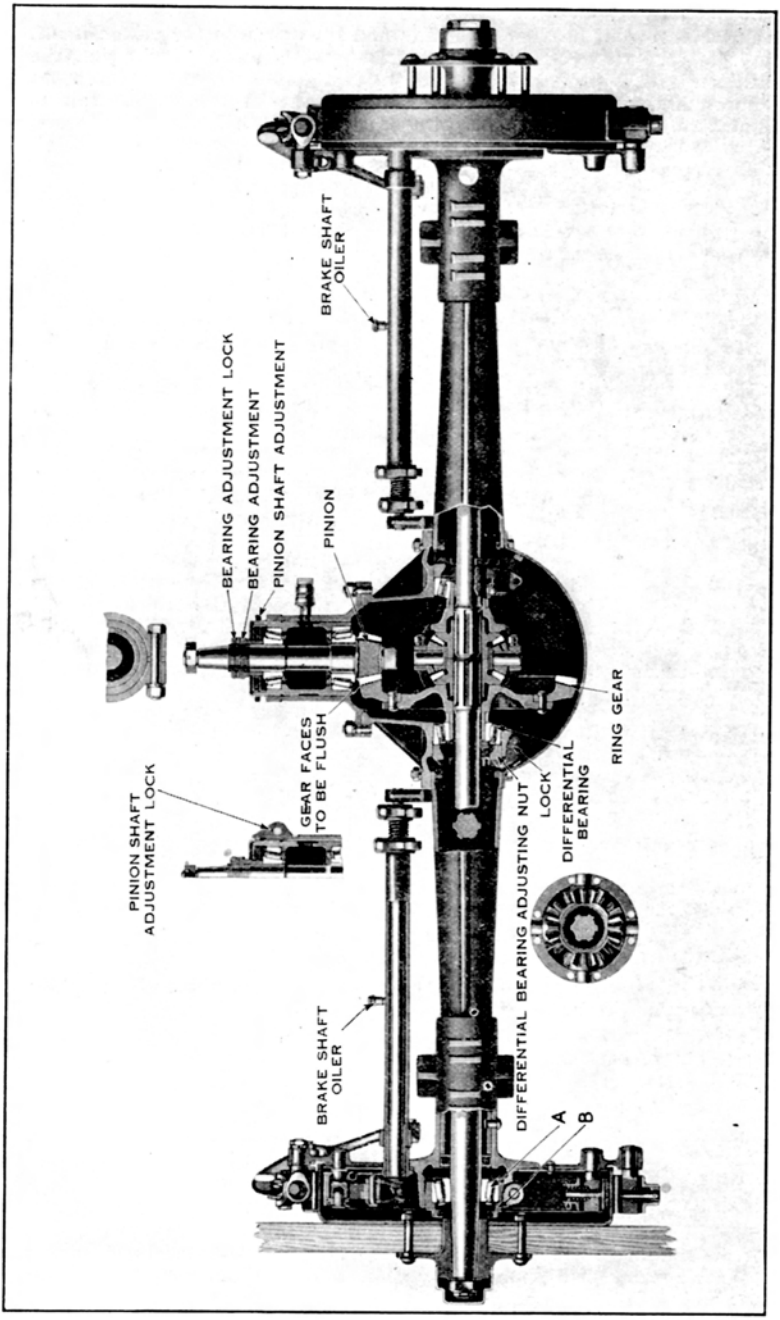
First—Adjust the pinion shaft bearings.

Second—Adjust the pinion so that the back face of the teeth on the pinion and ring gear are flush.

Third—Adjust ring gear to the left or right of the pinion, if necessary, in order to obtain back lash of at least .006" to .008" (approximately). More is permissible if the above back lash does not give satisfactory results.

(See Rear Axle diagram.)

To Adjust the Pinion Shaft Bearings First—Loosen the lock nut, then turn the adjusting nut to the right until a slight friction is felt on the bearings when the pinion shaft is rotated by hand. Then back off the adjusting nut sufficiently to allow about .005" end play after the lock nut has been tightened against the adjusting nut. Extreme care should be taken in this adjustment, as too much end play in the pinion shaft bearings will cause noisy gears and too little play will damage the bearings.



The Rear Axle

Adjusting Pinion So That the Back Face of the Teeth on Both Ring Gear and Pinion Will Be Flush

Remove differential cover plate on the rear of the axle housing. Take off the differential bearing adjustment locks and loosen cap bolts sufficiently to allow the differential bearing adjusting nuts to turn. If there is any side play in bearings, turn nuts up until this is removed, but do not bind. To move ring gear to left, loosen left side nut two notches and turn up right side nut the same. Repeat this operation until the required back lash is obtained. To move ring gear to right, reverse this operation. When completed, return locks and tighten bolts holding bearing nuts in place.

Adjustment of Wheel Bearings

Through usage the wheel or axle shaft bearings shown at "A" in the Rear Axle diagram develop a certain amount of play, due to natural wear. The wheels are rigidly fastened to the shafts by being drawn up on the taper; therefore, the bearing wear will cause side play in the wheels. These bearings may be adjusted as follows:

Remove the wheels. This should always be done with the wheel puller provided; never by striking the end of the shaft with a hammer, as this may injure the bearing.

Remove adjusting nut lock and loosen locking bolt. Take up the adjusting nut "B" until the drive shafts show no end play, but are perfectly free and the bearings do not bind. In making adjustment do not take up all the play from one side. Equalize it by taking up the same amount on each side until the proper result has been obtained.

When returning lock, if the notches do not correspond, back the nuts off until the lock will engage. Do not tighten the nut any more to make lock engage, or too much pressure will be placed on the bearings.

When replacing rear wheels, the key should not be inserted until the wheel has been mounted on the shaft, so that the keyways in both hub and shaft will line properly. Then drive in key until end is flush with hub.

Brake Adjustments

The first thing to take into consideration when adjusting brakes is to be sure that the brake control rods are adjusted so that the maximum braking effect is obtained when the brakes are applied. The rods should be adjusted so that the brake operating levers on the brake cross shaft point to the rear, and the lever which applies the contracting band should rest back against the stop. When you are sure that the leverage has been properly adjusted, then examine the brake bands themselves.

To Adjust Foot Brakes

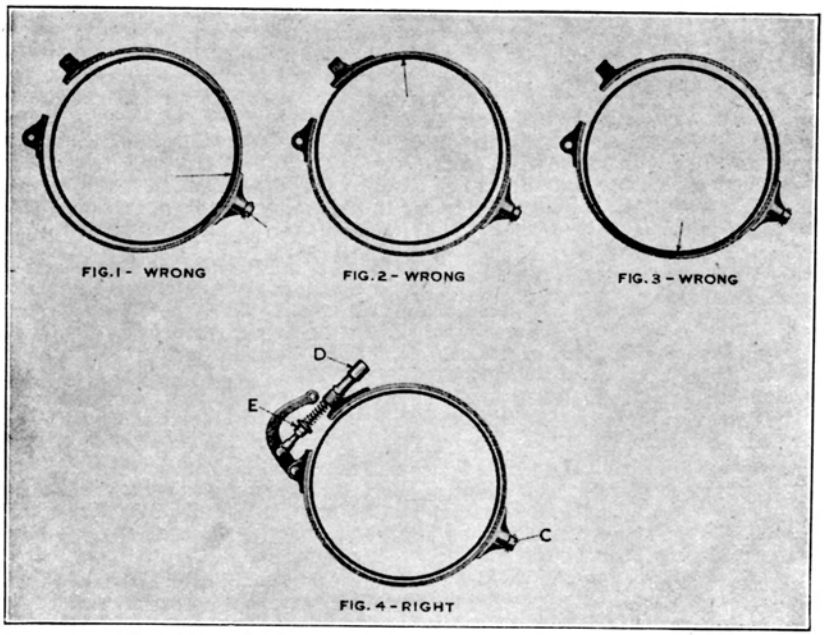
1. Turn adjustment "C" in until the band just clears the drum by the thickness of a thick visiting card.
2. Then turn check nut and nut "E" down, thereby raising the lower half of the band until proper clearance has been obtained.
3. The upper band will now stand away from the drum and can be brought to place by the adjustment nut "D."

Always follow the above procedure in adjusting the foot brake band—first, back; second, lower half; third, upper half.

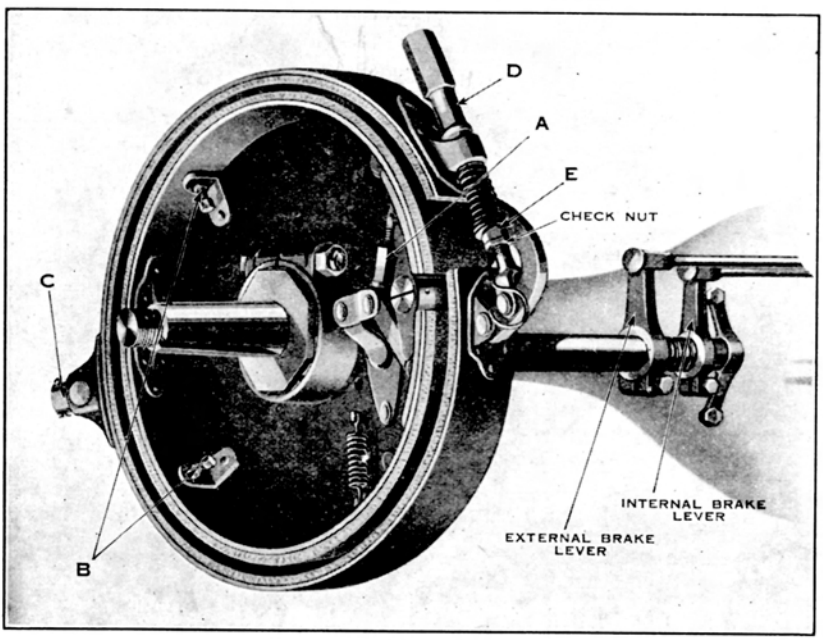
Adjusting the Hand Brake

Each internal brake is provided with set screws and locks, as shown at "B." These are for the purpose of making the band conform to the inside surface of the drum. The wheel may be removed with a wheel puller, and the band adjusted by means of these set screws until the drum will slide over the band snugly and the wheel revolve freely.

It will be noted that the internal brake band can be adjusted by means of the adjustment marked "A." The clevis pins should be withdrawn and the arm



Brake Band Adjustment



Brake Adjustments

"A" lengthened by turning out the clevis. It should not be lengthened enough to necessitate the drum and wheel being forced over it, as the wheel must be free when the hand brake lever is in "off" position. When the proper position has been reached, return clevis pins and secure work with a cotter pin.

If the brakes do not hold until pressure has been applied for several seconds, it indicates that the lining is worn, or the leverage is in need of adjustment. Check leverage before relining.

Steering Gear

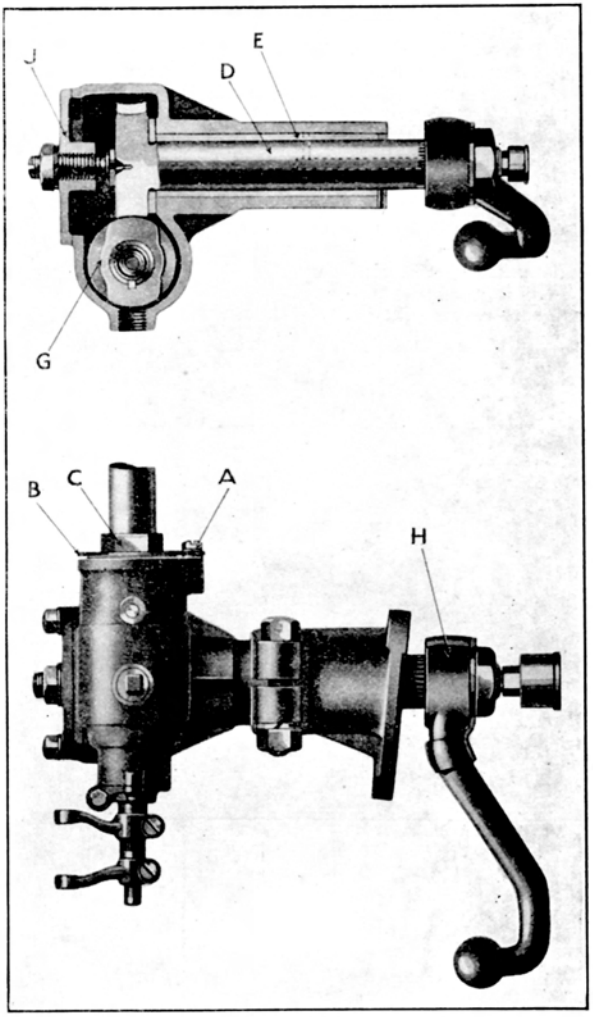
The Essex steering gear has been designed so that wear of any kind can be compensated. The steering gear case should be kept filled with light grade of Whitmore Compound. A heavy lubricant should not be used.

To Remove End Play in Steering Post

Take out locking screw "A" and lift lock plate "B" clear of adjusting nut "C." Adjust by turning the nut downwards until play is eliminated. Replace locking plate in position to bring one of the two holes as nearly in line with the hole in the housing as possible. If necessary, back off adjustment until screw can be entered through one of the two holes in the plate and through the tapped hole in the housing.

To Remove Back Lash or Play in Gears

In order to bring the worm wheel "D" deeper into mesh with the worm "G," first remove the steering gear case from the bracket on frame, after taking off the steering arm "H" and ball. Remove pin at outer end of case near arm, and turn eccentric bushing "E" until the mesh is correct. Then replace pin.



Steering Gear

If worm wheel is worn in one spot, give it about one-third turn and put the steering arm and ball back in new position.

To Remove End Play in Worm Wheel and Shaft Loosen lock nut and turn thrust adjusting screw in until play is eliminated. Then tighten lock nut.

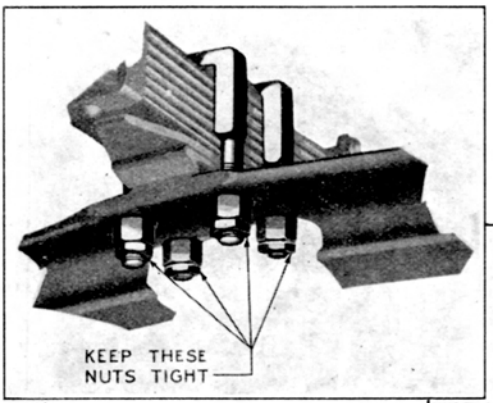
Springs and Spring Shackles

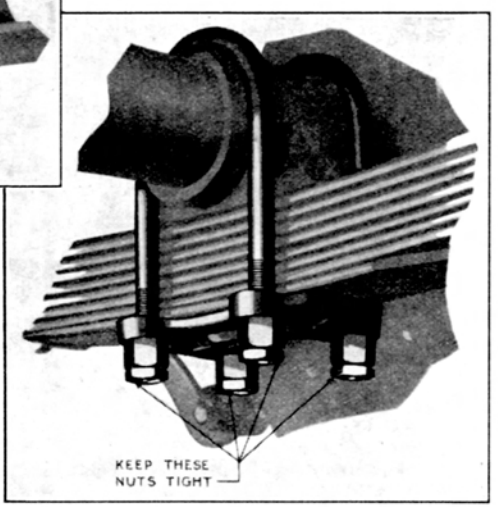
To eliminate squeaks and obtain easy riding, the springs should be lubricated with cylinder oil. Frequent attention with an oil can along the sides of the leaves is recommended. If you hear a squeak, when you step on the running board, the springs need attention.

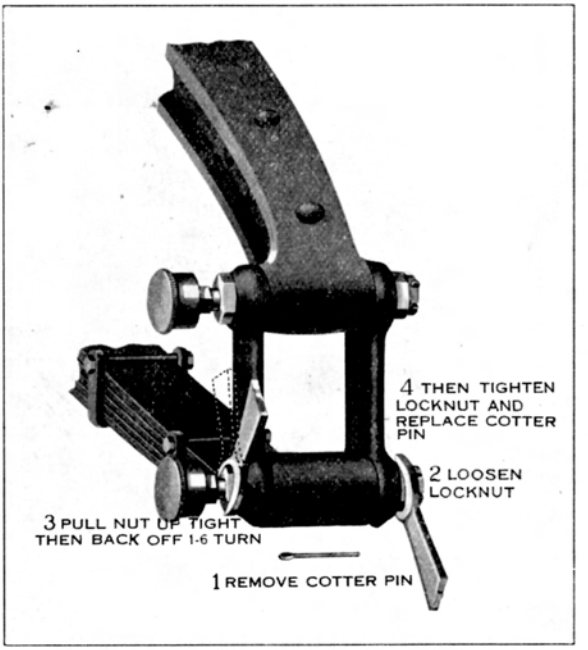
Spring Clips Spring breakage is usually caused by lack of lubrication and loose spring clips—those clips which secure the springs to the axles. It is essential that these clips be inspected regularly for tightness. (See illustration.)

Spring Shackles Spring eyes and shackles are subject to a certain amount of wear, which, in time, will cause a knock or rattle. This side play can be eliminated by loosening up the shackle bolt nut and turning the bolt until the threaded shackle takes up the play. Then tighten nut and reinsert cotter pin. (See illustration.)

Front Ends of Springs To tighten the front end of springs, it is only necessary to remove cotter pin and tighten the nut. Then back nut off one-sixth turn and insert cotter pin.







Spring Shackle Adjustment

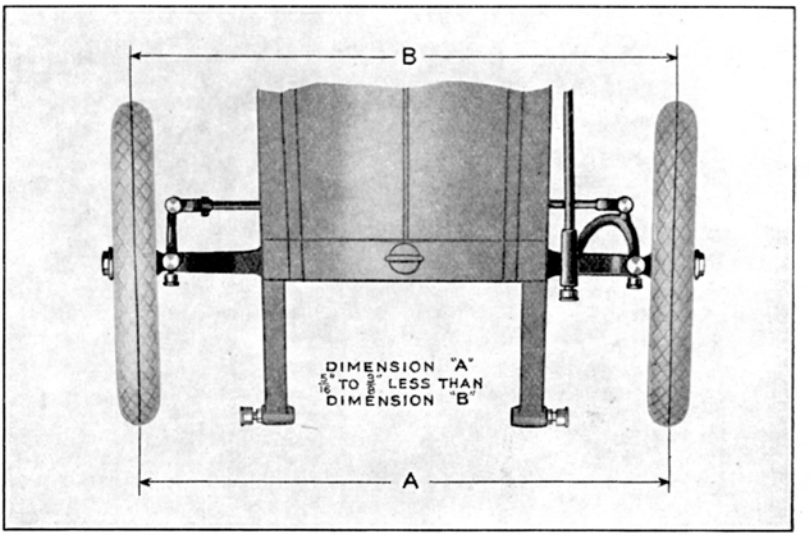
Wheel Alignment

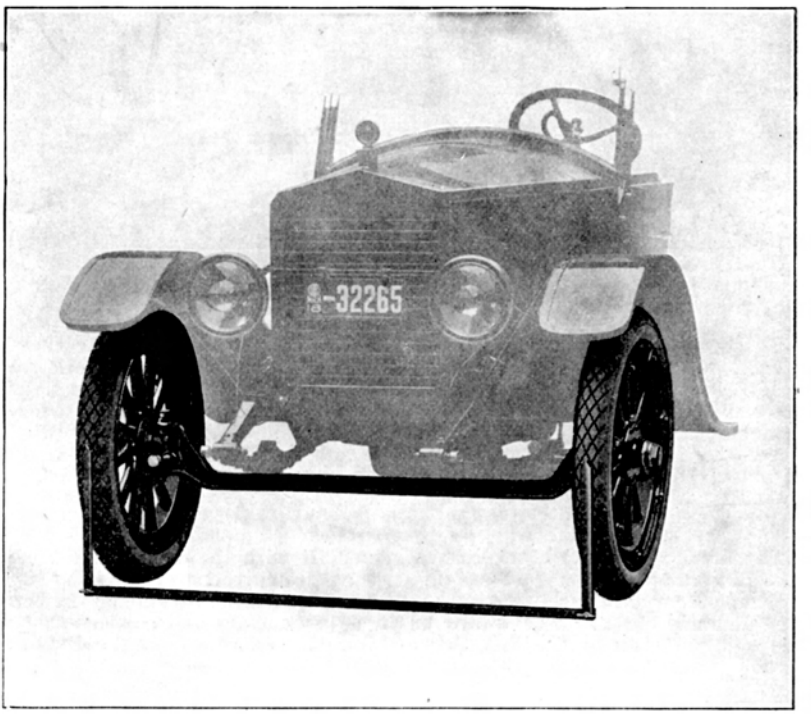
Because the alignment of the wheels is an important factor in the life of the front tires, the distance rod is provided with adjustments. The front of the tires should be about 5/16″ closer together than the rear, measured at the same height from the ground.

To check this adjustment, jack up the front of the car from the center of the axle, so that the distance rod is not interfered with. With both wheels free to revolve, a center line may be marked on each tire by holding a soft lead pencil against it when spinning. The pencil must be held steady or the result will not be a straight line. Next, measure with a tape or stick the distance between these lines at a point opposite the hub; turn the wheels half a revolution and measure again. The distance between the two results is the average, allowing for a slight wobble, and should be 5/16″ to 3/8″ less than the distance measured in the same way at the rear.

The handiest way to check this alignment is with the distance stick shown in the illustration. To adjust the distance rod, remove one of the bolts so that the clamp screw can be loosened and the clevis adjusted by turning on the threads of the distance rod. Any back lash in the axle knuckles and clevises should be taken up by straining the wheels outward in front before setting the distance by the rod.

The job should always be checked after the wheels have been let down on the ground, with the weight of the car on them.





Front Wheel Alignment

Cold Weather Precautions

There are four things which must be taken into consideration when operating the car in freezing weather. They are: Lubrication, danger of freezing the cooling system, difficulty in starting, and the increased attention required by the storage battery.

Lubrication Oils are affected by temperature. Many so-called medium oils become very sluggish in cold weather and are too heavy for the pump to handle. Therefore, in cold weather use nothing but light oil in the Essex. Change at least every 700 miles to prevent scored cylinders, burned bearings, and premature wear. Lubricating oil is rapidly diluted by gasoline and water vapor during the winter months, and becomes absolutely worthless as a lubricant. Avoid the frequent additions of new oil. Better allow the oil supply to get low, then drain off and refill with new. Detailed instructions on changing oil will be found on Page 17.

Danger of Freezing If temperatures below freezing are encountered, the water in the cooling system should be completely drained off if the car is allowed to remain idle for any length of time. Drain plug is in lower water connection, left-hand side of radiator.

If continually operated at low temperatures, an anti-freeze solution should be employed. We recommend the following:

For 5° below zero:

Alcohol	15%
Glycerine	15%
Water	70%
or	
Alcohol	30%
Water	70%

For 10° below zero:

Alcohol	18%
Glycerine	18%
Water	64%
or	
Alcohol	35%
Water	65%

Always adjust the shutters to maintain the motometer fluid at the arrow designated as anti-freeze; close them when the car is standing.

Difficulty in Starting Gasoline does not vaporize easily at low temperatures. It is necessary to increase the amount entering the combustion chamber in order to start a cold motor. This is done by closing the air valve or choking the carburetor by means of the button marked "choke" on the instrument board. It may be found necessary to pull the gas button out farther, thus enriching the mixture, but after the motor is running the gas adjustment button should be returned to the lean position as soon as possible. When using the choke, crank the motor for two or three revolutions with the choke pulled out, then let it go in in order to give the motor air. Then crank by alternately pulling the air button out and letting it go again until the motor starts. Remember that no matter how cold the motor is, it will not start on pure gasoline only, and should you crank continuously with the choke pulled out, it will be flooded so that it will be almost impossible to start it until the spark plugs are removed and dried and the motor cranked with the plugs out in order to get rid of the excess fuel. Be very careful not to choke the motor to excess and you will find starting much easier.

To Insure Easy Starting During Cold Weather Drain the water and sediment from vacuum tank and carburetor every week; otherwise it may freeze and block the flow of gasoline.

See that the ignition distributor is properly adjusted at all times. (See Page 26.)

Keep the motor as hot as is required. See Page 33.) Close the shutter when you stop the car.

Should you ever find the battery nearly exhausted and you have to resort to the hand crank in order to start the motor, proceed as follows:

First—Prime motor by either cranking with the choke pulled out for three or four revolutions, or by removing the spark plugs and pouring about a spoonful of gasoline into each cylinder.

Second—Remove the wire from upper terminal on the generator.

Third—Retard spark, throw on ignition switch and turn motor over with crank.

Fourth—As soon as motor starts, advance spark and then return generator wire to place at once; otherwise the generator may be injured.

The reason why it is advisable to remove the generator wire is that when the ignition circuit is in contact, connection is made between the storage battery and the generator, and when the battery is very low it is best to conserve all the available energy for the ignition only, by temporarily interrupting the generator circuit.

Storage Battery During the winter months lights are burned for longer periods and the starting motor takes more current to crank the motor. This drains the battery more quickly; therefore, have it tested every two weeks. Use a hydrometer in order to be sure that the cells register the proper specific gravity. Let your nearest Exide Battery Station make the inspection and advise you at least every two weeks.

Storing the Car

It is essential to observe the following details in order to prevent depreciation during the storage period.

Building Select a dry building, and preferably one not connected with horse stables. Dampness must be avoided, because in a short time rust will make inroads on the exposed metal parts, which is decidedly detrimental.

Preparation See that the car and chassis is perfectly clean. Drain all the oil from the motor base, replace the plug, and pour one gallon of castor oil in the oil reservoir.

Take out the spark plugs and pour one-half cupful of castor oil in each cylinder. Then replace plugs and wires.

Start motor and allow it to run at a moderate rate of speed for about ten minutes.

Drain all water from cooling system by removing plug in lower water inlet connection at left hand side of radiator.

Turn motor over a few times with starter.

Jack up all four wheels and let the air out of the tires. Cover the tires to exclude light.

Rub a small quantity of vaseline (not grease) on all nickeled parts, hub caps, exhaust manifold and carburetor and spark control rods.

Rub a little vaseline in the joints where the fenders join the splash guards.

Drain off all water and sediment from the carburetor and vacuum tank.

Remove battery from car.

Cover the car completely with some sort of tarpaulin or car cover.

Battery A storage battery gradually runs down when not in use, and if allowed to become exhausted, it may be prematurely ruined. If possible, allow an authorized Exide Battery Service Station to take care of the battery during the storage period. If this is not possible, then follow implicitly the rules laid down under "Storage Battery," on Page 27.

Washing the Car

The car should be regularly and systematically cleaned and renovated. The varnish on a new car is always benefited by an occasional washing with clear, pure water. The car, even when not in active use, should be cleaned at stated intervals. On a new car occasional washing with cold water serves to harden the varnish and increase its brilliancy. During the winter, if the washing is performed in a warm place, the use of cold water for an occasional washing may be continued, but cold water applied in a cold place at a frigid season of the year is injurious to the varnish.

When the car is in daily use or following each period of road service, the varnish should be washed, top cleaned and the interior furnishings of the car renovated.

Things to remember: Never wash the car in bright sunlight. The sun dries the water too rapidly, and causes streaks in the finish. Always use absolutely clean water and change it often. Never turn the hose on the body unless the stream is so broken up that it does no more than spray the body. We advise the use of the pail and the sponge in preference to the hose.

Clean Top First Before starting the washing of the car the top should receive attention. The top can be sponged off with clean tepid water and when coated with road dust or mud this water should contain enough Castile soap to provide sufficient alkali to cleanse. Follow this cleaning by drying with a chamois skin.

Washing the Body Begin washing the body by dipping the sponge well into the water, then begin at the top of the panels and gently dash the water obliquely against the panels. Another way is to squeeze the water out of the sponge at the top of the panels, which loosens the dirty accumulations, and causes them to drop off. These instructions are for cars that are washed immediately after road service.

When Washing is Delayed Provided the car has been put away for the night unwashed, and the mud and other road refuse allowed to dry on to the finish, it will harm the varnish to apply water and attempt to remove these dry, crusty accumulations at once. All such surfaces should have plenty of clean fresh water run down in an easy volume over the finish. Continue this practice until the dirt encrusted surface is thoroughly soaked up. Then let the work stand for 15 to 20 minutes for the water to so act on the body of dirt and mud that under a fresh flow of water it will readily run away without injury to the finish.

In all cases the mud and dirt should be floated off by a natural flow of water, rather than wiped off. This latter practice usually results in the finish being scratched and disfigured by the grit and dirt. It must be understood that a water-loaded sponge drawn or rubbed over a dirty or mud-bespattered panel develops a scouring effect. This diminishes the brilliancy of the varnish and reduces its capacity for protecting the undercoats.

The Second Washing After concluding the first or preliminary washing of the surface, a new sponge and a new pail should be taken in hand and the surface again washed with a fresh supply of clean water. A soft wash brush, oval in form and chisel pointed, should be used to tool around

the surface ornaments, moldings and other attached body fixtures. Such places cannot be effectively reached with a sponge.

Use the same care and precautions in washing the chassis and under no circumstances employ the same tools for the body and the chassis and vice versa. In this way avoid transferring grease and oil stains from one part of the car to the other.

Drying the Body and Chassis

For drying off the water from the body of the car or chassis, use a chamois skin free from lint and absolutely clean. Wring the chamois out after rinsing in clear water, or if dirty after washing out in a solution of soft water and Castile soap. Begin at the first part of the car washed, proceed to pass the chamois over the surface with just sufficient pressure to take up the water with the exception of a mist, which will quickly evaporate.

To attempt to wipe the car perfectly dry in all parts will result in injury to the luster of the finish. An erosive effect on the surface can be produced under the pressure of the chamois and this effect must be avoided at all times.

No car should be left unwashed for more than 24 hours.

Finish Cracked and Spotted By Mud

Mud in its various forms, in drying on a body of varnish, takes up the oil from the varnish, and in so doing destroys the luster. Road dirt or dust picked up on highways largely given to horse travel is often saturated with ammonia, and all such accumulations are destructive to the finish. Such road refuse, if allowed to dry upon the finish, not only spots the varnish, but fractures the film and causes it to decay and crumble away.

Mud and dirt from the roads traversing lime districts are likewise destructive to both the luster and the fabric of varnish, the latter disintegrating under the effects of lime. Some varnishes, or, in fact, a great many of them, will spot under the effects of soapy or dirty water, the alkali and capillary mediums contained in these waters going at once to the luster of the varnish.

The car not systematically and regularly washed will have its finish spotted from the effects of various gases and garage impurities. Many manufacturing cities are so poisoned with deleterious fumes that the finish on the irregularly and infrequently washed car is spotted and deprived of its luster in a comparatively short time.

Care of Enamel on Bonnet Spash Guards and Fenders

Notwithstanding the extreme care taken in enameling, and careful washing, the finish on these parts will show a tendency to dull from service. This is attributed to the fact that enamel has a peculiar affinity to dirt. The fenders are subjected to exposure, to dust, dirt, oil and grease. These conditions in time cause a sort of filmy covering to form, which deadens the original gloss. The longer this condition is allowed to exist, the harder it will be to restore the luster. This is brought about by the simple expedient of taking off the greasy substance which is adhering to the surface of the enamel.

There are a number of preparations for removing the dirt and cleaning the enamel, which can be secured from any accessory house. Careful washing with ivory soap and water, afterwards removing the suds before they are allowed to dry, and polishing with a chamois, will restore the finish. Fuller's earth and water can also be used to rub off the dirt if it is very obstinate, and will not harm the finish.

Cleaning of Nickel Plated Parts

All nickel-plated parts may be cleaned with lamp black or with regular silver cleaner paste. Use only the softest flannel rag or chamois to rub with.

Do not clean lamp reflectors except when absolutely necessary and then use Putz Pomade, applied with a very soft, clean chamois skin. These reflectors are silver plated and are very easily spoiled by frequent polishing.

Diagnosis of Trouble

Electrical Cranking Fails

1. Loose battery connections. The clamps on the battery post should be kept tight and the parts coated with vaseline, to prevent corrosion.
2. Depleted storage battery.
3. Brush contact faulty in starting motor.

Failure of Motor to Start

1. Water in gasoline. Drain from bottom of vacuum tank and carburetor.
2. Faulty ignition. Contact points out of adjustment or dirty. (See Pages 25 and 26.)
3. Resistance coil on distributor broken.
4. Water on coil or wires.
5. Broken down condenser or poor connections.
6. Motor flooded with gasoline, caused by continued use of choke. Crank motor with gasoline button in lean position, and choke button in, until the motor fires. If there is gasoline in the carburetor and a good spark at the plugs, the motor will start if properly handled.

If Motor Stops

1. Out of gasoline. Check main tank.
2. Vacuum tank not working. Open drain cock at bottom of vacuum tank and see if fuel flows. If not, then gently tap the connection on top of the vacuum tank, to which suction pipe to the motor is attached. Remove small pipe plug in top of vacuum tank and pour in a little fuel. This will wash off any dirt which has collected on the flapper valve and may restore action.
3. Vent in gasoline tank plugged. Vent is located in the gasoline gauge tube just below the gauge itself.
4. Loose electrical connections. (See also, "Failure of Motor to Start.")
5. Out of motor oil, indicated usually by knocking in the motor, followed by an abrupt stop. Do not attempt to use motor until the oil supply has been replenished, and the motor examined by a competent mechanic.

Reasons for Motor Missing

1. Driving with a cold motor. To thoroughly vaporize the fuel, it is necessary to adjust the shutter so as to maintain the motor at its most efficient temperature. (See Page 33.)
2. Too rich a gasoline mixture. See that button on instrument board is adjusted to lean position.
3. Short circuited spark plug. Clean the plugs and adjust the points to .025" to .028" gap, or to the thickness of a worn dime.
4. Improperly adjusted distributor points or poor electrical connections.
5. Tappets not adjusted properly, causing the valves to ride.
6. Valves may need regrinding.
7. When the motor misses you may locate the missing cylinder by short-circuiting the spark plugs on top of the cylinders, one at a time. After replacing the spark plug in the missing cylinder with a new one, you will have to determine whether the missing is caused by defective connections or wires leading to same. If the trouble still continues, turn over the motor slowly by the hand crank, in an endeavor to detect a defect in the compression of different cylinders.
8. The check valve on top of the vacuum tank, which shuts off the suction from the intake pipe, may not be seating properly. This will cause continual missing.
9. Packing gland nut in carburetor loose, causing excess gasoline to be drawn into the intake passage. Retighten gland according to instructions under "Gasoline System."
10. Water in gasoline, causing the motor to run spasmodically. (This is difficult to distinguish from other causes and should be one of the last things

looked for.) Drain some of the fuel from the vacuum tank and carburetor and note if any improvement in running occurs. If so, it is advisable to drain all the fuel from the tank, strain through a chamois skin and replace.

If Motor Lacks Power

1. Loss of compression, due to leaky valves.
2. Too rich a mixture. See that gasoline feed button is adjusted in lean position.
3. Late ignition. (See directions for timing the distributor, Page 24.)
4. Lack of oil in motor or improper motor oil. Use nothing but a high grade medium-light oil, and change it frequently.
5. Dirt in the gasoline, causing impeded flow of fuel to carburetor. Thoroughly clean the screen at the gasoline inlet at the base of the carburetor and drain sediment from vacuum tank.
6. Dragging brakes or improper lubrication, adjustment of wheel bearings, etc. The car should be rolled easily by hand when placed on a level surface. If brakes drag, the brake drum on the wheels will become hot. This can be detected by placing your hand on the parts.
7. Low tire pressure. The pressures advised by the tire manufacturer should be adhered to. Partially deflated tires present such a large surface to the road that a great deal of power is lost in friction.
8. Cylinders badly carbonized. This will be indicated by a knocking in the motor when endeavoring to climb grades. The remedy is, have the carbon removed immediately and the valves ground if necessary.

If Motor Knocks

1. Spark advanced too far. (See directions for timing the distributor, Page 24). Always retard the spark lever on the steering wheel quadrant if necessary when climbing grades at low speed.
2. Motor speed too low for the work the car has been called upon to perform. Transmission gears are placed there for a purpose, and the gears should be shifted to intermediate on any indication that the motor is laboring.
3. Loose timing gears.
4. Loose connecting rod bearings. Light knock at high speeds.
5. Loose wrist pins. A metallic knock, more noticeable when the motor is running idle.
6. Crank shaft bearing loose. Heavy pounding at low motor speeds and under heavy loads.
7. Worn valve tappets. Light tapping sound.
8. Tappet noise, due to improper adjustment.
9. Carbonized cylinders.

Reasons for Overheating

1. Water supply low.
2. Cooling system clogged with impurities. Remedy for this is to obtain about two pounds of Sal or washing soda, dissolve it in hot water and pour in cooling system. Drive car with this mixture for about one-half hour, then drain and flush out with pure water and refill.
3. Carbonized cylinders.
4. Lack of motor oil.
5. Ignition timing set too late, or owner driving with spark lever on steering wheel quadrant retarded.
6. Radiator shutter not opening to full extent.
7. Cells in radiator stopped up with mud. When cleaning the cells, do not poke a wire or other sharp instrument between them. Force the mud out with a hose by directing a stream of water from the motor side of the radiator.
8. Loose or broken fan belt, or fan blades having become bent so that they do not circulate the air properly.
9. Too lean a mixture of gasoline. Do not carry the gasoline feed regulator button in the extreme lean position in very hot weather if the motor shows any tendency to overheat.

10. Using too heavy an oil. Use nothing but high grade light oil and change it frequently.

In General 1. Transmission change speed lever slipping out of gear or jumping when the car is in motion. This is caused by excessive end play in the main transmission shaft, which can be corrected by removing the necssary amount of shims from the rear main bearing cap. (See Page 37, Transmission.)

2. If the lever slips out of gear, the interlocks which operate in the notched control shaft should be examined. The springs may be weak or broken and should be replaced if necessary. See that the interlocks seat properly in the notched shaft.

3. Clutch slipping. This may be caused by clutch out of adjustment, or the clutch oil having become gummed. Drain the oil out of the clutch by way of the plug in the housing. Flush out with kerosene and refill with one-half pint of a mixture of kerosene and light lubricating oil in equal proportions. For adjusting clutch pedal mechanism, see Page 34.

4. Play in driving mechanism when the clutch is engaged. This is usually caused by loose spring clips on the rear axle. The springs absorb the torque and drive, and it is necessary that these clips be frequently inspected and tightened if necessary. (See Page 42.)

5. Rear axle noise. Usually caused by insufficient lubricant. See that the rear axle contains the necessary amount of Whitmore's Compound, and make sure that the pinion shaft, immediately forward of the differential, is thoroughly lubricated. This shaft runs at the same speed as the motor, and unless properly lubricated will wear the bearings rapidly. If the rear axle is noisy on coast, or noisy when the throttle is closed preparatory to slowing down, there is a possibility that end play exists in the pinion shaft, or that the pinion shaft has cut, through lack of lubrication. Instructions will be found under the heading of "Rear Axle" for adjusting the pinion shaft and bearings.