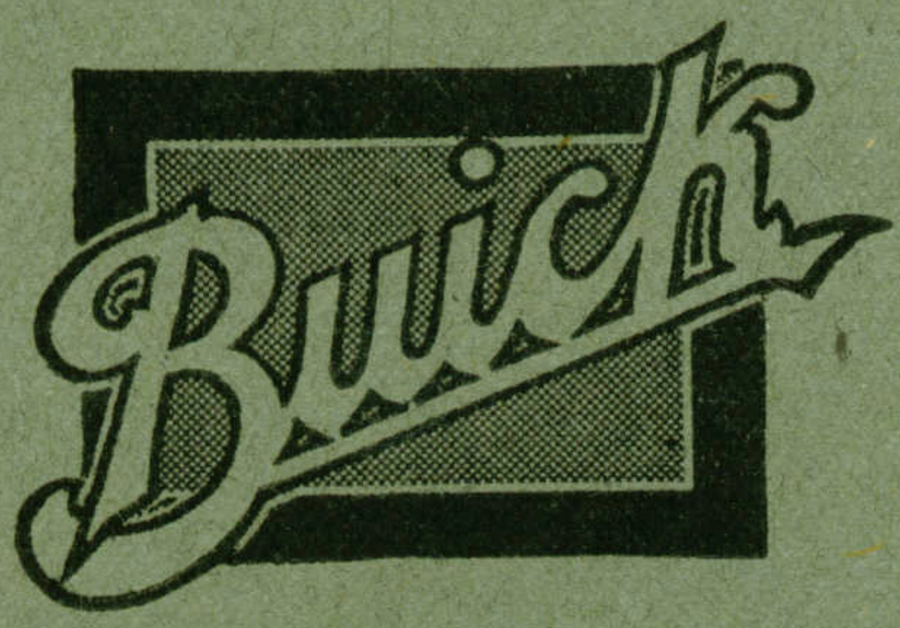
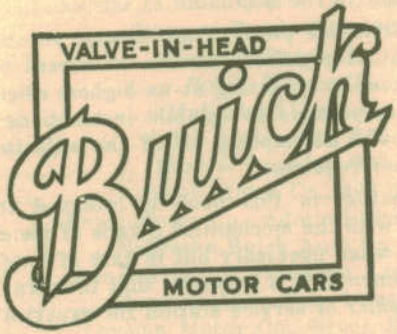
Reference Book



1920
Six Cylinder Models

REFERENCE BOOK



1920

SIX CYLINDER MODELS

BUICK MOTOR COMPANY

FLINT, MICHIGAN, U. S. A.

FLINT PRINTING CO., FLINT, MICH.

NOTICE

This book is not published to instruct the car owner how to assemble or disassemble his car but it is placed at the disposal of the owners and operators of Buick six cylinder motor cars for the purpose of conveying such specific and intelligent information as will enable them to derive the maximum of service.

Like any other fine piece of machinery, an automobile requires a certain amount of regular attention in regard to lubrication and adjustment, to keep it operating at its highest efficiency.

It is quite impossible to compile instructions sufficiently clear to warrant a novice attempting all of the adjustments and inspection which the car requires.

The information in this book is intended to familiarize the owner or driver with the mechanical details of his car so that he can give it attention when necessary but in case of an accident requiring repair or replacements, it is expected that the owner will call on the nearest Buick Dealer or service station for expert attention.

Repair parts or any additional information may be obtained from the nearest Buick Dealer or from any of the Buick Branches and Distributors listed on page three. In all correspondence concerning the car be sure to give Model and Serial number. The Model will be found stamped on a plate fastened to upper toe board. The Serial number is stamped on a small oval plate on rear end of frame.

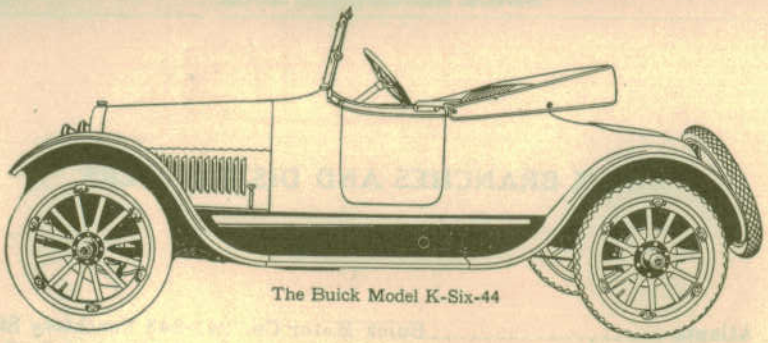
BUICK MOTOR COMPANY

Flint, Michigan, U. S. A., March 1, 1920.

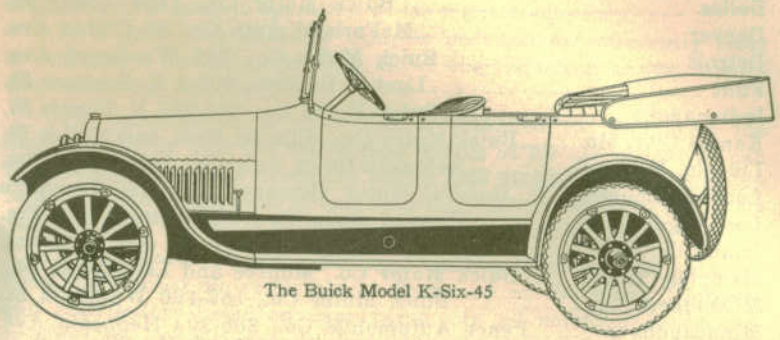
BUICK BRANCHES AND DISTRIBUTERS

Atlanta	Buick Motor Co., 241-243 Peachtree St.
Battle Creek	Buick Motor Co., 86 West Main St.
Boise, Idaho	Randall-Dodd Auto Co., 1119-1123 Main St.
Boston	Noyes-Buick Co., 15 Lawton St.
Buffalo	Buick Motor Co., 1094-1100 Main St.
Charlotte, N. C.	C. C. Coddington, 532 West Trade St.
Chicago	Buick Motor Co., 2031 Calumet Ave.
Cincinnati	Leyman-Buick Co., 630-634 Walnut St.
Cleveland	The Ohio-Buick Co., 19th, near Euclid
Dallas	Buick Motor Co., 1420 Young St.
Denver	McFarland Auto Co., 25 Colfax Ave.
Detroit	Buick Motor Co., 750 Woodward Ave.
Flint	Lunt & Davison, 602-4 N. Saginaw St.
Indianapolis	Buick Motor Co., 363-365 N. Illinois St.
Kansas City, Mo.	Buick Motor Co., Admiral Blvd. and McGee St.
Lincoln, Neb.	Nebraska-Buick Auto Co., 13th and P. Sts.
London, England	General Motor (Europe) Ltd., 136 Longacre
Los Angeles	Howard Auto Co., Olive and Tenth Sts.
Louisville, Ky.	Leyman Motor Co., Brook St. and Broadway
Memphis, Tenn.,	Buick Motor Co., Monroe and Lauderdale Sts.
Milwaukee	Buick Motor Co., 156-160 Wisconsin St.
Minneapolis	Pence Automobile Co., 800-804 Hennepin Ave.
New York City	Buick Motor Co., 55th St. and Broadway
New York City	General Motors Export Co., 1764 Broadway
Oklahoma City	Buick Motor Co., 504-506 N. Broadway
Omaha	Nebraska-Buick Auto Co., 1912-1916 Farnum St.
Philadelphia	Buick Motor Co., Broad and Poplar Sts.
Pittsburgh	Buick Motor Co., Baum St. and Euclid Ave.
Portland Ore.,	Howard Auto Co., 14th and Davis Sts.
Rochester, N. Y.	C. L. Whiting, 342 East Ave.
Saginaw	Garber-Buick Co., 204-6 N. Washington Ave.
St. Louis, Mo.,	Vesper Buick Auto Co., Grand Ave., at Lindell Blvd.
Salt Lake City	Randall-Dodd Auto Co., 53 West 4th South
San Antonio	Buick Motor Co., Avenue C and Travis St.
San Francisco	Howard Auto Co., Van Ness at California
Seattle, Wash.,	Eldridge Buick Co., 802 East Pike St.
Sioux City	Nebraska-Buick Auto Co., 313-315 Douglas St.
Washington, D. C.	Buick Motor Co., 1028 Connecticut Ave., N. W.

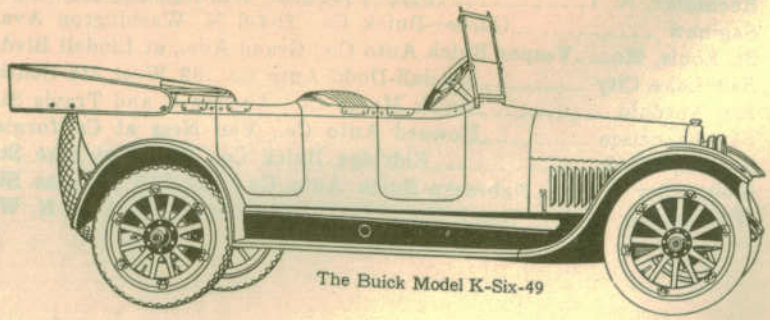
DEALERS EVERYWHERE



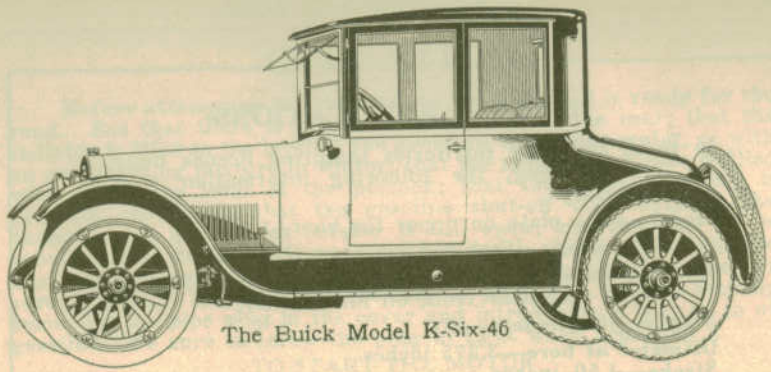
The Buick Model K-Six-44



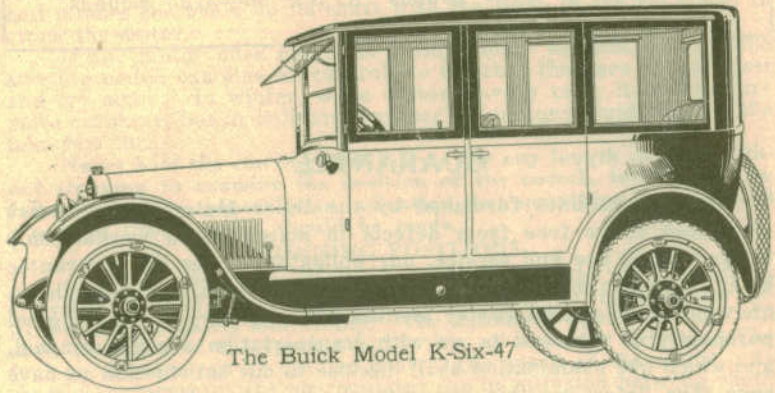
The Buick Model K-Six-45



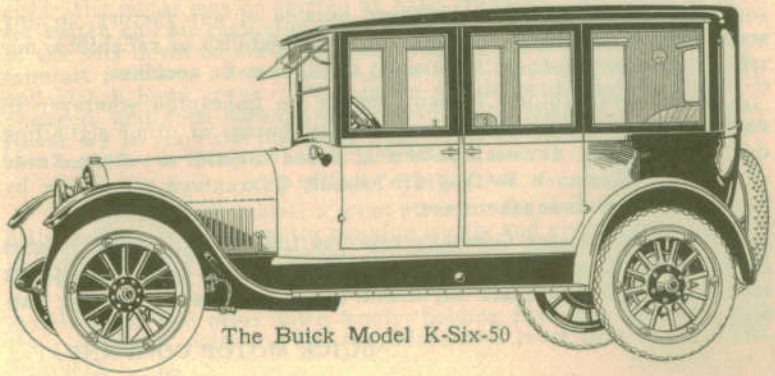
The Buick Model K-Six-49



The Buick Model K-Six-46



The Buick Model K-Six-47



The Buick Model K-Six-50

LICENSE APPLICATIONS

In those states or territories requiring license under a power rating, the following information will be necessary:

Model—(See plate on upper toe board.)

Serial Number—(See oval plate on rear end of frame.)

Motor Number—(See number stamped on left side of crank case near front oil filler tube.)

Number of cylinders—Six.

Diameter of bore—3.375 inches.
Stroke—4.50 inches.

S. A. E. or N. A. C. C. horsepower rating—27.3 horsepower.

Shipping Weight—

K Six 44—2815 pounds		K Six 47—3295 pounds	
K Six 45—2950 pounds		K Six 49—3175 pounds	
K Six 46—3100 pounds		K Six 50—3735 pounds	

GUARANTEE

The automobiles furnished by the Buick Motor Company are warranted to be free from defects in material and workmanship under normal use and service, our obligation under this guarantee being limited to making good at our factory any part or parts thereof, which shall within twelve months after delivery to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this guarantee being expressly in lieu of all other guarantees expressed or implied, and of all other obligations or liabilities on the part of the Buick Motor Company, and we neither assume, nor authorize any person to assume for us any liability in connection with the sale of Buick automobiles.

This guarantee shall not apply to any Buick automobiles, which shall have been repaired or altered outside of our factory, in any way so as, in our judgment, to affect their stability or reliability, nor which have been subject to misuse, negligence or accident.

The Buick Motor Company makes no guarantee whatever in respect to tires, rims, ignition apparatus, horns, or other signalling devices, starting devices, batteries, speedometers or other trade accessories, inasmuch as they are usually guaranteed separately by their respective manufacturers.

The Buick Motor Company reserves the right to make changes in design or add any improvements on Buick cars at any time without incurring any obligations to install same on cars previously purchased.

BUICK MOTOR COMPANY,
Flint, Michigan.

OPERATION

Before attempting to drive the car, make sure it is ready for the road. See that there is gasoline in the tank at the rear; that the radiator is filled to the level of the overflow with clean water, or with an anti-freezing mixture in winter; that the motor crank case is filled with oil to the level of the petcock; that the storage battery is properly connected; that the gasoline shut-off cock between the vacuum tank and the carburetor is full open; and that the car is provided with a driving license, that the fan is working and that the tires are properly inflated. If the car has been standing idle for several days, it may also be necessary to prime the vacuum tank by removing the pipe plug in the cover and introducing a pint or so of gasoline. Be sure to screw the plug in tight when replacing it.

TO START THE MOTOR

See that the ball-topped control lever stands in neutral position, where it is free to move sideways. Set spark and throttle levers on the steering wheel about one-third of the way down the sector. Unlock the switch and turn the ignition lever on switch to point marked "ON." Turn air regulator to "choke" position, hold clutch pedal out with left foot and press the starting pedal.

Pressing the starting pedal sets the electric starter in motion and meshes the gears on its shaft with the teeth in the fly wheel to crank the motor.

If the motor does not start within thirty seconds, release the starting pedal, examine all controls to see that they are properly set and try again. In winter, when motor is very cold, it will require more cranking, but in ordinary weather the motor should start on the first few turns.

Never hold the starting pedal down for any length of time without stopping to examine the position of the switch, levers, etc., as failure to start is generally an indication that something is wrong and a prompt investigation should be made.

RUNNING POSITIONS

As soon as the motor starts, turn air regulator to "Hot" position; close throttle and advance spark about half way down the sector until motor runs slowly and evenly. The automatic spark advance will now take care of the spark position for all ordinary driving. The foot accelerator can be used to control the speed of the motor. As the motor warms up, the air regulator can be adjusted between "hot" and "cold" positions to obtain even running at all speeds.

Never allow the motor to run any length of time with the air regulator turned to "choke," as this gives an excessively rich mixture and uses an abnormal amount of gasoline.

HAND CRANKING

If the storage battery should be run down or the starter out of order, the motor may be started by hand cranking. To crank by hand set switch and air regulator as before. Bring throttle lever one-third of the way down on sector and move spark lever slightly away from topmost position. Remove cap from starting crank below radiator and attach hand crank. Push in on crank until starting clutch is engaged, and turn motor over by pulling up sharply on the crank. **Never try to start the motor by pushing down on the starting crank as a back-fire is likely to result in a broken arm.**

TO START THE CAR

To start the car, select a quiet street or level road which has but little traffic. With the motor running slowly and evenly, take position in seat behind steering wheel, grasping the wheel firmly with the left hand. With the right hand, release the emergency brake lever, and push it as far forward as it will go. Place the left foot on the clutch pedal, and press down firmly, holding it in this position; with the right hand, shift the ball-topped control lever first to the right, then back.

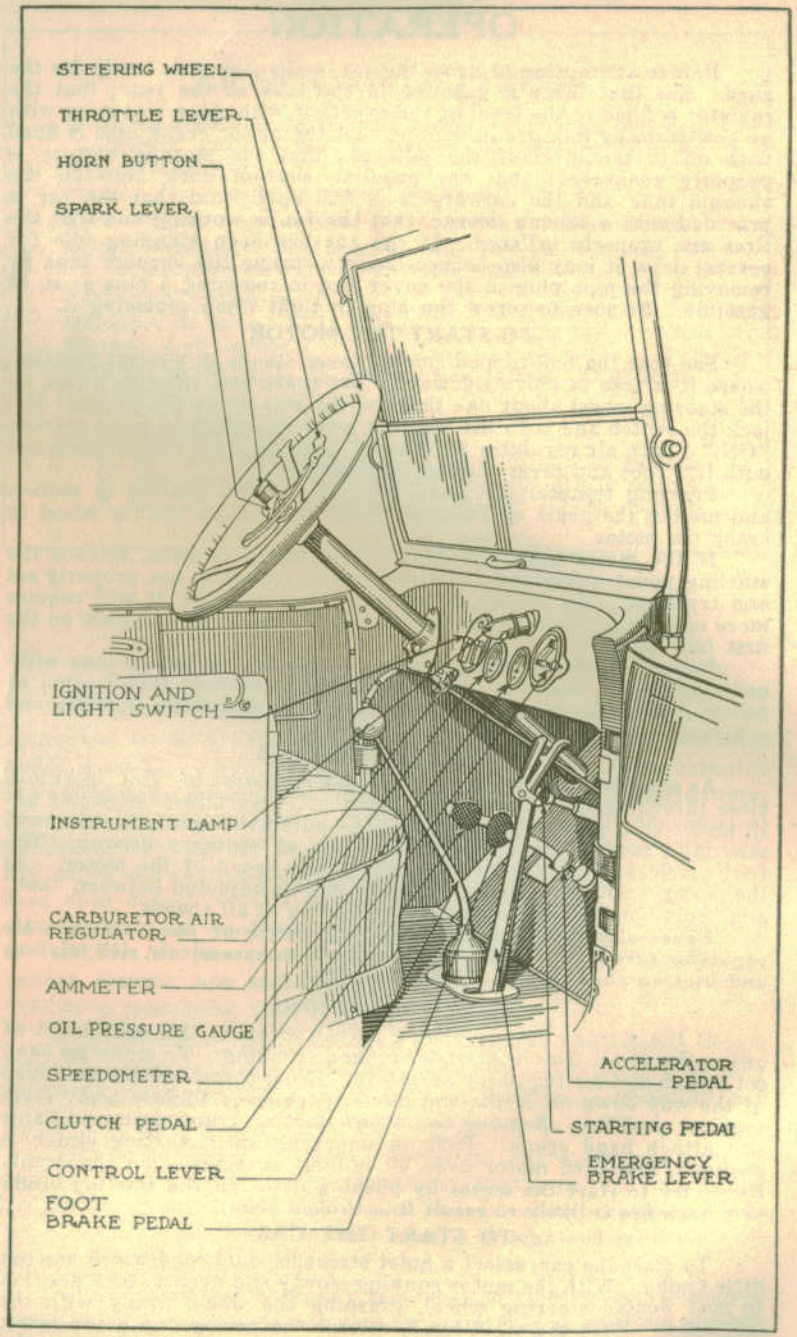


Plate 1

Driving Compartment

LOW SPEED

The gearset is now in the first, or "low speed" position. Gently release the pressure of the left foot on clutch pedal and at the same time press down slightly on the accelerator pedal with the right foot to increase the speed of motor. As the clutch takes hold, the car will commence to move forward. Continue to press down on the accelerator pedal until the car gains some headway before attempting to change to a second speed.

SECOND SPEED

When the car is well under way, disengage the clutch, at the same time releasing the pressure on the accelerator pedal to prevent the motor racing, and with the right hand shift the ball-topped control lever forward and to the left, then forward again. Engage the clutch immediately and accelerate the motor as before. The car is now in second or intermediate speed.

HIGH SPEED

Again accelerate the motor until the car is moving forward at a rapid pace; operate clutch and accelerator pedals as before; quickly shift the control lever straight back as far as it will go. The car is now in high speed which is the normal driving position.

SHIFTING GEARS

In shifting from a lower to a higher gear, as in getting under way, it is important that the speed of the car be accelerated just before making the change, so that the two gears that are to be meshed together will be running at approximately the same speed. The proper handling of the clutch pedal and accelerator so as to make the motor "pick up" its load quickly, and at the same time prevent it from "racing" when the clutch is released, requires considerable practice.

In changing gears, and especially when starting the car from a standstill, always let the clutch pedal come back gently. If the foot is suddenly removed from the pedal it will let the clutch take hold with a violent jerk.

In shifting gears, from one speed to another, the motion should be made firmly and without hesitation. If the gears fail to mesh correctly the first time, release the pressure on the control lever and clutch pedal for a moment and try again. With a little practice the various changes can be made easily and without noise.

SHIFTING DOWN

Shifting from a higher to lower gear, or "shifting down" is accomplished in the same way as shifting up; that is by releasing the clutch, moving the control lever quickly to the proper position, and engaging the clutch. It will be found much easier to shift gears from higher to lower speeds if clutch pedal is pressed down only enough to release the clutch.

DRIVING

Ordinarily the car is always driven in high or third speed and first and second speeds are used only for starting. Occasionally, however, a steep hill, muddy or sandy road will be encountered which requires more power, and since it is for this purpose that the lower speeds are provided, the driver should not hesitate to use them.

The Buick will climb any hill "on high" that any car can climb, but after the driver has demonstrated this to his satisfaction, it is suggested that he make use of a lower gear which will not cause so great a strain on his motor.

STEERING

Steering is largely a matter of practice. Drive slowly at first. Do not attempt to turn corners too sharply or too quickly. Always slow down or stop before crossing railroad and car tracks. In a short time a driver gets the "feel" of his car, and then steering becomes almost an involuntary action; so that all the attention can

be concentrated on the road. Learn to watch the road from 100 to 300 feet ahead of the car, depending on the speed. In this way there is always time to prepare for obstacles before the car reaches them.

HANDLING THE SPARK

Advance spark lever downward until it comes within the arrow points on sector marked "Driving Range." This gives the correct position for all ordinary driving, the automatic spark advance, which is incorporated in the ignition system, will control the spark position without further attention on the part of the driver. It is arranged to automatically advance or retard the spark to the proper position, depending on the speed of the motor, but as the car slows down, as in ascending a steep hill or negotiating a heavy road, it is necessary to retard the spark by hand until the motor runs smoothly and without knocking.

Never allow the motor to run for any length of time with the spark retarded, as such practice only consumes an abnormal amount of gasoline, has a tendency to overheat the motor and causes rapid carbonization.

TO STOP THE CAR

To stop the car, slow down the motor by removing the pressure on the accelerator pedal, then release the clutch, by pressing on the clutch pedal with the left foot. If the car retains too much headway apply the service brake by pressing the brake pedal with the right foot. Shift the control lever into neutral position. The foot may now be removed from the clutch pedal.

TO REVERSE

To reverse the motion of the car, or drive backwards, first come to a full stop. Release clutch and shift control lever to the right and forward. Engage clutch and accelerate motor as before.

Never attempt to reverse the motion of the car before it has come to a complete stop. The car cannot move in two directions at the same time and the result is certain to be serious if this is attempted.

EMERGENCY STOPS

If for any reason it should become necessary to stop the car suddenly, press both pedals and at the same time pull back on the emergency brake lever with the right hand. The car should not be stopped suddenly except in an emergency as such stopping is extremely hard on the tires and strains the entire mechanism. A good rule is to use brakes and clutch as little as possible and endeavor to control the car with the accelerator.

TO STOP THE MOTOR

To stop the motor turn ignition lever on switch to position marked "OFF" and at the same time open the hand throttle to the starting position. This will allow the motor to take in a full charge of gas before coming to rest and leave it ready for a quick start next time; also move the spark lever to the starting position and set the emergency brake before leaving the car.

Form the habit of locking the ignition switch when leaving car standing alone. Never leave car with motor running, as this is a useless waste of gasoline and there is always a chance that children or others may throw the transmission gears into mesh.

STARTING ON A GRADE

It sometimes becomes necessary to start the car on an up grade. To accomplish this, start motor as before, then release emergency brake and hold car with service brake while shifting gears. Now accelerate motor with the hand throttle while gradually releasing pressure on both pedals together. It takes considerable practice in operating the clutch and brake pedals to make the one take hold while releasing the other without "stalling" the motor, but it can be done very easily with a little experience.

SKIDDING

Sudden application of the brakes, especially when turning a corner or on slippery pavement, is liable to make the car "skid." Skidding is caused by the rear wheels suddenly losing their traction while the car is subject to centrifugal force from turning. The result is that the rear end swings suddenly toward the outside of the curve. The best way to avoid skidding is to drive slowly. When a skid occurs, release the brake for an instant and turn steering wheel in the direction the car is sliding.

Tire chains will be found a convenience when driving on wet pavements or muddy roads, but should not be used unnecessarily

RACING THE MOTOR

Never open the throttle suddenly or leave it open very far when the car is standing and the motor running idle. This is known as racing the motor, and there is nothing more injurious especially when the motor is cold. More motors have been ruined by racing while idle than have ever been worn out in actual driving under load.

SPEEDING

Drive slowly at first. Extremely high speeds are dangerous under all conditions and fifteen or twenty miles an hour on good roads is fast enough for the inexperienced driver. Learn to handle the car properly under all conditions of roads and traffic before attempting higher speeds.

RULES OF THE ROAD

The following "rules of the road" apply to the entire United States and the greater part of Canada. Every driver of a motor car should understand and obey them:

1. When meeting a vehicle going in the opposite direction, turn out to the right.
2. When passing a vehicle going in the same direction, turn out to the left.
3. In turning a corner to the right, keep as close as possible to the right hand ditch or curb.
4. In turning corner to the left continue past the intersection of the two roads or streets before making the turn.
5. In stopping the car always stop with the right hand side of the car at the right hand curb.

USE OF LIGHTS

Buick cars are provided with electric lights operated from the switch on the instrument board. For night driving on country roads, both head and tail lights should be turned on by turning lever on switch marked "Lights" to proper position as marked on switch. For city driving and when leaving the car standing at the curb, the large headlight bulbs should be turned off and the small bulbs turned on. Do not leave the car standing at the curb for any length of time with the large headlights burning as they require considerable current, and will eventually discharge the storage battery. A small electric lamp is also provided on the instrument board to illuminate the instruments at night.

ADJUSTING HEADLIGHTS

The beams from the headlights can be properly directed on the road by loosening the bolts which fasten the lamps to the fenders.

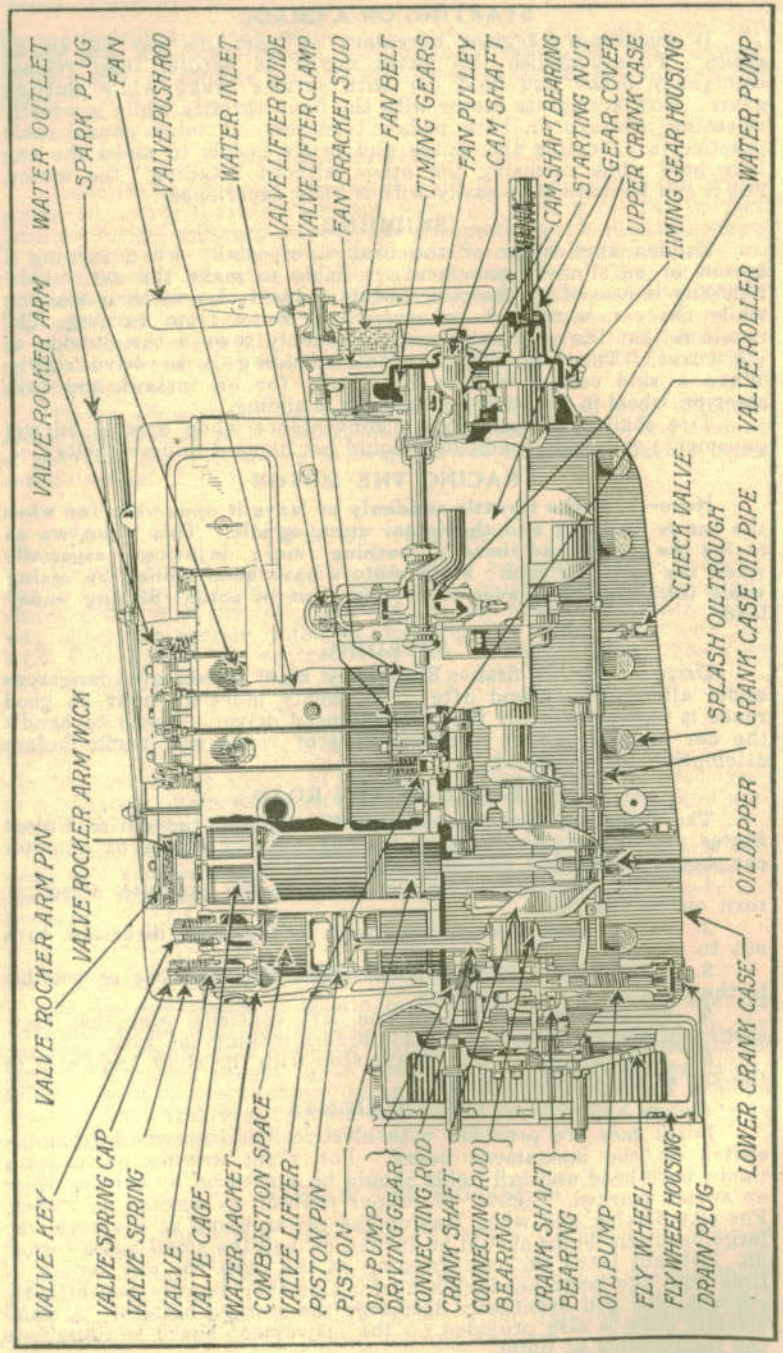


Plate 2

Interior Construction of Motor

and swinging the bottoms of the brackets. The brightest part of the light should strike the road about 300 feet ahead of the car. The lamps may be focused by adjusting with a screw driver the focus screw found on the back side of the lamp. Turn screw to the left to shorten focus and reverse operation to lengthen. When properly focused, the light should form a bright circle not over 18 inches in diameter on a wall 50 feet ahead of car.

WATCH THE INSTRUMENTS

Instruments placed conveniently on the instrument board keep the driver constantly informed as to the operation of his car, and he should form a habit of glancing at these instruments occasionally while driving.

The oil pressure gauge tells, by the position of the indicator hand, when sufficient oil is being circulated through the motor lubricating system.

The ammeter shows the amount of current, in excess of that being used for lights and ignition, going to the storage battery. It also shows the amount taken from battery when rotating the armature or idling the motor.

The speedometer gives the speed of the car and the number of miles traveled, both total and trip. The trip register may be set back to zero or to any given figure by turning the knurled finger screw protruding through the face.

To wind the clock, turn the knurled rim to the right as far as it will go, and to set the clock, pull out on knurled rim and set the hands by turning to right or left, as the case may be.

TO RAISE THE TOP

In case of rain, or as a protection from the sun, the top may be raised as follows: Remove dust cover and pull up on lever which fastens the bows to the top holders on the rear of the body Next pull up and ahead on the front bow until the top is fully extended, fasten in this position by attaching to windshield posts in front, the top can be raised most easily from the inside of the car

The side curtains are carried in an envelope underneath the rear cushion on model K49, in the rear compartment on K44, in a specially constructed pocket on the back of the front seat on K45 and can be attached by unfolding and stretching between the fasteners on the top bows and body. The door curtains are provided with steel supports which can be inserted in the sockets on the doors.

When folding the top, unfasten side wings, be sure that the side curtains are properly rolled and folded up, and that the folds of the top do not get caught between the bow spacers. Do not fold top when wet or damp.

LUBRICATION

1 **MOTOR. Motor Oil.**

Fill crank case reservoir through oil filler tube on left side of motor to the level of the petcock, and do not allow the oil to come above the petcock level as an excess will only cause the motor to smoke. The oil pressure gauge on instrument plate shows circulation by action of the indicator needle. Ascertain oil level occasionally by opening the petcock and when doing so make certain the petcock is not stopped up with dirt or sediment.

When oil level is below petcock, the quantity of oil in crank case can be determined by looking at measuring stick or gauge.

(Old oil should be drained from crank case and replaced with fresh oil as frequently as conditions make it necessary, depending on grade of oil used, climatic conditions and use to which motor has been subjected.)

2 **TRANSMISSION. Use steam cylinder oil for all temperatures above freezing. Thin with motor oil sufficiently to make liquid below freezing temperature.**

Remove filler cap on left side of transmission case and fill to level of opening.

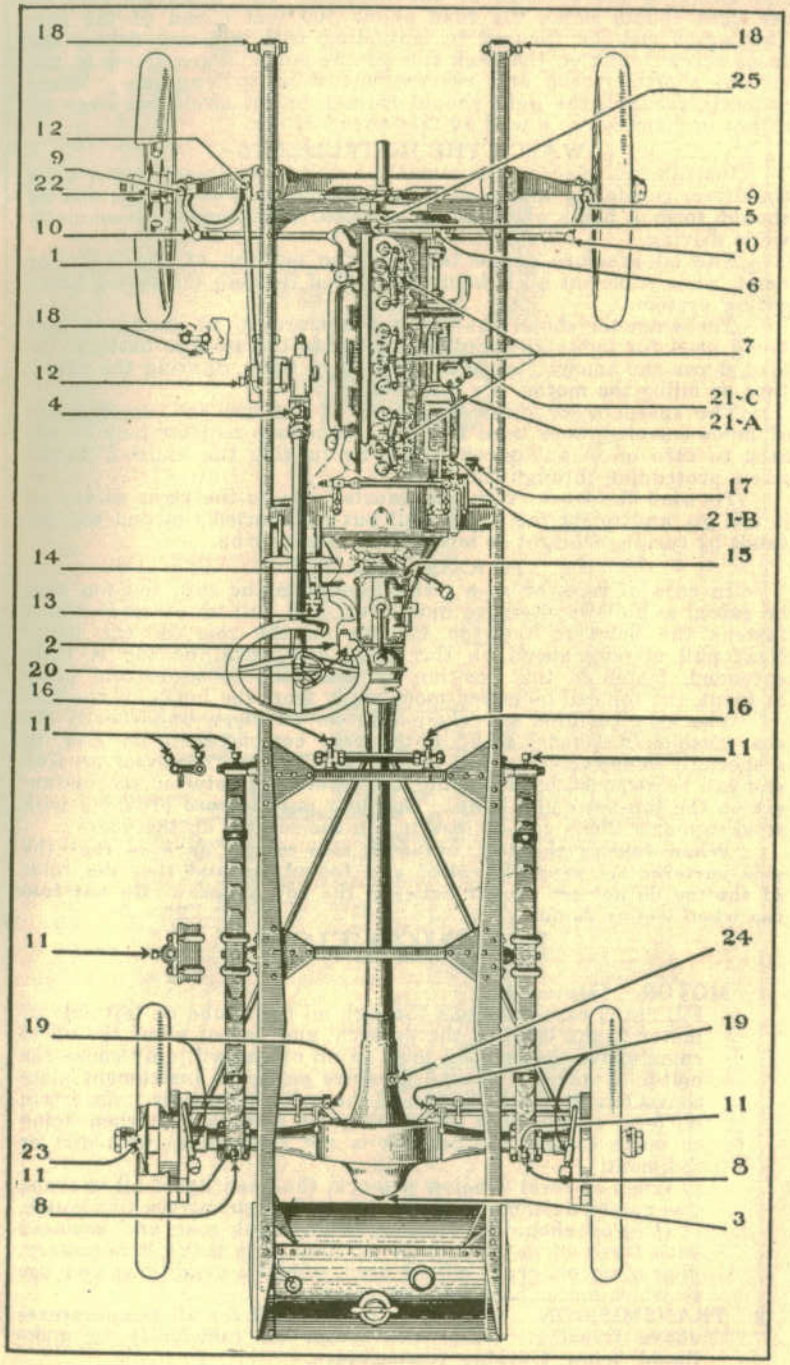


Plate 3
Lubrication Chart

3 **REAR AXLE.** **Use steam cylinder oil for all temperatures above freezing. Thin with motor oil sufficiently to make liquid below freezing temperature.**
Remove plug in differential housing cover and fill to level of the opening.

4 **STEERING GEAR.** **Steam Cylinder Oil.**
Remove oil cup cap, insert oil until positive housing is full.

5 **TIMING GEARS—Steam Cylinder Oil.**
Fill through wing plug on left side of timing gear case to within one inch of the level of the opening.

6 **PUMP SHAFT BEARING—Motor oil.**
Add one or two ounces at frequent intervals, but do not try to fill full, or the oil will overflow into the timing gear case.

EVERY 500 MILES

7 **VALVE ROCKER ARMS.** **Motor oil.**
Insert oil can spout and fill bracket with oil until wick becomes throughly saturated.

8 **REAR SPRING SEAT.** **Motor oil.**
Lift cap of oil cup and fill full allowing felt in oil pocket to become thoroughly saturated.

9 **KING BOLTS.** **Motor oil.**
Turn cap on oil cup until holes line up, **fill full of oil and give** cap half turn. Oil is fed automatically **through a wire wick** to the bolt.

10 **TIE ROD BOLTS.** **Soft cup grease.**
Give grease cups half a turn. Keep filled with grease. **There** is one cup at each end of the tie rod.

11 **REAR SPRING.** **Soft cup grease.**
Give grease cups on spring shackles, spring blocks and ends of springs half a turn. Keep filled with grease. **There are four cups to each spring.**

12 **STEERING CONNECTING ROD.** **Soft cup grease.**
Give grease cups a turn or two. Keep filled **with grease** There is one cup to each end of the rod.

13 **BRAKE AND CLUTCH PEDALS.** **Soft cup grease.**
Remove floor board and give grease cups one or two turns. Keep filled with grease. There is one cup on each pedal hub.

14 **CLUTCH RELEASE FORK PIN.** **Soft cup grease.**
Remove clutch cover and give grease cup one or two turns. Keep filled with grease.

15 **CLUTCH RELEASE BEARING RETAINER.** **Soft cup grease.**
Give grease cup—outside of transmission housing—one or two turns. Keep filled with grease.

16 **BRAKE SHAFT.** **Soft cup grease.**
Give grease cups one or two turns. Keep filled with grease. There is one cup at each end of the shaft.

17 **STARTER SLIDING GEARS.** **Soft cup grease.**
Give grease cup half a turn. Keep filled with grease.

18 **FRONT SPRING.** **Soft cup grease.**
Give grease cups half a turn. Keep filled with grease. There is one cup at the front end and two at the rear end of each spring.

19 **BRAKE CAM SHAFT.** **Soft cup grease.**
Give grease cup one or two turns. Keep filled with grease. There are four cups, two at inner ends and two at outer ends of the shafts.

20 **SPEEDOMETER SHAFT JOINT.** **Soft cup grease.**
Give grease cup on shaft housing one or two turns. Keep filled with grease.

21 **DELCO GENERATOR.**
A. **Soft cup grease.** Swing cover on front end of distributor housing near shaft to one side, and inject grease with grease gun, for lubrication of distributor gears, generator clutch, and forward armature bearing.

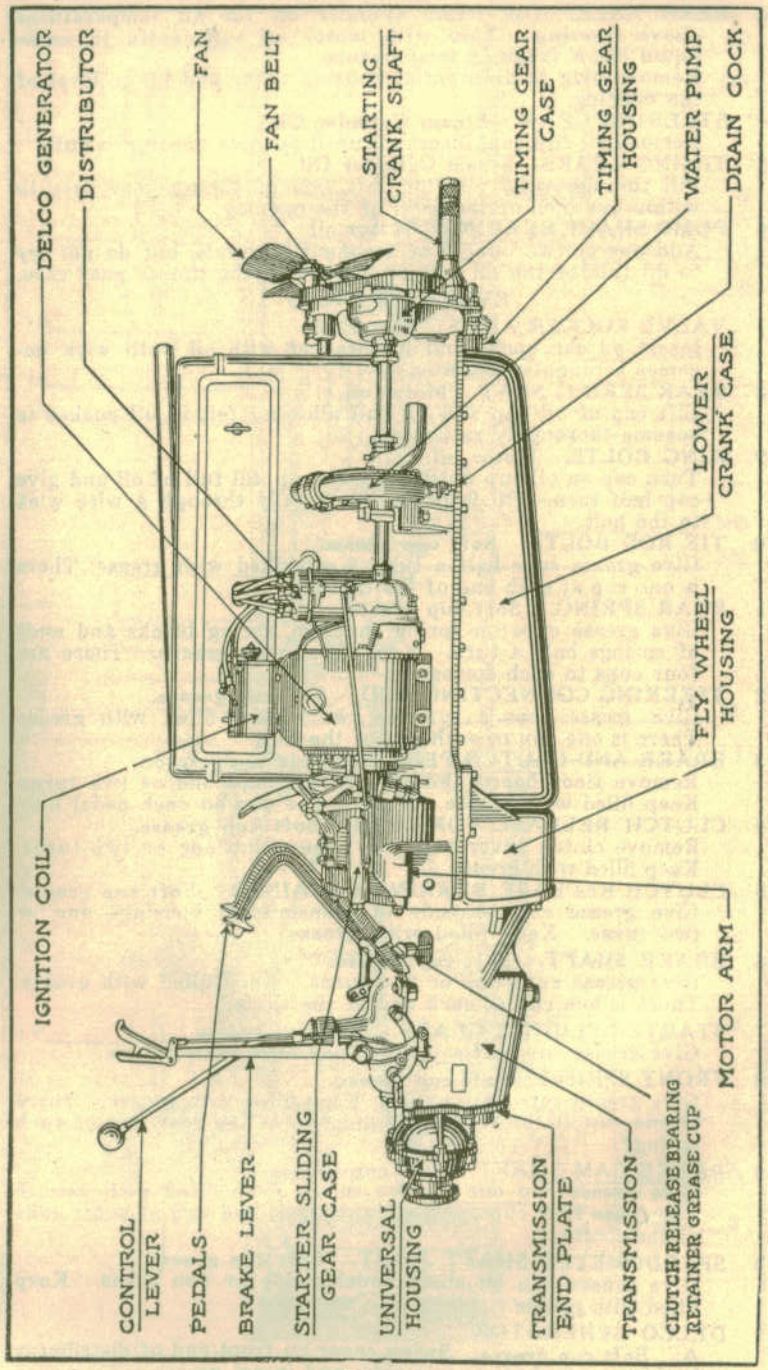


Plate 4.
Generator Side of Power Plant

B. Motor oil. Turn oiler in rear end of generator until hole is open and inject motor oil for lubrication of rear armature bearing.

C. Motor oil. Turn oiler on distributor cup and inject motor oil for lubrication of upper distributor shaft bearing.

EVERY 1,000 MILES

22 **FRONT WHEELS. Soft cup grease.**
Move or jack up car and turn wheels until pipe plugs in hubs appear on top. Remove plugs, fill hubs with soft cup grease and replace plugs securely, and at the same time remove hub caps and fill with grease.

23 **REAR WHEELS. Soft cup grease.**
Move or jack up car and turn wheels until pipe plug in hubs appear on top. Remove plugs, fill hubs with soft cup grease and replace plugs securely.

24 **PINION SHAFT BEARING. Soft cup grease.**
Remove adjusting cover on pinion flange and fill with soft cup grease. Use grease gun.

25 **FAN HUB. Motor oil.**
Remove plug in hub and inject a small amount of oil. Be sure and replace plug securely.

OVERHAULING

Three or four times a year all the oil should be drained out of motor, transmission and rear axle, and these parts washed out thoroughly with gasoline or kerosene. It pays to change the oil in the motor frequently or whenever it gets thin and watery. Do not use too much oil. Enough is just right and any more will simply run out of the bearings and collect dust and dirt on other parts of the car.

At least once a year the car should receive a thorough overhauling at which time the motor, clutch, transmission, universal joint, steering gear, and front and rear axle assemblies should be taken apart and carefully cleaned and adjusted before being reassembled. This work should be done by an experienced mechanic.

LUBRICANTS

Motor oil should be a high grade, medium heavy, mineral oil, with a flash point of not less than 400 degrees Fahrenheit and a viscocity of 80 to 90 Tagliabue or 62 to 72 Saybolt at 212 degrees Fahrenheit. This oil should be used exclusively in the motor lubricating system, for valve rocker arms, distributor and generator bearings, spring seats, king bolts and for all small joints not otherwise provided with lubrication, such as spark and throttle rods, brake rods, etc.

Steam cylinder oil should be a heavy mineral oil, free from acid, and should be used or mixed with the proper proportion of motor oil to keep it liquid at low temperatures for the transmission gears, differential gears and steering gear. It is better for this purpose than most of the so-called "gear greases."

Soft cup grease or vaseline should be a pure mineral product of a soft nature and should be used in all grease cups, such as those on the tie rod bolts, starter sliding gear, brake shaft, brake cam shafts, steering connecting rod and wheel hubs.

POWER PLANT

The unit power plant is the most important part of the car. It develops the necessary power for driving the car and delivers it to the axle and road wheels where it is finally converted into motion of the vehicle.

The power plant consists of:

The motor.
The lubricating system.
The fuel system.
The Delco system.
The cooling system.

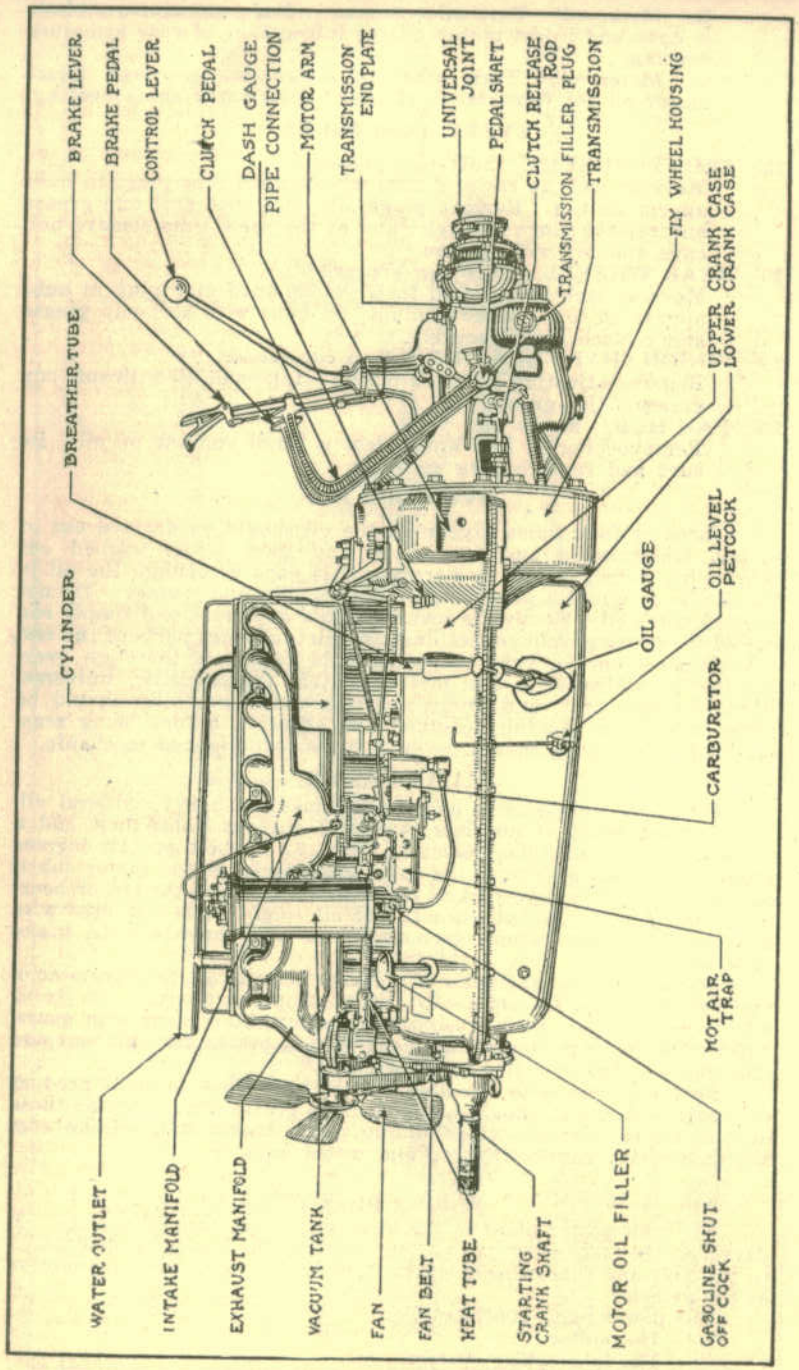


Plate 5
Carburetor Side of Power Plant

The exhaust system.
The clutch
The transmission gearset.
The universal joint.

The motor is the machine which turns the pressure of the exploding gas into rotary motion of the crankshaft.

The lubricating system supplies oil for the different parts of the motor automatically varying the amount to agree with the speed of the motor.

The fuel system pumps the raw gasoline from the fuel tank at the rear of the car, vaporizes it, mixes it with proper proportion of air and delivers it to the motor cylinders in quantities proportional to the load.

The Delco system generates the electric current, increases its voltage sufficiently to enable it to jump the spark gaps, and distributes it to the cylinders in proper rotation. It also supplies the electrical energy which is accumulated in the storage battery to crank or "spin" the motor for starting, and to operate the electric lights.

The cooling system protects the working parts of the motor by absorbing the excess heat of the explosions and diffusing it to the surrounding atmosphere.

The exhaust system carries the waste products of combustion away from the motor and muffles the noise of the explosions.

The clutch is the connecting link between the motor and the transmission, and connects or disconnects the two units at the will of the operator.

The transmission gearset allows the speed of the motor to be varied in relation to the speed of the rear wheels, so that the energy can be applied at a faster rate under certain conditions.

The universal joint is the flexible coupling which connects the power plant to the rear axle and allows the axle to move up and down over the road surface without interrupting the driving effort.

MOTOR

The motor consists essentially of a row of six cylinders in which the gas is exploded, the force of the explosions acting on pistons which move up and down in the cylinders. The pistons are connected by means of the connecting rods with the crankshaft, and as they move up and down turn the crankshaft around in a clockwise direction. At its rear end the crankshaft carries a heavy fly wheel which engages with the clutch and transmits the power on to the rear wheels. Teeth are cut around the rim of the fly wheel and a small gear, driven by the electric starter, engages with these teeth when spinning the crank shaft to start the motor. The crank case which is fastened to the frame of the car, supports the cylinders and encloses the crank shaft and its bearings.

At their upper ends the cylinders have two openings, closed by poppet valves. One of these communicates with the exhaust system and the other with the intake manifold and carburetor. The valves are opened and closed at the proper intervals in the cycle by rocker arms and push rods, actuated by the cam shaft, which is geared to the crank shaft and runs at one-half the crank shaft speed, so that the valves are each opened and closed once for every two revolutions of the crankshaft. At its rear end the cam shaft carries another gear which drives the oil pump located in the lower half of the crank case.

Spark plugs project into the combustion space at the upper ends of the cylinders and serve to ignite the gas when a cylinder is ready for the explosion.

A double wall or water jacket entirely surrounds the upper part of the cylinders and water is kept constantly circulating through the space between the two walls by means of the water pump, which is attached to the right side of the crank case and is driven by another

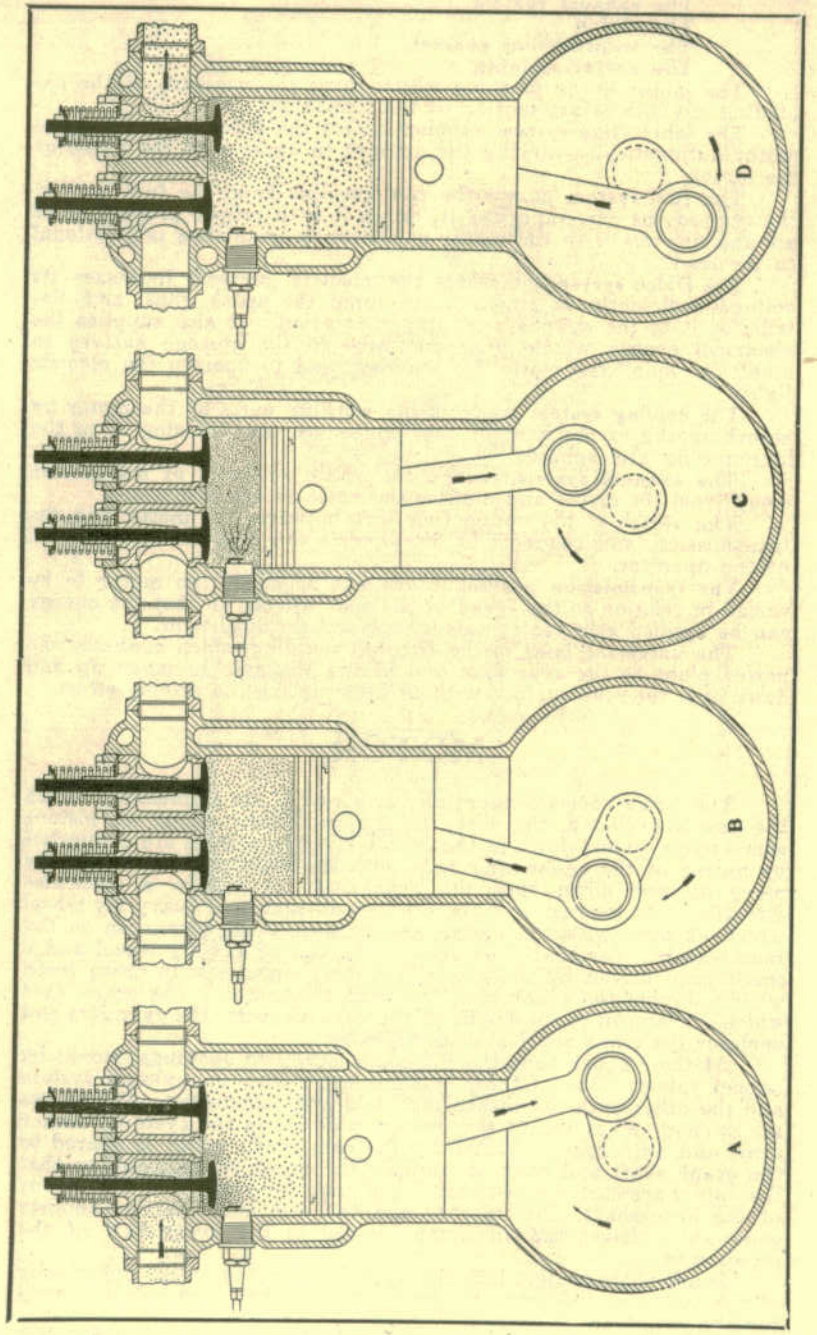


Plate 6
Cycle Diagram.

shaft geared to the cam shaft. The pump shaft runs 1½ times as fast as the crank shaft and also drives the Delco generator through a coupling at its rear end.

HOW THE MOTOR WORKS

The power of the motor is produced by burning or exploding charges of gas in the cylinders, above the pistons, the resulting pressure forcing the pistons down causing the crank shaft to rotate. In the four cycle motor, of which the Buick engine is an example, it takes four strokes of the piston or two complete revolutions of the crankshaft for each explosion or working stroke in any one cylinder. This will be more readily understood by reference to the cycle diagram.

As the piston starts down on the first stroke of the cycle, as in "A," the inlet valve is opened. The motion of the piston tends to create a vacuum in the cylinder, and this sucks in a charge of fresh gas from the carburetor, through the valve opening.

When the piston has reached the bottom of its stroke, and starts back, as in "B," the intake valve closes and the piston compresses the gas it has sucked in, into the space at the top of the cylinder.

As the piston reaches the end of its upward stroke, as in "C," the compressed gas is ignited by an electric spark which occurs at the points of the spark plug, and the resultant explosion creates a large amount of heat and pressure, which pushes the piston down during the next, or working stroke, and turns the crank shaft.

On the return upward stroke of the piston, "D," the exhaust valve is opened, and the piston pushes the remaining burnt gas out through the exhaust pipe, leaving the cylinder empty and ready for the beginning of a new cycle.

It will be noticed from the above that only one stroke out of the four is a working stroke in any one cylinder, but as the motor has six cylinders, the crank shaft actually receives three impulses every revolution.

TIMING THE VALVES

The exact point in the cycle at which the valves are opened and closed is determined by the shape of the cams which operate them and by the angular relation between the camshaft and crankshaft. If it should ever become necessary to remove one of these shafts or the gears which drive them, they must be replaced in proper relation to one another or the valves will be "out of time." To obtain this relation, the punch-marked tooth on the crank shaft gear should be set to match with the punch-marked space on the cam shaft gear.

ADJUSTING PUSH RODS

With the timing gears properly matched, the final setting of the valves can be made by adjusting the push rods to proper length by means of the adjusting ball ends and lock nuts. In making this adjustment turn the motor by hand, in clockwise direction, until line marked "1 and 6" on the fly wheel comes into line with line on the rim of the inspection hole. This is the firing position for cylinders No. 1 and No. 6, numbering from the radiator back, and one or the other of these cylinders will be found to have both valves closed so that both rocker arms will have a slight amount of play. The push rods for these rocker arms should then be adjusted from the back of cams and while motor is warm (see instruction plate on side of motor) so as to give .010 inch clearance between the end of the valve stems and the rocker arms. This is approximately the thickness of a sheet of heavy paper or very light card. Push rods for the other cylinders may be adjusted in the same manner. Best results will be obtained if the above adjustments are made while motor is idle and no one but an expert should attempt adjustment with motor running.

One-half teaspoonful of kerosene inserted around the valve stem at least once a week while motor is running will keep valve free from carbon and prevent it from sticking in the valve cage.

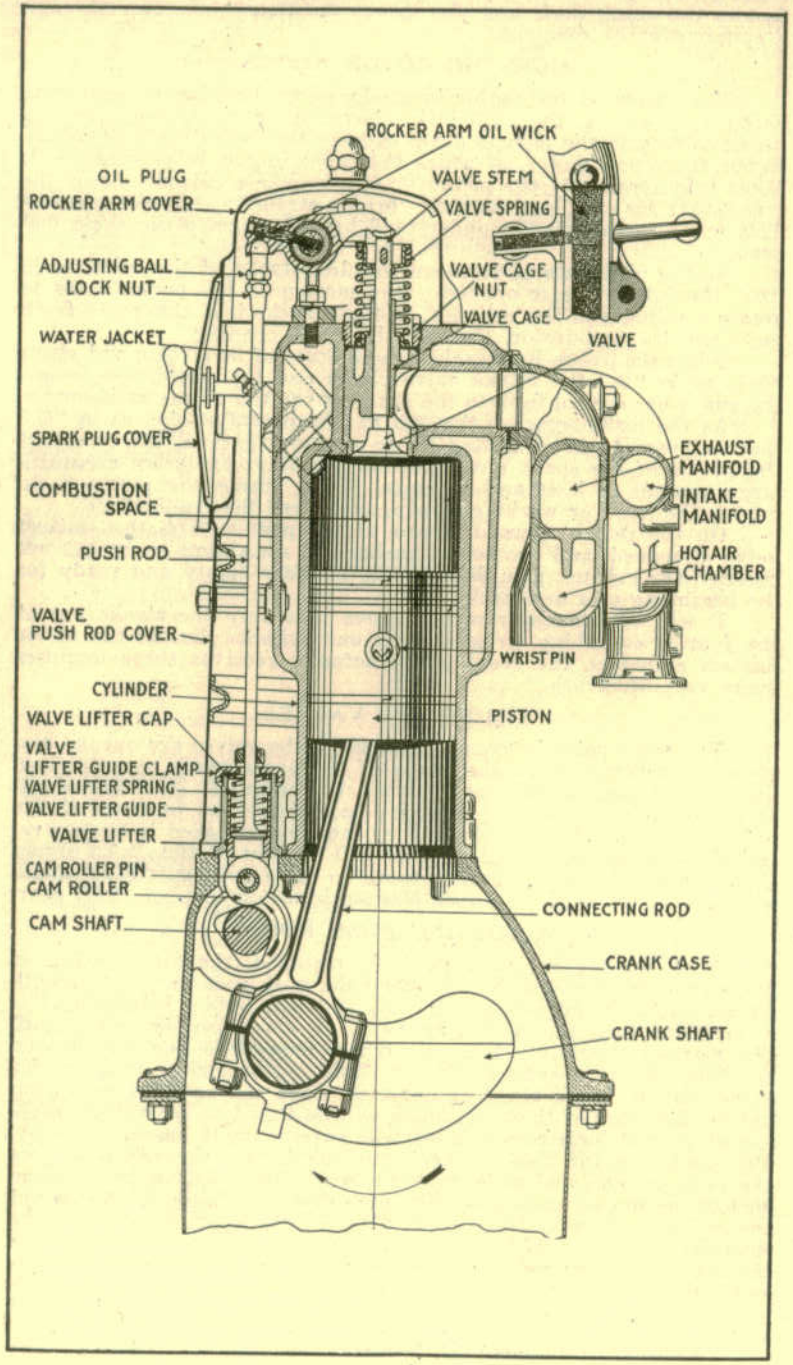


Plate 7.
Buick Valve Mechanism

In setting the marks on the fly wheel be careful to turn the motor only in clockwise direction, otherwise the backlash in the timing gears will affect the result. CAUTION: If adjustment is made while motor is cold the expansion of push rods when motor gets warm will cause valves to be held open.

GRINDING VALVES

To keep the motor up to its maximum efficiency, the valves must be gas tight when closed. When leakage occurs the valves should be ground as follows: Compress valve spring and lift push rod out of socket in valve lifter. Loosen valve cage nuts with the special drift furnished in tool kit and remove by unscrewing A light tap with a hammer on the end of the valve stem will loosen cage so it may be withdrawn. Be careful not to injure the small bronze packing ring on top. Remove valve spring and after cleaning with gasoline or kerosene, smear the valve and its seat with fine emery flour and oil, or with one of the grinding pastes now on the market. Grind by turning valve back and forth on its seat until both valve and seat show a bright ring 1/32" wide all the way around.

Be careful to clean out all traces of abrasive material before replacing the valve.

After grinding valves, it will usually be found necessary to readjust the push rods to compensate for the wear.

REMOVING CARBON

Too much lubricating oil or too rich a mixture will form carbon in the cylinder. An excessive deposit of carbon sometimes becomes incandescent and ignites the charges before the piston has finished its compression stroke, resulting in a knock in the motor.

The carbon deposit in the compression chamber may be burned out with an oxy-acetylene torch, or it can be scraped off with a bent scraper through the valve cage holes. Care should be taken to see that none of the carbon dust gets into the valves or cages.

ADJUSTING BEARINGS

A sharp, metallic knock in the motor, audible every revolution of the crank shaft, may mean that one of the bearings is loose. If retarding spark or removing the carbon does not stop the noise, remove lower half of crank case and examine bearings.

When the loose one is located, it can be taken up by removing the cap and taking out one or more of the thin metal shims. The same holds true of the connecting rod bearings. Note that bearing is bright and shows no indication of a lack of lubrication.

INSERTING PISTON RINGS

Piston rings seldom break, but if one does it can be most easily replaced by removing the connecting rod cap and pulling piston and rod out from below. The rings may be slipped on or off the piston by inserting thin strips of sheet metal under them to prevent their dropping into the grooves, until in their proper places.

ASSEMBLING CONNECTING RODS

In assembling connecting rods to the crankshaft, it should be noted that the connecting rods are offset from the center line with relation to the bearings and great care should be exercised when assembling rods to see that the identification marks, which are a raised pad and the forging number (36001) in the channel of the rod, are assembled next to the adjacent main crank shaft bearings. This also brings the smooth channel of the rod facing each other in pairs between the main crank shaft bearings.

KEEPING THE MOTOR CLEAN

Nothing will add more to the appearance of the car when the hood is raised, than a clean motor. Use soft cloth moistened with gasoline or kerosene and a stiff brush to get dirt out of sharp corners.

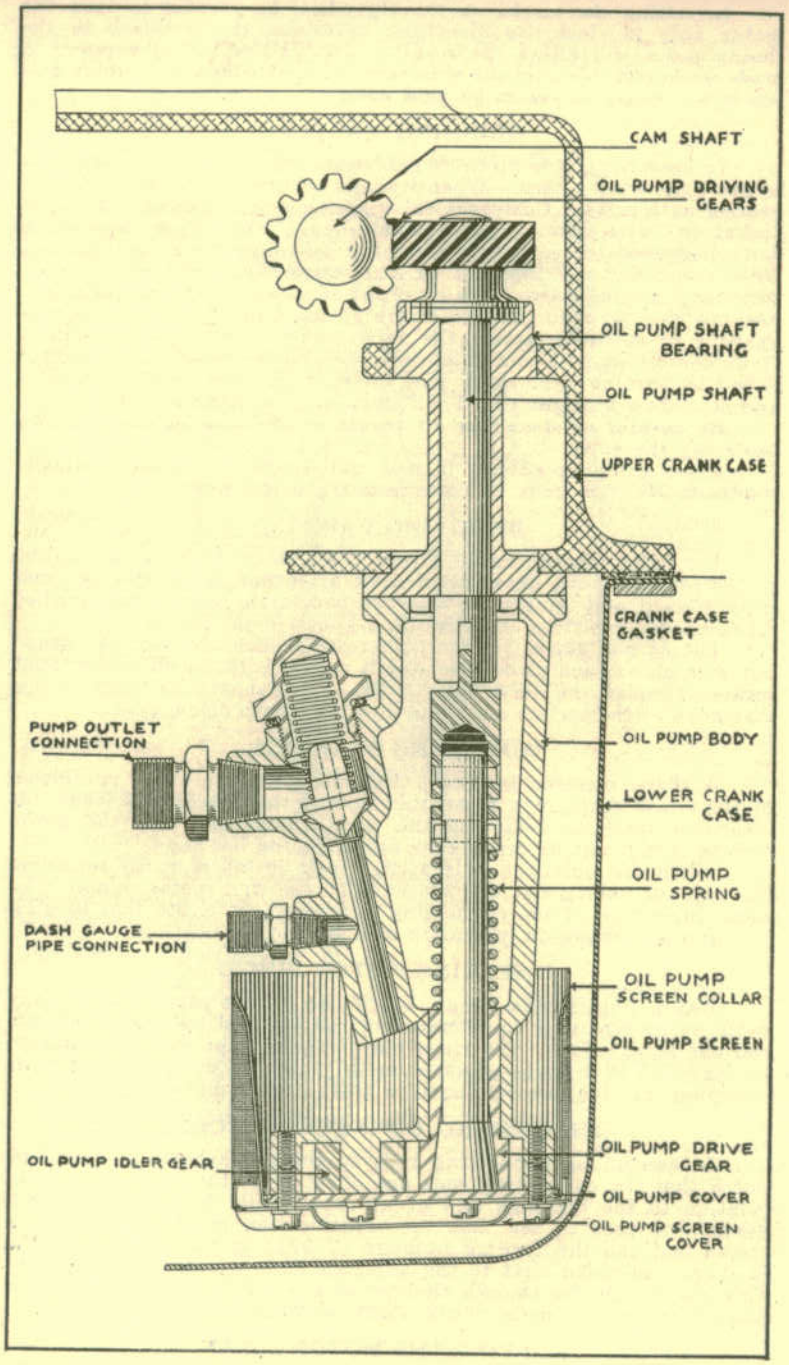


Plate 8
Oil Pump and Shaft

MOTOR LUBRICATING SYSTEM

The motor is provided with an automatic lubricating system which operates as follows:

Oil from the reservoir in the lower half of the crank case is drawn through a strainer into the pump enclosed in the rear end of the crank case. The oil pump forces a portion of the oil through a pipe and by-pass to the pressure gauge on instrument plate, where the pressure may be observed by the driver. The major portion of the oil passes through the oil distributor pipe to splash troughs fastened in the lower half of the crank case, into which the connecting rods dip, forcing some of the oil up into connecting rod bearings, and splashing remainder over the interior of the crank case and up into the pistons and cylinders. As the oil drains back, it is caught in ducts and led to all the bearings of the motor, the excess falling back into the reservoir to be used over again. The normal oil pressure as indicated by oil on the pressure gauge is four pounds. If indicator hand on pressure gauge should fall to zero while motor is running the motor should be immediately stopped and an investigation made to ascertain if oil in crank case is up to required level, should it prove to be so, an examination of the by-pass located on back of pressure gauge should be made, as the small hole will probably be found to contain some foreign substance which is preventing the flow of oil.

OIL CIRCULATING PUMP

The oil pump consists of two small gears enclosed in a close fitting housing and driven by a vertical shaft and spiral gears from the cam shaft. As the gears turn, they take the oil into the spaces between their teeth and carry it around to the outlet, where the action of the teeth meshing together squeezes the oil out of the spaces and forces it to flow to the pressure gauge on the instrument plate. The pump is automatic in action and requires no attention or adjustments, except the addition of fresh oil to the crank case reservoir, as often as necessary to keep the oil level up to the petcock.

OIL PRESSURE GAUGE

The oil pressure gauge merely indicates circulation of the oil, and does not show when the supply in the crank case reservoir is running low. Watch the oil level gauge on the crank case and test the oil level by opening the petcock at frequent intervals.

FUEL SYSTEM

The fuel system consists of the gasoline tank, piping, vacuum tank, carburetor, and intake manifold. There is nothing connected with the gasoline tank or piping to get out of order, the chief consideration being to carefully strain all gasoline and to avoid leaks which are sometimes caused by road vibration.

VACUUM TANK

The vacuum tank draws the fuel from the gasoline tank at the rear and delivers it to the carburetor at a constant head, as needed. It consists of two steel shells, the inner one of which encloses the float and the valve mechanism attached to the cover, while the outer one acts as the fuel reservoir and is connected to the carburetor. The float operates two small valves which control openings connected to the inlet manifold and to the atmosphere. A flapper check valve closes the bottom of the inner shell. As the inner shell empties, the float falls and opens the atmospheric valve.

The suction of the pistons tends to create a vacuum in the inner shell, drawing gasoline into the inner tank from the main fuel tank at the rear of the car. When the inner tank has filled, the float rises, closing the suction valve and opening the atmospheric valve, allowing air to enter the inner tank through the vent tube, while

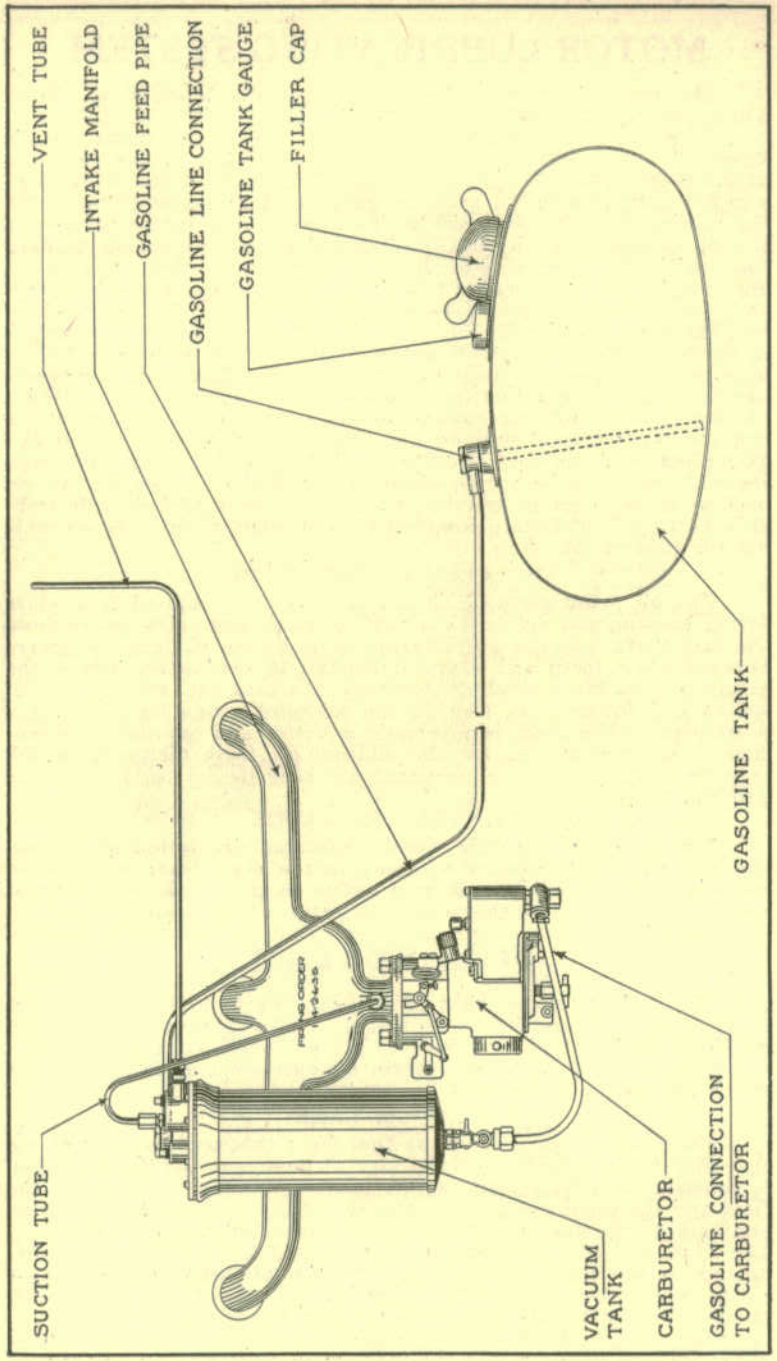


Plate 9
Fuel System

the gasoline passes through the flapper check valve into the outer tank and from there to the carburetor.

The action of the vacuum tank is entirely automatic. There are no adjustments, and it will require no attention aside from an occasional examination of the connections to see that they are tight and free from dirt. It is advisable to drain the tank every 500 miles to remove any sediment that may have collected.

The gasoline tank in the rear should be drained every 2,000 miles to remove any sediment and prevent same from reaching the carburetor and causing trouble.

Do not allow the vent tube or the small hole in the gasoline tank filler cap to get stopped up with dirt.

CARBURETOR

The carburetor is the instrument which measures the fuel charges for the motor, and mixes them with the proper amount of air to form a combustible gas. At a high rate of speed the velocity of the entering air increases until the air valve is lifted from its seat and an additional amount of gasoline spray is taken from the high speed nozzle. More air being also admitted by the valve lifting, the quality of the combustible gas going to the motor is thus automatically kept the same as the motor demands increase or vary.

The float chamber contains a cork float attached to a valve in such a manner that fuel is admitted to the carburetor only as it is needed to maintain a constant level in the spray nozzle, which is located in the mixing chamber.

The spray nozzle opening is regulated by a needle valve which constitutes the gasoline adjustment of the carburetor and it is surrounded by the venturi tube through which a portion of the incoming air passes at high velocity, picking up gasoline from the end of the spray nozzle.

The mixing chamber also contains the air valve and the high speed nozzle. The air valve is held to its seat by an adjustable spring which forms the air adjustment. At a high rate of speed the velocity of the entering air increases until the air valve is lifted from its seat and an additional amount of gasoline spray is taken from the high speed nozzle.

The air enters the carburetor through a three-way valve connected to the air regulator on the instrument board. By means of this valve, the air can be taken from the heater under the exhaust manifold or directly from the atmosphere. In the "choke" position this valve partly closes the air intake causing the motor to draw excessively rich charges for starting.

The opening between the mixing chamber and the intake manifold is controlled by a butterfly valve which is connected to the throttle lever on the steering wheel and thus determines the amount of gas being fed to the motor.

The upper end of the mixing chamber and the venturi tube, which houses the low speed nozzle, are surrounded by jackets through which some of the hot exhaust gas passes. This keeps the instrument warm and assists in the vaporization of the fuel. A damper valve in the inlet to the exhaust jacket is connected to and controlled by the throttle lever. At low throttle positions the damper valve is wide open admitting all the heat to the jacket, and at wide throttle the damper is closed. This, therefore, gives plenty of heat at the low throttle positions where it is needed most, and gradually shuts it off at the higher throttle positions where it is needed least. This system of exhaust heat to carburetor heat jacket is controlled by the Season Adjustment Valve or Carburetor Exhaust Heat Jacket Shut-Off Valve. This valve is located on the exhaust gas heat inlet tube to carburetor, at the end next to motor exhaust pipe. In warm weather, or with high test fuels, this valve should be closed, shutting off all exhaust heat to the carburetor jacket, preventing overheating of the carburetor and consequent loss in power of the motor. Care should be taken to see that in cooler weather,

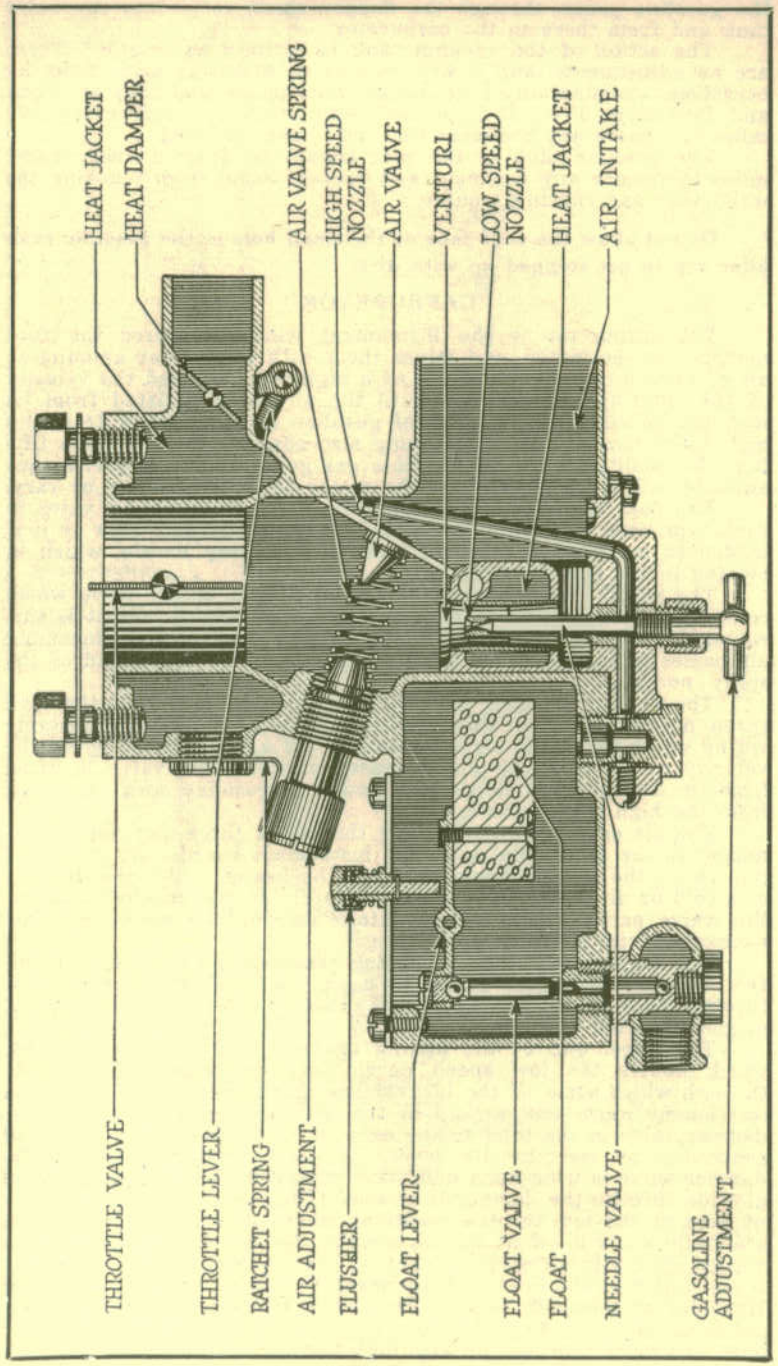


Plate 10
Carburetor

however, this valve is again set open, and it is best to keep it open always unless in hot weather motor shows lack of power. Observance of this advice will result in obtaining greater efficiency out of the fuel.

ADJUSTMENT OF CARBURETOR

For adjusting the carburetor, note the following:

1. Turn gasoline adjustment to the right until needle valve is completely closed.
2. Set air adjusting screw, so that end of screw is even with the point of the ratchet spring just above it.
3. Open gasoline adjustment by giving needle valve one full turn.
4. Start motor as usual; allowing it to run a few minutes with air regulator turned to "Hot" until motor is thoroughly warmed up.
5. With the spark lever fully retarded, turn gasoline adjustment to the right, closing needle valve until motor idles smoothly.
6. Advance the spark lever and turn air adjustment screw to the left a little at a time, until the motor begins to slow down or skip, indicating too much air; then turn it to the right until the motor runs smoothly.

To test the adjustment, leave spark lever advanced and open throttle lever quickly. The motor should accelerate instantly. If it skips or pops back, open gasoline adjustment slightly by turning needle valve to the left. Do not touch air adjustment again unless it appears absolutely necessary. The best possible adjustment has been secured when gasoline adjustment is turned as far as possible to the right and air adjustment is turned as far as possible to the left, letting motor idle smoothly and accelerate quickly when throttle is opened.

Care should be taken to keep the carburetor exhaust heat jacket and tubes clean to insure heat circulation, which enables the motor to run better and gives greater efficiency.

Do not attempt to adjust carburetor until certain that motor has good compression in each cylinder; that a good hot spark occurs at each plug at the proper time; and that gasoline is reaching the carburetor regularly from the vacuum tank. The carburetor should be the last thing to touch.

THE DELCO SYSTEM

The electrical equipment includes the Delco single unit, six volt starting, lighting and ignition system. This is manufactured and guaranteed by The Dayton Engineering Laboratories Company, Dayton, Ohio. It consists of the following Delco parts:

Motor Generator. No. 117.
Motor Clutch. No. 12224.
Ignition Coil. No. 2157.
Combination Switch. No. 1158.

and the necessary terminal clips for properly connecting the different units. The Delco apparatus does not include the storage battery, lamps, horn or wiring.

The electrical equipment on the automobile is for the purpose of providing a supply of electrical energy for cranking purposes and supplying the lights, ignition and horn. The storage battery is necessary because electrical energy must be available when the engine is not in operation.

MOTOR GENERATOR

The motor generator is for the purpose of supplying electrical energy for charging the storage battery and for furnishing this directly to the lights, horn and ignition. In addition to this the same piece of apparatus operates as a motor to perform the cranking operation. During the cranking period electrical energy is supplied by the storage battery.

The distributor is located in the forward end of the motor

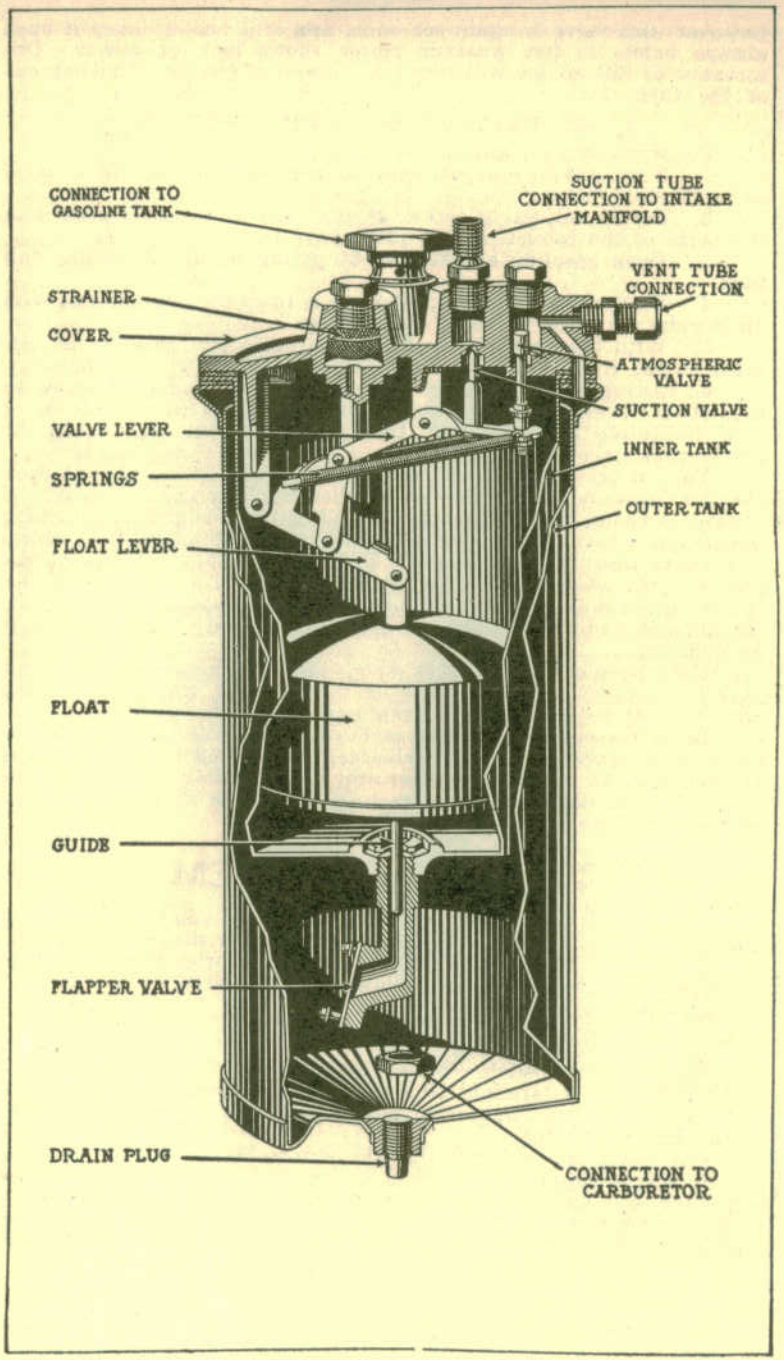


Plate 11
Vacuum Tank

generator. This is for the purpose of properly timing and distributing the ignition current for firing the mixture of air and gasoline in the different cylinders.

The motor generator is mounted on the right side of the engine and is arranged so that the extension of the water pump shaft drives the armature whenever the engine is in operation. At the rear of the motor generator are the starting gears. These are assembled in the bell housing covering the flywheel. They are for the purpose of making connection between the armature shaft and the flywheel for the cranking operation.

The motor generator proper consists of two principal parts, these being the frame and armature. The frame is an electro magnet energized by the field current and has pole pieces on each side of the armature, which places the armature in a strong magnetic field. The armature is the revolving element. This is made up of a round iron core of thin discs. In the slots of the core are wound insulated copper wire coils. These coils connect to the commutator at the forward end. The armature is mounted on suitable bearings.

An electrical voltage is induced in the armature windings whenever the armature is revolved. During the time the engine is operating the armature, the circuit between the generator winding and the storage battery is completed, thus allowing current from the generator winding to charge the storage battery and supply current directly for the lights and ignition.

During the cranking operation this is prevented by one of the generator brushes being raised off the commutator.

During the cranking operation the electrical current flows from the storage battery through the motor windings, causing the armature to rotate. The closing of this circuit is effected by the motor brush, which is operated by the starting pedal.

The operation of the distributor in no way affects the motor generator, it being located in this manner simply as a convenient method of mounting and driving.

OPERATION

The motor generator performs three different operations, which are as follows:

1. **Motoring the Generator.** This operation is necessary in order that the starting gears may be brought in mesh with the small gear on the armature shaft and with the teeth on the flywheel. This takes place whenever the lever on left hand side of ignition switch is turned to position marked "On." This completes the circuit from the storage battery to the generator windings and allows current to be discharged from the storage battery through the shunt field winding and the generator windings on the armature, thus causing the armature to revolve slowly.

2. **Cranking Operation.** The cranking operation is performed when the starting gears are brought fully in mesh and the motor brush makes contact with the commutator. This is so arranged that the starting gears are fully in mesh before the motor brush makes contact on the commutator. Since considerable power is required for the cranking operation, a heavy discharge from the storage battery is necessary. The cranking circuit is made up of heavy copper cable and the motor brushes and motor windings are designed to operate under high discharge. For this reason there must be no loose or poor connections in this circuit. All battery connections, motor connections and motor brushes must make good electrical contact.

3. **Generating Electrical Energy.** After the cranking operation is completed the starting pedal is returned by a spring. This disconnects the starting gears, raises the motor brush and allows the generator brush to make contact with the commutator while the armature is driven by the extension of the pump shaft. At very low engine speeds the voltage generated is not sufficient to overcome the

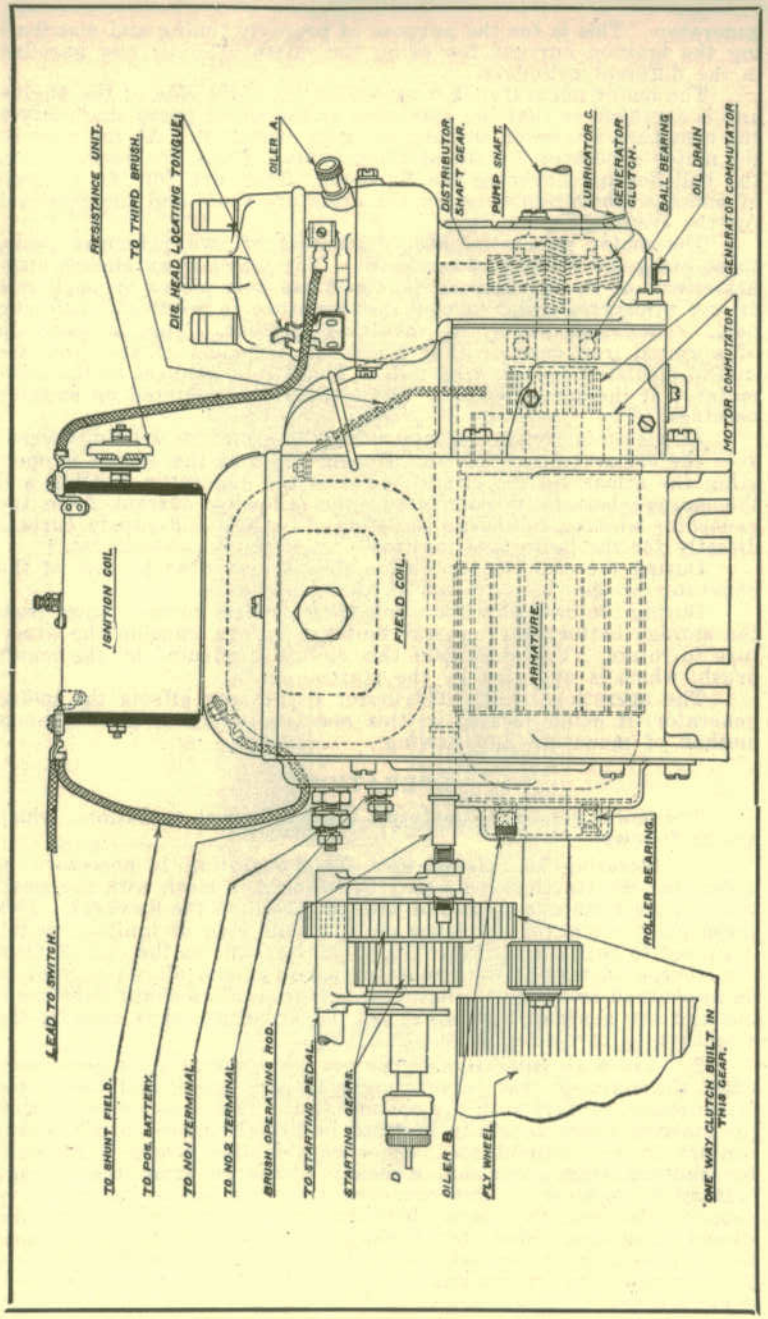


Plate 12
Side View of Motor Generator

voltage of the storage battery and a small amount of current may be discharged from the battery through the generator winding, but this amount is very small. At all normal engine speeds the voltage of the generator exceeds that of the storage battery and current is either charged into the storage battery or is used directly for lights, horn and ignition.

The ammeter on the instrument plate is for the purpose of indicating the amount of current that is being charged into the storage battery or discharged from it, with the exception of the cranking current.

REGULATION

The generator commences to charge the battery at engine speeds corresponding to seven miles per hour on high gear, providing no current is being used for lights. The output of the generator increases until approximately twenty-five miles per hour and at the higher speeds the output is decreased. On account of the variable speeds at which the generator must operate it is necessary that the output be regulated so that sufficient current is obtained at the lower engine speeds without excessive current at the higher speeds. The regulation is what is known as "third brush excitation," 'in which the current for magnetizing the frame is conducted through the auxiliary or third brush on the generator commutator. With this arrangement the natural function of the generator itself causes less current to flow through the shunt field winding at the higher engine speeds. This weakens the magnetic field in which the armature is rotating and decreases the output of the generator.

ADJUSTING THE CHARGING RATE

The output of the generator is adjusted at the factory to give ample current for average driving conditions but as the service demanded of some cars is far from normal, in some instances the output of the generator will be found to be insufficient and in other instances considerably in excess of what is required. To meet these conditions the third brush is arranged to move towards the right or left, to either increase or decrease the output. This adjustment should only be made by competent mechanics who have much more complete information on the method of making this adjustment than is possible to include here. These instructions are contained in the Delco Service Manual which is supplied to all Buick dealers, and the dealer or his mechanic should make this adjustment.

LUBRICATION

There are five places to lubricate the motor generator. Referring to the side view of the generator, they are as follows:

1. Oiler "A" is for lubricating the bearings on the distributor shaft. This should receive four or five drops of engine oil every week.
2. Oiler "B" is for lubricating the roller bearings on the rear end of the armature shaft. This should receive four or five drops of engine oil every week.
3. Lubricator "C" is in the front end of the motor generator. This is for lubricating the ball bearing on the armature shaft, the distributor driving gears and the generator clutch. This is packed with soft cup grease and should be replenished every season. In cold weather it is advisable to add some lubricating oil.
4. Grease cup "D" is for the purpose of supplying lubricant to the starting gears, shaft and one-way clutch. This forces grease through the hollow shaft into the clutch. This cup should be given a turn or two every two weeks.
5. That part of the distributor head upon which the rotor button bears. This should have a small amount of vaseline applied two or three times during the first two thousand miles usage of the car. The rotor button should be kept polished smooth and bright.

DISTRIBUTOR.

The distributor is mounted on the front end of the motor gen-

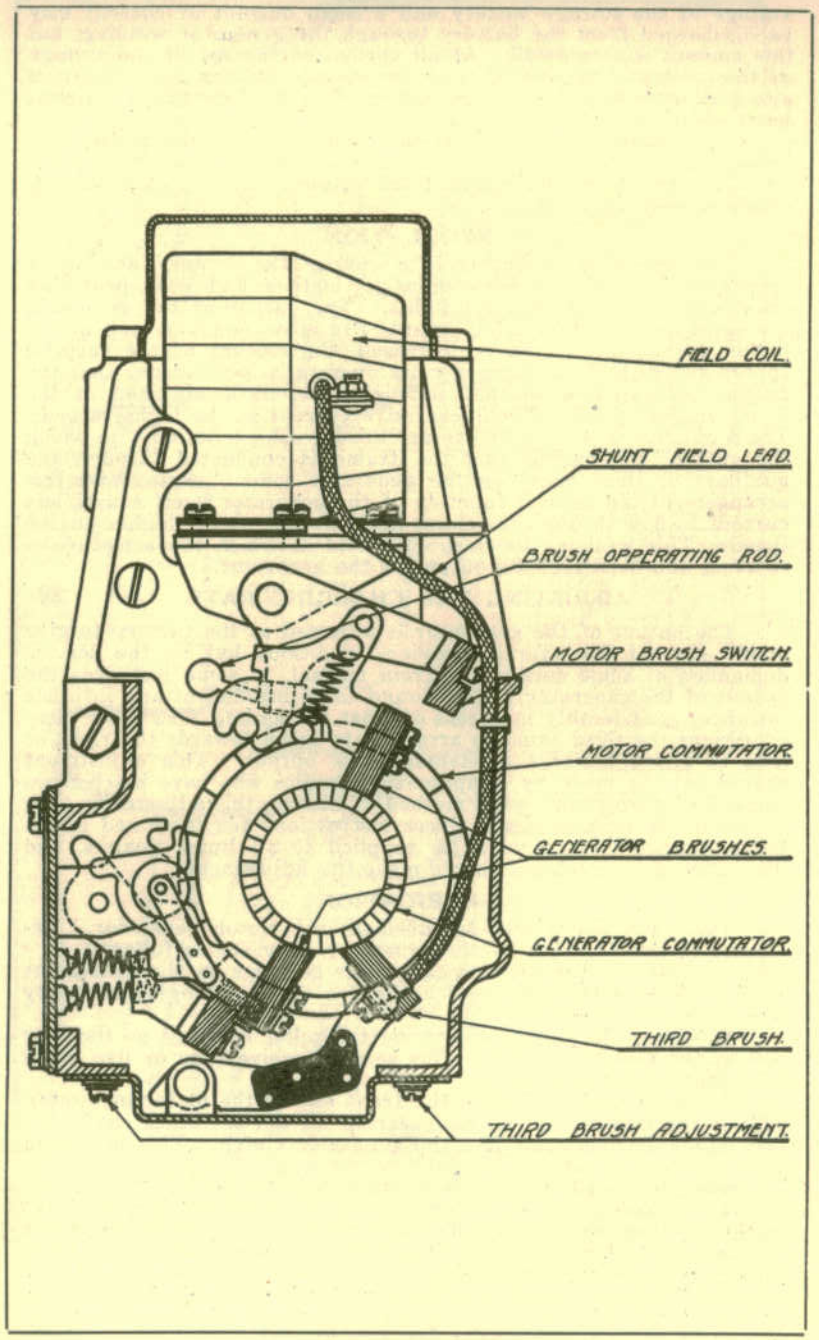


Plate 13
End View of Motor Generator

erator. The purpose of the distributor is to secure the proper timing and distribution of the ignition current. The distributor is driven by a spiral gear which is cut on the outer face of the generator driving clutch. The driving gear is operated by the pump shaft at one and one-half times crankshaft speed. This drives the vertical shaft of the distributor at one-half crankshaft speed. The vertical shaft carries the automatic advance feature, the breaker cam and rotor.

The distributor is equipped with both manual and automatic spark control. The manual control is for the purpose of securing the proper retard for starting, very slow idling and the necessary advance for low engine speeds over which the automatic feature has no control. The automatic control is for the purpose of securing the additional advance which is necessary to secure the proper performance at the higher engine speeds.

The breaker cam and timing contacts are for the purpose of securing the proper timing of the ignition. This is accomplished by the interruption of the flow of current through the primary winding of the ignition coil by these contacts.

The rotor is for the purpose of distributing the high tension current from the center terminal of the distributor head to the proper terminal for firing the cylinder under compression. The breaker cam and rotor are so located that when the current is interrupted and the spark is produced, the rotor will be located in the proper position to fire the cylinder which is under compression.

ADJUSTING TIMING CONTACTS

The timing contacts are operated by the breaker cam which should be carefully adjusted so that when they are held apart the widest opening should be the thickness of the gauge on the distributor wrench marked "Distributor," which is eighteen one thousandths of an inch (.018").

CARE OF DISTRIBUTOR HEAD AND ROTOR

The current for firing the automobile engine must be of a very high voltage. On account of this all parts which conduct this current must be highly insulated. For this reason the high tension wiring has very heavy rubber insulation. The distributor head and rotor are made of bakelite which has very high insulating qualities.

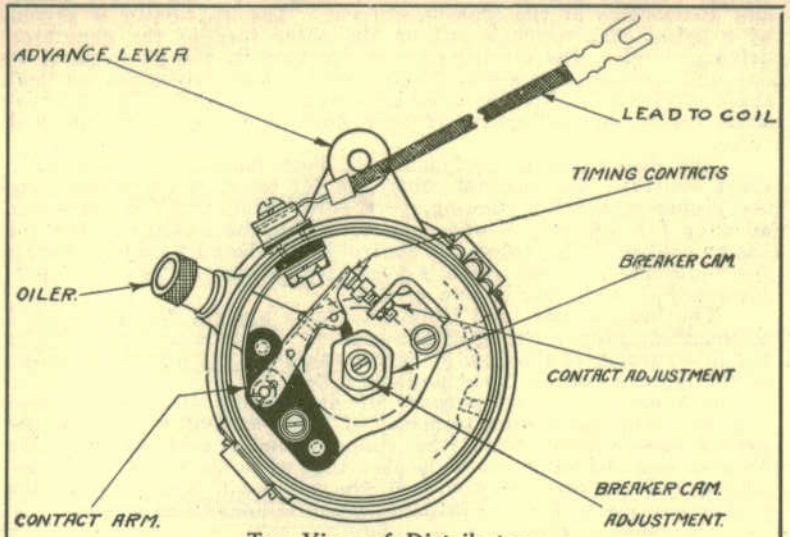
It is important that the distributor head and rotor be kept clean, otherwise the foreign matter will conduct the high tension current to improper terminals, or the ground, causing faulty ignition. The distributor head should be wiped clean with a soft rag and a small amount of vaseline applied on the rubber track as explained in a previous paragraph. The rotor button should be kept smooth and bright and care taken to see that the proper spring tension is maintained on the rotor button. Excessive pressure will cause wearing of the button and head. The center contact in the distributor head should make contact with the rotor. The distributor head should be properly located by the locating tongue in the hold-down clip.

ADJUSTING SPARK PLUGS

The proper gap when adjusting the spark plug electrodes should be thirty-thousandths of an inch (.030"), or the thickness of the gauge marked "Spark Plug.". On former Delco wrenches where the gauges were marked "For Steel Cam Distributor" and "For Fibre Cam Distributor," both gauges together are required to give this adjustment.

IGNITION COIL

The ignition coil is mounted on top of the motor generator. This is for the purpose of transforming the electrical energy from the storage battery or generator into a current of very high voltage, suitable for firing the charge in the combustion chamber. The coil



Top View of Distributor

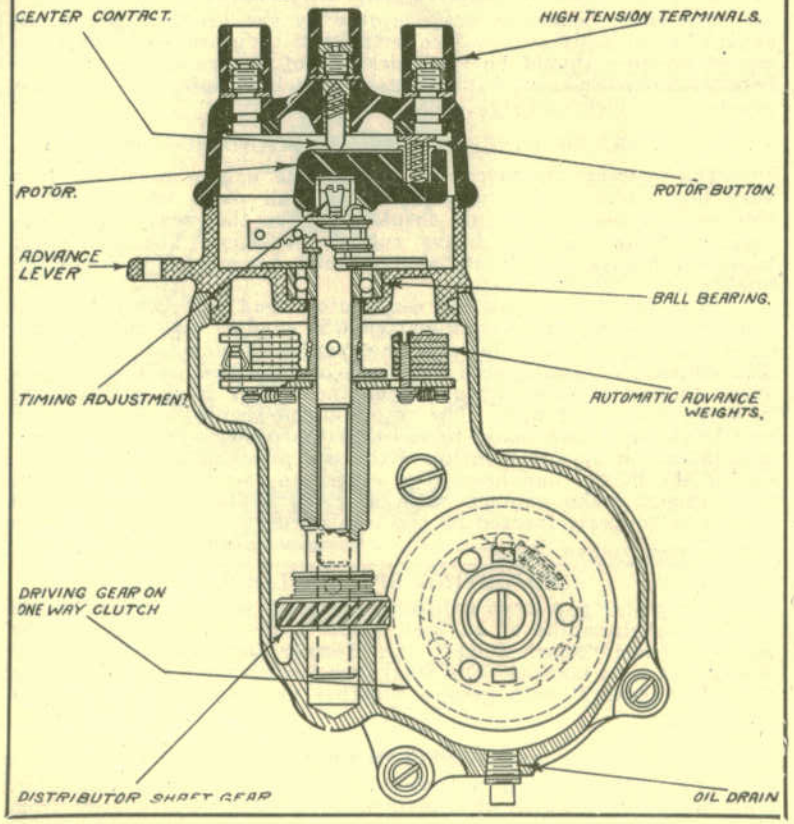


Plate 14
Sectional View of Distributor

proper consists of an iron core made up of a number of small iron wires. Wound around and insulated from this is the primary winding, consisting of a comparatively few turns of copper wire. It is through this winding that current is supplied for magnetizing the core of the coil. Wound around and insulated from the primary winding is the secondary winding which consists of several thousand turns of very fine insulated copper wire. One end of this winding is grounded to the ignition coil mounting bracket and the other end terminates at the high tension terminal at the top of the coil.

CONDENSER

The condenser is incorporaed in the base of the ignition coil. This consists of two long strips of tinfoil insulated from each other by parafined paper. Each strip of tinfoil is provided with a terminal which is connected as shown in the circuit diagram. The purpose of the condenser is to increase the voltage of the high tension current and to decrease the amount of burning and sparking at the timing contacts.

RESISTANCE UNIT

The resistance unit is mounted on the forward end of the ignition coil. This consists of a special resistance wire wound on a porcelain spool and connecting in series with the primary winding of the coil. This connection is shown on the circuit diagram. It is for the purpose of preventing an excessive discharge from the storage battery when the engine is not running and the ignition switch is on and the contacts are closed. It also causes the spark obtained to be more nearly uniform at the different engine speeds.

TIMING THE IGNITION.

The ignition system is carefully timed when the cars leave the factory and under ordinary conditions need not be touched by the car owner. But should it be necessary to retime the ignition system for any reason it can be done by following these instructions:

1. Place the spark lever on the steering wheel in the fully retarded position.
2. Turn the engine to the seven degree mark (which is approximately one inch after dead center), with the No. 1 cylinder on the firing stroke.
3. Loosen the timing adjustment screw in the center of the distributor shaft and turn the breaker cam so that the rotor button will be in the position under No. 1 high tension terminal when the distributor head is properly located. This determines the proper lobe of the cam to time by. The cam should be very carefully located so that when the slack in the distributor gears is rocked forward the contacts will be opened by the cam; and when the slack is rocked backwards the contacts will just close.
4. Tighten the adjustment screw securely and replace the rotor and distributor head with the head properly located by the tongue in the hold-down clip. The cylinders fire in the following order, 1-4-2-6-3-5.

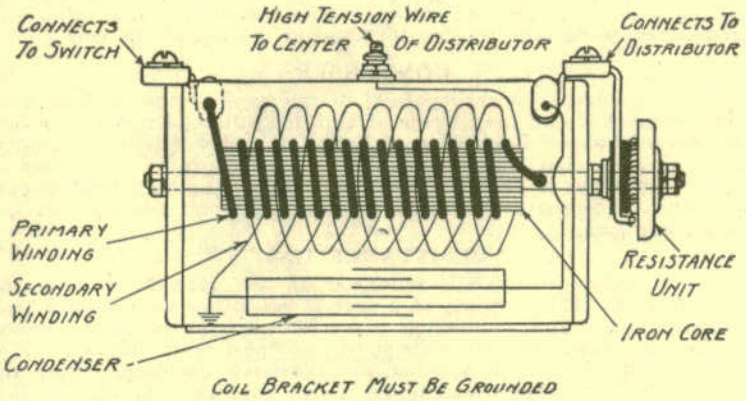
COMBINATION SWITCH.

The combination switch is located on the instrument board and is for the purpose of controlling the light and ignition circuits, and the circuit between the generator and the storage battery.

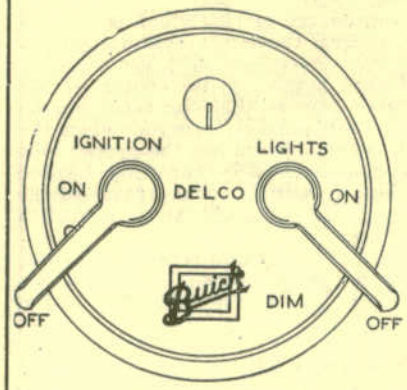
The lever on the left of the switch controls the ignition and the circuit between the generator and storage battery.

The lever at the right controls all lights, having three positions, off, dim and bright.

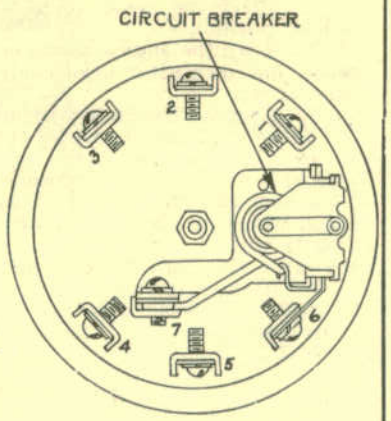
The lever at the left of switch marked "Ignition" controls both the ignition circuit and the circuit between the generator and storage battery. By controlling the latter circuit it performs the function of an automatic cut-out which is commonly used for this purpose. For this reason this lever should not be left on the "On" position when the engine is not running.



Sectional View of High Tension Coil



Front View Delco Switch



View Showing Terminals

Plate 15
Views Delco Coil and Switch.

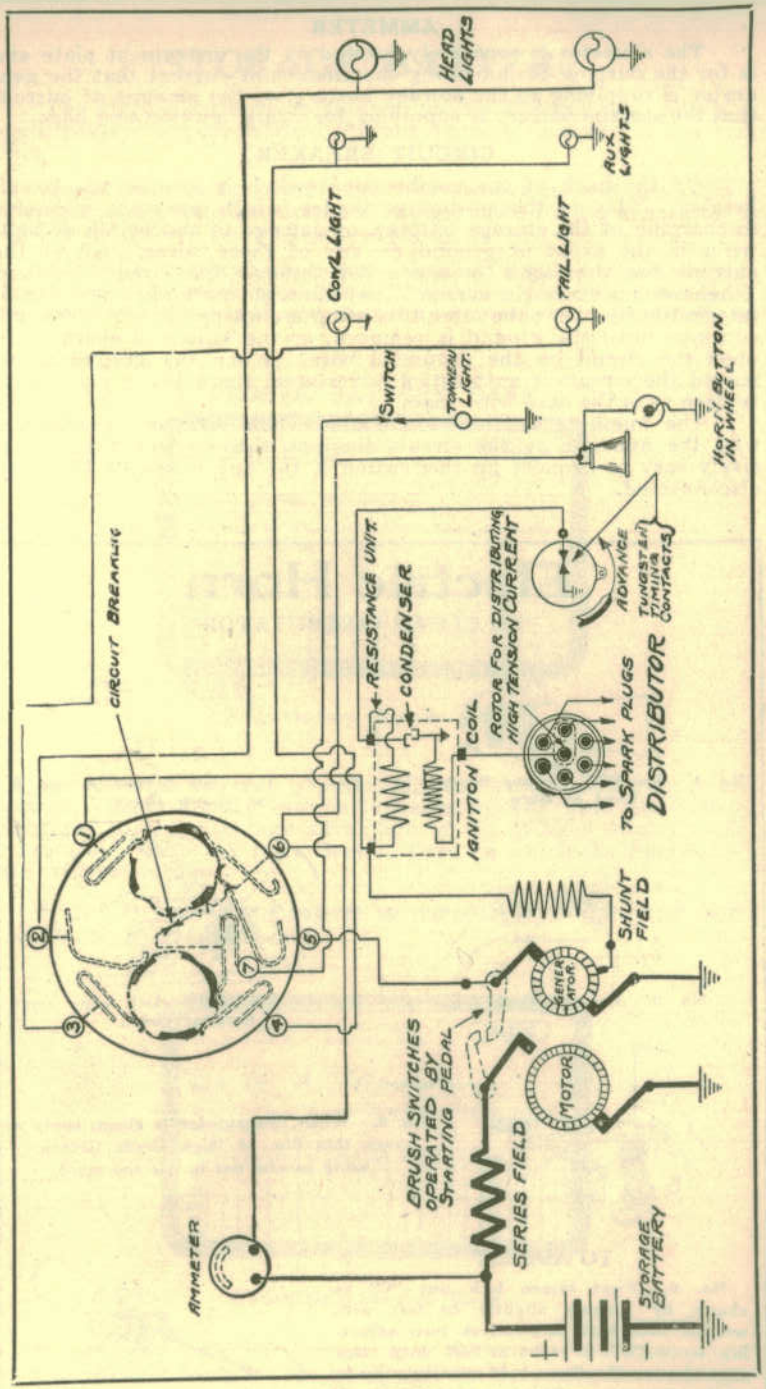


Plate 16.
Circuit Diagram.

AMMETER

The ammeter is separately located on the instrument plate and is for the purpose of indicating the amount of current that the generator is supplying to the storage battery, or the amount of current that the storage battery is supplying for lights, ignition and horn.

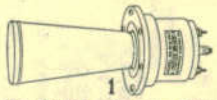
CIRCUIT BREAKER

On the back of the combination switch is located the circuit breaker. This is the protective device which prevents excessive discharging of the storage battery, or damage to the switch or light wires in the event of ground on any of these wires. All of the current for the lights is conducted through the circuit breaker. Whenever an excessive current flows through the circuit breaker, it intermittently opens the circuit, causing a clicking sound. This will continue until the ground is removed, or the switch is operated to open the circuit on the grounded wire. When the ground is removed the circuit is automatically restored, there being nothing to replace as is the case with fuses.

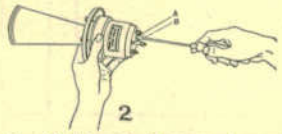
The numbers on the switch and switch terminals correspond with the numbers on the circuit diagram, this making it comparatively easy to connect up this switch if for any reason it has been disconnected.

Electric Horn

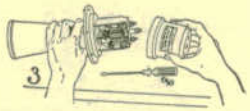
TO CLEAN COMMUTATOR



No. 1. Do NOT remove Screws in front of Horn.



No. 2. Take out Screws A and B as shown above.



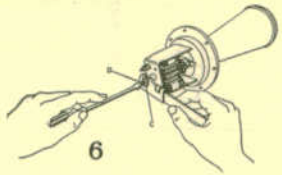
No. 3. Remove Back Cap.

No. 4. With dry cloth wipe commutator clean.

No. 5. When commutator is clean, apply a very thin film of High Grade Grease, being careful not to use too much.

TO ADJUST

No. 6. First loosen lock nut "C" as shown by turning slightly to left with wrench, then with screwdriver turn adjusting screw "D" to right or left until clear tone is secured. Then hold adjusting screw at its present position, and tighten lock nut "C," setting it up TIGHT.



STORAGE BATTERY

The storage battery on this car is the Willard type SJWN-4, manufactured by the Willard Storage Battery Company, Cleveland, Ohio.

The storage battery is the heart of the electric system. It is a reservoir into which the electrical energy made by the generator, is stored for ignition, lighting, and cranking the motor.

A storage battery is an electro-chemical apparatus entirely different from the mechanical parts of the car. Its life depends on the care which it receives and the kind of service demanded from it.

PROPER BATTERY CARE


WILLARD SERVICE STATION.
111 N. Main St., Blankville, Wisc.
Willard
Mr. J. R. Watson
Is entitled to WILLARD CONSULTING SERVICE twice each month. Registered 6/1/19

	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sept.	Oct.	Nov	Dec.
OUT												
LEAK												
WEAK												
DRY												
O'K												

Registration Service Card.

1. When a new car is purchased, the owner should go to the nearest Willard Service Station immediately and have the battery registered in order to take advantage of the Willard 90-day insurance policy. Also ask for a Service Card on which the registration date will be written.

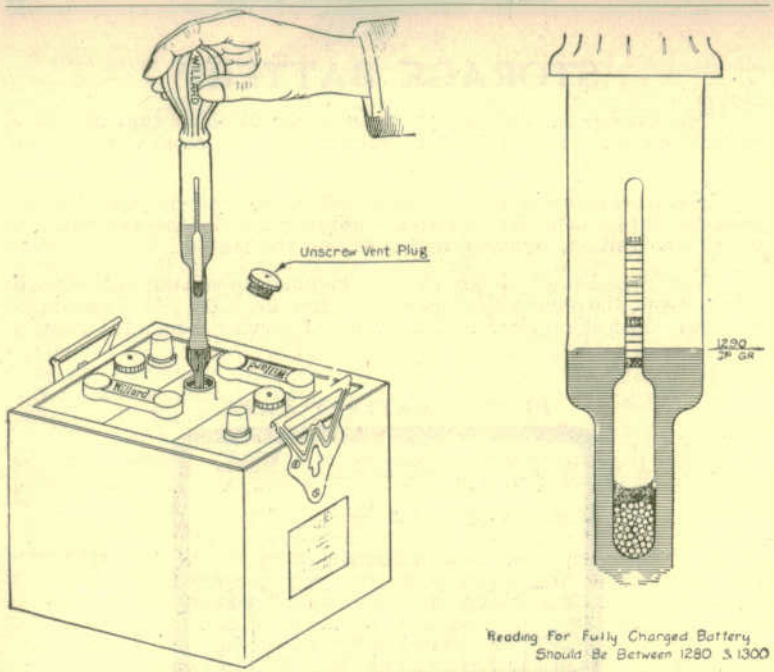
If you buy a Willard battery to replace the one you now have, it will be registered when sold.


WILLARD SERVICE STATION.
111 N. Main St., Blankville, Wisc.
Willard
Mr. C. R. Brown
Is entitled to WILLARD CONSULTING SERVICE twice each month.

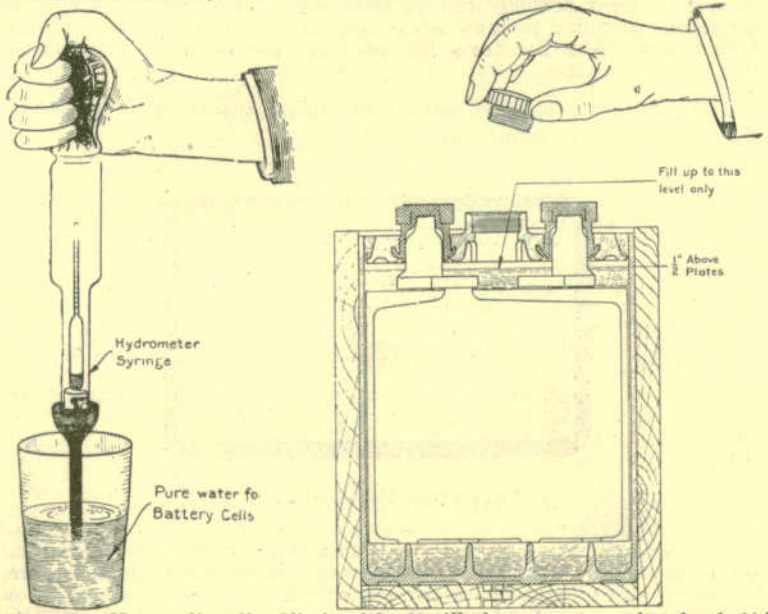
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
OUT												
LEAK												
WEAK												
DRY												
O'K												

Consulting Service Card

2. If your car is not new call at a Willard Service Station and get a Consulting Service Card which will entitle you without charge, to testing and filling service twice a month. At the same time you will be given advice which will help you to get the best possible service from your battery.



3. Test all cells with a Willard hydrometer on the first and fifteenth of every month. If any cells are below 1.275 on two successive testing dates, take the battery to the Willard Service Station and have it fully charged. In taking these readings, care should be exercised to return the electrolyte from the hydrometer syringe to the same battery cell from which it was taken.



4. Keep all cells filled with distilled water to a level of ½" above the top of the plates. Never fill ABOVE this level.

5. Keep the battery and battery compartment clean and dry.

6. Keep the terminals clean and tight and well covered with vaseline to prevent corrosion.

7. Never allow the battery to become heated in service above 100° F. Watch the battery for heating one or more times every day in warm weather. If the top connectors feel more than blood warm to the touch, take the temperature with a dairy thermometer. If the temperature registers over 100°F. burn all the lamps while driving. If the temperature reaches 120° F.,, battery may be ruined.

8. In order to prevent freezing in cold weather, test your battery frequently and see that the gravity is kept up to at least 1.275. A discharged battery will freeze at a little below the freezing point.

9. When filling, if one cell takes considerably more water than the others, this indicates a leaky jar and the battery should be taken or sent to a Willard Service Station. Unless repaired immediately, the battery may be ruined.

10. If you lay up your car, the battery should be removed and placed in storage with a Willard Service Station, who will issue a receipt for it.

A battery will slowly discharge when standing idle. Serious injury will result if it is not kept charged and it is not practical to do this by running the engine when the car is not in use.

WILLARD SERVICE AND ADJUSTMENT POLICIES

1. We insure every new Willard Battery for 90 days from the date of purchase, provided the battery is registered immediately at the nearest Willard Service Station. If any repairs are necessary during this period, the same will be made without charge to the owner. Recharging is not considered repairs and the owner is expected to pay for any recharging that may be necessary.

2. During the fourth, fifth, and sixth months of ownership, if a battery needs any repairs the same will be made on a basis satisfactory to the customer.

3. During the seventh, eighth, ninth, tenth, eleventh, and twelfth months of ownership, if repairs are necessary the owner will be given the option of paying the regular charge for the same or he may exchange the old battery for a new one by paying a fractional part of the retail price, based on the number of months of service received from the old battery. For example: if the battery has given eight months' service, the adjustment price for the new battery would be eight-twelfths (8-12) of the retail price.

4. Willard Service Stations will keep dealers' stock batteries fully charged at a minimum cost to the dealer, and will register and accept responsibility for them under our service policy, provided they are not over six months old at the end of the storage period.

5. All questions concerning batteries which have not been registered or which may have attained some age at the time the car is delivered, are to be settled in the customer's interest between the car dealer and the Willard Service Station dealer.

6. Batteries shipped bone dry with cars and prepared by the Willard Service Station at destination, will be registered by them at the same time. Bone dry batteries prepared by the dealer himself are to be registered at the nearest Willard Service Station in the regular way.

7. With motor car dealers located in places where there is no Willard Service Station, the nearest service station will make arrangements with the dealer whereby all Willard Service and Adjustment Policies will be handled through the dealer.

WILLARD SERVICE STATIONS

The Willard Storage Battery Company have the most complete and extensive storage battery service organization in the world.

The benefits of the above Service and Adjustment Policies, can be had only through authorized Willard Service Stations. If there is none as yet in your city, consult your dealer.

We strongly recommend that you take advantage of the service which we have provided for you by equipping our K series cars with Willard batteries.

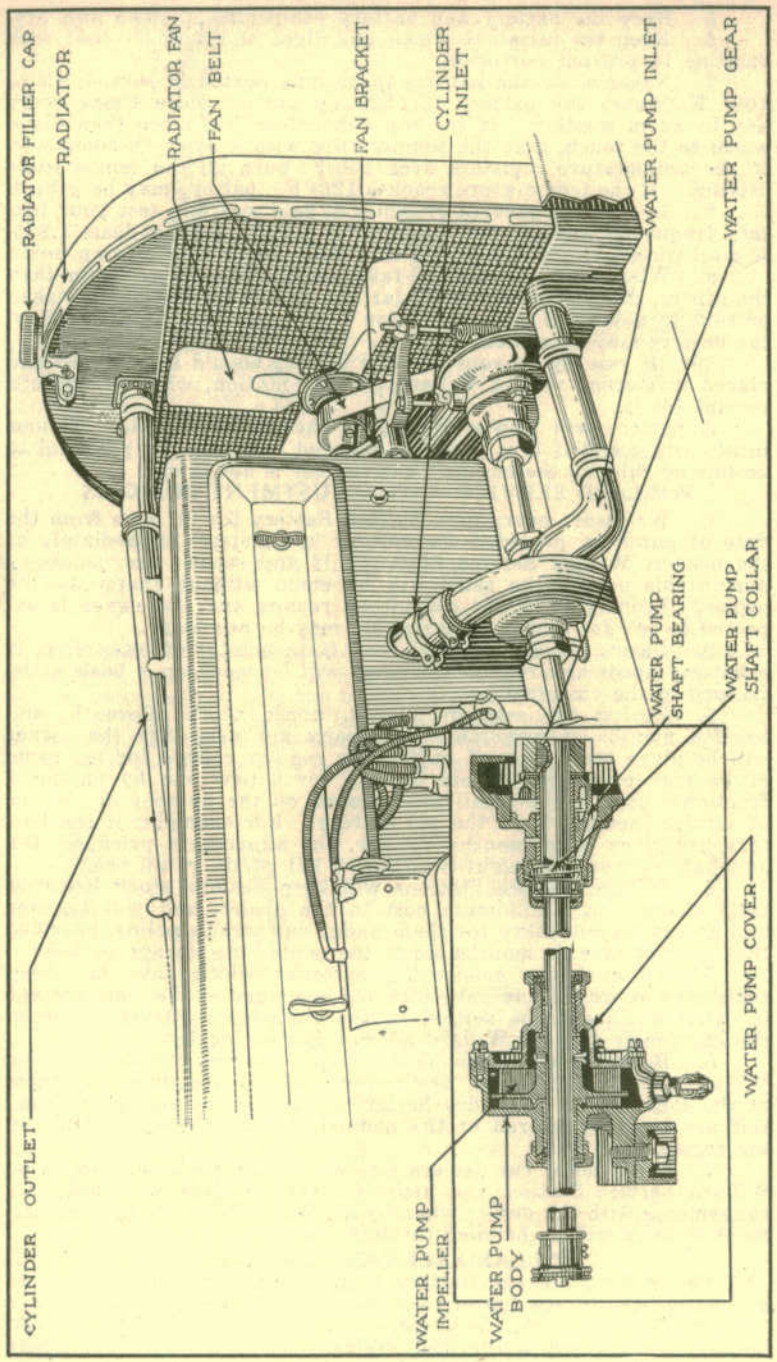


Plate 17
Cooling System

STORING STORAGE BATTERY

Remove storage battery by disconnecting both positive and negative leads from battery. Take Hydrometer reading of solution to ascertain that battery is in the fully charged state (Specific gravity 1.285); add pure distilled water if necessary to bring solution ½" above plates, being sure to thoroughly mix the water added with solution contained in the battery.

Replace filler-plugs, apply a thorough coat of vaseline to terminals, nuts and washers, which will prevent corroding. Place battery in a room where the temperature will always be above freezing. This is important. Once a month remove plugs and bring solution to ½" above the plates by adding distilled water as before. Take hydrometer reading, and if specific gravity has fallen below 1.285, have battery charged to bring it back to fully charged state.

STORING CAR FOR WINTER

If car is to be placed in storage during the winter months, the following instructions should be carefully adhered to:

Wash and dry car thoroughly, using a pure soap, cold water and soft chamois; a soft cloth saturated with kerosene (coal oil) will be found convenient to remove any surface grease from motor metal parts. With top in the fully raised position, place car in dry place, free from dust. By some convenient method, jack car up, so weight is entirely removed from all wheels, deflate tires to few pounds pressure. Drain all water from radiator, motor and water pump, by removing plugs and opening petcocks. Drain all oil from motor by removing plugs in bottom of crank case. Insert a few drops of kerosene around each valve stem; also pour a tablespoonful of kerosene on top of piston, through spark plug hole, and replace spark plugs. Be sure water is thoroughly drained from all parts.

PUTTING CAR INTO SERVICE

In putting the car into service in the Spring, care should be taken to see that all parts are in proper working condition before attempting to use car. First inflate tires to proper pressure. See that radiator is filled with clean water; that crank case is filled with motor oil and the oil level is no higher than petcock opening. See that spark plugs are clean and free from carbon.

Connect Storage Battery by replacing Positive and Negative leads. Insert a few drops of motor oil in all oil holes; fill grease cups with fresh grease; apply a few drops of kerosene to each valve stem and make sure fan is properly working. It is advisable to turn motor over a few times with the hand crank to make sure all moving parts are free before attempting to use the self-starter. Transmission and differential should be carefully inspected to see that they contain the proper amount of oil. Storage battery should be in the fully charged state (specific gravity 2.285) and solution ½" above plates.

COOLING SYSTEM

The cooling system includes the radiator, water circulating pump, water connections and radiator fan.

RADIATOR

The radiator consists of an upper and lower tank connected by a large number of narrow passages in the cellular core. The hot water from the motor enters the upper tank and gradually flows through the passages in the core to the lower tank while a current of cool air is circulated through the opening in the core by the radiator fan. An enameled shell encloses the radiator and supports it on the frame of the car.

WATER PUMP

The water pump is of the centrifugal type and consists of an impellor with curved blades, fastened to the shaft, and a loose fitting, air tight casing, with inlet and outlet connections, fastened to the motor crank case. As the impellor revolves, it draws water

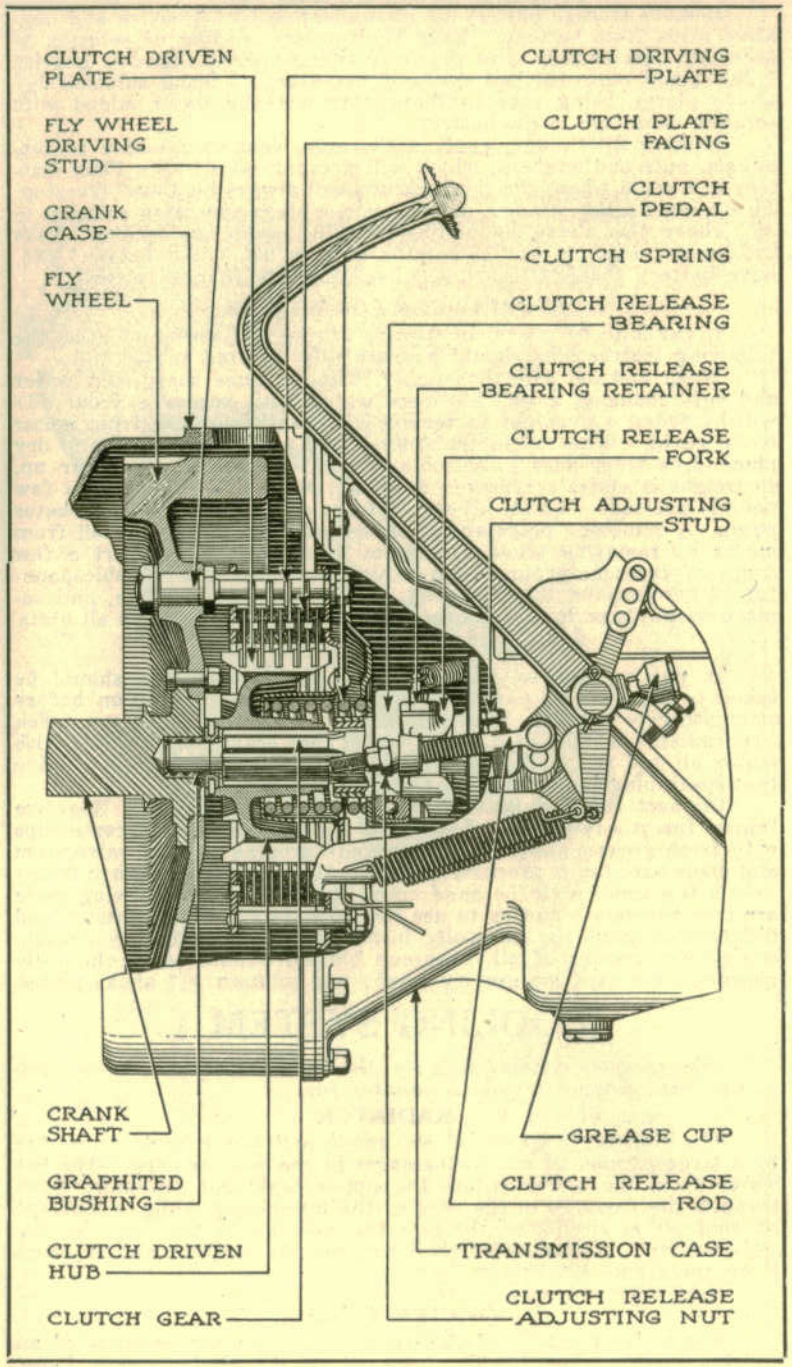


Plate 18
Clutch

from the radiator to the center of the impellor and by centrifugal force, throws it off at the outer ends of the blades and out of the casing to the cylinder jackets.

In order to keep the casing air tight the pump shaft is carried in glands, filled with prepared wick packing which also acts as a lubricant. These glands should be tightened from time to time as they show indications of leakage, but care must be taken to keep them from binding the shaft.

RADIATOR FAN

The radiator fan is mounted on the front end of the motor and is driven by belt from the cam shaft. It should be lubricated at intervals by introducing motor oil through the oil plug hole on fan hub. The belt can be tightened by loosening clamp bolt and swinging bracket up.

To prevent overheating, keep radiator filled with clean water, see that fan belt is tight, and avoid leaky connections.

DRAINING

To drain cooling system, take wing plug out of bottom of radiator and open draincock in water pump. Do not store car without draining cooling system thoroughly.

ANTI-FREEZING MIXTURE

In cold weather, the cooling system should be drained and filled with a solution that will not freeze when car is allowed to stand. The best anti-freezing mixtures are composed of denatured alcohol and water, as follows:

Freezing Point	Alcohol	Water
10° above zero	20%	80%
5° above zero	30%	70%
20° below zero	40%	60%
35° below zero	50%	50%

Four ounces of glycerine added to these mixtures will retard the evaporation of the alcohol to some extent, but the alcohol will always evaporate more rapidly than the water and more should be added at frequent intervals to keep the mixture up to strength.

CLUTCH

A gasoline motor cannot be started under load and for this reason the motor is connected to the driving mechanism by means of a friction clutch which can be released by pressing down on the clutch pedal.

The clutch consists of a series of steel plates operating between steel plates faced with asbestos friction material, which are connected alternately to the fly wheel or to the clutch shaft of the transmission. When the clutch is engaged, a spring forces the plates together so that they revolve as a unit with the fly wheel of the motor, but when the clutch pedal is pressed down the plates separate, those connected to the fly wheel continuing to revolve while those connected to the transmission are stopped.

ADJUSTMENT OF CLUTCH

In the course of time the friction facing on the clutch discs will wear and when this occurs the clutch should be adjusted to prevent slipping. Adjustment can be made by moving lock nut and adjusting nut on clutch release rod to allow more clearance between the clutch release bearing and the plates. When properly adjusted there should be 1/32″ clearance between the ball thrust bearing and the rear plate against which it operates.

The position of the clutch pedal can be adjusted by means of the set screw in the rear end of the clutch release rod.

Do not put any oil or grease on the clutch discs.

The clutch is lubricated by two grease cups, one located on the clutch release yoke pin and one on the clutch release bearing retainer, both of which should receive attention at least once every 500 miles. A few drops of oil applied to the pins on which the discs slide will prevent squeaking.

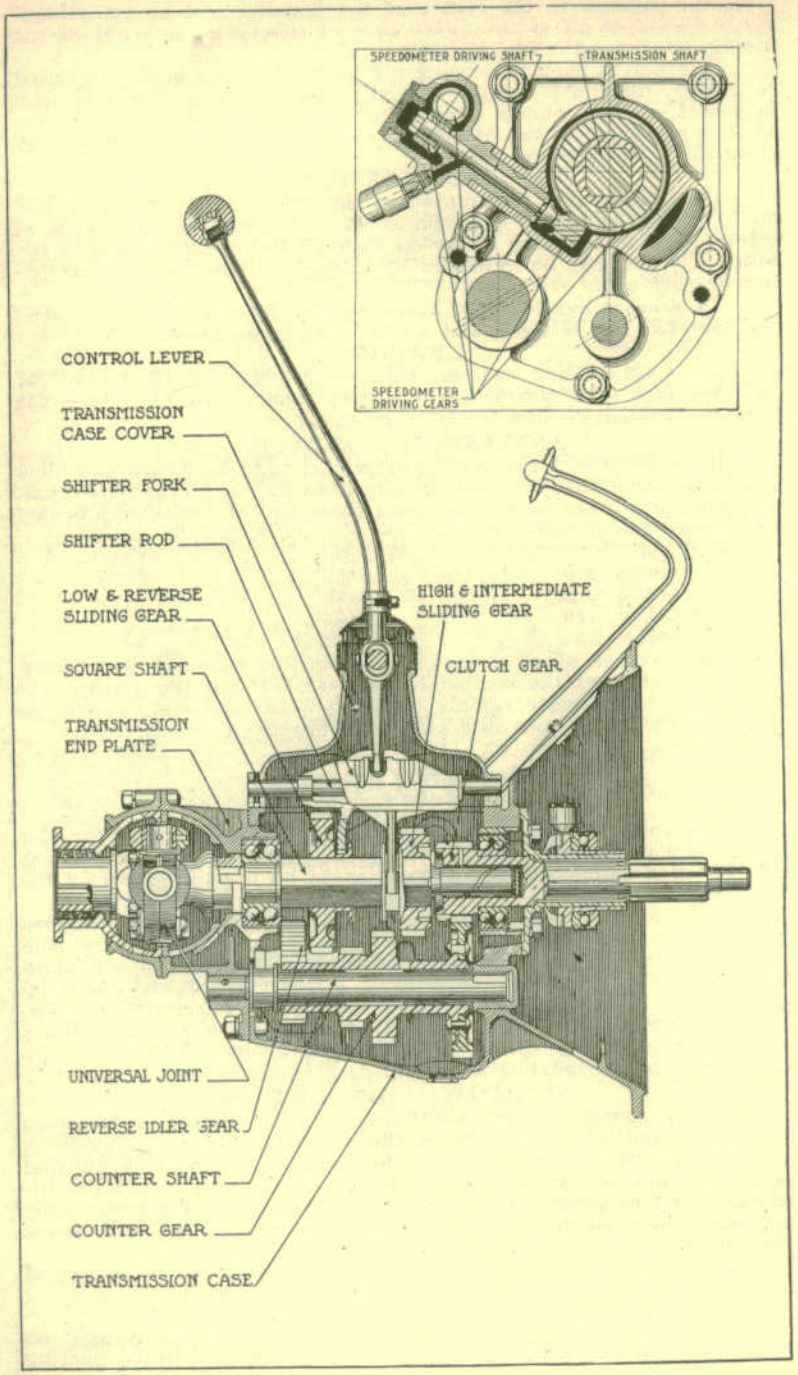


Plate 19
Transmission

EXHAUST SYSTEM

The exhaust system includes the exhaust manifold, exhaust pipe, cutout valve and muffler.

The muffler consists of three concentric sheet metal drums which are perforated at opposite ends, so that the gas is compelled to travel the full length of each drum in turn while it is expanding and losing its heat.

In the front muffler head a plug is provided principally to test the firing of the motor and this plug should never be removed for use as a warning signal or for amusement. Removal of this plug will not increase the power of the motor.

The exhaust system requires no attention on the part of the driver. If, after long use, the muffler should become filled with soot, it can be cleaned by removing the rear head.

TRANSMISSION

The transmission system includes all those parts which transmit power from the motor to the rear wheels, but generally the transmission gearset alone is described by this term.

GEARSET

The gearset, or change speed gear, is made necessary on account of the fact that a gasoline motor develops power in proportion to its speed; the higher the speed, the greater the power output. On the other hand the car frequently requires more power at low speeds than at higher and at such times the gearset is used to change the ratio between the speed of the motor and the speed of the rear wheels.

The change speed gears are carried on two shafts, the lower of which is known as the countershaft and carries the counter gears, while the upper or main shaft carries the sliding gears. The main shaft is mounted in a ball bearing at its rear end and runs in a bearing in the clutch gear at its forward end.

The counter shaft is stationary and the counter gears revolve on it. The reverse idler gear is mounted on a separate shaft to one side of countershaft and is in constant mesh with the counter gear. The sliding gears are mounted on the main shaft in such a manner that they can be moved along to engage with one or the other of the countergears.

The high and intermediate sliding gear is provided with internal teeth on its forward side so that it can be moved over the clutch gear to lock the main shaft and clutch gear together

All the gears run in a constant bath of oil which also lubricates the bearings of the main shaft, clutch gear and universal joint. An oil filler hole is provided on the side of the transmission case for introduction of new oil, and a drain plug at the bottom allows emptying and cleaning.

NEUTRAL POSITION

The clutch gear is directly connected to the motor and consequently turns in the same direction, but the countergear, being in constant mesh with the clutch gear revolves in the opposite direction. When the control lever is in neutral position, neither of the sliding gears is in mesh with any other gear and therefore the main shaft does not turn.

FIRST SPEED POSITION

When the control lever is moved to the first speed position, the low and reverse sliding gear is slid into mesh with the countergear and the car moves forward; but owing to the fact that the power is being transmitted from the smaller to larger gears, the rear wheels of models K-44, K-45, K-46 and K-47 make approximately one revolution for every 13¾ revolutions of the motor and of model K49 and K50 one revolution for every 15½ revolutions of the motor.

SECOND SPEED POSITION

When the control lever is moved to the second speed position, the low and reverse sliding gear is drawn out of mesh with the countergear and the high and intermediate sliding gear is moved back into mesh with the intermediate speed counter gear. In this position the main shaft also turns in the same direction as the motor but the rear wheels of models K-44, K-45, K-46 and K-47 now make approximately one revolution for every 7¼ revolutions of the motor and of models K49 and K50 one revolution for every 8 revolutions of the motor.

HIGH SPEED POSITION

When the control lever is moved to third, or high speed position, the high and intermediate sliding gear is moved forward on the main shaft until the internal teeth slip over and engage the teeth of the clutch gear, locking the main shaft and clutch gear together, thus giving the motor a "direct drive' to the rear axle. The rear wheels of models K-44, K-45, K-46 and K-47 now make approximately one revolution for every 4 1/10 revolutions of the motor and of models K-49 and K-50 one revolution for every 4 6/10 revolutions of the motor which are the ratios of the driving gears in the rear axle.

REVERSE POSITION

Moving the control lever to the reverse position slides the low and reverse sliding gear back into mesh with the reverse idler gear which in turn meshes with countergear, the main shaft now turns in the opposite direction to the motor, driving the car backwards. In this position the rear wheels of models K-44, K-45, K-46 and K-47 now make approximately one revolution for every 17¾ revolutions of the motor and of models K49 and K50 one revolution for every 20 revolutions of the motor.

CONTROL LEVER

The sliding gears are moved back and forth on the main shaft by means of shifter forks which are carried on a rod in the transmission cover. The control lever is pivoted in the cover so that it may be swung to one side or the other. When swung to the right it picks up the fork which moves the low and reverse sliding gear, and when swung to the left it operates the high and intermediate sliding gear. Small spring plungers in the sides of the cover engage with slots in the shifter forks to hold the sliding gears in position.

UNIVERSAL JOINT

The transmission gearset is fastened solidly to the car frame, but the rear axle is hung on springs and must be free to follow the uneven surface of the road. In order to allow continuous transmission of power from the gearset to the rear wheels, the universal joint is interposed between them. It consists principally of a ring carrying four bearings. A yoke attached to the main shaft of the gearset is connected to two of these bearings, while the splined yoke that slips on forward end of axle is connected to the other two. The joint is enclosed in a spherical housing and is automatically lubricated by oil from the transmission.

SPEEDOMETER

The speedometer registers the speed at which the car is traveling, the total number of miles traveled, and the trip mileage. The total cannot be reset, but the trip mileage can be reset to zero by pulling out and turning the knurled finger nut backward or forward, which protrudes through the face for that purpose.

If the speedometer head is removed for any reason, handle it as you would a fine watch, as the head is made up of such intricate parts that it can easily be damaged by rough handling.

The drive is taken from a spiral gear which is attached to the main shaft of the transmission, through a series of reduction gears which are enclosed in a housing which is fastened to the transmission end plate by means of two set screws.

The cable or drive shaft is enclosed in a flexible tube which is attached with a knurled nut at either end and can be lubricated by removing ;remove ring at lower end of driving key and pull cable clear of the tube from opposite end. Then smear cable freely with a good quality of cup grease twice a year. And under no circumstances should the instrument head receive oil.

The series of gears at the lower end receives lubrication from the universal joint and grease cup placed on housing for that purpose; therefore, they should not be molested only when necessary, and if for any reason the speedometer should require attention other than occasional oiling, the car should be taken to the nearest Buick dealer or Service Station.

REAR AXLE

The rear axle assembly includes the propellor shaft, differential, axle shafts, brakes and wheels and constitutes the final element in the driving mechanism.

PROPELLOR SHAFT

The propellor shaft transmits the power from the universal joint to the driving gears of the differential. It is enclosed for its entire length in a steel tube carrying the driving flange which attaches to the universal joint housing on the rear of transmission. The driving effort from the rear wheels is transmitted by the pinion tube through the transmission case to the frame of car. The pinion tube also absorbs the torque reaction of the bevel driving gears. At its rear end the propellor shaft is mounted on ball bearings and carries the driving pinion which meshes with the large ring gear on the differential.

The depth to which the pinion meshes with the teeth of the ring gear is adjustable and adjustment can be made by removing the cover plate on the right side of the pinion flange and loosening the adjusting sleeve clamp screw on top. The sleeve which carries the outer bearing can then be turned to adjust the position of the pinion.

Adjustment of the pinion shaft should be made only by an experienced mechanic. In case of trouble, take car to the nearest Buick dealer or service station.

DIFFERENTIAL

The differential equalizes the amount of power applied to each of the rear wheels and allows one wheel to travel faster than the other wheel when the car is rounding a curve. It consists of a case mounted on roller bearings and held in position between adjustable ball thrust bearings. The large driving ring is attached to the outside of the case and meshes with the driving pinion. Inside of this case is a set of four bevel gears, all of which mesh with the side or intermediate pinions, into which the main axle shafts slide from the outside, they being connected to the rear wheels.

When the car is being driven straight ahead, the differential gears lock themselves and revolve with the motion of the case as a solid unit.

When the car turns a corner, the inside wheel slows down retarding its main shaft and the intermediate gear to which it is connected in the differential, but since the motor continues to drive the differential case at the same speed, the side pinions begin to revolve on their bearings, thus increasing the speed of the outside wheel.

The differential bearings are the taper roller type and should be so adjusted that the differential will rotate freely without any perceptible end play or shake. These bearings are adjustable for wear and any excessive amount of wear that may develop would probably occur in the first 1,000 miles and examination should be made of these bearings after a run of this distance.

The position of the differential driving gear with respect to the driving pinion can be adjusted by removing the cover plate on axle housing and by turning adjusting sleeves which carry the

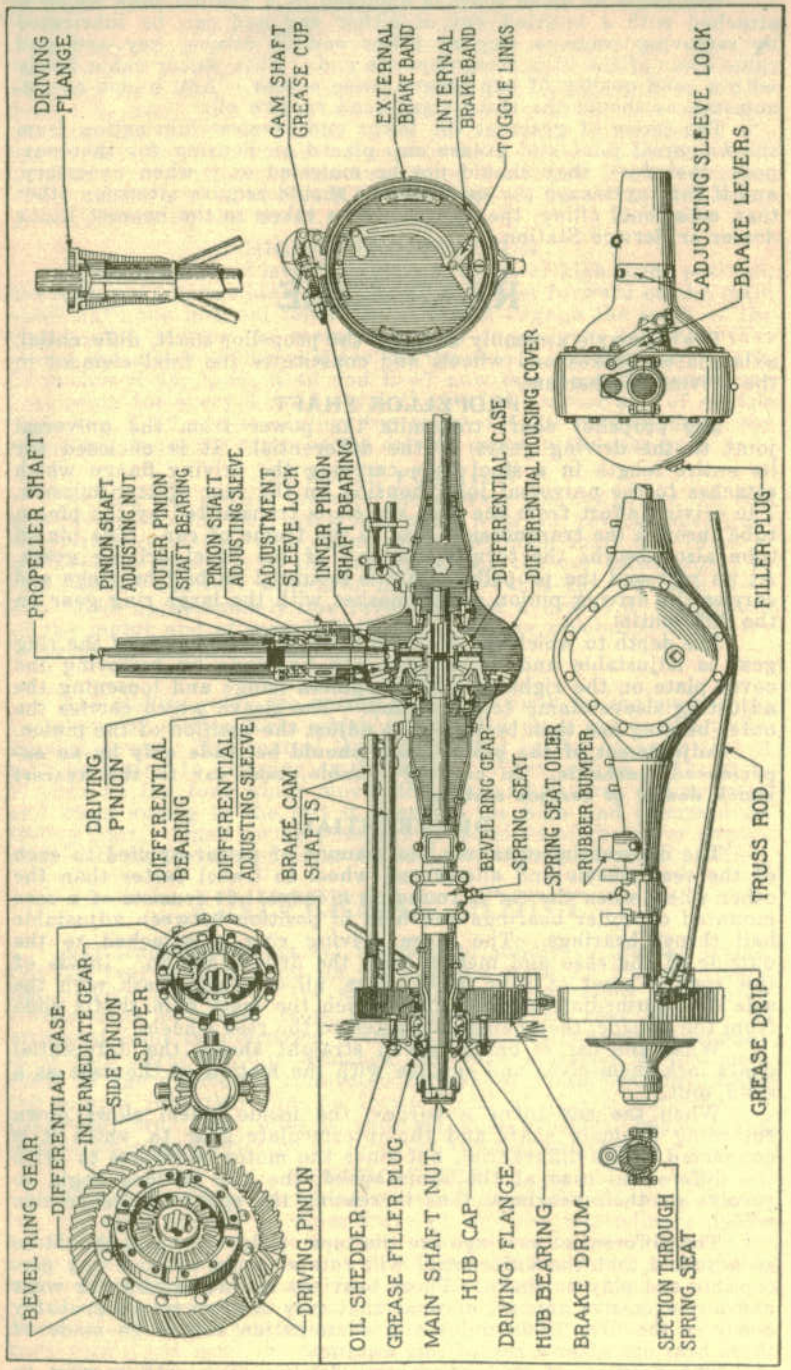


Plate 20
Rear Axle

bearings on which the differential is mounted. Both sleeves must be turned the same amount and in the same direction to prevent any end play in differential bearings.

The differential and its bearings run in a continual oil bath introduced through the filler plug in the axle housing. The old oil should be drained off, differential washed out with gasoline and fresh oil introduced at least every 1,000 miles.

Adjustments should be made by an experienced mechanic and in case of trouble, car should be taken to nearest Buick dealer or service station, and the following directions will assist in adjusting the Rear Axle Spiral Bevel Gears.

INSTRUCTIONS FOR ADJUSTING SPIRAL BEVEL GEARS IN REAR AXLE

In order that the Spiral Bevel Ring Gear and Pinion may operate correctly, the rear axle must be in perfect alignment. That is, the differential axis must be in the same plane as the pinion axis. If there is any variation at all, the pinion axis must not be above the gear axis, as that would throw the contact or load on the heel of the tooth.

It is very important that a careful inspection of the bearings be made before they are put back in their respective positions. If single row ball bearings are used, they may have a little angular movement, but must not have any radial play. By angular movement, we mean a slight rock; an action which we get in a ball joint, By radial movement we mean straight movement up and down. If the bearings are laid on a surface plate and you can move the cone straight over against the outer race and notice much play that way, the bearings should not be used. Also, make sure that the balls are not damaged. If they spin freely, no doubt they are all right. If the bearing sticks, clean it carefully with gasoline to make sure that all foreign matter is removed. Also try and keep them in a clean place.

If the bearings are of the roller type, examine the rolls and make sure they are not pitted or worn too bad. Also inspect the linings or cups which fit into the differential or pinion housing. If these are pitted or excessively worn, they should be replaced with new parts.

Make sure that all parts which go on the inside of the gear housing are thoroughly cleaned. Any chips, grit or other hard substances grind out the bearings and gears very quickly. All studs and nuts must be a good fit in threads, so as to hold the gears and bearings in place. If these are loose, they will let the gears vibrate, and they will probably go to pieces in a very short time.

In mounting ring gear on differential, inspect ring gear seat of differential case to determine whether it runs true with the bearing hubs. If it runs out more than .002″, face it off in lathe to make it run true. When riveting ring gear on case, make certain that it is riveted tight. Ring gear should not run out more than .008″, using the bearing hubs of the differentials as centers.

When driving pinion on shaft, see to it that it does not ride the key, also that it is driven on tight. Pinion must not run out more than .004″ on shaft.

The most common method of setting up Spiral Bevel Gears, is to set ring gear and pinion so they come flush, either at the large or small end of the teeth, and have an operating clearance of from .005″ to .008″. For perfect adjustment, however, this method must be forgotten. An experienced mechanic can very often locate the proper running position by his sense of touch, but even that is not always dependable. This method is not correct at all times. This depends largely on the cut of the gear and the variation that takes place in its manufacture.

When the mechanic is ready to place the gears back into the axle, the best way to do is to roll the pinion around the ring gear by hand and note the position which the pinion takes at the large or

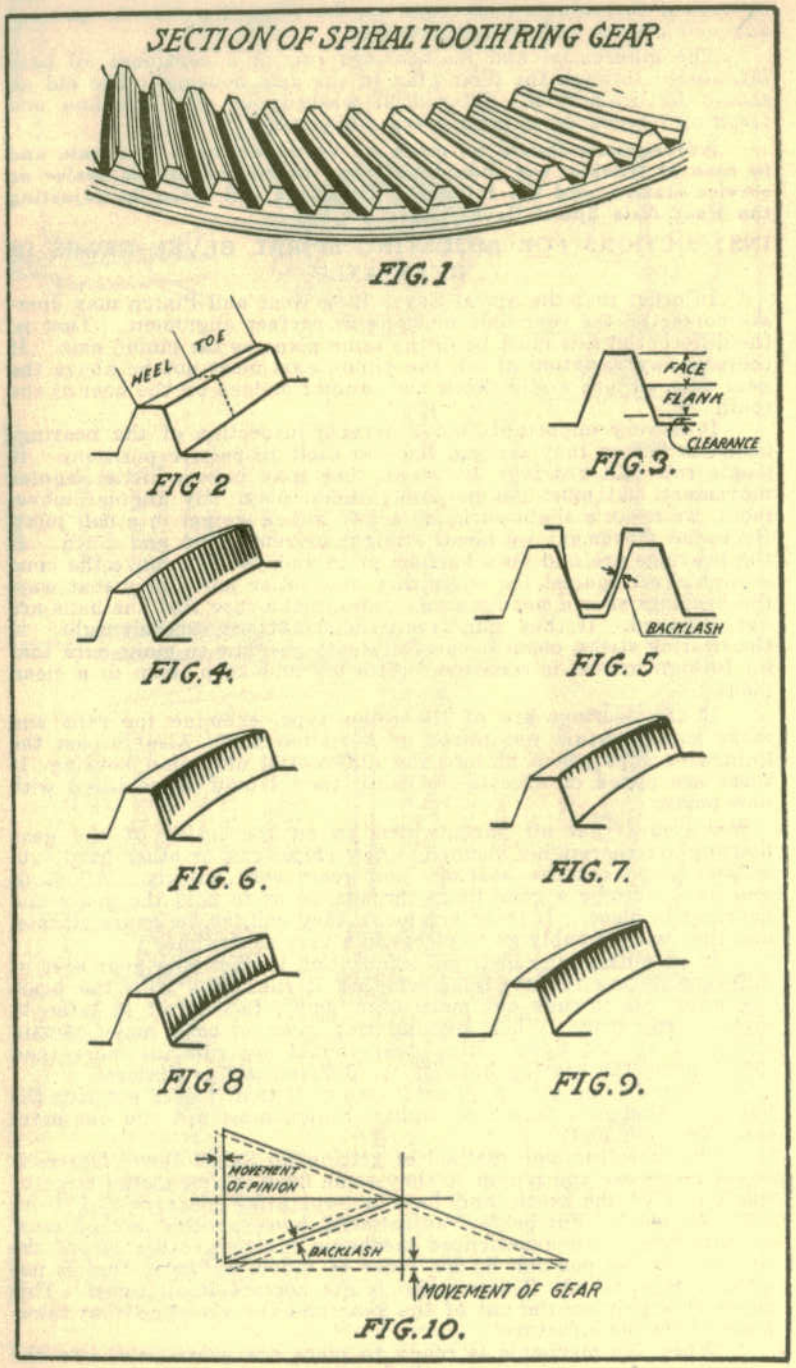


Plate 21
Sections of Ring Gear and Pinion.

small end, whether it sticks out or runs in. Assemble them in the axle as near as you can, in that position, allowing from .005" to .008" back lash between them. Place the axle under the car, and at the same time paint the gear teeth with a thin coat of white lead. After this is done, jack up the rear wheels and start the motor, throwing transmission into high gear, also throw in your brake, which must be equalized so you can get about the same load on each wheel. This will wipe the paint off the teeth. You may find a condition as illustrated in Figure 9. The shaded portion represents the contact of your gear. That means the load is pulling on this portion of the teeth. In that case, move your pinion in, or toward the rear, two, three or more notches of your adjusting nut, until the pinion wipes off the paint as shown in shading on Figure 4.

Figure 4 illustrates what we term a desirable contact on the Spiral Tooth Ring Gear. Contact as shown is just a trifle heavier on the toe of the tooth (Figure 2) than it is on the heel. The heel of the gear tooth is the large end, and the toe is the small end. We intend to set the gears in this way, so as to be sure that we get an even contact when a full load is applied; the pinion in that case always having a tendency to lift.

If you have a contact as illustrated in Figure 8, or where the load comes on what we term the flank of the gear tooth, it means that the pinion is too far in toward the axle. Gears set up in this way are noisy. To correct, pull pinion out until contact comes to the full working depth of gear tooth, without leaving lowest point of contact (See Figure 4.) If the contact is as shown in Figures 8 and 9, it should only be changed by moving the pinion. If the load is centered in this place, you always find that you will have a noisy axle. Noise almost always can be eliminated by the pinion adjustment.

If the contact on tooth appears as shown by shading in Figure 6, it means that there is too much back lash between Ring Gear and Pinion. Gears set up this way will eventually break off at the heel. To correct, move ring gear toward pinion, but make sure there is back lash, as gears cannot run tight. If the contact still shows heavy on the heel, the large end of the gear, (See Figure 2) change the gears. If you still have that contact, the axle is machined wrong or sprung.

Contact as shown in figure No. 7; that is, heavy on the small end, or the toe of the tooth is not bad, although it doesn't want to be centered there too much. Gears set up this way will eventually break off at the toe. To correct, move ring gear away from pinion. Under no circumstances should the gear pass with a heavy contact on the heel.

Figure 10 illustrates two cones, which spiral bevel gears really are. It illustrates to you the difference you get in back lash, by moving either the ring gear or the pinion the same amount. For example, on a 4:1 gear ratio, it would be necessary to move the pinion four times as much as the ring gear, in order to get the same amount of back lash. So when it is necessary to increase or decrease back lash very much, it is best to try to move the ring gear. However, you can tell from your contact just which of the two gears to move.

When the gears are adjusted in this manner under the car, and you feel sure that you have them set up as good as you can make them, you may run car out on the road and give it a one mile test without putting oil in the axle housing. This will tell what can be expected, as far as noise is concerned. Oil will not deaden the noise very much; it only acts as a lubricant. If you find it advisable to make further adjustments to make axle quieter, before filling up case with oil and turning car over to the customer, paint the gears up again and make certain that you have contact as illustrated in Figure 4. Full tooth contact is necessary to carry the load.

While this method may seem complicated at first, with a little practice a good mechanic can set up gears in the above manner almost as easy as by guess work, and it certainly will give a lot more satisfaction to the owner of the car.

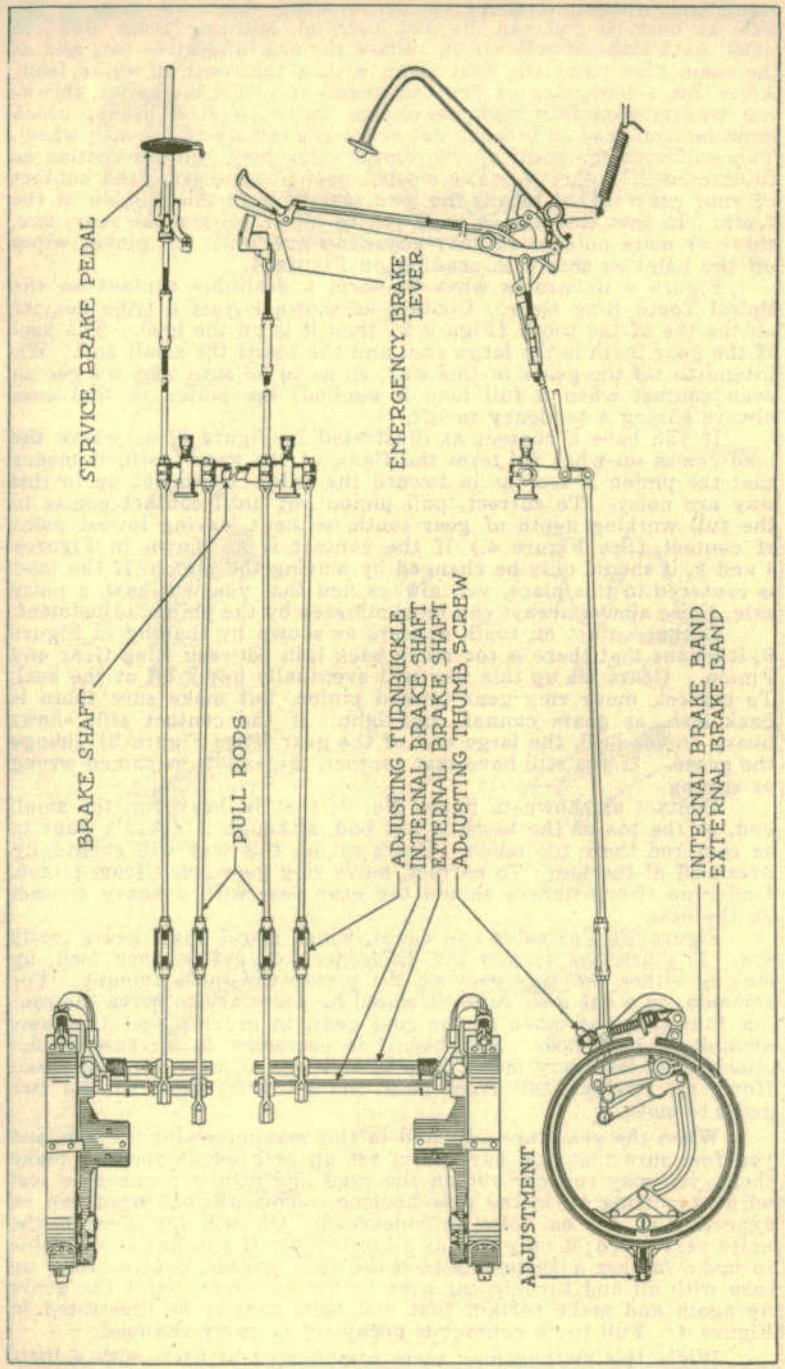


Plate 22
Brake Adjustments

WHEEL HUBS

Driving flanges are keyed to the outer ends of the axle shafts and bolted to the wheel hubs, which run on double row ball bearings mounted on the outer ends of the axle tubes, so that all the weight of the car is carried by the housing, and the axle shafts transmit only the driving effort. The hub bearings are lubricated with cup grease introduced through a filler plug hole in each hub. The hubs are also provided with felt washers and oil deflectors which throw off any oil which might work out from the differential and prevent it from getting on the brake. This surplus oil or grease is drained off through a drain tube which projects from the inner side of the brake flange underneath the axle tube. **CARE SHOULD BE EXERCISED TO SEE THAT THESE TUBES ARE ALWAYS OPEN AND CLEAN.**

BRAKES

The brakes are supported by brake flanges attached to the main tubes of the axle and are operated by the brake cam shafts. They consist of steel bands lined with friction fabric and so arranged that they can be expanded or contracted against the circumference of the brake drums by means of a pedal or lever.

SERVICE BRAKES

The external or service brakes are operated by the right pedal in the driving compartment. Wear of the brake lining can be taken up by adjustment of the thumb screw and lock nuts at the opening in the band and by means of the adjusting screw in the anchor pin at the rear. The bands should be adjusted to allow a uniform clearance of 1/16 inch between the lining and the circumference of the drum, when the brakes are released. The throw of the brake levers and the position of the pedal can be adjusted by means of the turnbuckles in the brake rods.

See that brakes on both wheels are adjusted alike.

EMERGENCY BRAKES

The emergency brakes are the internal brakes and are operated by the hand brake lever in the driving compartment. They are seldom used and hence wear very slowly, but when adjustment is necessary, it can be made by shortening the rods with the turn-buckles.

SPRING SEATS

The rear springs are attached to the rear axle by means of spring seats which are free to turn to the axle tube. The spring seats are provided with felt pads and oilers and should be filled with motor oil at least once every 500 miles.

FRONT AXLE

The front wheels are mounted on steering knuckles pivoted to the front axle, so that they may be turned by the steering gear. Steering arms attached to the knuckles are connected by an adjustable tie rod, and the left steering arm has a third arm which connects to the steering gear by means of the steering connecting rod.

TIE ROD ADJUSTMENT

The front wheels do not stand exactly square but are set at an angle which makes the car steer easily. This angle can be adjusted by means of the adjusting yokes on the tie rod. When properly adjusted, the wheels should measure ⅜ to ½ inch closer together at the front than the rear and 1 7/16 inch closer at the bottom than at the top, these measurements being taken between the inner sides of the wood felloes.

FRONT HUBS

The front wheels run on proper bearings, which are lubricated through a grease plug on the hub flange, and by filling the hub caps with soft cup grease. In mounting the front wheels, care should be exercised to thoroughly saturate the bearings with grease, and also fill the space between the bearings with grease. The best lubricant for front wheel bearings is a straight mineral grease which does not

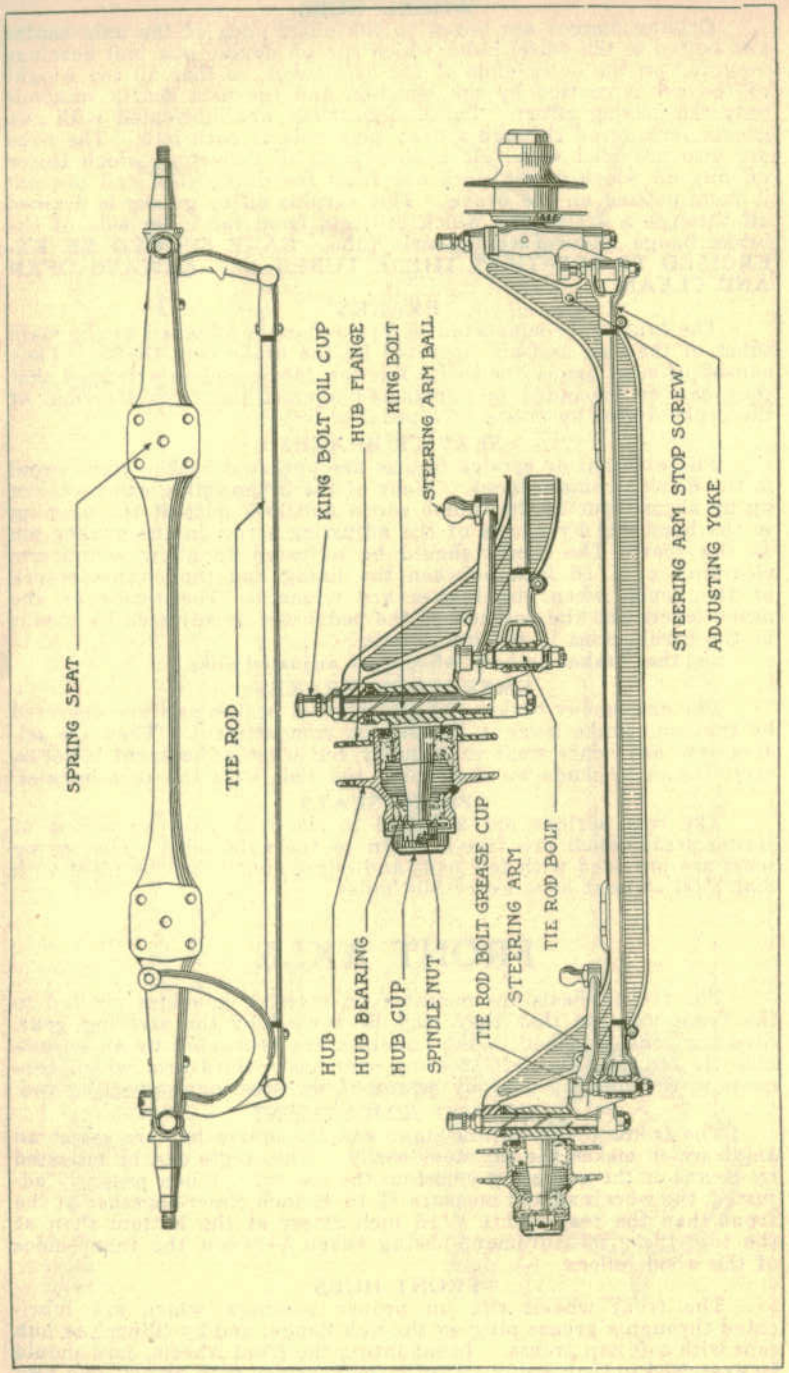


Plate 23
Front Axle

contain any free acid or acid forming compounds and which is also entirely free from graphite, asbestos, fibre and other foreign matter.

There are two bearings to each front wheel and these are held in adjustment by the spindle nut, which is fastened with a cotter and also by a safety washer, which is interposed between the spindle nut and the cone of the outer bearing. The bearings should be adjusted by drawing the spindle nut up tightly, revolve the wheel a few times to insure that all parts are properly seated, at the same time tapping the safety washer lightly to insure a proper contact with the outer bearing. The wheel will now revolve somewhat stiffly, and proper adjustment can be obtained by backing off the spindle nut two cotter pin slots. Lock the nut at this point with the cotter and test the adjustment by spinning the wheel. The wheel should rotate freely but without perceptible shake, and in testing for the shake it is advisable to insert a chisel or small bar between the steering knuckle and the axle, to insure that any play in the king bolt is not confused with play in the bearings.

These adjustments should be made by a competent mechanic or the car taken to the nearest Buick dealer or service station.

STEERING GEAR

The steering wheel is attached to a long tube, the lower end of which carries a double threaded worm or screw, engaging with two half nuts which slide up and down in guides in the steering gear housing. The threads on the steering screw are right and left hand, and one of the half nuts has a right hand thread; the other a left hand thread. When the steering wheel is turned, one of the half nuts rises in its guide while the other is forced downward. At their lower ends the half nuts carry hardened steel thrust blocks which push against rollers attached to the steering yoke and by their motion the yoke is tilted in the housing, moving the steering pitman arm backward and forward, and by means of the steering connecting rod, turning the front wheels to one side or the other.

The steering screw is provided with a ball thrust bearing and adjusting nut at its upper end for the purpose of taking up any backlash or lost motion in the steering wheel. For best results the steering wheel should have not over one inch of lost motion at wheel rim.

A generous sized oiling cup is provided in the steering gear housing and the housing should be kept filled with heavy steam cylinder oil.

The sector bracket which carries the spark and throttle levers on top of the steering wheel is supported by a stationary tube inside the steering tube. The spark and throttle connections are operated by small concentric tubes enclosed in the stationary tube and carrying bevel gears at their lower ends. The horn button is located in the center of the steering wheel and is connected with the horn by a wire through the center of the inner tube.

SPRINGS

The springs are interposed between the axles and the frame to absorb road shocks before they are transmitted to the remainder of the mechanism or to the passengers.

The front springs are attached to the frame at both ends and to the axle in the center, while the rear springs attach to the frame at their centers and front ends and carry the axle on their rear ends.

The springs are provided with grease cups at their ends and these should be given a turn or two every 500 miles and refilled with soft cup grease as often as necessary.

Squeaking springs can be overcome by jacking up frame of car to release weight on springs and inserting heavy steam cylinder oil between spring leaves.

After the car has been driven a few hundred miles there is a tendency for the spring clips to loosen. The spring clips should be tightened as often as found necessary.

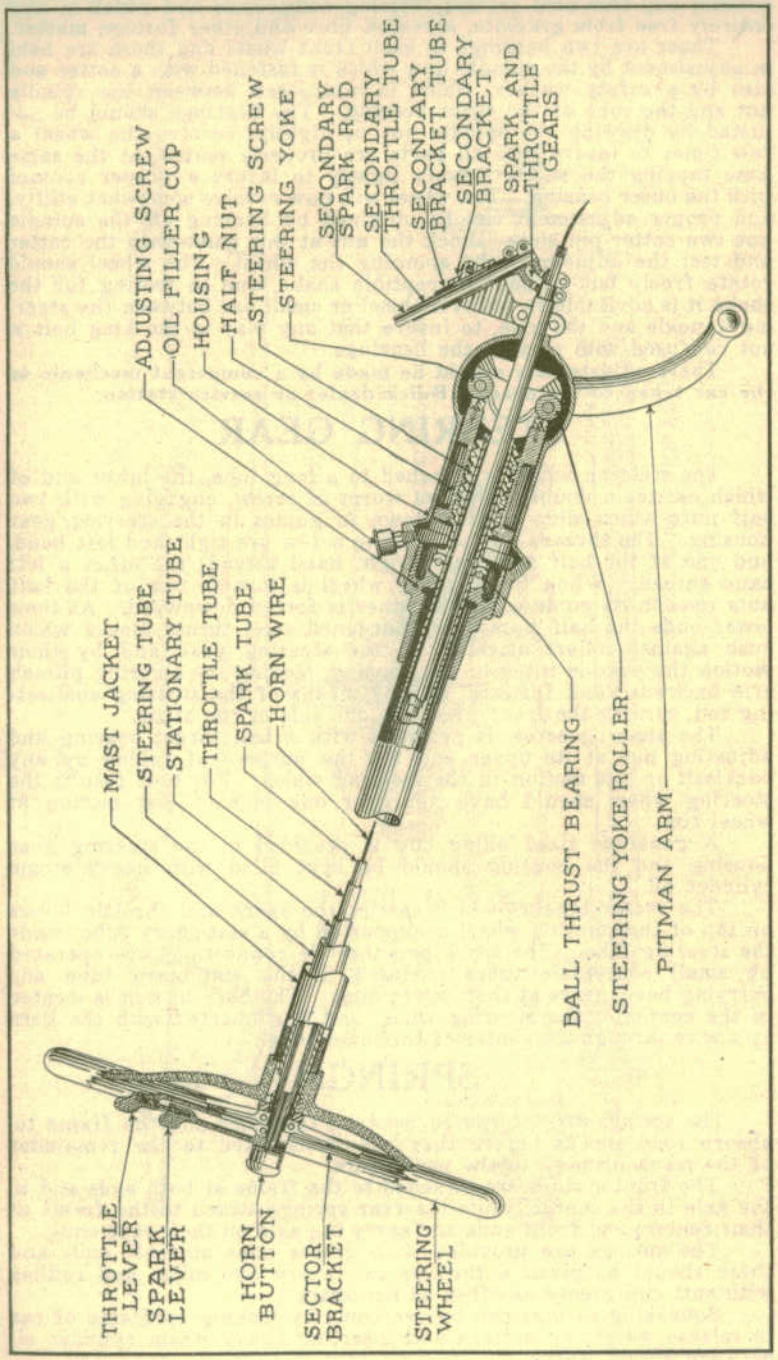


Plate 24
Steering Gear

Broken springs are almost invariably caused by careless driving or loose spring clips. See that spring clip nuts are tight at all times.

WHEELS

Automobile wheels are of the artillery type, in which the spokes meet at the center and are bolted between the flanges of metal hubs. A steel felloe band is shrunk on the wooden felloes to carry the demountable rims.

TO REMOVE RIMS

The demountable rims are the Bolted-On type and may be removed from the wheels with the tire by the following operations:

With the brace wrench, back out all bolts about ¾″ except the ones on either side of tire valve (Fig. 1), insert screw driver at right hand side of wedge, between rim and felloe band, (Fig. 2), and strike handle of screw driver to free the wedge. When free, turn wedge around, (Fig. 3), and tighten bolt to hold wedge in this position so it will not interfere with rim while dismounting.

TO REPLACE RIM

Loosen nut at lower edge of tire carrier with brace wrench and turn lug until it clears rim. Remove valve stem cap and nut and lift tire and rim off of carrier. To replace rim on wheel, tire must be fully inflated. Insert valve stem in hole in wheel and push lower edge of rim on wheel with the foot, taking care to see that driving lugs on inner circumference of rim rest between lugs on felloe band. Replace the two wedges opposite the valve stem first, drawing them up evenly but not to their final position; then replace the remainder of the wedges and draw bolts up evenly until all are tight. Note that edges of rim at split are even and not more than 1/32″ apart.

TO REMOVE TIRE FROM RIM

First of all make sure that all air is out of tire before attempting to remove it from rim. To take the rim out of the tire, lay the rim and tire flat, as in Figure 4, so that the end of the split farthest from the valve stem is up. Unlock rim by turning latch, then force screw driver into recess under end of rim lock nearest to valve stem. (See Fig. 4.) Then by pressing down end of screw driver throw the end of the rim out of the tire (See Fig. 5.) It will be seen in this operation that the two short ends of the rim are brought together, thus reducing the circumference of the rim. Now turn the rim and tire completely over, as in Figure 6, and force the screw driver between the rim and both beads of the tire. This entirely frees one end of the rim. Take free end of the rim in the hands, holding the tire firmly with the feet, and pull the rim entirely out of the tire (See Fig. 7).

TO REPLACE TIRE ON RIM

Lay the rim flat with the tire on the rim as in Fgure 8. Raise the end of the rim which is drilled for the valve stem, and after the valve stem has been inserted, put both beads of the tire for a distance of about six inches, into the end of the rim that has been raised up. (Be sure that the other end of the rim is under both beads of the tire.) Being sure that the beads of the tire are properly started, follow all the way around putting both beads entirely on the rim as you go. Do not permit the other end of the rim to slip into the tire until the very last. If the tire is too stiff to force in by hand use screw driver as in Figure 9. Having put the tire on the rim and with the lock in place, force the latch into position as in Figure 10. The tire is now ready for inflation.

TIRES

Tires are of the standard straight side type into which two rings of braided steel wire are moulded to form the beads which hold the tire on the rim.

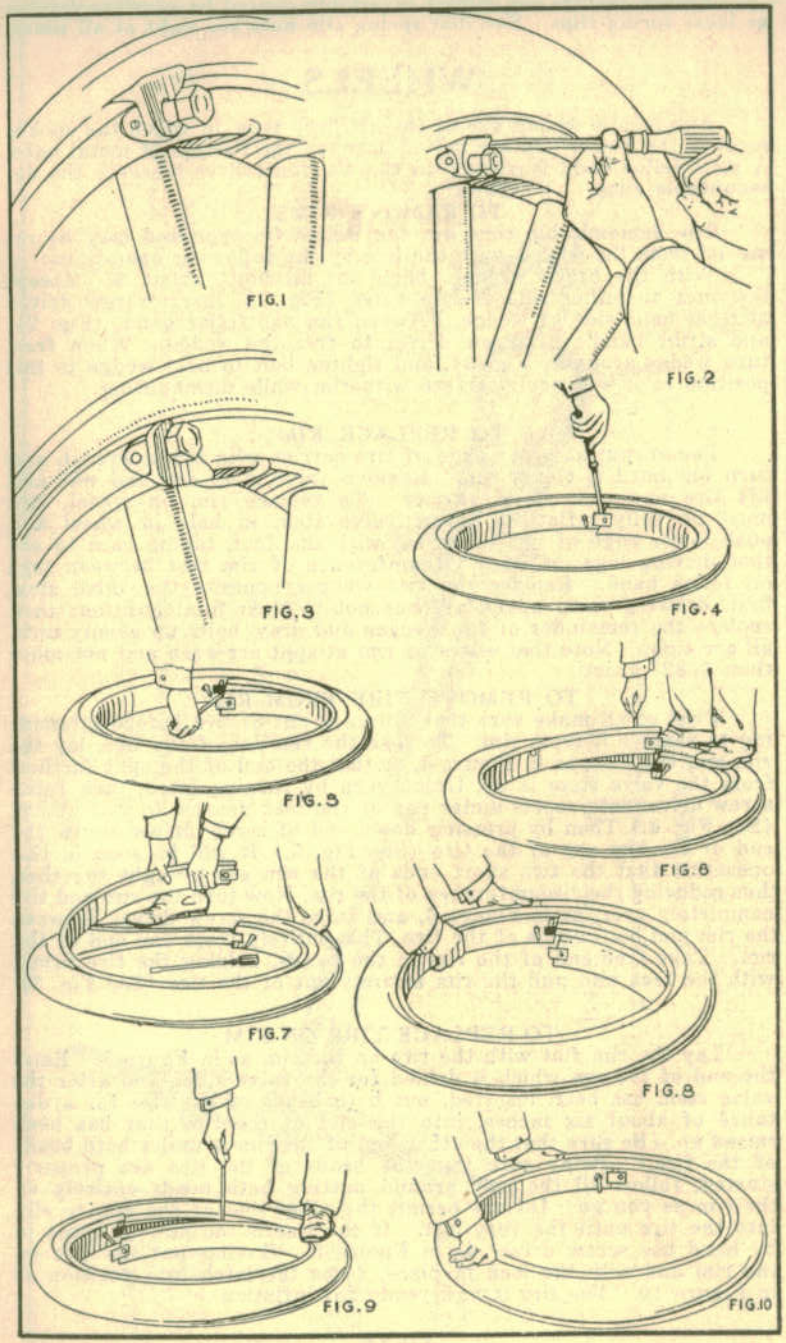


Plate 25
Operation of Demountable Rim.

Punctures cannot be avoided, but a well inflated tire is less likely to pick up nails than a soft one. Bruises, cuts, and sand boils can generally be avoided by careful driving, but should be repaired soon as they appear. Gasoline and oil should be kept away from the tires as they tend to soften the rubber. If car is to be out of service any length of time, remove tires, deflate to a few pounds pressure and store in a cool, dark place. Three-fourths of all tire trouble is due to a lack of pressure; therefore, a gauge should be used to determine the pressure and tire should be kept inflated to 20 pounds pressure per inch of width.

BODY

The body is the passenger carrying part of the car and consists principally of an oak frame covered with a steel shell, and into which the seats and cushions are fitted. It is bolted to the frame of the car and to prevent squeaks the body bolts should be kept tight. Aside from washing and cleaning, the body will require no further attention.

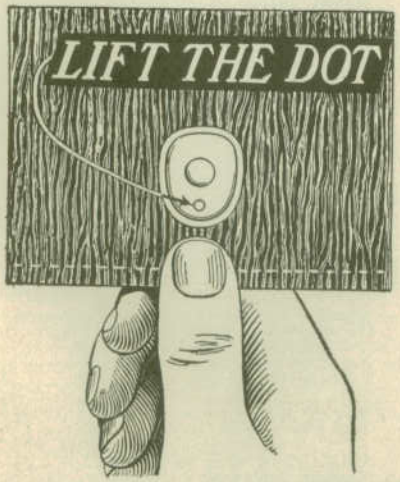
WASHING

When washing the car, soak the dirt off with a gentle stream of cold water. Do not use a nozzle. Do not rub. Mud is much more easily removed before it gets dry and hard. Grease can be removed with soap suds and a soft sponge. Rub as little as possible and use a neutral soap. Rinse thoroughly with cold water, dry and polish with a piece of clean soft chamois skin.

TOP

The top should never be folded until it is thoroughly cleaned and dried. Dust on the outside can be removed by washing with clear cold water and a neutral soap. Be sure to rinse thoroughly with clear water or clean with a clean moist cloth. The inside should be dusted out with a stiff whisk broom.

When folding be careful to see that the cloth is not pinched between any of the bow spacers and sockets. Always slip dust cover over top when it is folded to keep out dust and dirt.



LIFT THE DOT FASTENER

The "lift the dot" fastener is used to fasten the side curtains in place. To remove fastener from over stem, grasp the curtain just below the fastener as shown in cut and give it a sharp quick jerk.

WINDSHIELD

The windshield is adjustable for rain vision and ventilation by swinging the glass in or out. Friction stops hold the glass in any position and may be tightened by turning the small acorn nuts on the posts. The large nuts which fasten the windshield posts to the cowl bracket should be kept tight at all times.

INDEX