Studebaker

Information

On the Operation
and Care of the

Model "35"

The Studebaker Corporation of America
Detroit, Michigan

remains closed, and as a result, the exploded gas is forced through the exhaust valve into the exhaust pipe, hence to the muffler, which silences the noise of the exhaust. (See Fig. 4.)

In order that the crankshaft shall continue turning between the completion of one power stroke and the commencement of the next, it is necessary to have a flywheel. This is of sufficient weight and consequent inertia to insure the even running of the motor.

On a Studebaker "35," as stated above, there are four cylinders, each going through this operation, and the "Power Strokes" are so arranged that they follow each other so that power is being exerted on the crankshaft every half revolution. The power which is thus developed by the rapid turning of the crankshaft is carried from the motor to the rear axle by the transmission mechanism, which consists of a clutch, universal joint, drive shaft and transmission gears.

TO START MOTOR—See Illustration No. 2, Page 8

See that gear shifting lever is in "neutral" position. Open throttle lever (T) about one inch. Retard spark by placing spark lever (S) in extreme lower position.

When the motor is cold, move pointer on carburetor dash adjustment to point marked "start." (See under carburetor on page 14.)

Throw switch lever to position marked "B." Everything is now ready to operate the starter. To do this, pull the lever on the steering post towards you and hold it there until the motor starts. The instant it starts on its own power, release the lever. This is important. (See "Operating Electric Starting System for First Time." Page 52.) If the motor should not start at once, do not continue to operate the starter, open the throttle (T) a little wider and try again. It will sometimes be advisable to prime the carburetor. (See paragraph 3 under Cold Weather Suggestions, Page 60.)

If it does not now start, refer to "Condensed Suggestions," Page 56.

As soon as the motor begins to run on its own power, turn switch from position "B" (battery) to position "M" (magneto). Advance the spark lever to about the center point on the segment on the steering wheel as indicated in illustration. Adjust the throttle lever so that the engine runs slowly, but evenly.

For location of spark lever on segment in general operation see under "Spark Lever" on page 18.

If, for any reason, the driver wishes, on occasion to crank the motor by hand, the adjustment for starting should be exactly the same as that used for the operation of the electric starter. The crank should be inserted at the front of the radiator to engage with the crank shaft and in cranking the motor, care should be taken to make the crank engage at the point with the handle nearest to the ground. Then it should be pulled up clock-wise from left to right with a short, snappy pull.

If batteries become exhausted unexpectedly, the car can be started on the magneto, as follows: *Advance spark lever to regular running position,* or even beyond, being careful to retard it to running position after motor starts.

Open throttle lever about one inch and turn coil switch to position marked "M" (magneto.) Start the motor by cranking rapidly clockwise. As soon as the motor starts, proceed as directed above when starting on battery. The secret in starting on the magneto is to spin the motor

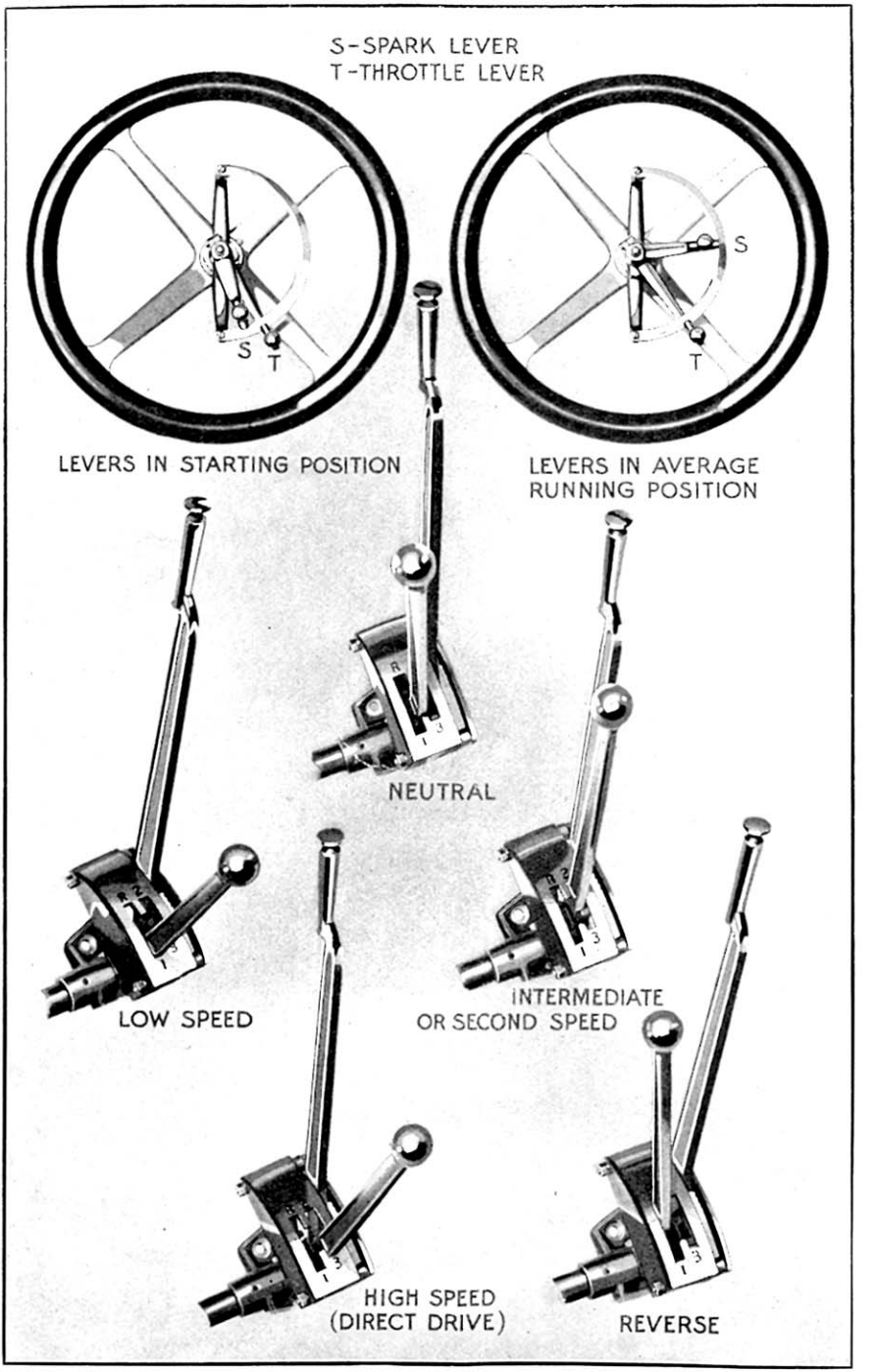


Illustration No. 2
Showing the different positions of the gear shift lever.

rapidly. This is necessary in order to develop a powerful enough spark from the magneto to ignite the gas.

TO DRIVE CAR

With motor running, car is ready to drive. Release the hand ("emergency") brake, if it has been set, by pushing it to its furthest forward position. It is a good plan to set it whenever leaving car. Beginners especially should early get the habit of always trying the emergency brake before starting the car. Depress clutch (left) pedal as far as it will go, disengaging clutch.

Grasp the gear shift lever and pull it quickly back into first speed position marked "1" on the H Plate. (See diagram for "low speed" position.) Gently press upon the accelerator (which is the foot control of the motor, corresponding to the hand throttle) to give somewhat more speed to the engine already running slowly. Gradually release clutch pedal, thus engaging clutch. The car will start easily. Increase the speed by gently pressing on the accelerator so as to give the car good rolling momentum.

As it gathers momentum again release the clutch by pressing forward on the pedal, and with a quick, decided movement, shift the gear shift lever from first speed position into second or "Intermediate" speed marked "2" on the H plate. (See diagram for "second speed" position.) Again let the clutch in gently and accelerate to acquire further momentum.

Once more disengage clutch and slip the gear shift lever into third or "High" Speed marked "3" on H plate. (See diagram for high speed".) This position is used in all ordinary driving. First and second speeds are used in starting, or when, on account of exceptional hills, very heavy roads, or in slowing down for traffic, it becomes desirable to give the motor additional leverage to enable it to pick up under load.

One rule the driver must always remember: The clutch must be disengaged whenever brakes are put on or gears shifted. By pressing the clutch pedal down, the clutch is disengaged from the flywheel and all the transmission mechanism remains inoperative as long as it is held in this position. If you try to shift gears without disengaging the clutch, you are trying to slip into mesh gears which are traveling at high speed, and are certain to injure the gear teeth.

Be careful to engage the clutch gently and without jerk. This is really very simple, and with a little practice you will soon do it correctly. Also accelerate the motor *gently* so that you do not "race" it. Racing a motor loosens the bearings and other parts and will cause trouble and damage if continued for any length of time.

TO STOP CAR

Move hand throttle to lowest position. Remove foot from accelerator, disengage clutch by pressing forward the clutch pedal as far as it will go, and apply brakes by pressing the brake pedal which is at the driver's right foot. (See "use of brakes," page 43). In emergency cases when it is necessary to stop instantly, throw out clutch and pull up hand ("emergency") brake lever, also.

After the car has come to a stop, while the clutch is still disengaged, move the gear shift lever to neutral position and permit the clutch to engage once more. The clutch is now turning with the motor, but the car is motionless because the gear shift lever is in neutral position. (See "Transmission Gears" (1) Page 37.)

TO REVERSE CAR

Never attempt to reverse the car until it has come to a *full stop*, or you will damage the gears. To reverse the car, disengage the clutch and place the gear shift lever in the position marked "R" on the H plate. (See diagram for "reverse" position.) Speed the engine up slightly and let in the clutch very gently. As it is difficult for a beginner to steer a car in reverse great care must be used in reverse to keep the feet on the control pedal ready for instant action. Do not speed up the engine too fast.

TO STOP MOTOR

Turn switch on coil to "OFF" position. This stops the electric current and prevents further ignition of the gas in the cylinders. Just as you turn the switch to "OFF," advance the throttle about three inches, and leave it advanced until motor has stopped. This fills the cylinders with gas and facilitates starting next time.

Gasoline System

(See Illustration No. 3, Below.)

In filling the gasoline tank, care should be taken that no dirt or foreign matter be allowed to drop into the tank. Gasoline should always be strained through a chamois. This not only frees it from dirt, but eliminates any water as well.

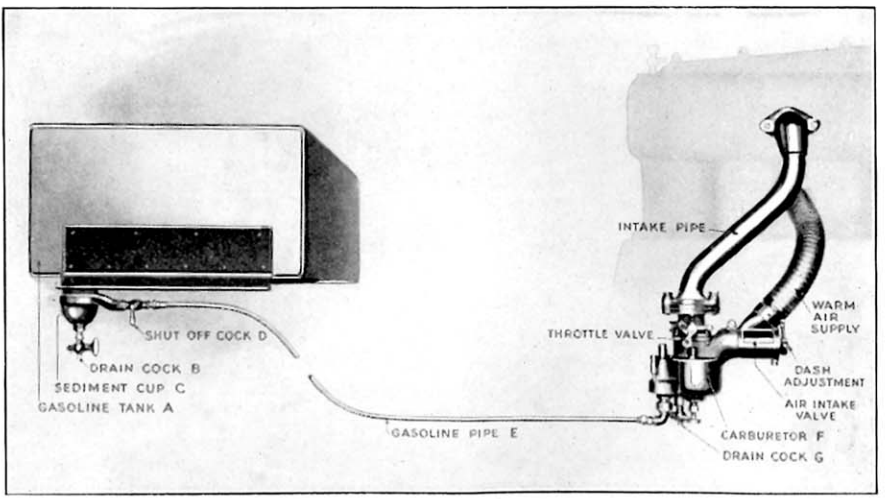


Illustration No. 3. Gasoline System

GASOLINE DRAIN COCK

The gasoline drain cock (B) and sediment cup (C) are located at the bottom of right side of tank. The sediment cup should occasionally be drained through the drain cock (B). If you have any reason to believe that the gasoline contains any water, drain off some of the supply through the drain cock (B). The gasoline shut-off valve (D) is in the gasoline pipe (E) just as it leaves the gasoline tank.

GASOLINE FEED

The tank being higher than the motor, permits gasoline to be fed to the carburetor (F) by gravitation. In case of an obstruction in the gasoline line, which, of course, can be detected by opening the drain cock (G) in the carburetor, detach the gasoline pipe (E), both at the gasoline tank end and carburetor end, and thoroughly clean.

CARBURETOR—See Illustration No. 4, Page 12

The carburetor is located on the right side of the motor, and is of the float feed type. (See illustration No. 10, Page 26.) It consists of a float chamber (D), mixing chamber (L), spray nozzle (G), float (C), and throttle valve. The gasoline flows by gravity from the gasoline tank into the float chamber through the needle valve (B).

The needle valve is controlled by the cork float (C), which rises as the float chamber (D) fills with gasoline. The cork float closes the needle valve (B) automatically when the gasoline is at the proper level in the float chamber. (See "Float" below.) The gasoline is drawn by the suction of the pistons through the spray nozzle (G) into the mixing chamber (L) or (technically known as) Venturi tube. Here it mixes with warm air from the valve chamber, which is drawn through the hot air intake pipe.

The explosive mixture of gasoline vapor and air is admitted into the intake manifold through the butterfly throttle valve, which is controlled by both the throttle lever on the steering post and by the foot accelerator pedal.

CARBURETOR—(1) Float (C)

This is a U-shaped cork ring, covered with shellac to render it impervious to gasoline, which floats on top of the gasoline supply in the float chamber (D). Its function is to automatically open and close the needle valve (B) which controls the inflow of gasoline. The float thus keeps the gasoline in the float chamber at a proper level, in relation to the spray nozzle.

The priming pin (which does not show in the illustration), is devised to press down the float and permit the float chamber to fill with gasoline above the ordinary level, thus providing a "rich" mixture for starting the motor. If motor starts with difficulty, it is sometimes advisable to press down priming pin to prime the motor. Be sure that priming pin rises again after you release it. If it is caught in any way the carburetor will flood.

The needle valve (B) is a cone-capped pin which is controlled by the float, and which opens and closes the gasoline feed pipe as the float falls or rises.

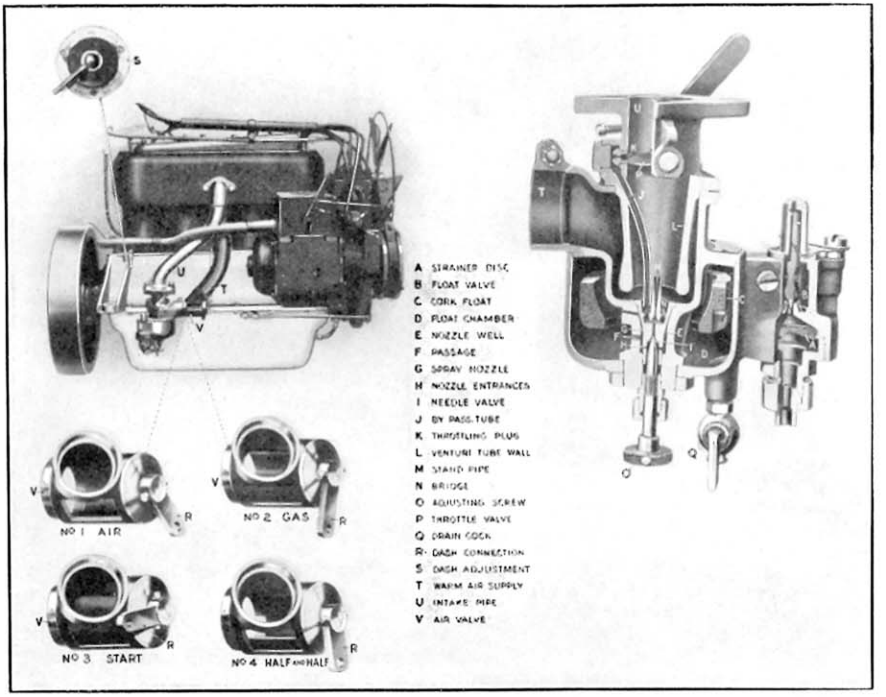


Illustration No. 4. Sectional View of Carburetor

CARBURETOR—(2) Mixing Chamber (L)

This is simply a tube in which air sucked from the hot air intake pipe, and the gasoline vapor sucked through the spray nozzle in a fine spray, come together and are mixed so as to form an explosive gas.

CARBURETOR—(3) Air Intake Valve (V)

Sudden temperature changes (40 deg. in 12 hours being quite common), affect both gasoline and air. As the temperature falls, the gasoline becomes heavier, making it harder to get through the nozzle and more difficult to vaporize; in other words, very cold air tends to condense gasoline instead of vaporizing it.

Gasoline, to work right in the motor, must be vaporized and properly mixed with the entering air, either by heat or high velocity.

To accomplish this result, there is an air intake valve which will:

Supply all cold air for summer, as shown by "Air." (Cut No. 1.)

Supply all hot air for winter, as shown by "Gas." (Cut No. 2.)

Supply any proportion of hot and cold air, as shown by "Half and Half." (Cut No. 4).

Or it will place a strong suction on the carburetor, as in "Start" (Cut No. 3), thereby priming the motor on a cold morning, and keep the motor running. All of this can be accomplished from the dash. See "Dash Adjustment," Paragraph 7, Page 14.

CARBURETOR—(4) Throttle Valve (P)

This is controlled both by the hand throttle lever on the steering post and by the foot accelerator. It is of the butterfly type, and merely opens or closes the entrance from the carburetor to the intake manifold. (See "Throttle Valve Adjustment," Paragraph 9, Page 14.)

CARBURETOR—(5) Carburetor Drain Cock (Q)

This is located at the bottom of the float chamber, and is the lowest point in the gasoline system, consequently it is a place where water will locate should any be allowed to get into the gasoline tank. It is a good practice to drain off a little gasoline at intervals of about once a week. This will allow the water or sediment to escape.

CARBURETOR—(6) Operation

Before the gasoline enters the float chamber (D), it passes a strainer disc (A), which removes all foreign matter that might interfere with the seating of the float valve (B) under the action of the laminated cork float (C), and its lever.

Gasoline passes from the float chamber (D) into the nozzle well (E) through a passage (F) drilled through the wall separating them. From the nozzle well, the fuel enters the nozzle proper (G) through the holes (H) in its walls, and rises past the needle valve (I) to a level in its cup-shaped upper end, which just submerges the lower end of a small tube (J) which has its outlet at the edge of the throttle disc.

Cranking the engine, with the throttle kept nearly closed, causes a very energetic flow of air through the tube (J) and its throttling plug (K). But the lower end of this tube is submerged in gasoline, with the engine at rest. *Therefore, the act of cranking automatically primes the motor.* With the motor turning over under its own power, flow through the tube (J) takes place at very high velocity, thus causing the gasoline entering the tube with the air to be thoroughly atomized upon its exit from the small opening at the throttle (P) edge. This tube is called the "low speed tube "because, for starting and idle running, all of the gasoline and most of the air in the working mixture are taken through it. In adjusting always wait an appreciable time.

As the throttle opening is increased beyond that needed for idling of the motor, a considerable volume of air is caused to move through the passage bounded by the conical walls (L) of the so-called strangling tube. In its passage into the strangling tube, the air is made to assume a circular converging stream form, so that the point in its flow at which it attains its highest velocity is in the immediate neighborhood of the upper end of the "standpipe" (M), set into the body of the nozzle piece (G). The velocity of air flow being highest at the upper or outlet end of the standpipe, the pressure in the air stream is lowest at the same point. For this reason, there is a pressure difference between the top and bottom openings of the pipe (M), thus causing air to flow through it from bottom to top.

With very small throttle opening the action through the standpipe, (air passing downward through the series of openings (N) in the standpipe supporting bridge) keeps the nozzle cup thoroughly cleaned out, the gasoline passing directly from needle opening into the entrance of the standpipe.

CARBURETOR—(7) Dash Adjustment (S)

Set the spark control lever, throttle and battery switch and operate starter. If motor does not start place dial (S) at "Start" and operate starter again. After motor is running place dial half way between "Gas" and "Start" for a few moments. This places an extra suction on the carburetor until motor and air are warm.

In warm weather, the dial should be over to "Air."

In cold weather, the dial should be at "Gas."

The air intake valve (V) performs the dual function of giving hot and cold air and at the same time increases or decreases the fuel flow through the nozzle, due to the heating up of the gasoline by the incoming hot air.

To get the most satisfaction and the most economical service out of your car, study the dash adjustment of your carburetor carefully. It is of the utmost importance that there be a proper proportion of air in your mixture. It means not only greater fuel economy, but more power and flexibility and a cleaner, cooler running motor in every way. Freedom from ignition, compression and other motor troubles is dependent, to a surprising degree, upon the simple consideration of keeping your mixture always properly regulated from the dash. You will learn by a little attention how to handle this adjustment at all times. The wider it is open the more air you are getting in the mixture. Under heavy loads and when cold it will need to be closed somewhat. When the motor is hot and on long, level stretches it should be wide open. Make it a general rule to use all the air the motor will take.

CARBURETOR—(8) Gasoline Adjustment (O) (This adjustment rarely necessary)

After starting motor, set air valve to supply half hot and half cold air to carburetor. Let motor run until intake manifold warms up, then with throttle control lever slightly open, turn gasoline adjustment (O) by eighth turns to the right to cut down the gasoline supply until the motor begins to misfire. Then gradually increase the gasoline supply by turning the gasoline adjustment (O) to the left until the motor picks up and runs regularly without missing. The motor will not show the effect of a gasoline adjustment instantly, wait from 30 seconds to a minute to get the full effect.

CARBURETOR—(9) Throttle Valve Adjustment

The throttle valve should be adjusted so that when the hand or foot throttles are closed, the motor will just run evenly on all four cylinders. This can be ascertained by the regularity of the impulses in the exhaust when both the spark and throttle levers are set at their lowest positions. If the motor, however, should run too fast, or should stop when the throttle is at lowest position, adjustment is necessary, directions for which are as follows:

Loosen the set screw which locks the adjusting screw where throttle shaft enters carburetor. Place throttle in lowest position.

If motor runs too fast, unscrew adjusting screw so that butterfly valve in carburetor is closed a little tighter.

If motor runs too slow, screw in the adjusting screw so that valve is held a little more open. Lock adjusting screw with set screw after adjustment.

GRADE OF GASOLINE

There has been so much misunderstanding on the part of the average car owner in regard to the kind of grade of gasoline to use, that it is necessary to devote a little space to this subject.

The common standard, at least to the layman's mind, is gravity, such as 72 degrees or 64 degrees, etc., but this is not a true standard unless coupled with it is given the field from which the crude oil is produced. For instance, it is found that 62 gravity gasoline made from Ohio crude oil gives the best results. It is also found that 58 to 60 gravity gasoline is best if made from crude oil pumped in Kansas and Oklahoma. Gasoline showing 56 gravity made from Texas and California crude gives very excellent results, which all goes to show that a gravity test means nothing, and should not be used as a standard in speaking of the different grades of gasoline.

The real true test of gasoline is made by finding its initial and maximum boiling points. A grade of gasoline which has a low initial boiling point is quicker and more spontaneous, and if used, will greatly facilitate the starting of the motor. However, if this particular gasoline happens to have a low maximum boiling point, it will not develop as many heat units, or is not as satisfactory to use, as a gasoline which has a higher initial boiling point and also a higher maximum boiling point. This latter might cause difficult starting of the motor, but it contains more heat units and is cheaper and more satisfactory in the end.

Going into the matter a little more thoroughly, it is not difficult to understand what "boiling point" means, for it is nearly self-explanatory. It is the point on the Fahrenheit Thermometer at which a liquid will begin to boil. That is only the initial boiling point, and the refiner does not stop here. He distills a given quantity of gasoline, and while it is in process of distillation, ascertains at what point each 10% of the liquid will boil until the entire quantity has evaporated. In this manner, he determines not only the initial boiling point, but the maximum boiling point and all intervening boiling points as well.

Consequently, the refiner knows and distinguishes gasoline not by *gravity*, but by *boiling points*. He knows it would be impossible to use the changing standard of gravity, but, knowing the boiling points, he can depend upon the quality of the goods.

In supplying yourself with gasoline, instead of attempting to buy it according to a gravity scale, and to pay an exorbitant price for some special kind or grade, purchase good gasoline sold by a reliable and responsible garage or supply store and manufactured by a distilling company of the same reputation.

Ignition System

The purpose of the Ignition System is to supply an electric spark to each of the four cylinders. The spark is so timed as to ignite the compressed charge of gas at the correct instant. The current is supplied either by magneto or battery. The magneto produces a current which passes through a coil on the dash which induces a secondary or high tension current that is carried to the spark plugs to make the spark. (See "Magneto," Page 17.)

A series of four dry cells makes up the battery (B) which provide a low tension current from which a high tension current is induced by the same coil on the dash.

BATTERY—See Illustration No. 5, Page 16

The battery (B) consists of four dry cells located in the tool box compartment over the rear axle. They are used for starting the motor; or to operate the car in case of accident to the magneto. (The motor, however, can be started on the magneto. See "To Start Motor," Page 7.)

The dry cells require no attention except to see that the connections are tight and that they are not short-circuited by tools or anything of a metallic nature which might be placed near them. Care should be taken, however, to see that the battery cells are replaced whenever they show exhaustion. The electric starter will not start the motor promptly if exhausted cells are used. They should regularly be tested for strength. A set of dry cells should run from 500 to 1,000 miles, but their life will vary

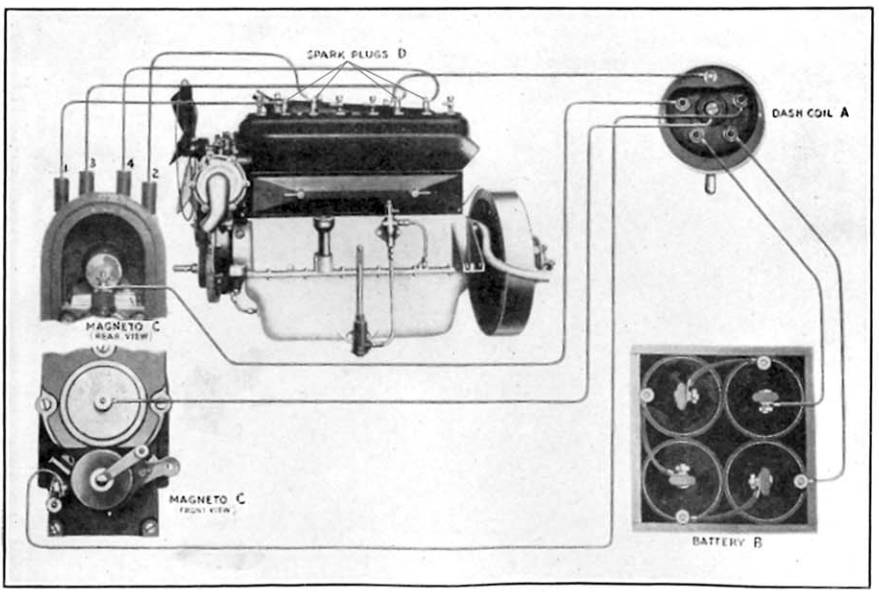


Illustration No. 5. Ignition Wiring Diagram

considerably. You will notice them growing weak by difficulty in starting, and, if possible, you should secure an ammeter to test them, which can be purchased at any automobile accessory store. Any dry cell in the series which tests below ten amperes should be discarded, as it makes the others practically valueless, and has the same effect on them as one bad egg in an omelette has on the good ones.

In replacing the dry cells be careful to wire them with one pole always connected to the opposite pole of another. (See B, Illustration No. 5, Page 16.)

MAGNETO—Operations. See Illustrations Nos. 5 and 7, Pages 16, 20

The magneto furnishes the supply of electric current for igniting the gasoline charge in the cylinders. It consists of two steel magnets (A) bent into a yoke which form a magnetic field. Between the poles of these magnets is an armature turned by the motor. In revolving, it repeatedly cuts at an angle the lines of force which pass between the poles of the magnets, and this induces an electric current in the copper wiring about the armature. This low tension current is short-circuited when the two platinum points (B) of the circuit breaker (C) in the "breaker box" (D) are in contact, and at this instant it does not go beyond the magneto, but at the instant these two platinum points separate, the current can find no other path excepting through the wires to the coil on the dash (see under "Coil"). Here, by the "transformer" principle it is stepped up to a high tension current. It then returns to the high tension distributor (E) where it is distributed in turn to the proper cylinders through the spark plugs. The cylinders of the Studebaker "35" fire in the following rotation: Cylinders No. 1, No. 3, No. 4, No. 2—No. 1 cylinder being directly back of the radiator.

COIL—See Illustration No. 5, Page 16

The coil (A) is enclosed in an insulating housing of hard rubber. It is attached to the dash under the hood. It requires no adjustment and should be left alone. It should be kept dry. If allowed to become very wet, the water is liable to get inside and injure it. If, after careful investigation, you think you are having trouble with the coil, see a Studebaker Dealer, write to the nearest Branch, or to the Technical Department, The Studebaker Corporation of America, Detroit, Mich.

When car is not in use, keep the switch on the "OFF" position. If it is left on the battery position it may exhaust the batteries in a few hours.

SPARK PLUGS

Four spark plugs (Illustration No. 5, Page 16) are used—one screwed into each valve cap over the inlet valve. Their function is to lead the electric current into the "firing chamber" of the cylinders where separated wires form a break or "gap" in the circuit across which the current must leap or "arc." In "arcing" it flames or "sparks" with sufficient heat to ignite the gasoline vapor. The plug is insulated and the gap is formed between two wires. These wires should be separated by 1/32 of an inch, or about the thickness of a smooth dime. They should be kept clean and free from oil or carbon, as these will tend to short-circuit the plug and kill the spark, rendering the cylinder inoperative.

To clean the spark plug, it is best to use a tooth brush and gasoline. If the insulation cracks, the plug becomes short-circuited and useless, and must be replaced. The careful motorist always carries an extra spark plug or two as preparation for emergencies.

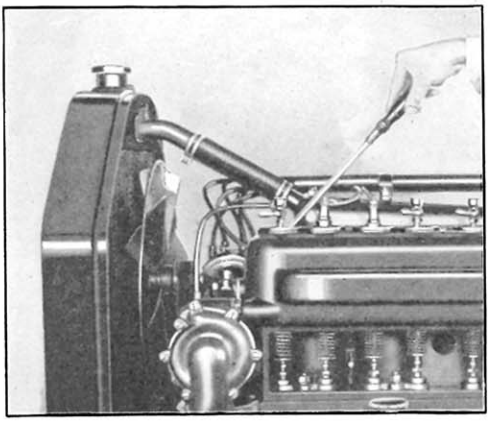


Illustration No. 6. Short Circuiting Cylinder to Test Spark Plug

To determine whether or not a cylinder is firing, start the motor and hold a screw-driver between the terminal at the upper end of the spark plug and the cylinder wall. Be careful to grasp the screw driver by the wood of the handle to protect your hand from an electric shock. If it has been firing, the short-circuiting will make a perceptible slow up in the running of the motor, which indicates that the spark plug is in good order. If there is no change, test the spark plug as follows: Remove the plug, and with wiring attached, lay it on its side on the cylinder. Start the motor and if the plug is good, you will see the spark jump between the points. If these are 1/32 of an inch apart and it refuses to give spark, your trouble is in the plug, or wiring to that plug. If plug proves good, the trouble is due to some other cause. When a motor misses occasionally under heavy load but fires perfectly under light load it is an indication that the spark plug points are too far apart or the current delivered by the ignition system is not up to standard strength.

WIRING—(Ignition System)

The Ignition System is wired according to Illustration No. 5, Page 16. Care should be taken that the wires are kept clean and are not allowed to become covered with grease or dirt, also that the insulation is intact. *If wiring is for any reason removed, be sure and replace it according to the diagrams.*

These cautions, however, should be observed: First,—See that the boot or covering is securely placed over the wires leading from the magneto, and from the coil. Wire terminals on the magneto, coil, spark plugs and the dry cells, should be gone over and tried with the fingers. Sometimes the vibration of the car works them loose and when they are found so they should be tightened. If they become loose the motor is likely to misfire.

SPARK LEVER

This is located on the inside or top of the sector over steering wheel (See "S" Illustration No. 2, Page 8) and controls the time at which the spark occurs. When the lever is at lowest position, the spark is retarded and occurs after piston has reached highest point of up-stroke and has started down. When the spark lever is advanced, spark occurs

in the cylinders before the piston reaches the top of its up-stroke. When the motor is running fast, the spark should always be advanced for the reason that the explosion of the gas by the spark is not instantaneous, and the advanced spark allows time for the fired gas to develop to maximum pressure at the instant the piston starts on its downward stroke. However, when the car is driven over rough roads, hills, sand, etc., or at any time when the motor is running slowly, the spark lever should be retarded, as then the explosion should occur when the piston is at or near dead center or just after it has started down. This position of the lever results in developing maximum power under the above conditions.

The Studebaker motor is timed at the factory so that the spark lever should not be advanced to its furthermost point except when the motor is running at very high speed. A good driver learns to save gasoline, save his motor and secure maximum power by properly adjusting the location of his spark lever to the speed of his motor.

The first indication of an excessively advanced spark is the knock or pounding in the motor which—to the trained driver's ear—is instantly discernable when the motor is laboring at slow speed on steep grades or in deep sand with the spark too far advanced.

At 20 miles an hour on an average road, the spark lever should be midway of the sector, at 30 miles an hour two-thirds the way, and when the throttle is wide open on an average road, and the motor is operating at its highest speed the spark should be advanced to the extreme position.

MAGNETO—(1) Care

The magneto requires little or no attention other than keeping it clean from excessive oil and water. It should be oiled once a month with one or two drops of thin oil in oiler on armature shaft. (See Oiling Diagram, inside of back cover.) The distributor cover (H) can easily be removed by removing the three machine screws which fasten it to the magneto frame. The breaker box cover can be removed by swinging the contact arm (F) to one side. The cover can then be pulled off like the cover of a pepper box. When this is taken off, the inside should be carefully wiped out with clean waste moistened with gasoline. There are five carbon contact points (I) in the distributor which should be cleaned very occasionally when there seems to be magneto trouble. Be careful in removing the points not to lose the small coil springs which give the points this contact tension.

MAGNETO—(2) Adjustment—(See Illustration No. 7, Page 20.)

The magneto requires only one adjustment, and should be left exactly as it leaves the factory until motor has been run at least one season. This one adjustment refers to the platinum points (B) in the breaker box (D). If the platinum points are dirty, clean with gasoline and dry. If the points are pitted, dress them smooth with a very fine piece of emery. Then have someone turn the motor over with the starting crank until the cam (J) on the end of the armature shaft has opened the two points at its widest. There should be a clearance between them of just 1/32 of an inch, which is the thickness of a smooth dime. If this clearance is any more or less, it will be necessary to loosen the adjusting

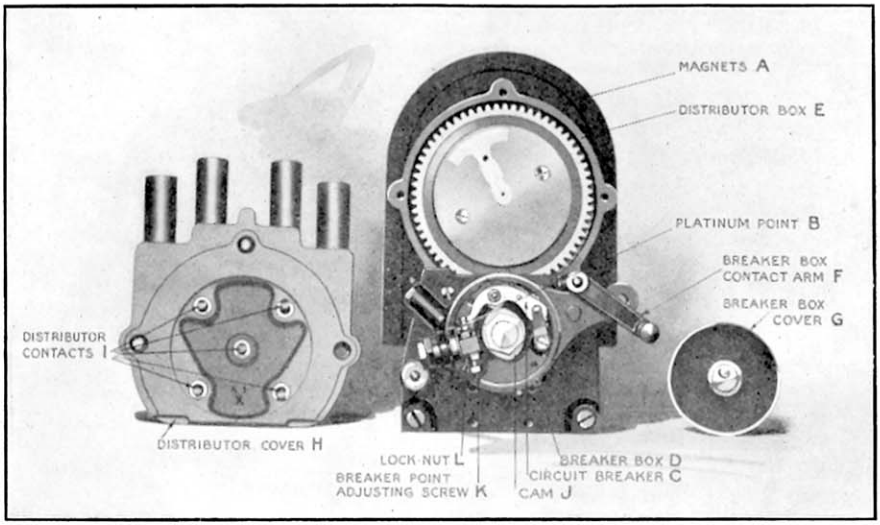


Illustration No. 7. Magneto

set screw (K), on one end of which is one of the platinum points (B), and set this screw either up or down, as it is necessary to make the correct adjustment and arrive at the clearance referred to above. Before attempting to turn this screw be sure to loosen the lock nut (L) which sets this screw. After adjusting, tighten this nut (L) to lock the adjustment. Replace cover (C) and contact arm (F) and connect up the magneto according to directions of the Wiring Diagram.

Do not "fuss" with your magneto. Leave it alone. If you are in doubt about it take it to some competent repair man for any adjustment, or write to Technical Department, The Studebaker Corporation of America, Detroit, Mich., for instruction.

TIMING OF THE SPARK

If it is ever necessary to remove the magneto for repairs or replacements it should be reset in the following manner:

Open exhaust cock on cylinder No. 1. Turn motor until air stops escaping from exhaust cock. The instant air stops escaping from exhaust cock the compression stroke (See Fig. 2, Illustration No. 1, page 6), is complete and the dead center markings "O" on the fly wheel for cylinder No. 1 will be under the pointer. Turn motor very slightly until this marking is ¼ inch past the pointer.

The magneto can then be placed in position without being bolted down, the ignition wires connected up as indicated in wiring diagram on page 16, and the breaker box fully retarded. Turn coil switch to position "B." Detach wire from spark plug (Cylinder No. 1) and hold it (by the insulation) 1/32 of an inch from the spark plug (No. 1 cylinder) and turn the magneto slowly by hand until the spark jumps from the wire to the plug. The motor must remain stationary during the above operation. The instant the spark occurs stop turning the magneto. You

will notice a series of holes on the flange coupling on the shaft which turns the magneto from the timing gears. Insert the spacer which goes between the two halves of this coupling and insert the small bolts in the holes that are most nearly opposite each other. When this is done bolt the magneto firmly to its base, being positive that the coupling between the magneto and shaft lines up properly. It is advisable to turn the motor over slowly by hand to see that the spark occurs on all four cylinders in this order: No. 1 cylinder, No. 3 cylinder, No. 4 cylinder and No. 2 cylinder.

This paragraph is, primarily, meant for repair men, or owners, who are familiar with the dissembling and assembling of the motor, and we would not suggest that an owner who is not well posted or equipped to do this work attempt it, but take it up with a Studebaker Dealer, Branch, or write for full instructions to Technical Department, The Studebaker Corporation of America, Detroit, Mich.

Lubrication System

It has been said that three-fourths of the trouble with motor cars is due to carelessness on the part of the owner in keeping his car properly lubricated. **We emphasize this statement.**

The lubrication of a car might be divided into three important headings:

First—Oiling the motor.

Second—Keeping grease or oil in the transmission and rear axle.

Third—Keeping all grease cups in all parts of the machine always filled. In a moment we shall discuss the first and third. The second will be discussed under "Transmission (4) Care," Page 39.

MOTOR LUBRICATION

The function of the Motor Lubrication System is automatically to supply oil to the cylinders, connecting rods, crank shaft bearings, camshaft, and all parts within the crank-case and cylinders that require lubricating. It consists of a reservoir of ½ gallon capacity, and two pipes, one leading from the reservoir to the crank case and the other to the timing gear case.

On the reservoir there is a gauge and a filler cap. The filler cap is removed to fill the reservoir with oil.

MOTOR LUBRICATION SYSTEM—(1) Operation—(See Illustration No. 8, Page 22.)

The motor is lubricated by what is known as the Constant Level Splash System. This means that a quantity of oil is carried in a reservoir (F), which is formed by the lower part of the case which contains the crank shaft of the motor. A pump (B) of the plunger type draws the oil from this reservoir and (G) sprays it over the connecting rod bearings. It pumps the surplus oil through a sight feed (J) or indicator on the dash, from which it flows over the timing gears (D) at the front of the motor and returns to the reservoir. The oil draining from the spray collects in troughs (E) which maintain a constant level of oil just under the connecting rods. At each revolution a short projection (M) from

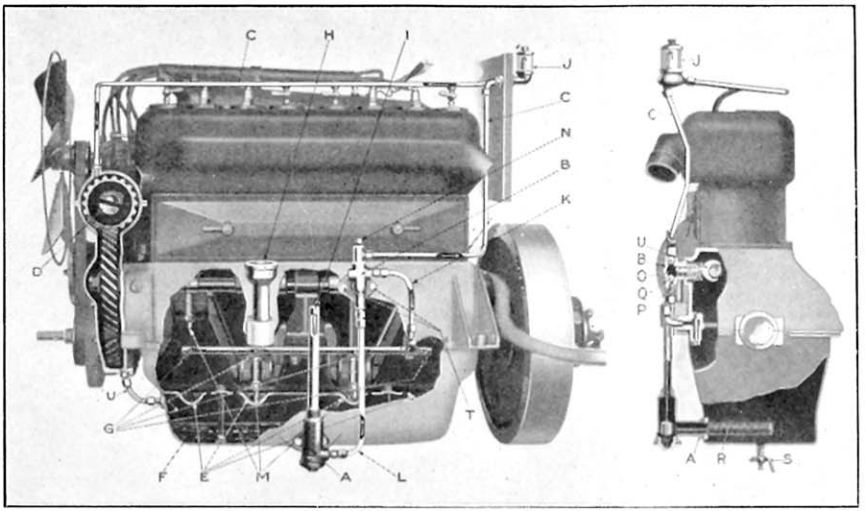


Illustration No. 8. Motor Lubrication System

the connecting rods dips into these troughs and splashes oil over the lower ends of the pistons, and over all cam and crank shaft bearings. Study carefully the illustration on this page which shows the oiling system.

MOTOR LUBRICATION SYSTEM—(2) To Fill With Oil

To fill the oil reservoir of the motor, pour the oil in through a funnel shaped tube (H), which you find on the left side of the motor. This funnel shaped tube is called the "breather pipe."

If motor smokes badly with blue smoke you have flooded your oil reservoir. Drain out surplus through drain plug at bottom of oil reservoir until gauge at side of motor indicates correct supply.

MOTOR LUBRICATION SYSTEM—(3) Sight Feed

At the side of the "breather pipe" there is a gauge (I) which shows the amount of oil in the reservoir. Pour the oil in the breather pipe until the gauge indicator rises to the highest point of the gauge. Be careful that there is no more oil poured into the motor than just enough to bring the indicator to the highest point shown on the gauge. The only attention necessary to keep the motor perfectly lubricated is to see that the gauge indicator shows that there is oil in the reservoir.

When the motor is running a stream of oil can be seen dropping through the "sight feed" (J) on the dash. This "sight feed" can be seen from the seat and should not be forgotten by the driver. If the oil should cease to flow through the "sight feed" when the motor is running, the motor should be stopped and hood lifted to ascertain if the gauge (I) at the side of the breather pipe shows oil in the reservoir. If

it does show oil in the reservoir, then either the oil pump or the connecting oil pipes are clogged and should be cleaned out.

The pump (B) is made of heat treated steel. It operates in a bearing of cast iron, and only under the most extraordinary circumstances can it get out of order.

MOTOR LUBRICATION SYSTEM—(4) To Clean Pump and Pipes

In case you think that the pump is clogged it is a good plan before taking it down to try priming it with the same kind of oil that you put in the crank case. To prime the pump, remove the plug (N), pour in oil until it fills, replace the plug and start motor. If priming does no good proceed as follows:

The pipe (C) which runs from the pump to the "sight feed" should be disconnected at the joint immediately next to the pump and the motor started. If oil flows from the pump it indicates that the pump and the pipes below are clear and that the trouble must be in that part of the system leading from the pump through the "sight feed" to the timing gears. These pipes then should be carefully disconnected and the clogging obstruction removed and the pipes replaced. If, however, no oil flows from the pump, the pump should be removed by unscrewing the two bolts (T) which fasten it to the motor casting. This should be done very carefully to prevent the plunger (O) from falling into the crank case. This plunger in the pump is operated by an eccentric (U) on the cam shaft which forces it outward and a coil spring (P) forces it back. See that the spring is in perfect condition and in proper place and that the pump plunger works perfectly. There is a ball check valve (Q) beneath the pump and two above the pump; one of those above controls the pipe leading to the connecting rod spray nozzles and the other, the pipe leading to the "sight feed."

When the pump is taken down it must be primed with oil through the plug (N) in the pump housing just above the plunger. If a car has been stored for several weeks and the oil gums or seeps out of the pipes and pump, it may be necessary to prime the pump to start it. In any event, if a car has been stored away for any length of time, it is advisable to flush out the oiling system thoroughly as described below.

MOTOR LUBRICATION SYSTEM—(5) To Clean Reservoir

The oil in the reservoir at the bottom of the crank case should be drained out completely two or three times a season and the entire reservoir thoroughly flushed out with gasoline. The pipe which draws the oil from the reservoir is protected by a long fine screen (R), which extends into the bottom of the reservoir. This screen cannot be injured when it is in place. It absolutely prevents dirt and foreign substances from being drawn into the pump.

There is a drain cock (S) at the bottom of the reservoir in the crank case, which can be opened to drain the reservoir and oiling system and to drain the flushing gasoline off after the motor has been worked. In this connection, it might be well to remove the two bolts, which fasten the pipe to the crank case at the point (A) where it enters. When these bolts are removed, the strainer can be slipped out from the bottom of the oil reservoir and inspected.

Gasoline will cut gummy oil, and especially so, if, before you remove the drain plug and screen, you will open the exhaust cocks at the top of

the cylinders and turn over the motor several times by hand (with the switch lever on the dash in the "off" position) and churn the gasoline in the crank case.

USE OF GREASE CUPS AND OTHER OILING POINTS

(See Oiling Diagram, Inside Back Cover.)

Make it your first duty upon receiving your car to study diligently the oiling diagram given in the rear of this book and learn to locate and identify every part on your car as indicated on the diagram.

As long as you operate your car you should in all cases faithfully follow directions concerning lubrication. By so doing you will receive maximum service and satisfaction.

The grease cups should be kept filled and screwed down regularly as the diagram directs.

KIND OF OIL AND GREASE TO USE

There are many good lubricants on the market and it pays to use only the very best quality. We will not attempt to name all the brands which will give satisfaction in a Studebaker car, but below is a list of the better known brands which we recommend.

For the Motor—Polarine Oil.

For the Transmission—Non-Fluid Oil (New York & New Jersey Lubricating Co.).

For the Rear Axle—Heavy Grease (No. 3 Cuyago, Standard Oil Co.).

For Universal Joints and Steering Rod Boots—Heavy Grease.

For Grease Cups and Steering Gear Housing—Cup Grease.

For Electric Starter Gear Box—Oil-Dag mixed with good engine oil. (See Instructions, page 51.)

For Magneto and Starter Generator—Highest grade light machine oils.

For Brake Swivels, Etc.—Any good grade machine oil.

Other oils, lubricants, etc., may be satisfactory, and in this connection we might mention the following brands: Monogram, Packard, Havoline, Harris, Arctic and Texaco. It is not a good plan to do too much experimenting—after you find a satisfactory brand.

If you must experiment, however, remember that in winter a lighter oil should be used in the motor and transmission than in summer. In the list we recommend above for specific parts the same grade may be used summer and winter. *Finally, do not under any circumstances use fibre greases of any kind at any time.*

Motor Cooling System

WATER SYSTEM—(See Illustration No. 9, Page 25)

There is a great amount of heat generated by the explosions in the cylinders and by the friction of the moving parts, which necessitates some method for cooling the cylinders, as otherwise the motor will overheat and lose power rapidly. (See "Overheating of Motor," page 51). Water is used for this purpose in the Studebaker "35." The water system, which contains 16 quarts, consists of a radiator, hose connections, water line, pump, and water jackets which are incorporated with the cylinders.

The radiator should always be kept full of clean, soft water.

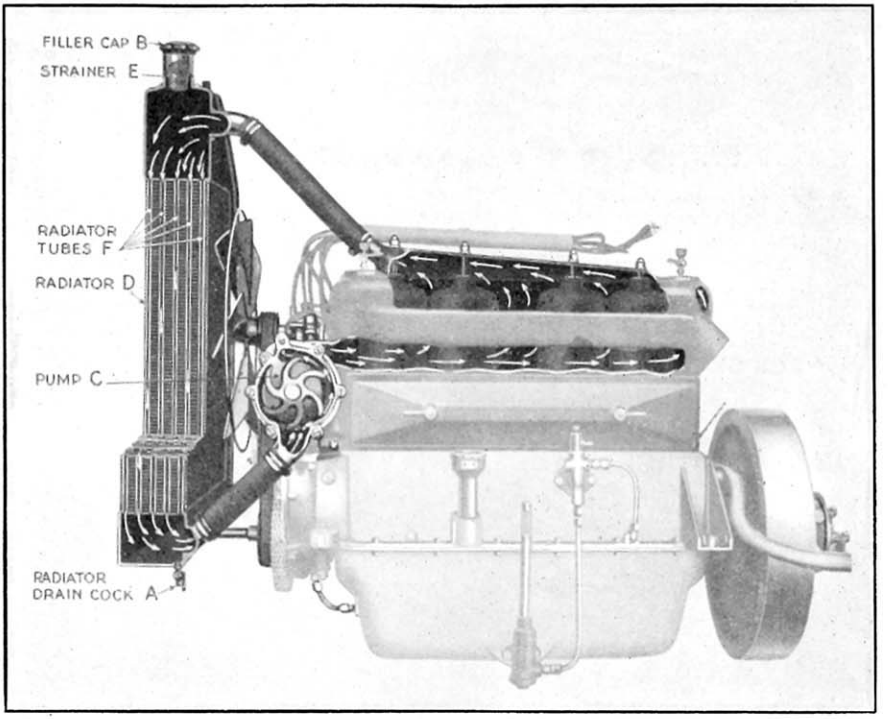


Illustration No. 9. Motor Cooling System

WATER SYSTEM—(1) Operation

The radiator being filled with water and the motor running, the centrifugal pump forces the water to circulate as follows: From the pump it is driven through the lower water line into the cylinder water jackets. Here it absorbs the heat and goes on to the upper water line and thence to the radiator. In the radiator it percolates slowly down through many fine tubes and is cooled by the air rushing through the fins surrounding the tubes, and thence returns to the pump.

The action of the air through the radiator is facilitated by a fan on the front of the motor which is rapidly turned by a belt, connected to a pulley attached to the front of the crankshaft. This fan tends to pull in the air through the radiator and assists in the cooling operation.

WATER SYSTEM—(2) Radiator, Pump and Fan

The radiator is of the tubular type. If the radiator fills with sediment from the use of dirty or hard water, it should be cleaned with a strong solution of soda. Pour this in and let stand over night; next morning run the motor for a few minutes, drain the radiator and fill with clean, soft water. Be careful not to allow oil to mix with the water, as it tends to interfere with radiation.

WATER SYSTEM—(3) To Drain System

It is a good plan to drain the water from the radiator about once a month and refill with clean pure water, opening the drain cock and continuing to pour water in after the system fills in order to flush it out thoroughly Close the drain cock after you are satisfied that the system is thoroughly clean.

WATER SYSTEM—(4) To Clean Radiators, Etc.

When the radiator gets splashed with mud do not attempt to clean it out by poking it with a sharp instrument. Take a hose with a good strong stream, open the hood and squirt water through it from the rear, **being very careful not to wet the magneto,** until the mud and dirt softens and is driven out. Do not attach license number plates or broad and heavy objects of any kind to the front of the radiator to obstruct the passage of air through the openings and to chafe holes in the tubes (F).

WATER SYSTEM—(5) Care of Pump

The pump is of the centrifugal type and requires no attention other than to see that it does not become choked by using dirty water.

WATER SYSTEM—(6) Care of Fan

The fan requires no particular attention, except oiling. (See Oiling Diagram.) Sometimes the belt gets a little loose and causes the fan to slip and not to turn as rapidly as it should. If this happens, loosen the nut which holds the eccentric arm of the fan, raise the arm slightly and retighten the nut. This will tighten the belt.

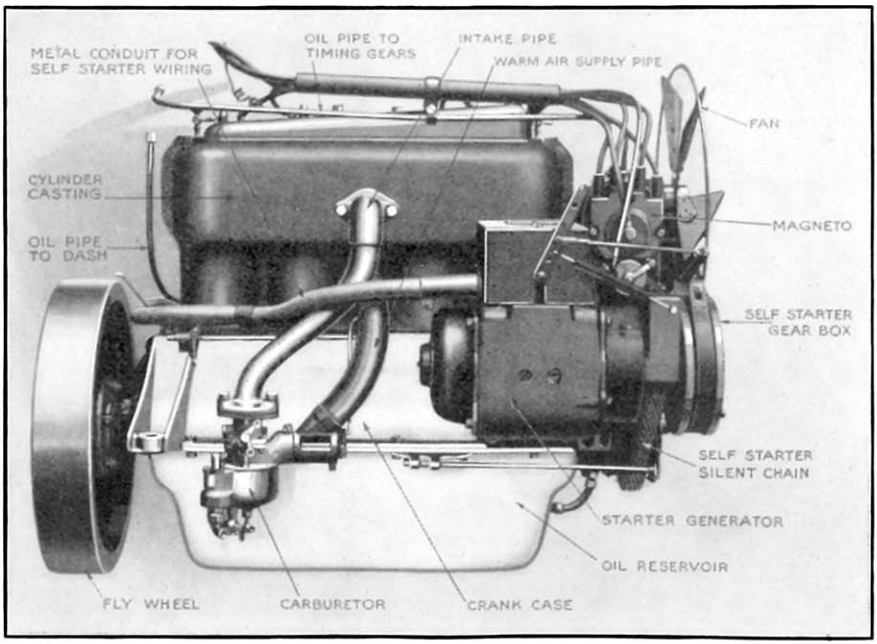


Illustration No. 10. Studebaker "35" Motor Right Side

Important Features of Motor and Suggestions

CARE OF NEW MOTOR

It is necessary to handle a car with a new motor more carefully than one which has been run for some time. This is due to the fact that the bearings are fitted rather tightly, and if the motor is run continuously at a high rate of speed, overheating and possibly a burned bearing will result. Do not under any conditions "race" a new motor.

To forestall motor trouble we again caution you to be sure to keep plenty of oil in the crank case of the motor as described.

LOSS OF COMPRESSION

Compression is made by the ascending piston compressing or forcing the gas into a small space between the top of the cylinder and the piston at the highest point of the upward stroke. It is quite important that this compression should be equal in all the cylinders and up to the proper standard.

The compression of a motor can be tested by cranking it—a motor with good compression cranks with a springy resistance. If it cranks too easy, it may be considered an evidence of poor compression and the cylinders should be tested for compression one at a time, as follows:

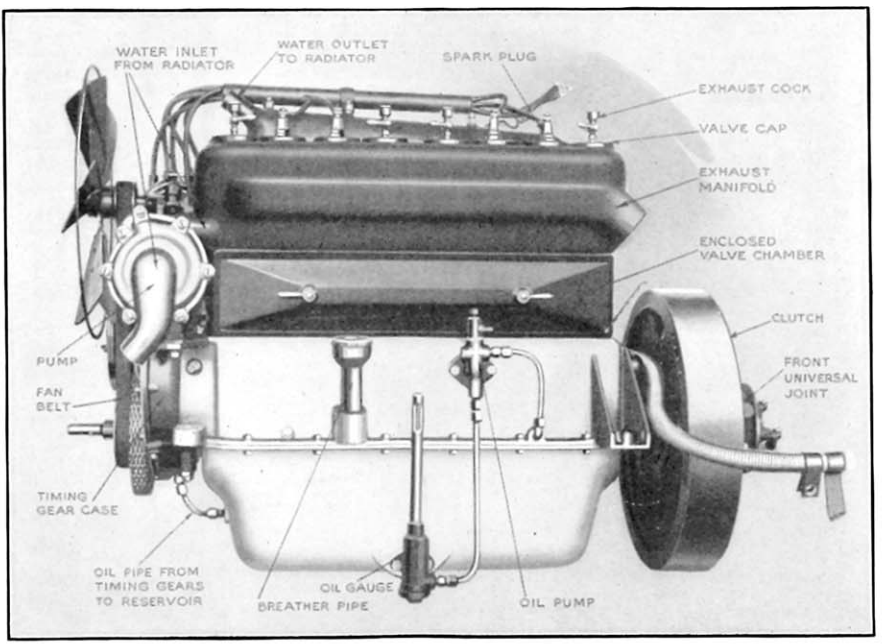


Illustration No. 11. Studebaker "35" Motor Left Side

The exhaust cocks (Illustration No. 11, Page 27) on three of the cylinders, say No. 2, 3, and 4 should be opened and the compression response No. 1 noted when turning the motor over. Then close the exhaust cock No. 2, open the exhaust cock on No. 1 and turn over and crank the motor to test No. 2 and so on until the four cylinders are tested. Compression loss is obviously due to the escape of gas when the piston is moving upward. There are three ways that it can escape:

LOSS OF COMPRESSION—(1) Its Cause

Due to abuse or long usage a motor may lose compression to some extent:

First—around valve caps.

Second—between piston and the cylinder walls.

Third—through the valves due to improper closing.

The valves may not close properly:

First—because there may not be enough clearance between the stem of the valve and the push rod.

Second—because carbon may be lodged under the rim of the valve where it seats in the cylinder casting.

Third—the valve itself might be warped so as to not seat properly.

LOSS OF COMPRESSION—(2) How to Find Its Cause

A leak at the valve caps can be detected by pouring oil or water over the cap on the top of the cylinder block and if bubbles occur when the piston is moving upward, it is an indication that there is a leak. It can be corrected by tightening the cap. A compression leak between the piston and cylinder walls is rather difficult to test—probably the best way is to correct first the valve compression leaks and valve cap compression leak, and if the compression is still poor, then the leak must be between the piston and the cylinder wall. This can only be corrected by taking out the pistons and putting in new piston rings. There are four rings to each piston. The owner of a car, however, will very seldom be troubled by a compression leak between the piston and the cylinder wall. The rings are held in close contact to the cylinder walls by spring tension. This means that when free they are a little larger than the bore of the cylinder and they are sprung into place in the grooves of the piston and inserted into the motor and the wear is taken up and the contact surface perfected by the action of the spring tension. The average owner of a car should never attempt to take down his motor and remove the piston. This can be done satisfactorily only by a first class garage man who has the tools and experience to do the job perfectly.

VALVES—(1) Inlet and Exhaust. (See Illustration No. 13, Page 30)

There are eight valves—two for each cylinder. These valves are operated by a camshaft which turns in the crank-case, and, by reason of the accurate grinding of each cam, raises or lowers the valves at precisely the correct interval. The head of the valve is a round disc, the under rim of which is beveled. (See Illustration No. 13, Page 30.) This fits closely into a bevel seat in the cylinder casting. As the camshaft raises the inlet valve 5/16 of an inch, the gasoline mixture from the carburetor enters. The camshaft turning permits the valve to lower again, which is

accomplished by the pressure of a spring (A) attached to the valve stem (B). By removing the valve chamber cover on the left side of the motor all the valve stems and springs appear in plain sight and are very accessible. The bevel rim of the valve top should fit in the bevel seat perfectly, so that no gas can escape, and the compression in the firing chamber at all times be maintained.

The exhaust valves are identical in appearance and operation, merely rising at different intervals and permitting the exploded gases to be driven out by the uprising piston into the exhaust manifold (C) and then into the muffler.

VALVES—(2) Grinding Valves

It is necessary sometimes to grind the seat of the valves so that the head will seat accurately. When the motor is new, this is very rarely necessary, but after it has been run for some time, carbon is deposited on the valves and they may become pitted.

Remove spark plugs (D) and exhaust cocks (E) and turn out the valve caps (1) into which they fit. A wrench A4855 is provided for this purpose. Fill up the opening leading from the valve chamber into the cylinder with rag to prevent dirt falling into cylinder. This is very important, but be careful not to allow any rag or even lint to fall into cylinders.

VALVES—(3) To Remove

Remove the cover from the valve chamber on the left side of the motor by unscrewing the winged nuts. By taking special valve lifting tool, AA5550, or a file or screw driver and prying up the washer which holds the spring under compression the pin which holds this washer to the valve stem can be withdrawn and the washer and spring will then drop off and the valve can be lifted out. Apply carefully a little valve grinding paste of emery and oil, or powdered glass and oil, to the valve edge and valve seat. Replace the valve in the cylinder and rotate it gently back and forth with a valve grinding brace, which you can secure from your dealer, or the nearest Studebaker Branch, by ordering Part No. S6572. Remove the valve at brief intervals and examine it to note whether or not you are getting a perfect seat. Never allow the valve grinding paste to become dry or gummy when grinding the valves. A drop of oil added now and then will keep it in the right pasty condition. When the bevel surface on both the valve and the seat are bright and satin smooth the seating may be said to be perfect. Deep pits or "rings" in either the valve or

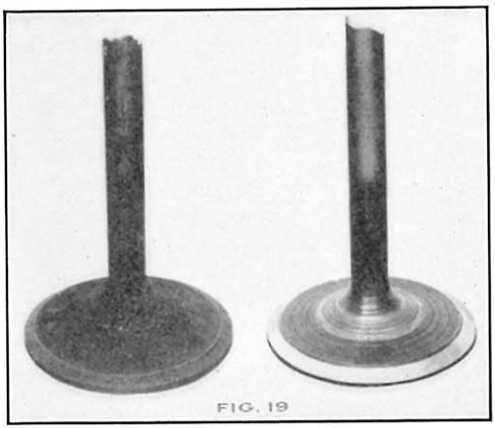


Illustration No. 12. Valve Before and After Grinding

the seat can best be removed by coarser grained emery or grinding paste, but in finishing the job a finer grain should be used. Valve grinding is always a careful, delicate job, and it should only be undertaken with care and perfect preparation. When finished, remove from the valve all traces of the valve grinding paste with gasoline. Do not forget to remove rag or waste. Replace valve, spring, retainer and adjusting nut. (There is a special valve seat reaming tool AA1390 provided to ream out the valve seats when the seats are badly pitted, but the use of this tool is recommended only for expert repair men).

VALVES (4) TO ADJUST

Clearance between the push rod and valve stems should be about .004 of an inch. To adjust the clearance between the push rods and the valve stem, fit a wrench over the flattened side of the push rod (H), and, while holding the push rod, fit a second wrench over the lock nut (F) which locks the push rod adjusting screw (G). Loosen this jam or lock nut a few turns, then the adjusting screw (G), the head of which lifts the valve stem, can be turned up or down according to whether you wish to increase or decrease the clearance between the push rod and the valve stem. After valves have been newly ground, it is advisable to leave a clearance space of not less than 1/64 of an inch between push rods and valve stems. The car should be run about 20 miles and the push rods then given their final adjustment while the motor is warm. To test the accuracy of the final adjustment detach the wire from No. 1 spark plug, open all exhaust cocks, and with the switch thrown on battery side, turn

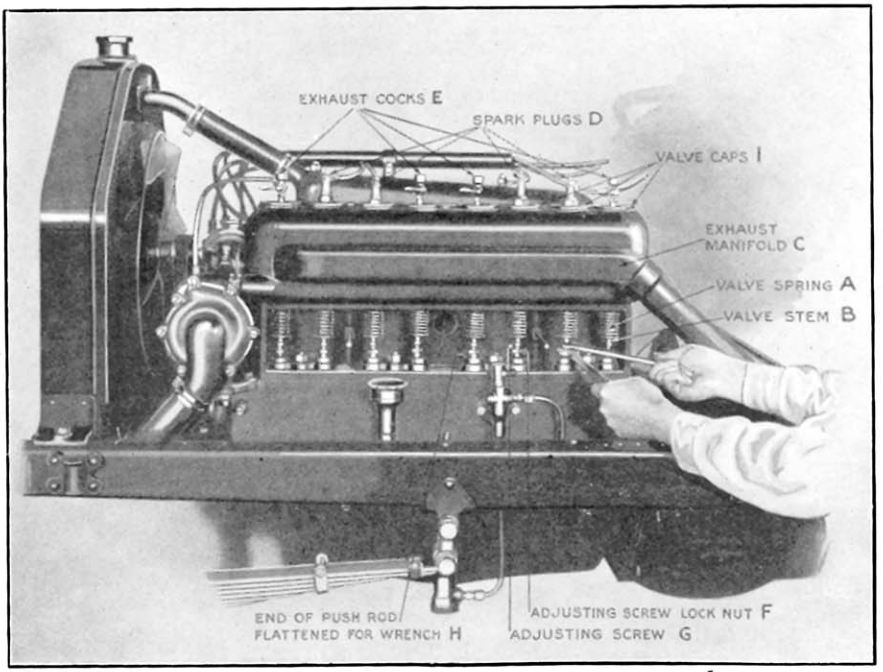


Illustration No. 13. Adjusting Valves

the motor over slowly until the spark is obtained on No. 1 cylinder. Both valves of No. 1 cylinder will then be seating. A piece of ordinary letter paper is about .004 of an inch thick and if the clearance between the valve stem and the push rod adjusting screw is more or less than this, turn the adjusting screw until the space between this screw and the valve stem is just sufficient to allow the passage of a piece of letter paper, then secure the lock nut again in position; go over both sets of valves of the remaining cylinders in this manner and after spinning the motor a number of times, check these over thoroughly to see that no mistake has been made before starting the motor. A quiet motor depends upon properly set valves.

CARBONIZATION OF MOTOR—(1) General Indications

If you should note that the motor, when fully supplied with water and oil and the spark lever in proper position (see "Spark Lever," Page 18), is overheating easily, has weak compression and develops a "knock" or "clank" when on a hard pull or going up a grade, there is probably a large deposit of carbon in the cylinder compression chambers. This may be due to the use of poor lubricating oil or incorrect adjustment of the carburetor. (See "Carburetor," Page 11.) Even though it is not affected by these two conditions, a small residue of carbon will adhere to the interior of the compression chamber, and if left for a great length of time, will develop the trouble mentioned above. Of course the carbon sticking to the inside of a cylinder becomes red hot and preignites the charge.

CARBONIZATION OF MOTOR—(2) Remedies

It is an excellent plan about once a week to pour a few tablespoonfuls of kerosene into the cylinders of the motor through the exhaust cocks (E, Illustration 13, Page 30) and allow it to stand over night. To get the best results the kerosene should be poured in while the motor is still warm. In the morning the motor should be cranked over several times, with the switch on the off position. This will work the kerosene and dissolved carbon out of the motor through the exhaust pipe. This operation, if frequently used, will, to a considerable extent, keep the compression chamber clean and free from carbon. If there is a great deal of hardened carbon deposit which has accumulated through a considerable period of inattention it will be necessary to scrape the walls of the compression chamber.

A great many owners condemn a perfectly good motor for lack of power, when the fault is entirely due to their carelessness and lack of attention and not to the construction of the motor. A motor to deliver its quota of power must be kept free from carbon. The valves must be kept in perfect adjustment and they must seat perfectly to give proper compression.

A pint of kerosene allowed to stand over night in the motor every two or three weeks will save gallons of gasoline and dollars of expense in operating an automobile. A little precaution and a little work in keeping valves ground and adjusted properly will give your car the extra power to get to the top of the hill first or to beat the other fellow on the level stretch of road.

TIMING GEARS—(See Illustration No. 15, Page 34)

These consist of three spiral gears running in a housing on the front of the crank case of the motor. One gear is fastened on the end of the

crankshaft and turns a gear which operates the camshaft. The camshaft gear in turn operates a third gear which drives the pump and magneto shaft.

The pump and crankshaft gears are of the same size and turn at the same rate of speed. The camshaft gear is twice the size of the crankshaft gear, because each valve opens only once every two revolutions of the crankshaft (see "Principle on Which Gasoline Motor Works," Page 5) making it necessary that the camshaft turn only half as fast as the crankshaft.

TIMING GEARS—(1) Operation

The Timing Gears of the Studebaker motors are distinctive and different from those of the majority of cars. The helical gear system is used.

The gear wheel (D) which drives the magneto and pump shaft is operated at right angles to the cam shaft gear (B) which turns it. By this method Studebaker gears run very much more quietly, wear less and place the pump and magneto shaft in a very much more convenient position than is possible with the old style gears.

These gears run in an oil tight case and are lubricated by a constant stream of oil flowing over them.. (See Illustration No. 8, Page 22.) They require no attention whatever excepting to see that the oil constantly runs through the "sight feed" on the dash.

It is the function of the timing gears, as their name implies, to turn the cam shaft at such a speed that the opening and closing of the valves will be exactly timed in proper relation to travel of the pistons in the cylinders.

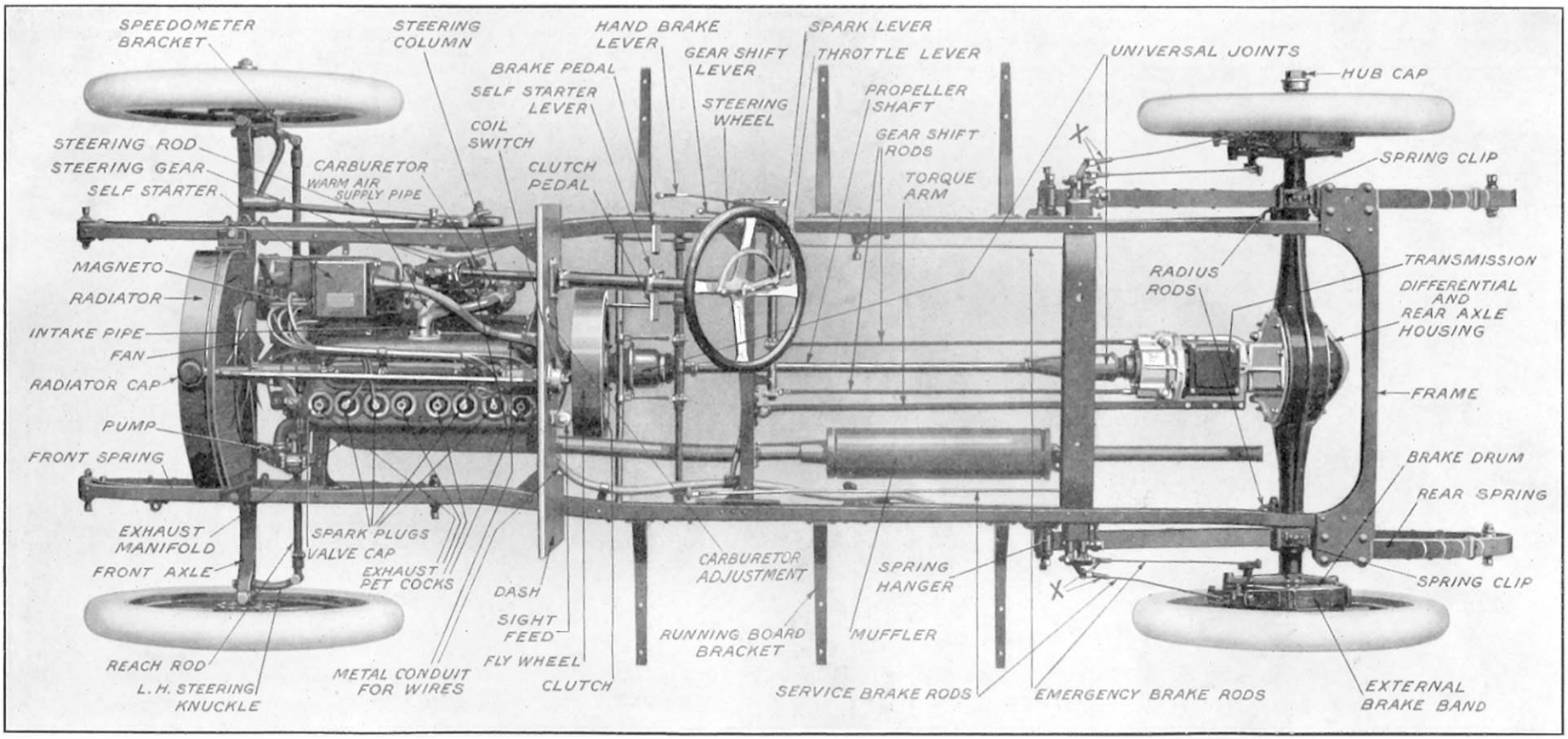


Illustration No. 14. Studebaker "35" Chassis

TIMING GEARS—(2) To Remove

If it is ever necessary to remove the timing gears for any cause, the only caution necessary to replace them perfectly is to see that the marks on the crank shaft gear (A) and the cam shaft gear (B) are put on with the marked tooth on the smaller gear (A) exactly between the two marked teeth on the larger gear (B) at point (C) shown in diagram. (In removing crank shaft and cam shaft gear wheels great care should be used not to damage bearings or shafts. The gear wheels should be removed only with special tools provided for this purpose. Crank shaft gear puller yoke AA5563 should be used to remove the crank shaft gear wheel, and cam shaft gear puller A1325 to remove cam shaft gear wheel). The magneto and pump shaft gear (D) can be placed in position in the separate assembly shown in illustration, and this assembly bolted in position above the cam shaft gear. The arrangement of the timing—so far as the gears are concerned—is thus completed, and the timing of the spark in relation to the position of the piston can be regulated through the magneto coupling, as described in paragraph, "The Setting of the Magneto."

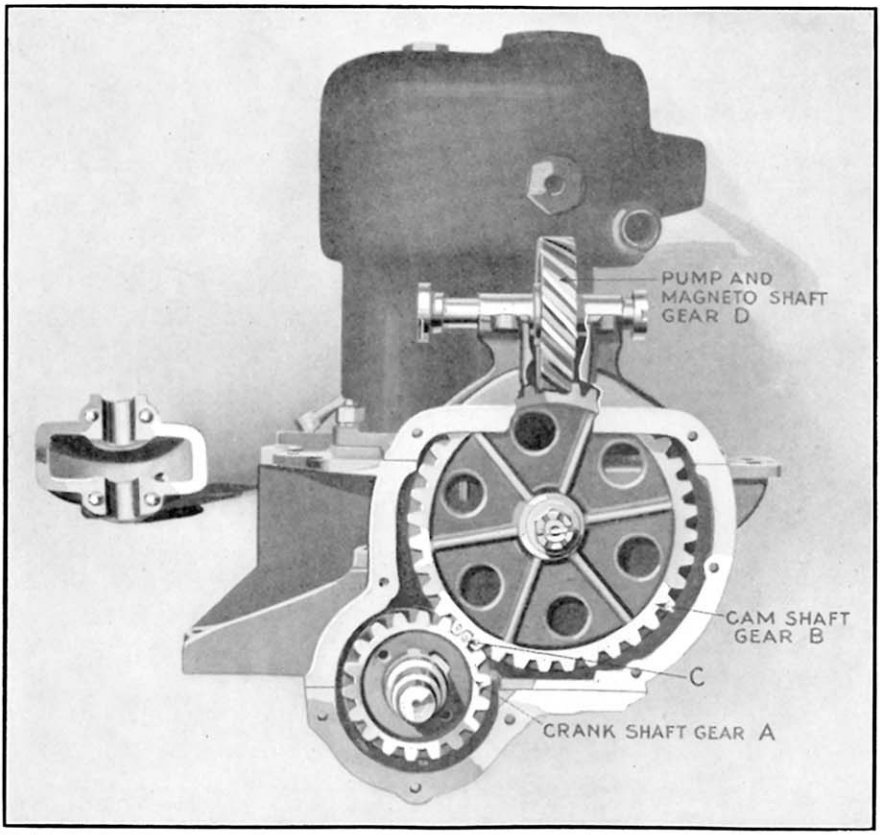


Illustration No. 15. Timing Gears

Transmission System

CLUTCH—(See Illustration No. 16, Page 35.)

The clutch is directly in the rear of the motor and fits into the flywheel (A). It is made up of a stamped steel spider (B) with a rim which is cone shaped and resembles a narrow section of a large flower pot. This cone (C) is attached to the propeller shaft leading to the rear axle and connects the motor and transmission mechanism. A heavy spring (D) is used to press it hard into the fitting section on the inside rim of the flywheel. The cone is faced with leather (E), which grips this inside rim, holding both tightly, and as the flywheel revolves with the crankshaft (F), the clutch and propeller shaft also revolve. Under the leather face of the cone shaped rim is a series of flat springs (G) which allows the leather surface to engage less harshly with the inside of the flywheel (A). In order to disengage the clutch, it is necessary to press down upon the foot pedal at the driver's seat. This presses back the spring (D), the leather faced cone (C) slips back from the flywheel and the flywheel revolves without the cone and propeller shaft turning. It remains in this position—disengaged—as long as the driver presses down upon the clutch pedal.

CLUTCH—(1) Care

The clutch leather (E) should be treated occasionally with a little neatsfoot or castor oil. Never use lubricating oils on the leather as they will cause it to slip. The clutch bushing is oiled by an oil lead (H) bored through the center of the crankshaft (F).

CLUTCH—(2) Remedies for Troubles.

If the clutch slips, clean the facing thoroughly with kerosene and apply neatsfoot oil. This same remedy can be applied if the clutch becomes dry and "grabs."

To apply this oil remove the board from the floor of the car immediately in front of the front seat ("floor board"), cut a stick just the right length to hold the clutch out by bracing the clutch pedal forward from the front of the front seat. The oil can then be worked in with a stiff feather. **Do not use too much oil.**

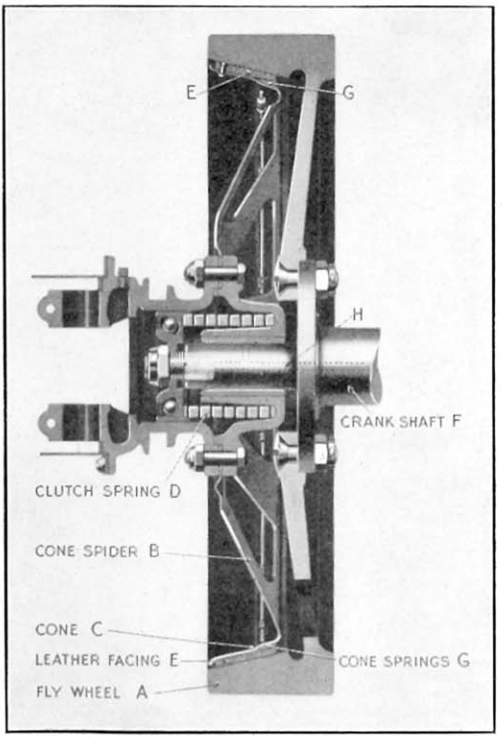


Illustration No. 16. Clutch

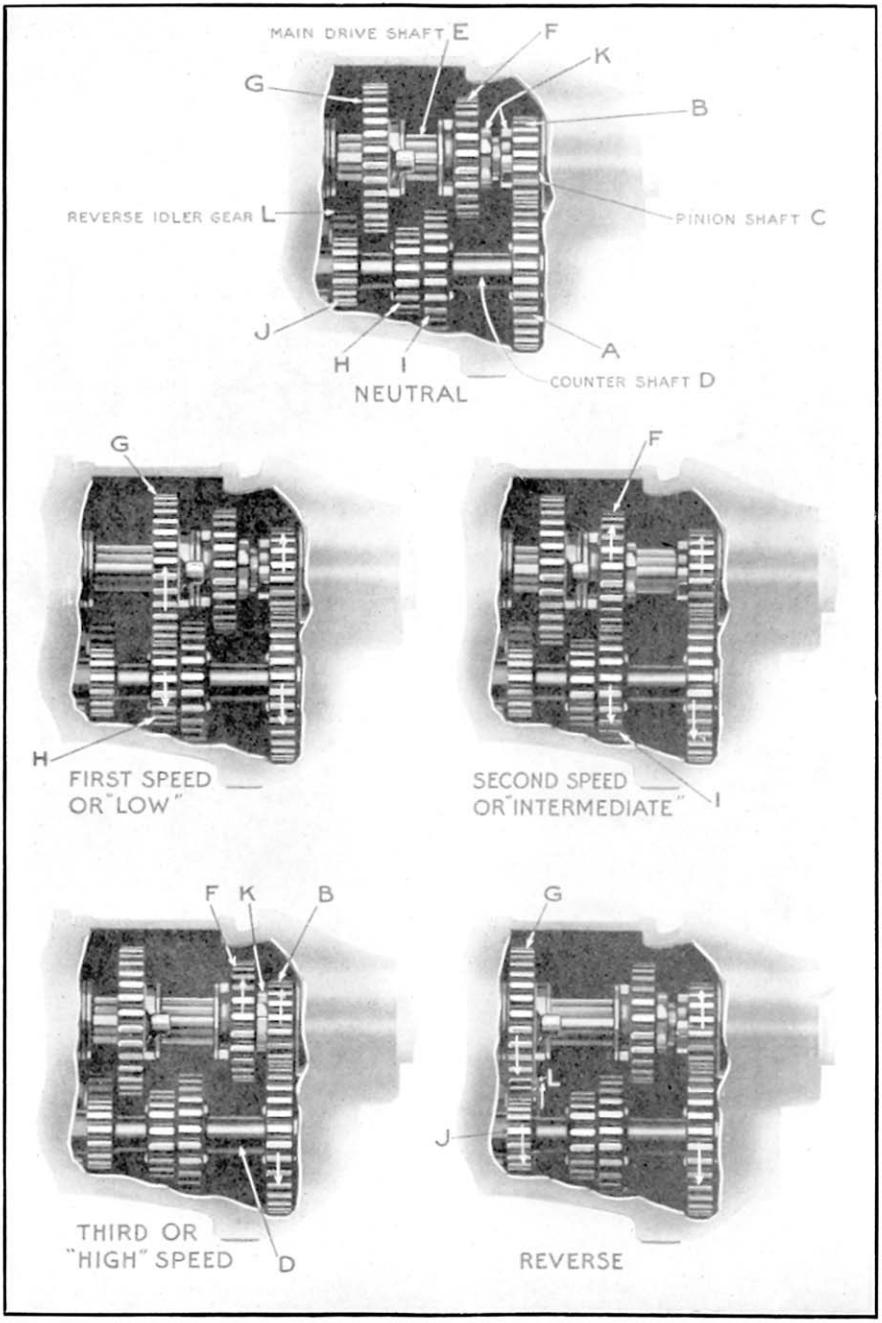


Illustration No. 17. Position of Transmission Gears in Different Gear Shifts

The clutch leather which comes with the cars should wear for many seasons, but if it becomes damaged by abuse so that it must be replaced, order a new facing through your Studebaker dealer or the nearest Branch.

The proper care of the clutch will add much to the pleasure of driving a car. In the first place, one-half the knack is the ability to work the clutch skillfully. It is obvious that if the clutch is held partly out and the flywheel of the motor allowed to just slip over its surface, heat is very quickly generated, the leather scorched and hardened and future trouble contracted for.

CLUTCH—(3) How to Use Properly

The clutch on an automobile should be either in or out absolutely.

A good many drivers make it a plan to keep their foot off the clutch pedal while they are driving. The weight of the foot on the pedal and a little nervous tension in the driver's leg is sometimes just sufficient to hold the clutch out just far enough to "slip it" on a hard or sudden pull. Another good way to spoil a clutch is to throw it out in traffic until the car comes almost to a standstill—then to accelerate the motor and slip the clutch in with the gear shift lever still in high speed. When the car slows down with the clutch out, the gear lever should be slipped to second speed and if the car comes to a full stop, to low speed. Another important point in driving is to learn to engage the clutch gradually and not to "bang" it in with the motor racing.

Remember these points when driving car.

TRANSMISSION GEARS—(1) General Construction. (See illustrations Nos. 17 and 18, Pages 36 and 40.)

From the clutch the drive is taken by a propeller shaft equipped with a universal joint at both ends to the gear case just forward of the rear axle. Within this aluminum case are housed the transmission gears. The function of the transmission is to increase the pulling power of the motor by giving it, through the changing of gears, a greater leverage on the rear wheels. This is necessary, as the same power for starting the car and for going over heavy roads and up hills need not be used when driving over a smooth road or pavement.

The Studebaker "35" transmission is of the sliding gear type and has three speeds forward and one reverse, as follows:

"First," or "low," speed is geared at the ratio of 12½ to 1. In other words, when the hand lever is thrown into the first speed slot, gears in the transmission are meshed so that it is necessary for the crankshaft of the motor to turn twelve and one-half times in order that the rear wheels turn once.

"Intermediate," or "second," speed is geared 7¼ to 1; "high," or "third," speed is geared 3.7 to 1, and "reverse," is geared 17 to 1.

The transmission which provides this gear reduction consists of three shafts and a series of gear wheels. Two of these shafts are in direct line with each other, the end of the longer one turning in the end of the shorter one. The longer shaft is called the main drive shaft, the shorter shaft is called the pinion shaft. The third shaft operates parallel with the pinion and the main drive shaft and is called the countershaft. The main drive shaft carries two sliding gears of unequal sizes. These gears can be slid into mesh with gears of unequal

size on the countershaft. One of the sliding gears can also be moved into engagement with an idler gear supported by the transmission case. The operation of these gears may be described as follows:

TRANSMISSION GEARS—(2) Action of Gears—(See Illustration No. 17, Page 36.)

You will note from the picture that the large gear (A) on the front end of the countershaft (D) is always in mesh with the small pinion gear (B) on the end of the pinion shaft (C). (See (C^1) in Rear Axle Illustration, Page 40). The power from the motor is carried through the clutch and propeller shaft to this pinion which delivers it to the large gear on the countershaft (D), consequently, with the clutch engaged, the motor running, and the hand lever in neutral, the pinion shaft is turning, but the main drive shaft (E) on which are the sliding gears (F and G) is not turning.

When the operator throws the lever into "first" speed, he pulls forward the sliding gear (G) in mesh with the third gear (H) on the countershaft. This results in the sliding gear turning, which, of course, turns the main drive shaft and the rear wheels. In the same way, when the operator throws the lever into the slot marked "Intermediate," the front sliding gear (F) is thrown back in mesh with the second gear (I) on the countershaft. When he throws the lever into "high" speed, the front sliding gear (F) is thrown forward but does not mesh with any gear on the countershaft. By means of jaws (K) attached to its hub, pinion (F) engages with similar jaws (K) (See "neutral" position) on the hub of pinion (B). Pinion (B) is forged integral with pinion shaft (C) which, through the universal joint ("V," Rear Axle Illustration, Page 40), is always in connection with the propeller shaft. Therefore on high speed the propeller shaft turns the rear axle direct without the power going through the countershaft (D) or its gears (H, I, J), but the countershaft gears and the countershaft turn *idle* on high speed through the fixed pinion (A) which is always in mesh with pinion (B).

When the lever is thrown into "reverse" speed, the rear sliding gear (G), instead of meshing with one of the gears on the countershaft, is thrown back in mesh with the "idler" (L), which is always in mesh with the small gear (J) on the countershaft, and, there being an odd number of gears in mesh, the drive shaft turns in the opposite direction and the rear wheels turn backward, instead of forward.

When the gears are thrown in mesh on any speed, they are automatically locked in that position by a ball and spring lock (A), (Rear Axle illustration, page 40) which acts on the shifting rod (B), same illustration.

You probably will never find it necessary to use "first" speed except in starting from a standstill or on the most severe road conditions. The car should be run as much as possible on "third" speed, but whenever on heavy roads, steep hills, or when driving in congested traffic use your "second" speed freely, as it is there for that purpose. In fact, it is much better to change into "second" speed when the engine is laboring under an unnatural load than to cause undue wear and tear on the transmission and universal joints by remaining in "first" speed.

TRANSMISSION GEARS—(3) Care Necessary in Changing Speeds

In shifting gears, it is always necessary to disengage your clutch by pressing left pedal to the extreme point. You will find yourself only half

releasing clutch if you do not use care and acquire correct practice. Shift the gear lever without timidity and with a quick, rapid movement. In passing from "first" to "second" speed and from "second" to "third" speed, do not accelerate motor while clutch is released. It should slow down a trifle between each shift. In stepping down, however, from "third" to "second" accelerate your motor very gently while clutch is released in order that the gears which must engage together may be traveling at approximately the same speed, as already described.

TRANSMISSION GEARS—(4) Care

In oiling diagram, you are instructed to put non-fluid transmission oil in the transmission case at certain intervals. In addition to this it is advisable to add that the transmission case should be thoroughly cleaned out regularly several times a season. This can be done by removing the hand cover from the transmission case and unscrewing the plug at the bottom of the case. After the oil has drained off kerosene or gasoline should be flushed over the gears and the entire case washed out very thoroughly. The plugs should then be replaced, new oil placed in the gears and the cover tightly screwed down. Sufficient oil should be placed in the transmission case to touch the countershaft. This will require about two pints.

UNIVERSAL JOINT—(See (C) Rear Axle Illustration, Page 40

The universal joint, sometimes called the "Toggle" joint, is a device for the transmission of a rotary motion through an angle as between the clutch and transmission. The angle of drive, however, between the motor and axle of a Studebaker car is much less than it is on the average car. The Studebaker "35" is equipped with two universal joints, one at the forward end of the propeller shaft where it is attached to the clutch. (See Clutch Illustration, Page 35, and Chassis Illustration, Pages 32 and 33), and a second at the rear where the propeller shaft connects with the pinion shaft. These need no attention except to be kept well covered and lubricated. (Note oiling diagram.)

Rear Axle and Running Gear

(See Illustration No. 18, Page 40)

The rear axle, not including the transmission, consists of a drive pinion (D) and ring gear (E), differential gears (F), rear axle shafts (G), all of which are enclosed in a housing of pressed steel (H), and rear wheels, bearings, brakes and tires. The rear axle is geared 3.7 to 1 on direct drive and is of the full floating type. In a floating axle the weight of the car is not carried on the axle shafts which turn the rear wheel. As already mentioned, the axle shafts are encased in a housing (H) of pressed steel. In a full floating axle, this housing extends into the hubs (I) of the rear wheels and the rear wheels turn on ball bearings (J) set on this housing, thus relieving the axle shafts (G) absolutely of all weight of the car.

The full floating axle shafts are flanged to the outside of the hub of the rear wheels. This flange (K) is bolted to the rear wheel with six bolts (L). By removing these bolts the flange and the entire axle shaft can be withdrawn, leaving the rear wheel in place and still carrying the load of the car.

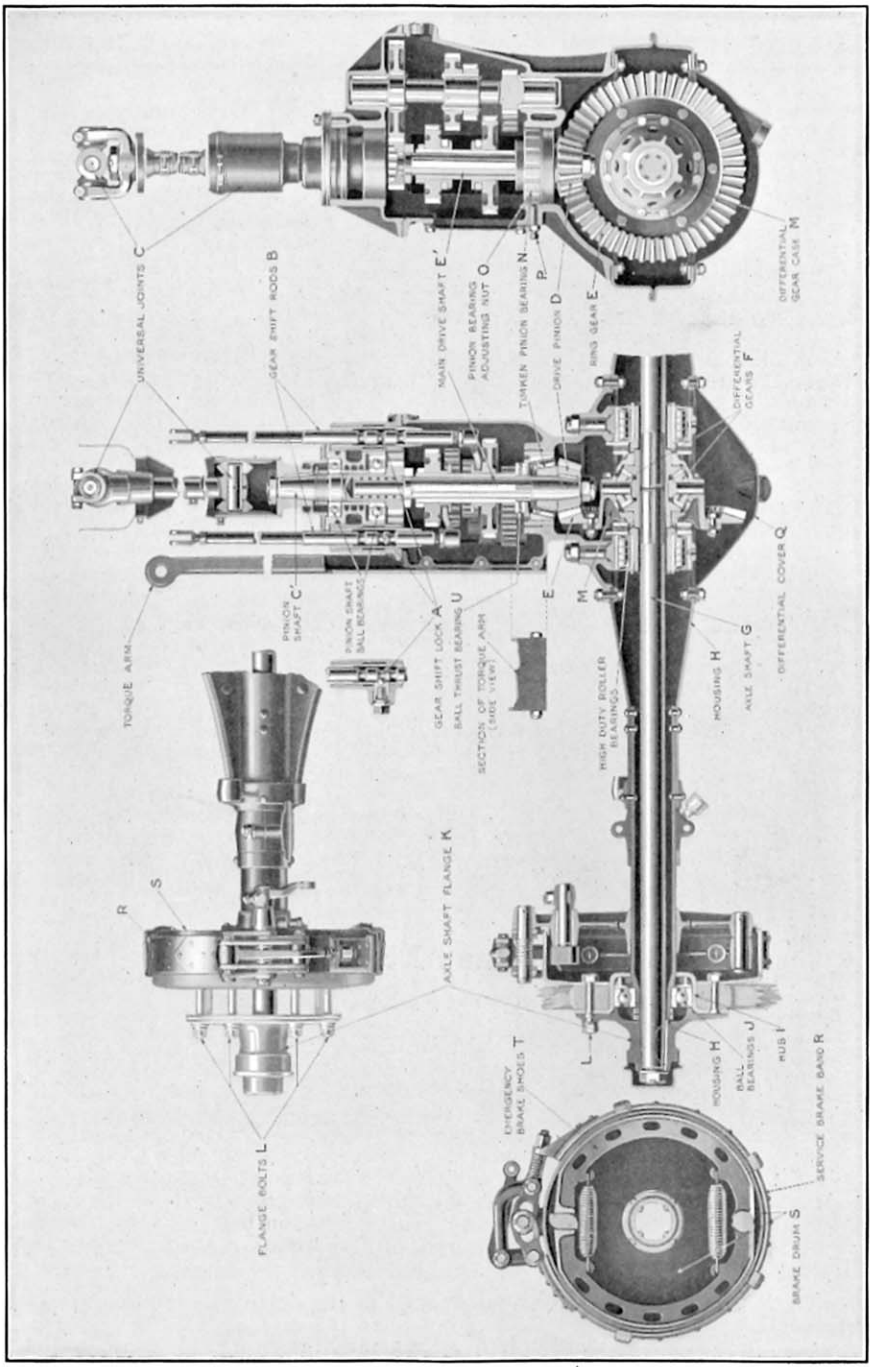


Illustration No. 18. Studebaker Full Floating Rear Axle

PINION AND DRIVE GEAR

The pinion (D) is on the rear end of the main drive shaft (E^1) and is in mesh with a large ring gear (E) which is bolted to the casing holding the differential gears. The power delivered to the main drive shaft through the medium of the transmission gears is transmitted to the ring gear which turns the axle shafts.

The drive shaft (E^1) on which the pinion gear is keyed, turns in a Timken Roller bearing (N) which is held in a large, hollow, adjustable retaining nut (O). This nut is threaded, allowing it to be screwed or turned in the housing to secure the proper adjustment.

PINION AND DRIVE GEAR—(1) Adjustment

After a car has been driven about 7,000 miles or over, the wear between the drive pinion (D) and the ring gear (E) may occasion a slight noise in the rear axle. This wear can be taken up by adjusting the pinion (D) by means of the pinion bearing adjusting nut (O). Remove the cover from the transmission case and the nut (O) is accessible. Unloosen the set screw (P) which holds this adjusting nut and the adjusting nut (O) can be turned sufficiently to take up the wear between the drive pinion and the ring gear. It can be turned by a drift punch. In using the punch and driving the bearing around be very careful not to be too vigorous. Great care should be used in adjusting this pinion not to draw it too tightly. During the operation the rear wheels should be jacked clear of the floor, the transmission set in neutral position, and the rear wheels moved back and forth to try the adjustment as it is being made. The adjustment of Timken bearing (N) is reinforced by ball thrust bearing (U). In adjusting the pinion it is usually necessary to adjust ball thrust bearing (U) in relation to Timken bearing (N). This can be done as follows: The adjustment of the ball thrust bearing is held by a pin which passes through a collar holding this bearing. This pin is held in place by a circular spring which encircles the collar. Carefully lift the spring off the collar and the pin, which is attached to it, will come with it. Ball thrust bearing (U) can then be adjusted by turning it inward to tighten the adjustment. Special tool, spanner SA5567, is required to turn bearing (U).

During the pinion adjustment, the differential cover (Q) should be removed. The pinion can then be seen and easily tried by hand to determine its adjustment. This, in connection with moving the rear wheels jacked clear of the ground, should enable you to determine the adjustment. Unless you are an experienced mechanic, it would be better for you to leave these adjustments to an experienced garage man.

DIFFERENTIAL—(See Illustration No. 19, Page 42)

Since an automobile is not pulled but is driven by power transmitted to the rear wheels, it is essential there be some device whereby one wheel is allowed to turn faster than the other, which action takes place in turning corners. Power, also must be delivered to each wheel regardless of their relative speed and in direct proportion to the resistance of each wheel. This device is known as the differential, its construction and operation may be described as follows: Four small bevel gears (D) are placed at right angles to each other on a rigid frame work (F) in such a position that they are not in mesh with each other but mesh on opposite sides with two larger bevel gears (G) which are slip keyed, independently of each other, to an axle shaft. (See Rear Axle Illustration No. 18, Page 40.) The frame work (F) which carries the four small bevel gears is bolted to the large ring gear wheel (H) which receives through the pinion the power from the engine.

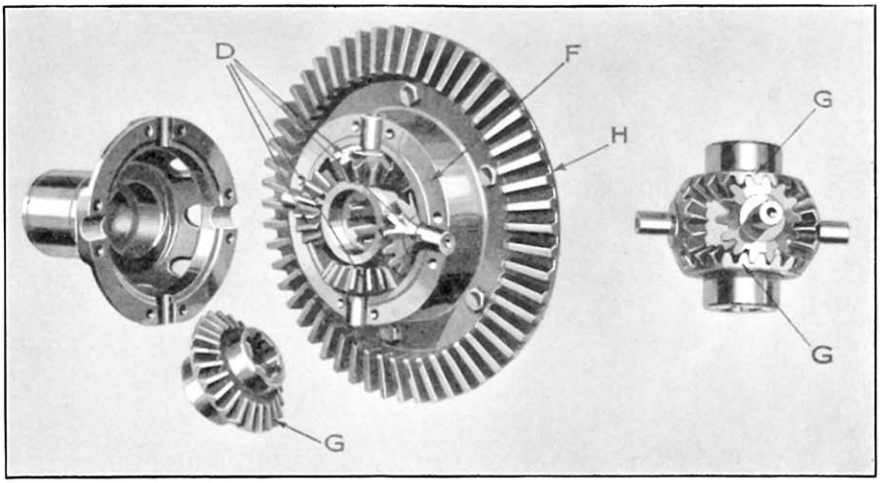


Illustration No. 19. Differential Gears Disassembled

The whole mechanism is enclosed in the differential housing where it operates in grease.

The two axle shafts project out of each side of this housing, and the ring gear is bolted to it. By such an arrangement of gears, it is possible for one wheel to turn slower than the other, and even for one to turn in one direction while the other is turning in the opposite direction.

The differential assembly being bolted to the inside of the ring gear consequently must move with it, but just as soon as it is necessary for one shaft to turn slower than the other, it is enabled to do so through the action of these gears, even though the ring gear is turning at a greater speed.

This is rather difficult to explain clearly, but with the assistance of the picture on this page you can better understand the operation. The differential requires no adjustment, and it is only necessary to keep it properly lubricated. (See "Oiling Diagram" Back Cover.)

It is advisable at least once a season to clean the differential thoroughly. This can best be done by removing the cover (See (Q), Rear Axle Illustration No. 18, Page 40) at the rear of the housing and washing out with gasoline. Repack with fresh grease, being careful to replace cover with gasket in perfect condition. It should be lubricated regularly through the plug in the differential cover as shown in oiling diagram.

BRAKES—(See Rear Axle Illustration No. 18, Page 40)

These are two in number, operating on each rear wheel. The service brake is controlled by the brake pedal and consists of a band (R), lined with Raybestos, contracting on the brake drum (S).

The emergency brake is controlled by the hand emergency brake lever and consists of two cast iron shoes (T) which expand against the inner rim of the hub drum (S).

BRAKES—(1) Care

The service brake should be kept clean and free from grit, dirt or oil. Both brakes should be so adjusted that when pushing down on the foot lever, or pulling back on the emergency lever, equal braking power will be delivered to each wheel. If not, the brake will not only tend to wear quite rapidly, but will also shorten the life of the tire.

BRAKES—(2) Adjustment

The service brake is operated by a pedal from which a long rod passes back to a transverse bar on the chassis directly beneath the tonneau. This brake bar is equipped with individual levers outside the frame and just back of the forward attachment of the rear springs (See Chassis Illustration, point marked "X," Page 33) at either side of the car. To these levers are attached the brake rods which run directly to the brake drum.

The emergency brake can best be adjusted at the point where the emergency brake rods are attached to the levers outside the frame as above described. The rods are attached to the levers by clevises; unpin the clevis from the lever and the clevis, which is threaded to the rod, can be turned in either direction to shorten or lengthen the rod as required. These clevises are marked (X) on the chassis illustration, Page 33.

The service brake can best be adjusted by the adjusting nut attaching the brake band to the link on the brake drum.

BRAKES—(3) To Equalize

It is very important that the brakes on each wheel should be adjusted to clamp each wheel with equal pressure. If the brake sets harder on one wheel than it does on the other, it will not stop the car as efficiently as if both brakes were adjusted with equal pressure, and, furthermore, the tire of the wheel on which the brake sets harder will wear very much more quickly. To set the brakes with equal pressure the rear axle should be jacked up so that wheels will turn free. Set the brake gradually and try each wheel. Adjust the brakes until the pressure on each wheel is the same.

BRAKES—(3) How to Use

The proper care used in keeping the brakes perfectly adjusted and reasonable care used in applying the brakes will save 25% of tire expense. The practice of some drivers in setting the brakes hard whenever they stop the car and thus cause the wheels to lock and the tires to slide may appear very smart from a spectacular standpoint, but it is a very foolish and unnecessary waste of good tire material.

Learn to apply the brakes easily and gradually, excepting in emergency cases. Really good driving is shown by the ability of the driver to bring his car to a standstill exactly at the point desired without sliding the rear wheels.

TIRES

The tires on the Studebaker "35" are Goodrich 34" x 4". They should be kept inflated to 75 to 80 pounds pressure. (Note that in hot weather and especially on rough roads the road friction will heat the tire and materially increase air pressure. Allowance should be made accordingly when inflating.)

You can obtain a pressure gauge from any accessory or tire store. The cause of 75% of tire troubles is under-inflation, and to keep your tire expense at a minimum, see that they are inflated regularly to the pressure as explained on page 43. Tires should also be kept free from oil and heat as much as possible.

TIRES—(1) To Demount Rim from Wheel

Remove valve cap and lock nut. Turn valve side of rim to top of wheel, loosen rim clamps, turn free from rim, pull bottom of rim well out and lift straight up so as to bend valve stem.

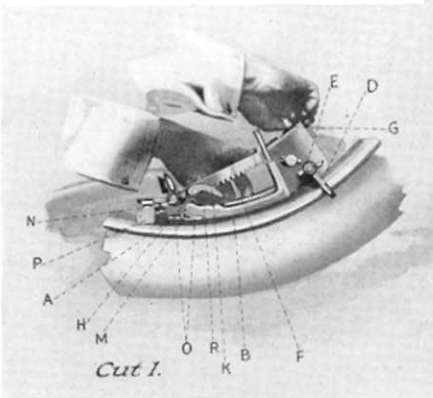
TIRES—(2) To Put Rim on Wheel

Have valve hole in felloe on top. Insert valve stem holding rim well out from wheel at both top and bottom. Now push rim on firmly so that joint will wedge itself between edges of drive plate on wheel. Place clamps in place over rim, but before attempting to tighten see that the rim is tight to the back flange, then tighten clamps over rim pulling up nuts as far as possible with fingers. Then use wrench a few turns at a time on each nut until rim is drawn rigidly to place. Put on valve cap. Tires of course can be fully inflated on rim before rim is placed on wheel.

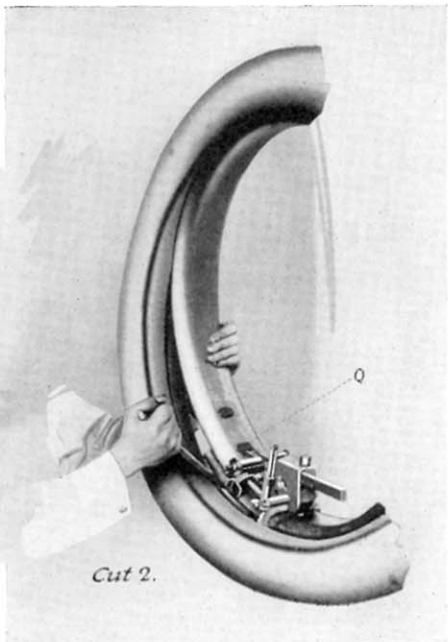
TIRES—(3) To Remove Tire From Rim (See Illustration No. 20, Below)

In your tool kit you will find a power tool No. AA4878 and an extra joint pin (M). You will also find a drift pin to drive out the joint pin. The brace wrench AA5569 used to remove the bolts from the rim clamps will fit nut (G) of the power tool.

Tires sometimes become partially stuck to rims; therefore, loosen tire bead on both sides of the tire completely around the wheel. Drive pin (M) out of joint (O) with drift pin. Set power tool with fulcrum (A)



Cut 1.



Cut 2.

Illustration No. 20. Tire Remover

on curved face of joint (O). (See diagram.) A heel-plate on rim at (B) will then be fitted into a catch plate in base of power tool. Fasten rear clamps (D) to rim and turn up from nut (E) securely. Adjust rack (F) by worm screw nut (G) so that groove (H) will fit snugly over fulcrum (A), holding pawl (K) free from its notch with second finger of left hand as shown in cut one. Drop rack (F) into position, loosen thumb nut (N), hook clamp (P) under rim with the point of (F) under heel-plate (Q) on rim and tighten nut (G). Before proceeding see that all clamps grip the rim firmly. Now expand the rim by applying brace wrench to nut (G), turn to right and the rim will open at joint (O). Continue to open until pawl (K) drops into notch (R). The opening in the rim will now be ⅜ of an inch wide. Pawl (K), when it drops into notch (R), will lodge and by turning nut (G) in the opposite direction, rack (F) will rise on pawl (K) lifting up the rim over fulcrum (A). Continue turning (G) until the rim is contracted sufficiently, which will be about 4 inches—not too far to strain tool unnecessarily, and the tire can readily be removed from the rim.

In turning nut (G) the brace wrench should turn smoothly at all times. If it works very hard it indicates that the tire is stuck to the rim—probably in the clinch of the rim—and should be therefore loosened with the tire iron. To remove the tire, insert tire iron between rim and casing at the joint in rim, (Cut II), and pry it off.

TIRES—(4) To Replace Tires on Rim

Remember that the inner tube must be placed in casing before you attempt to put the tire on the rim.

Enter valve stem in hole, seeing that the edge or bead of the casing is forced well into place, at least a foot each side of the valve, **and be sure that the inner tube and tire flap do not stick out from slit in casing.** Then insert tire iron between rim and casing at point opposite from valve and pry tire into place. Don't use a screw driver or any sharp pointed tool that may cut the rubber.

To prevent the possibility of tire becoming stuck to rim, it is a good plan to coat the inner surface of the rim flanges with graphite before placing tire on rim.

Apply brace wrench to nut (G) and expand rim until pawl (K) can be lifted from notch (R) and with pawl (K) lifted from the notch (R)—reverse direction of brace wrench, drawing the ends of the rim together until they close tightly at joint (O). Unclamp power tool and drive in joint pin at (M).

Front Axle

The front axle is an "I" beam unit drop forging and requires no attention except to see that all moving parts are kept well lubricated. (See "Oiling Diagram.")

STEERING GEAR

The steering gear is of the worm and worm wheel type. It is irreversible, which means that a shock or blow from a rut or road obstruction cannot turn the steering wheel in the driver's hands. The only way in which the position of the wheels can be altered is by movement of the

steering wheel and inasmuch as the shock of the road cannot be transmitted to the steering wheel, the driver does not need to hold the steering wheel rigid to keep the car on the road. All chance of accident, due to the wheels being turned one way or the other, by rough places in the road, is eliminated.

STEERING GEAR—(1) Care

The steering gear requires no care except to see that it is lubricated, and in addition to the instructions under Oiling Diagram, it might be well to call attention to the illustration. You will notice Plug (E) in the center of the housing on top. By removing this plug, grease can be forced into the housing with a grease gun. At the bottom of the worm wheel housing, you will notice Plug (F). Once in a season, it is a very good idea to thoroughly flush out the gear housing by removing Plug (F) and Plug (E). Gasoline squirted through the opening at Plug (E) will thoroughiy wash off the gears and grease and sediment will drain off through Plug (F). The cup (G) lubricates the upper thrust bearing on the steering column. There is a similar bearing at the lower end of the steering column which is lubricated automatically from the gear housing. Cup (H) lubricates the worm wheel bearing. These cups should be kept filled with grease as described under Oiling Diagram.

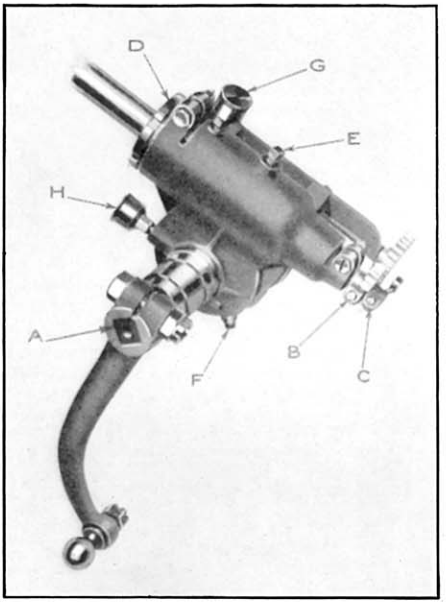


Illustration No. 21. Steering Gear

STEERING GEAR—(2) Adjustment

After having driven the car for some time, it is possible that a little back lash or play will develop in the steering gear.

To make the adjustment, proceed as follows:

First block the front end of the car clear of the floor so that the weight is removed from the front wheels and they can be moved readily with the steering wheel. From the steering wheel turn the wheels to the extreme right or left, as though about to turn a sharp corner (to the left gives you better room to work). You do this because there is less wear at the angle positions than in the straight ahead position, and a tight adjustment straight ahead would probably be a binding adjustment in the angle positions. In extreme position, work the steering wheel slightly to ascertain the amount of back lash or lost motion. It must be remembered that it is not advisable to try to adjust a steering wheel absolutely without back lash. If this is attempted, too much rigidity will result, with undue wearing and with unnecessary difficulty in steering. If, however, the steering wheel can be moved

slightly up and down, it is an indication that the ball bearings should be slightly taken up to prevent this end play. They are taken up as follows:

Remove the cotter pin from the castled nut on the top of the housing, unloosening the bolt a few turns and adjust by screwing the large nut (D) slightly into the case, trying the steering wheel continually to see if it is not tightening too much or binding. Special spanner will fit this nut or it may be turned with a light hammer and a drift punch used with extreme care.

After this adjustment is made, if there is too much play or back lash to the steering wheel, it is an indication that the cogs or teeth on the worm wheel and worm gear are worn. In the Studebaker "35" this can be immediately corrected by turning the worm wheel one-quarter way around, thus presenting new sets of teeth to engage with each other on both the worm wheel and the worm. This adjustment can be made almost instantly, as follows:

Remove the cotter pin from the nut on the clamp bolt above shaft (A)—Unloosen this bolt, remove the steering arm, then turn the steering wheel a quarter way around and fit the steering arm back on the shaft (A) and tighten up with the clamp bolt. You can readily understand that this will present the engagement of entirely new sets of teeth in the worm wheel and worm as above described.

STEERING GEAR—(3) Lining Up Front Wheels

It is also necessary that the front wheels be correctly lined up. It occasionally happens that they are thrown out of line through one of the wheels having been bumped in running against a curve or a rough place in the road. If the wheels are out of alignment, extra wear of the tires will result and should be remedied. A fairly exact way of determining this is to use a straight edge and measure between the felloes of the wheel or the edges of the rims on the wheels at the point directly in front of the front axle.

Carefully make note of this distance and measure in the same way across the wheels directly back of the front axle. The difference between these two measurements will be the amount that the wheels are out of alignment horizontally. If the wheels are only slightly out of true horizontally, the trouble can be remedied very easily in the clevis engagement between the reach rod and the steering knuckle on the left wheel. Remove the clevis from the steering knuckle and turn by half turns until the distance between the rims of the wheels, both in front and back of the axle, are exactly the same. If the steering knuckle, however, is very badly bent is must be *cold* straightened at a Repair Shop and by a very skilled blacksmith. Heating it will ruin the effects of its original heat treatment and render it unsafe to use on your car. Rather than attempt to straighten a badly damaged steering knuckle, it is better to order a new one from a Studebaker Dealer or Branch.

The front wheels may look to be out of true perpendicularly; they are purposely placed two degrees out of true perpendicularly, in order to hang to the road better. A severe disalignment perpendicularly is occasioned only by a very severe shock and it is not advisable to attempt to repair either a steering knuckle or a front axle which has been injured to such an extent as to spring it perpendicularly. The car should be taken to a Studebaker Dealer or to the nearest Branch to be repaired or to have the damaged part replaced.

Springs

There are two important points to remember concerning the care of springs. First, see that plenty of grease is kept in the grease cups and that the cups are screwed down regularly to force the grease into the bushings. Second, see that the "clips" which fasten the spring to the axle are kept tight. After driving a new car, say 200 or 300 miles, the clips should be tried with a wrench. Loose clips are the most frequent cause of springs breaking.

If the springs should squeak after being carefully lubricated through the oil cups, jack the car up by the body, allowing the weight of the axles and wheels to separate the leaves of the springs. Then apply a graphite lubricant between the leaves of the springs and the noise will disappear. Studebaker springs, however, very seldom get noisy.

Body

CARE OF BODY

Studebaker cars are finished with exactly the same care and same number of coats of paint and varnish as the most expensive cars on the market. Since varnish seasons over a considerable period of time, the body consequently requires some care.

In the first place, never let grease or mud remain on the car longer than is absolutely necessary or it will damage the varnish. Do not attempt to scrape the mud off, but rinse the body thoroughly with clear water until the mud and foreign matter is removed.

If a stream of water from the hose is used be careful not to use a nozzle which will throw a strong stream of water. Remember that water should be flowed gently upon the body and with an unnozzled hose. In washing the car, avoid the use of gasoline or strong alkali soap. If soap is required to remove greasy substances, use only pure castile soap. Excepting for this purpose there is no reason why the soap should be ordinarily used. Do not use a rag to wash a car, and even if a sponge is used, it must be remembered that every particle of grit or sand which clings to the sponge will scratch the varnish. Water should not be allowed to dry, as this will cause the varnish to become cloudy and streaked; it should be wiped dry with chamois skin. Before any attempt to wipe the body is made, it is best to be sure that every particle of dirt and grit are rinsed off, grit in the chamois skin will scratch the varnish of your car. In using water on the body of your car be careful of its temperature. Ice cold water from the hydrant flowed on a body in a garage or in atmosphere which is 70° or more Fahrenheit, will tend to spoil the varnish. Water that is too warm will also injure the varnish. Expert washers say that a car should be washed with water at about 60° to 70° Fahrenheit.

The chassis and wheels should be washed with warm water and Castile or Ivory Soap dissolved in water, applying the same with a soft sponge until all grease is removed. Rinse it with clear water and dry thoroughly with chamois skin. Never use a sponge or chamois on the body that has been used on the chassis. Give the car good care, and its handsome appearance will last for a long time.

CARE OF TOP

The top should also have careful attention, and we offer some suggestions as to its care:

Dust should be removed from the mohair with a dry brush. Do not use gasoline or naphtha, as these will disintegrate the rubber in the fabric and cause it to separate and leak. To remove grease spots, use Castile Soap and warm water and carefully rinse with clean, warm water. The inside of the top should be cleaned with a stiff brush. Follow the same method as above in removing spots from the inside of the top.

Never put the top down or fold while wet or moist, as moisture might cause mildew in the fabric when closely folded together. When the top is down, it should be fastened securely with the straps that are provided, thus avoiding all chafing of the top fabric.

In putting the top down, be careful that the folds are properly made so as not to bunch up or crowd a certain amount of the fabric in one spot where it has to be crushed together in order to get the boot over it. If it is properly folded the boot will fit snugly over every part of it without crowding.

By adhering closely to these instructions, there is no reason why a top should not wear and last as long as the car.

Electric Starting and Electric Lighting System

The Studebaker-Wagner System for electric lighting and cranking consists of the following parts: Starter-Generator, Controlling Mechanism, Gear Box and Storage Battery.

STARTER GENERATOR—(See Illustrations Nos. 22 and 23, Pages 50 and 51)

The Starter-Generator is a combination of electric motor and generator. Operating as a motor, it receives electric current from the storage battery and delivers power through a gear box, and silent chain drive to the engine shaft. It ordinarily delivers sufficient power to run the engine up to a speed of 60 to 80 revolutions per minute. Operating as a generator, it supplies current to the storage battery, thus keeping the battery fully charged. Observe the following instructions:

STARTER-GENERATOR—(1) Instructions

Bearings should be oiled once a month, or once for about every 1,000 miles of travel, with a good grade of engine oil.

To oil the bearing, at the gear box end, apply oil can to self-closing oiler "G."

To oil the bearing, at the opposite end, remove screw F, Fig. 1, and apply oil through this hole, being careful to replace screw when through oiling. A dozen or so drops of oil to each bearing is sufficient.

No internal care or adjustments are required by the starter-generator. The carbon brushes bearing upon the commutator of the revolving armature will last from 1½ to 2 years without renewal.

If any trouble whatever exists with the starter-generator system, in the great majority of cases this trouble will be in the battery. Follow carefully instructions under "Proper Care of Battery."

THE CONTROLLING MECHANISM

This consists of two parts:

First, A cylindrical switch, actuated by the lever "Q" to which the starting handle on the steering column is connected. The electrical connections of the starter-generator to the switch, are so arranged that an easy movement of the actuating levers causes the cylindrical switch to connect the starter-generator as a motor. When the engine fires and the lever is released, the spring "D" pulls the cylindrical switch to normal position. The internal connections of the starter-generator are then proper for charging as soon as the proper speed is reached. This corresponds to a car speed of approximately 8 to 10 miles per hour.

Do not disturb this switch under any circumstances. There is nothing about it which can get out of order, and tampering with adjustments will simply lead to trouble.

Second, An automatic circuit breaker which connects the starter-generator to the battery when the voltage of the generator reaches a point slightly higher than that of the battery. When the voltage reaches this point, the generator will deliver current to the batery.

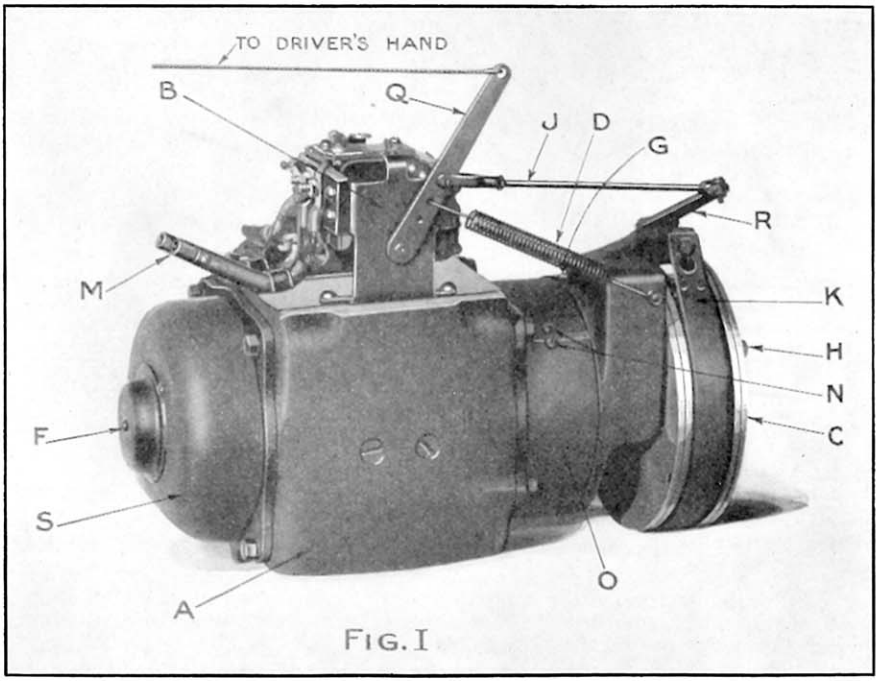


Illustration No. 22. Right Side of Electric Starter

GEAR BOX

The Gear Box "C" is a simple planetary gear box, mounted on the starter-generator shaft. This gear is locked to the shaft, and runs freely with it and without speed reduction when the engine is running normally. When the controlling lever is operated for starting, the outside member of this planetary gear is clamped by the brake band "K." As long as the brake band is tightly clamped, the planetary gear is in operation, and the starter-generator will turn the crank shaft.

GEAR BOX—(1) Instructions

The gear box should be oiled about once a month, using a good grade of engine oil mixed with "Oil-Dag," which can be obtained at any supply house. Follow directions coming with "Oil-Dag" for mixing.

To oil gear box, remove Plug "H," Fig. 1, 2, and put in about one-fourth pint of this mixture, after which replace plug, screwing same in tight.

The brake band "K," Fig. 1, 2, is properly adjusted on shipment, to clamp the gear box tightly when the operating mechanism is actuated. When the controller is released, this brake band should expand away from the gear box, allowing gear box to rotate freely. If by chance, this adjustment should be found slightly incorrect, as might happen after several

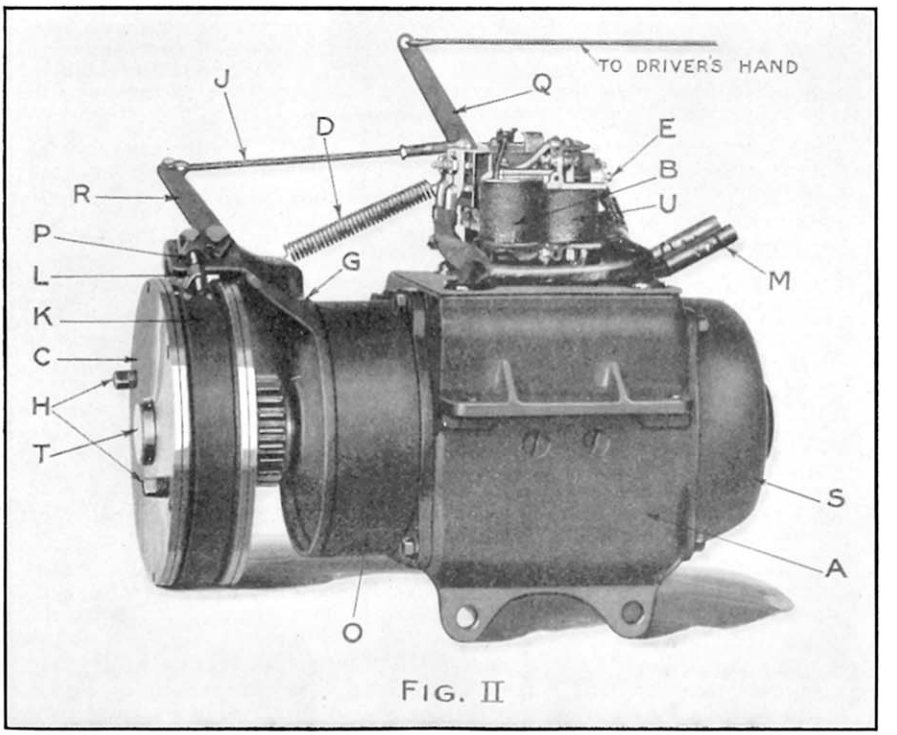


Illustration No. 23. Motor Side of Electric Starter

months' operation, re-adjustment can be very simply made by tightening the screw "L," Fig. 2.

With occasional inspection of the brake band and filling of the gear box with lubricant, there will be practically no chance for gear box troubles.

Lubricate silent chain occasionally with ordinary lubricating oil.

OPERATING ELECTRIC STARTER SYSTEM FOR FIRST TIME

Cranking the car with the Studebaker-Wagner starter-generator system is the essence of simplicity. Pull the handle on the steering post and the cranking operation is automatically taken care of by the starter. When the engine fires and is running normally, release the handle.

If the starter does not turn over the engine, something is wrong. The operating mechanism should be released at once, as under these conditions the battery is rapidly discharged.

If the starter-generator is making an effort which is sufficient to turn over the engine, make sure that the engine is free and for this purpose release the clutch. If the starter-generator still fails to turn the engine over, it will probably be due to low battery. Crank the engine by hand and recharge the battery as instructed under Storage Battery on next page.

To determine whether the starter-generator is properly delivering current to the battery under normal running conditions, first, turn on all lamps with engine idle; second, then start engine. If the lamps brighten up perceptibly, when the engine is driving the generator, the system will be delivering the current properly.

Storage batteries are fully charged when shipped, but the charge runs down gradually when the battery is not used, and if the battery has been two weeks or more in transit, it may have insufficient power for cranking.

STORAGE BATTERY—(See Illustration No. 24, Page 53)

A lead type storage battery of six cells, delivering an electric pressure of approximately 12 volts is used. For the proper care of the Storage Battery observe the following instructions:

The owner of an electrically equipped car should own a syringe hydrometer which is an instrument for testing the strength of the battery solution (electrolyte). A hydrometer can be purchased for two or three dollars through any Studebaker dealer or any good electrical house.

Examine battery upon receipt of car and also about once every two weeks, and see that the liquid covers the plates about one-quarter inch. To examine battery, lift the lid of battery case, and take off small caps which cover the cell vent holes.

Water for use in the storage battery ought always to be distilled. If it is impossible to secure distilled water, clean, fresh rain water may be used. Ordinary top water which contains mineral salts will damage the battery.

If the liquid is too low, add distilled water. If any new liquid is added to the battery, the tops of the cells should be wiped clean and dry, as dirt and dampness may lead to trouble. Do not forget to replace the vent caps and close the lid. The specific gravity of the liquid when the battery is fully charged should read on the hydrometer 1.280 to 1.300 per cell.

If the liquid tests lower than 1.250, the car should be run preferably at a speed of 15 to 20 miles per hour, until **each** cell of the battery has reached a point not lower than 1.280. If it is inconvenient to run the motor long enough to bring the reading up to its proper figures, the battery should be taken out of the car and charged from some outside source at the normal rate, as specified on the battery name plate of the battery until the strength of each cell is up. Pure acid should never be added to a battery cell. If it is impossible to bring the reading up, or if some of the solution has been spilled, more solution may be added, consisting of one part of chemically pure sulphuric acid (known to the trade as battery acid), with three parts of distilled water. Always add acid to water. Never pour water into acid. Still further, the acid should be added very slowly, a few drops at a time.

For the proper working of the electric starting device, it is imperative that the battery should be amply charged. If the starter cranks the engine slowly, the liquid should be tested to see that it is up to or above 1.280 in each cell. In demonstrating or exhibiting the starter, each time the engine is started, it should be run long enough to refill the battery to compensate for what has been taken out, and the engine should be run at least twenty times as long as the time the battery is used in operating the starter. For example: if it takes two seconds to start, the engine should be run 40 seconds to make up for the current used.

There is no danger of overcharging the battery. The characteristics of the starter-generator are such that the charging current begins to flow into the battery at about 10 miles per hour, reaching about 8 amperes at 15 miles per hour, and thereafter as the speed of car increases, gradually

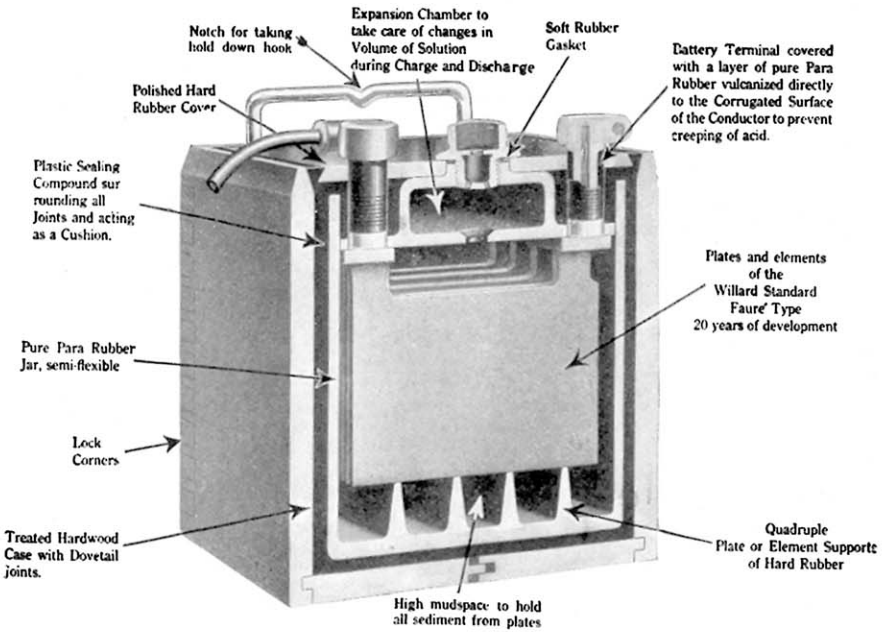


Illustration No. 24. Storage Battery

diminishes to 2 or 3 amperes at 50 to 60 miles per hour. This charging current can flow into the battery continuously without damage.

Under ordinary running and starting conditions, the battery will never become so weak as not to properly crank the motor. If it does, it will probably be due to external causes, such as a ground in the wiring circuit or taps; lack of pure water in the battery, or lack of proper filling; too extravagant use of the current without charging sufficiently to make up for the current used.

When system is operating satisfactorily, a hydrometer test of battery will not be necessary. It is also usually unnecessary to test the voltage of the battery; if, however, this at any time becomes desirable, the necessary instrument (voltmeter) may be found at any well-equipped garage or supply house. A voltmeter test should never be made directly across the terminals of an idle battery. It should be made only while the battery is actually delivering current to the starter-generator.

STORAGE BATTERY—(1) Taking Out of Commission

When a battery is not to be used for some time we advise that it be placed in the care of a battery station, where it will be given proper attention until the battery is again to be used. A battery must not be stored away more than 30 days without means provided to connect it with a recharging current of the proper amperage once a month. Before placing the battery in the car again, each cell should be carefully inspected to see that the electrolyte covers the plates, adding pure water if necessary. If the engine is to be operated while battery is out of the car, connecting rod (J) (See Illustrations Nos. 22 and 23, pages 50 and 51) between controller lever (Q) and brake lever (R) on gear box (C) must be removed and the spring (D) disconnected from lever (Q) and the switch pulled *and secured* in starting position. Operation of the generator with switch in generating position and without a battery, is dangerous. When battery is removed, if the wiring is not disconnected from the starter-generator, *be sure that the terminals of all wires removed from the batteries are perfectly insulated.*

CAR WIRING SYSTEM

The wiring system of the Studebaker "35" within the chassis is enclosed in flexible metal conduits. The wires leading to the switches and dashlight in the body are plugged so that the body of both closed cars and touring car models can be removed without in any way disturbing the wiring—merely disconnect it by pulling out plugs. The system is so designed that it requires absolutely no attention and it should not, under any circumstances, be disturbed. It positively cannot get out of order excepting in case of very severe accident.

With the Studebaker-Wagner System, the car wiring is exceedingly simple, consisting of two main wires connecting the starter-generator to battery, and a three-wire arrangement of circuits connecting the lamps to the battery, thus permitting with a 12-volt starter generator and 12-volt battery, the use of a six-volt lighting system.

The wiring system should require no attention whatever at any time.

ELECTRIC LIGHTS

The bulbs in the head lights are 7 volts, 16 candle power; side lights 7 volts, 4 candle power; dash and tail lights 7 volts, 2 candle power. They can be purchased at any good supply house.

Do not operate your car with one or two lamps burned out. Replace the lamp immediately or turn off the pair with the missing lamp, otherwise the current demand from the battery will not be properly balanced. Do not tamper with the wiring of your car and especially not with the connections in the lamps, for that is where short circuits and grounds are most likely to occur.

Do not replace a lamp bulb with one of higher or lower candle power than the original.

Do not expect to get the best results with dirty or cracked reflectors or lenses, or with head lights jarred out of perfect focus. Clean the reflectors only with chamois and powdered dry rouge—a coarser fabric will scratch the reflector surface.

SPECIAL

If there should exist troubles which these instructions do not clear up, visit the nearest Studebaker Dealer or Branch, or describe the case fully in a letter and further suggestions, if necessary, will be sent you from the Studebaker Technical Department at Detroit.

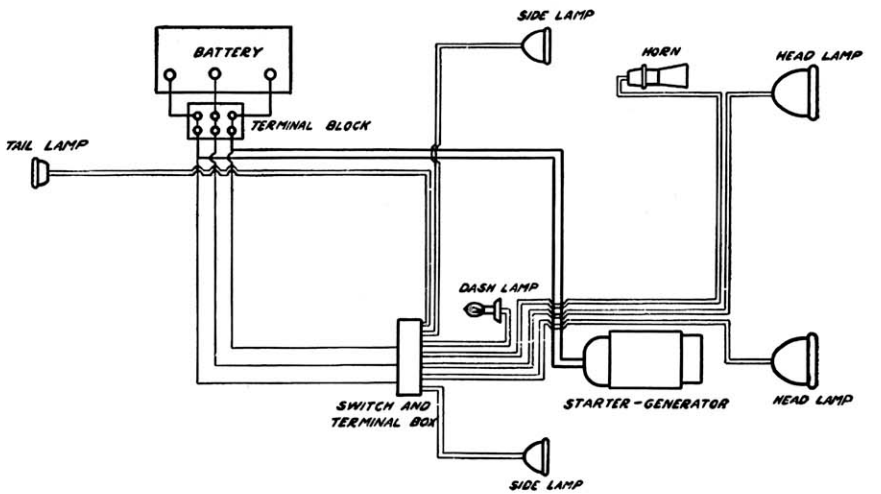


Illustration No. 25. Electric System Wiring Diagram

Condensed Suggestions for the Car Owner

Do not touch any adjustments or tamper with any parts until you are sure as to what is the cause of the trouble. When in doubt do not attempt to overcome it until you have analyzed it thoroughly. There is always a sure cause for automobile trouble, **find it before you begin to fix it.**

IF MOTOR FAILS TO START

(1) Be sure gear shift lever is in neutral position.

(2) Look in the gasoline tank, but not with a lighted match or cigar!

(3) Be sure that the gasoline is turned on in the gasoline line.

(4) Be sure that the gasoline is running into the carburetor which can be ascertained by opening the drain cock at the bottom of the float chamber.

(5) Prime the carburetor by pressing down carburetor priming cock.

(6) Be sure that switch is thrown to battery side.

(7) Be sure that all the terminals are tight on the batteries, and on all parts of ignition system, and that no wires are short circuited in any way.

(8) Be sure that the batteries are not below the limit of strength—that is, each dry cell should test ten on an ammeter gauge. One weak dry cell will make it very difficult to start the car and should be immediately discarded.

(9) Examine spark plugs to see that they are clean and points properly set. To test them, see "Spark Plugs," page 17.

(10) To be sure that spark is being delivered to plug, throw switch to battery side, disconnect terminal from one of the spark plugs and hold it about 1/32 of an inch from top of plug. Have someone crank the motor by hand very slowly. If spark hops from terminal to plug, the Ignition System is not at fault.

(11) Be sure the gasoline is not stale or mixed with kerosene or water. Water which is heavier than gasoline, can be separated from gasoline by opening the drain cocks under the tank and under the float chamber of the carburetor.

(12) In extremely cold weather the gasoline may be too cold to vaporize. A rag soaked in boiling water and wrapped around the carburetor and intake pipe will assist vaporization but great care must be used to see that none of the water enters the carburetor through the air intake pipe or in any other way. With this caution in mind, boiling water can be poured over the intake pipe and carburetor until these parts become thoroughly warm.

(13) Be careful in washing the car that water does not get into the carburetor through the air intake pipe thus making the starting of the motor impossible until it is drained out.

(14) If motor still refuses to start, it may be possible that you have flooded it with too much gasoline.

If so it is necessary to clean out this rich gas from the cylinders. Turn the pointer on the dash to "Air," retard the throttle lever one inch on the sector and spin the motor a few turns with the starter or by hand, always remembering the caution that to operate the motor by starter too long a period unnecessarily weakens the battery charge. The most thorough way to clean cylinders of too rich a mixture is to crank it over by hand several times with the exhaust cocks open. Then close the exhaust cocks and crank in the regular way.

IF MOTOR STOPS

It is due to:

(1) Lack of gasoline.

(2) Lack of oil.

(3) Overheating of motor due to lack of water.

(4) Improperly adjusted carburetor. See that the vent in the gasoline tank stopper is open.

(5) Failure of Ignition System.
   (a) Short-circuiting of wire or terminal.
   (b) Disconnected or broken wire or wires.
   (c) Wet Magneto.

IF MOTOR OVERHEATS

It is due to:

(1) Lack of proper lubrication. (See "Lubrication System," Page 21.)

(2) Defective water circulation. It is necessary to ascertain that the radiator is full and it not leaking.

(3) Carbon in the cylinders. (See page 31.)

(4) Incorrect adjustment of carburetor. A too "rich" gas mixture from the carburetor will cause overheating. Adjust carburetor.

(5) A broken fan or a slipping fan belt will cause a motor to heat rapidly. Same should be repaired.

(6) Driving with a retarded spark and an open throttle will also cause this same trouble.

IF MOTOR FAILS TO DEVELOP POWER

(1) A choked muffler causing back pressure. Tap the muffler lightly with a stick or hammer to loosen up the deposit of soot.

(2) Compression leaks (See under "Loss of Compression," Page 27).

(3) Improper carburetor adjustment giving too rich or too lean a mixture.

(4) Ignition spark weak due to faulty ignition system, dirty spark plugs or improperly adjusted spark plugs.

(5) All causes under "If motor overheats."

IF MOTOR MISSES

(1) See various instructions under ignition system, etc., such as faulty spark plugs, weak battery, broken, disconnected or grounded wires.

(2) Gasoline mixture too rich or too lean—improper mixture is only ignitable by strong spark. It can be distinguished from ignition trouble by very weak explosion impulse when explosion occurs. A too weak mixture is also indicated by coughing in the carburetor. If mixture is too rich, back fire sometimes occurs in exhaust pipe and muffler.

(3) Spray nozzle in carburetor intermittently closed by loose particle of dirt.

(4) Valve spring weak or broken; sticking, binding or broken valve, or one badly in need of grinding.

(5) Excessive motor lubrication.

AIR LEAK IN INTAKE MANIFOLD

It occasionally happens that on account of the vibration transmitted to the motor, the connections of the intake manifold to the carburetor and the cylinders become loose and air is sucked in on the intake stroke of the piston. This extra air being drawn in causes the mixture to be too "lean" and results in the motor running unevenly and skipping. This condition can be remedied by tightening up these connections, and also, if necessary, by installing new gaskets.

DRIVING IN HEAVY TRAFFIC

In going through crowded streets, it is always best to drive on "second" speed, as this obviates the necessity of continually changing from one speed to the other. The "second" speed of the Studebaker "35" is geared 7 to 1 and should be used for that purpose.

SKIDDING

In driving over wet pavements or slippery roads, do not make sudden turns or changes of direction, also avoid sudden application of brakes. If, however, you feel the car is starting to skid, turn the front wheels quickly in the same direction that the rear of the car is turning, which will tend to straighten it out. This is similar to the turn of the front wheel in riding a bicycle. In skidding, throw out the clutch and close the throttle, but do not put on the brakes hard.

MOTOR BEARINGS

After an automobile has run a great many miles the crank shaft ("main") bearings wear slightly and allow play as also do the connecting rod bearings. The first evidence of a worn bearing is a "motor knock." To test bearings, grasp the fly wheel and jerk it vigorously; if play is discovered it is an indication that the bearings should be "taken up." The bearings are "split," that is, arranged in two halves bolted together. Between the halves, "shims" (very thin strips of metal,) are placed, as the bearings wear, one or more shims can be removed and the bearings drawn up. This operation should be undertaken only by a good mechanic.

TIGHTEN BOLTS AND NUTS

It is very important that you should go over your car periodically, try and tighten up all loose nuts and bolts. This should be taken care of especially during long hard tours and about once a month under average driving conditions.

CHANGING SPEEDS

Every time the gears clash noisily, there is some harm done. A driver should learn how to change speeds quietly and without any wear and tear on the transmission gears. This is not difficult and can be attained by practice and close attention.

INSTALLING OF ACCESSORIES OR PRIVATE PARTS

Do not let any inventor or accessory company try out any new ideas, such as spring wheels, shock absorbers, solid tires, etc., on your car until you are absolutely sure, in your own mind, that they are not harmful. In fact, it is best to write to one of the Studebaker Branches, or to the Technical Department of The Studebaker Corporation of America, Detroit, Mich., and find out what we have to say before installing anything of the above nature.

TOURING

When driving your car away from home and through strange towns, it is always best to inquire for a Studebaker Dealer. Studebaker cars are sold in every section of the country, by over 2,000 dealers. We feel confident you can obtain much better satisfaction and receive better treatment from them than you would from dealers handling other lines of cars.

On page 2 of this book, you will find a list of our Branches. Each one is fully equipped to take care of orders for repair parts and to make repairs. You can obtain any parts from them without delay, and no matter where you are, it is only necessary to write, or call on, the nearest Branch to procure what you want. We advise you, however, always to order parts through your dealer, if possible.

Cold Weather Suggestions

STARTING CAR IN COLD WEATHER

When the motor is cold, it is more difficult to start than when warm, and in order to facilitate this operation in the winter, it is sometimes necessary to vary the regular procedure.

(1) Examine the batteries and note that all of the terminals are tight and that dry cells are fresh. (See "Battery," Page 16.)

(2) Be sure that the gasoline used has been strained through a chamois to eliminate any water which might possibly be in it.

(3) Prime the carburetor by pushing down on the primer pin and holding it until the gasoline squirts out of the small vent. If motor does not start, inject some gasoline into each one of the pet cocks in the top of the cylinders. This raw gas is quickly ignited and will start the motor. If the motor is very cold, it greatly assists the starting to pour some hot water on the gasoline intake pipe; or to wrap around it cloths soaked in boiling water, and to fill the radiator with hot water.

USE OF ANTI-FREEZING MIXTURE

In freezing weather, the water circulation system should be filled with some sort of anti-freezing solution. Below are the formulas for two which will give satisfactory results:

For temperature not lower than 5 degrees below zero—

Wood Alcohol	15%
Glycerine	15%
Water	70%

For temperature not lower than 15 degrees below zero—

Wood Alcohol	17%
Glycerine	17%
Water	66%

The cooling system of the Studebaker "35" has a capacity of 16 quarts. Alcohol should be added occasionally to make up for the evaporation. This is due to the fact that a solution of alcohol lowers the boiling point of the water, consequently on warm days, with the motor running idle, the solution will tend to boil easily and evaporate. Do not use a solution of calcium chloride, or any alkaline solution, as these are injurious to the metal parts.

In purchasing lubricating oil, ask for the light non-fluid transmission oil instead of the medium heavy, which may be used in warmer weather. Most of the motor oil manufacturers make three grades, and light is the best to use in cold weather. In the transmission and rear axle use light non-fluid transmission oil instead of the heavy, as recommended for warmer weather.

It is a good plan to cover the hood with a blanket or cover made for that purpose when driving in freezing weather. This keeps the motor warm and eliminates, to some extent, difficulty in starting and causes the motor to run more evenly.

STORING CAR

If you do not wish to run your car in freezing weather, obtain four jacks and lift it up off the floor of your garage. Drain off all of the water by opening both pet cocks, start the motor and allow it to run for about a minute. In fact, if you do run your car in cold weather and do not use the anti-freezing solution, it is necessary to drain the radiator when you leave the car for any length of time.

Tire manufacturers advise that the four tires should be removed, wrapped up and put in a dark, dry place. Clean the body and top, and with the top up, cover the whole car with some heavy sheeting. Remove batteries, as these are affected by the cold and will run out much faster than in warm weather. This is a good point to remember even when the car is driven in cold weather.

See instructions under "Taking a Battery Out of Commission," Page 54, for care of Electric System when car is stored.

INDEX OF ILLUSTRATIONS

INDEX

DP 308-15½-5-15-13
AMERICAN PRINTING COMPANY, DETROIT

Studebaker "35" Oiling Chart

EXPLANATION OF KEY LETTERS

O—Oil every 100 miles.
ON—Oil every 500 miles.
TC—Fill with cup grease and turn down cup two turns every 100 miles.
GMB—Fill boot with grease every 1,000 miles, or as needed.
OM—Oil every 1,000 miles.
NFN—Non-fluid oil every 500 miles.
COD—Cylinder oil according to gauge.
GN—Grease every 500 miles, or as needed.
GM—Grease every 1,000 miles, or as needed.