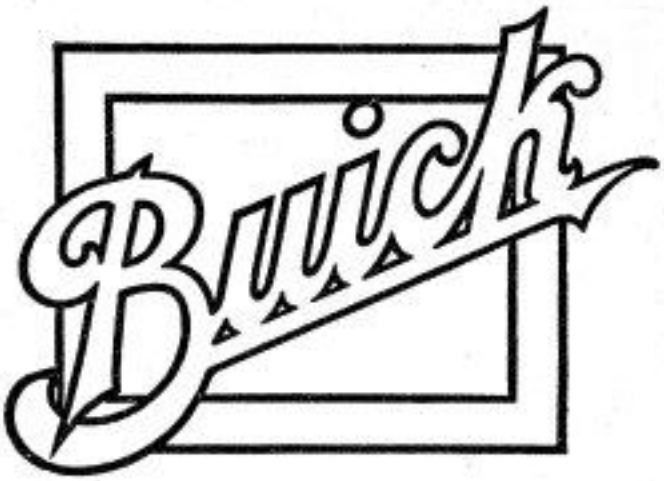


REFERENCE BOOK

MODELS B36-B37-B38-B55

COMPILED AND EDITED BY
THE ENGINEERING DEPARTMENT
BUICK MOTOR COMPANY, FLINT MICHIGAN

BUICK REFERENCE BOOK

for

MODELS B36–B37–B38–B55

Containing

INSTRUCTIONS FOR OPERATION
MAINTENANCE AND REPAIR

ISSUED BY THE
BUICK MOTOR COMPANY
FLINT, MICHIGAN

INTRODUCTION

This Buick Reference Book has been designed and written primarily to help the owners and users of Buick cars realize the maximum in service, enjoyment and satisfaction from the use of their vehicles. To that end it contains complete and detailed instructions for the operation, care and maintenance of the automobile, carefully arranged in a manner to make this information quickly available to the average motorist. The alphabetical index in the back of the book will be found convenient for ready reference.

But wholly aside from the more practical details of the text, we hope that a careful reading of this little volume will give you a better understanding of the scientific and mechanical principles which underlie the construction and operation of your car. You are now the master of a vehicle of which you may well be proud in any company, and at your finger ends you control the power of many horses and the speed of the wind. We trust you will carefully read and religiously observe the instructions contained herein that you may obtain the greatest possible amount of service and satisfaction from your investment.

BUICK MOTOR COMPANY.

Flint, Michigan.
September 1, 1913.

PART I.

OPERATION

DELIVERY

When there is a Buick representative in the town where you live, your new car will be delivered to you with its tanks and radiator full, and all ready to run. The representative will also probably give you your first lesson in driving the car and point out to you the principal parts that will require immediate attention or lubrication. With his help you will have no difficulty in getting started right, and a good start is half the race.

On the other hand, if your location is such that you receive the car by freight and take it over directly from the railroad company, the following instructions will be found very helpful in unloading the car and getting it ready to run.

The manner of loading and shipping the automobile will differ somewhat with the railroad and the kind of freight car available, but where the car is delivered directly to the owner by freight, it will probably occupy an entire box car by itself. In this case the freight car should be "spotted" opposite a loading platform at the height of the car floor.

Before accepting the shipment from the railroad company it is well to see that the seal on the car door has not been broken or the contents tampered with. In any event take the number of the seal and the number and initials of the freight car for future reference in case anything should be missing.

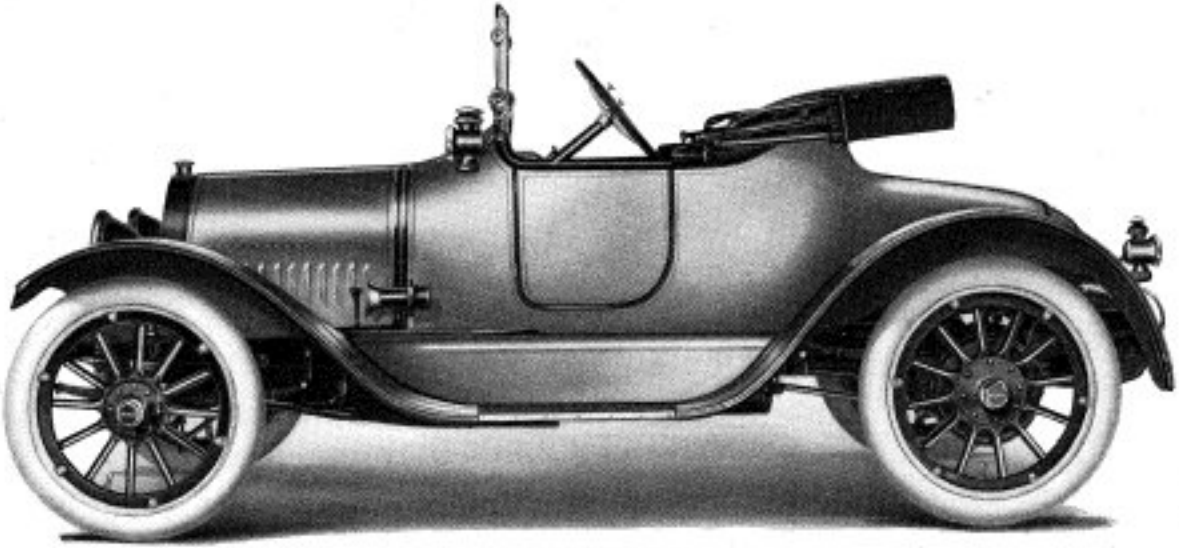
When the car is opened the automobile will be found standing with its wheels blocked up to prevent any movement in transit and at the same time to prevent injuring the tires. Remove the blocks and carefully pull all nails that may be left sticking in the car floor before attempting to remove the automobile.

CHECKING CONTENTS

The next thing is to open the tool box which will be found under the rear seat, and obtain the list of parts and sundries which accompanies the car. Carefully check off each of the items before the automobile is removed from the freight car, as any claims for damage or shortage must be made immediately. If everything is O. K. you can proceed to unload the car.

UNLOADING

Automobiles are always shipped with the emergency brakes set up hard, and before attempting to move the car they must be released. Press the button on top of the right hand lever in the center of the front compartment of the car, and shove it as far forward as it will go. If the brakes have been set so long that they stick and the car appears hard to move, a tap on the lever located just in front of the rear axle underneath the car will usually loosen them effectively.



Buick Model B36

In getting the automobile out of the freight car considerable backing and turning will be necessary and great care should be exercised to prevent scratching the varnish or bending the fenders.

TO ATTACH DRIP APRON

Cars are generally shipped with the drip apron or mud pan separate and after unloading, the apron should be attached. Lay the apron under the car with the shallow end toward the front, then raise and shove forward above the front axle. Secure all fasteners under the frame.

FILLING THE RADIATOR

In shipping automobiles the railroads require that all gasoline be removed, and in cold weather the radiator is also drained to prevent any danger of freezing during shipment. The next thing to do, therefore, will be to remove the radiator cap and see that the radiator is filled with clean water. Soft water is best if available and clean.

ANTI-FREEZE

If the car is received in cold weather and there is any danger of the water freezing, fill the radiator with "anti-freeze," which is half clear water and half denatured alcohol, with 4 to 6 ounces of glycerine added to prevent the alcohol evaporating. This solution will not freeze at any temperature less than 20 degrees below zero but it does not cool the motor as well as pure water and should be replaced by water as soon as the weather gets warm enough.

FILLING FUEL TANK

The gasoline tank is slung below the frame at the extreme rear of the car and the filler cap is right on top where it can be easily reached.

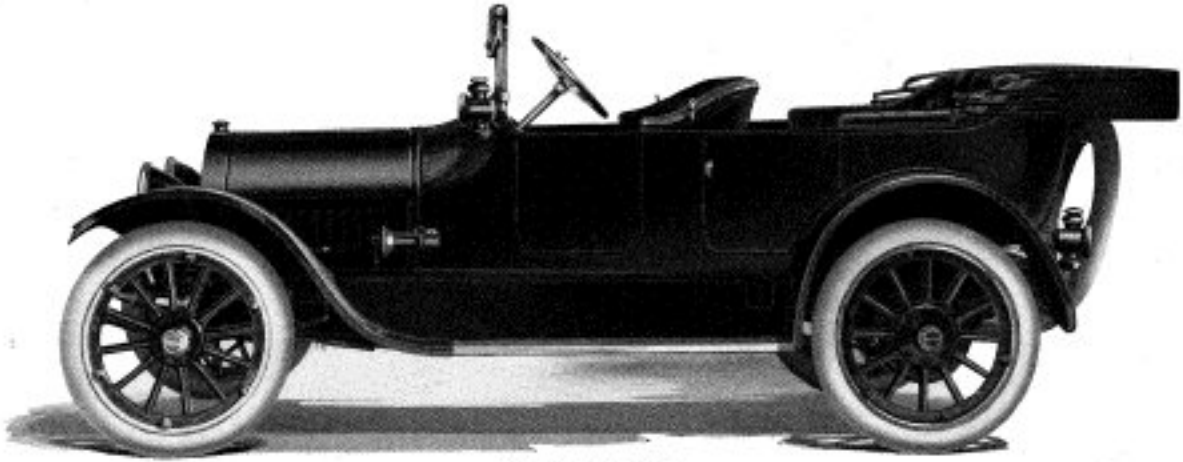
To fill the tank, unscrew the filler cap and insert a large funnel which has had a piece of dry chamois fitted into it. The chamois makes an effective filter which not only removes the particles of dust and dirt from the fuel, but separates any water from the gasoline as well. The tank will hold about 20 gallons of gasoline.

Before trying to start the motor, raise the hood on the left hand side and make sure that the gasoline shut-off cock, in the pipe which runs from the tank to the carburetor, is turned so that its handle lies lengthwise of the pipe. If turned crosswise the gasoline cannot flow to the carburetor.

CONNECTING BATTERIES

When the car is shipped the terminals of both the batteries are disconnected to prevent them from short circuiting in transit. The storage battery is located on the right hand side next to the frame and directly under the front floor board. See that each of the lead straps is connected to a terminal on each cell, and that the cables are securely fastened to the two end terminals.

In connecting the storage battery, be careful to connect ground cable—or the cable which is connected directly to the frame of the car—*last*, and



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when disconnecting battery, disconnect ground cable first. This will prevent shock and possible burning of terminals.

The dry battery will be found under the front seat on the left hand side. See that each of the cells is connected to its neighbor, and that the terminal wires are connected to the end cells.

INSPECTING OIL LEVEL

Before the car leaves the factory all grease cups and other lubricating devices are supposed to be filled and a certain amount of oil left in the crank case of the motor. To make sure there is enough oil to insure proper lubrication of the motor, open the small pet-cock on the left side of the lower half of the crank case. If the oil flows from the opening the motor has enough. If not, add oil through the breather tube on the left front leg of the crank case after removing the cap. It might also be well to examine all grease cups to see that none have been lost or overlooked and left dry. Their location is shown in the lubricating charts, Plates I and II, Figure 4.

OPERATING LICENSE

In most states a license is required before a motor car can be driven on the public streets, and it might be well to remind the new owner here that he should have either a license or a permit from the local police before attempting to drive his car.

After making sure that both the storage and dry batteries are connected; that the radiator and gasoline tank have been filled; that there is enough oil in the crank case; that the carburetor shut-off valve has been opened, and that your car is provided with a legal license tag, you are ready to start your motor.

STARTING THE MOTOR

Since the gasoline tank is lower than the carburetor, it is necessary to use pressure on the gasoline. Ordinarily a small air pump on the engine supplies plenty of pressure for this purpose but after filling the tank the pressure will have to be brought up with the hand pump attached to the steering column. Turn stop cock at bottom of pump to the vertical position and give pump a dozen quick strokes. This should produce enough pressure to start the motor, after which the engine will supply its own pressure as needed.

Take your position in the driver's seat behind the steering wheel. See that the ball-topped gear shift lever at the right stands in a perfectly vertical position. Set spark and throttle levers on steering wheel in positions shown in Figure 2. Throw the ignition switch on the dash to the side marked **battery.**

With the right hand press down firmly and sharply on the starting lever, located on the front edge of the seat. This throws the electric motor in mesh with the gear teeth of the gasoline motor fly wheel and "spins" the motor.

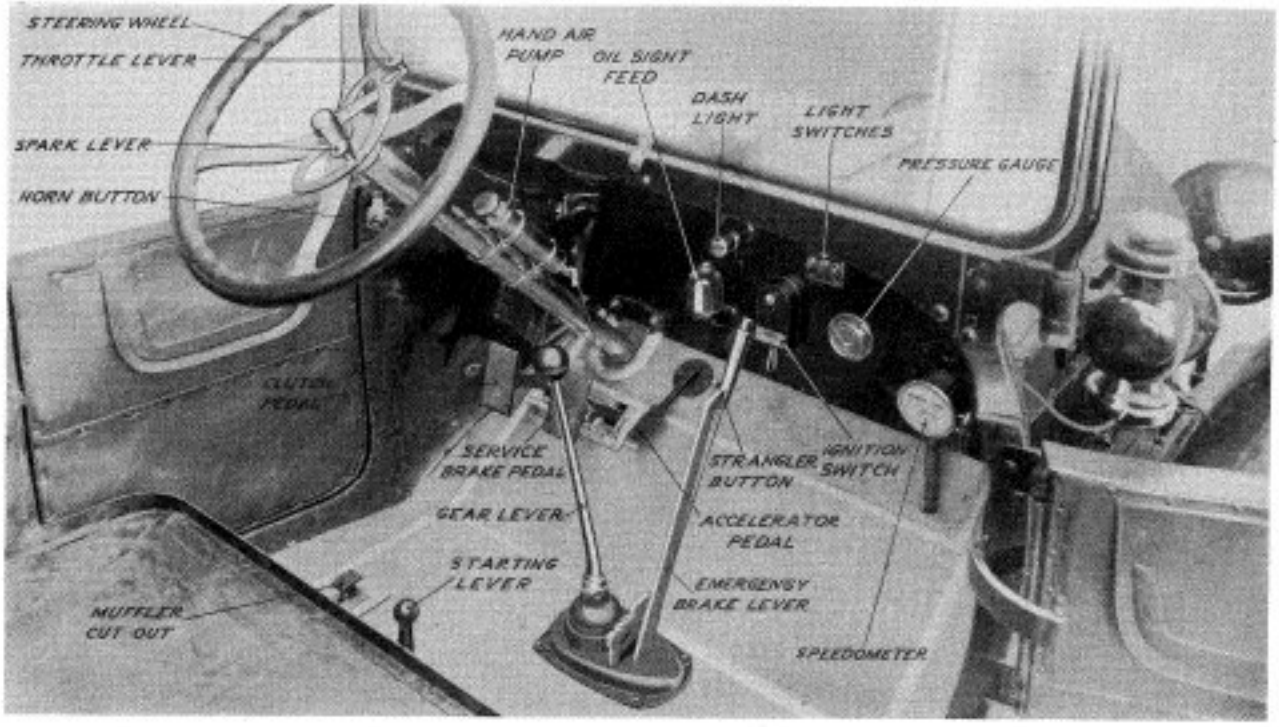


Figure 1.
Driving compartment of car showing location of instruments and control levers.

PRIMING THE MOTOR

If the motor does not start at once, press the strangler button which projects from the foot board to the right of the clutch and brake pedals (See Figure 1). This button closes the air intake of the carburetor and momentarily gives a very rich mixture which should fire easily. This action is analogous to "priming" the motor, and no other priming is necessary.

If the motor fails to start within the first thirty seconds after completing the above operations, release the starting lever immediately and investigate. Never hold the starting lever down for more than a minute at a time, as the starting motor takes a large amount of current and letting it run for any length of time is very hard on the storage battery. If the motor has compression, spark and gasoline, it will start on the first few turns, even in the coldest weather. When it fails to start, it is a sure sign that something is wrong and a prompt investigation should be made.

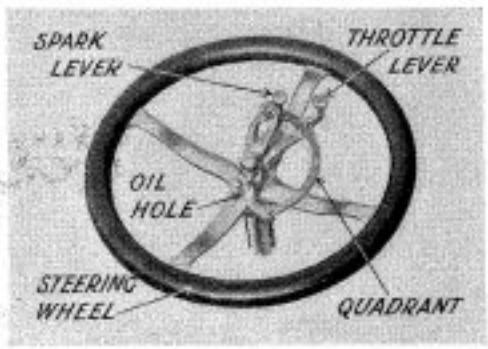


Figure 2.
Steering Wheel with spark and throttle levers in starting position.

RUNNING POSITIONS

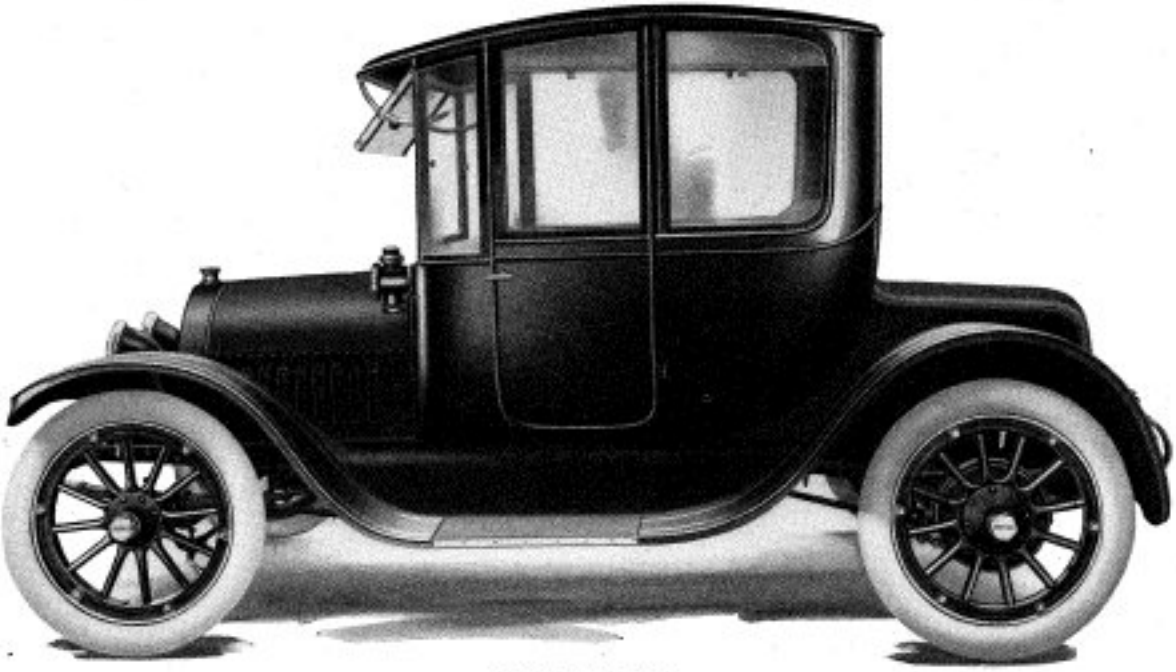
As soon as the motor starts, throw the ignition switch to the side marked **magneto,** close the throttle lever on the steering wheel until the motor runs slowly and evenly, and advance the spark by moving the spark lever about two-thirds of the way down the quadrant. This is the ordinary running position of the spark and throttle controls and by using the foot accelerator for driving, the levers can be left in this position for all ordinary roads.

CAUTION—Always throw the ignition switch over to magneto position as soon as motor starts. Never run the car with switch in battery position as this runs down the dry cell starting battery very rapidly.

HAND CRANKING

If for any reason the storage battery should be run down, or the starting mechanism not in working order, the motor may still be started by hand cranking. To crank by hand set spark and throttle levers as in Figure 2, see that gear lever is in neutral or vertical position, and throw ignition switch to battery side. Remove the nickeled cap from the starting crank shaft by turning it to the left and drawing it straight off. Attach the hand crank that will be found in the tool box, and turn the motor over by pulling up sharply on the crank until the motor starts.

Never try to start a motor by pushing down on the starting crank as a back fire may break your wrist or arm.



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STARTING THE CAR

To start the car select a level road, preferably one which has but little traffic on it. With the motor running slowly and evenly take your seat behind the 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 it down firmly as far as it will go. With the right hand shift the ball-topped gear lever first to the right and then back (See Figure 3). Always shift the gear lever with a firm, sharp motion but do not jerk or jam it.

FIRST SPEED

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

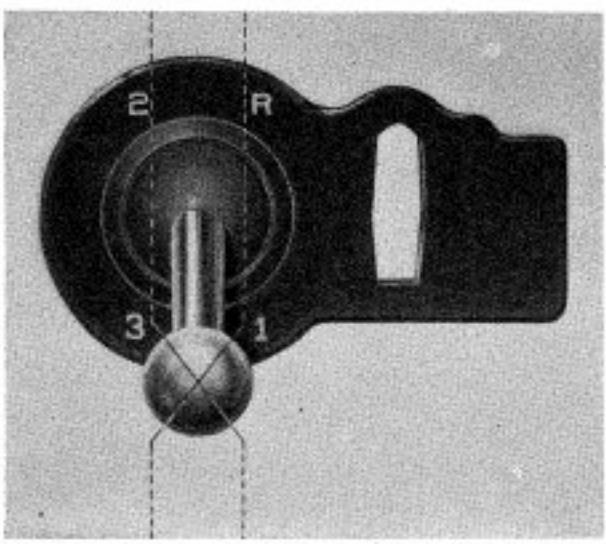


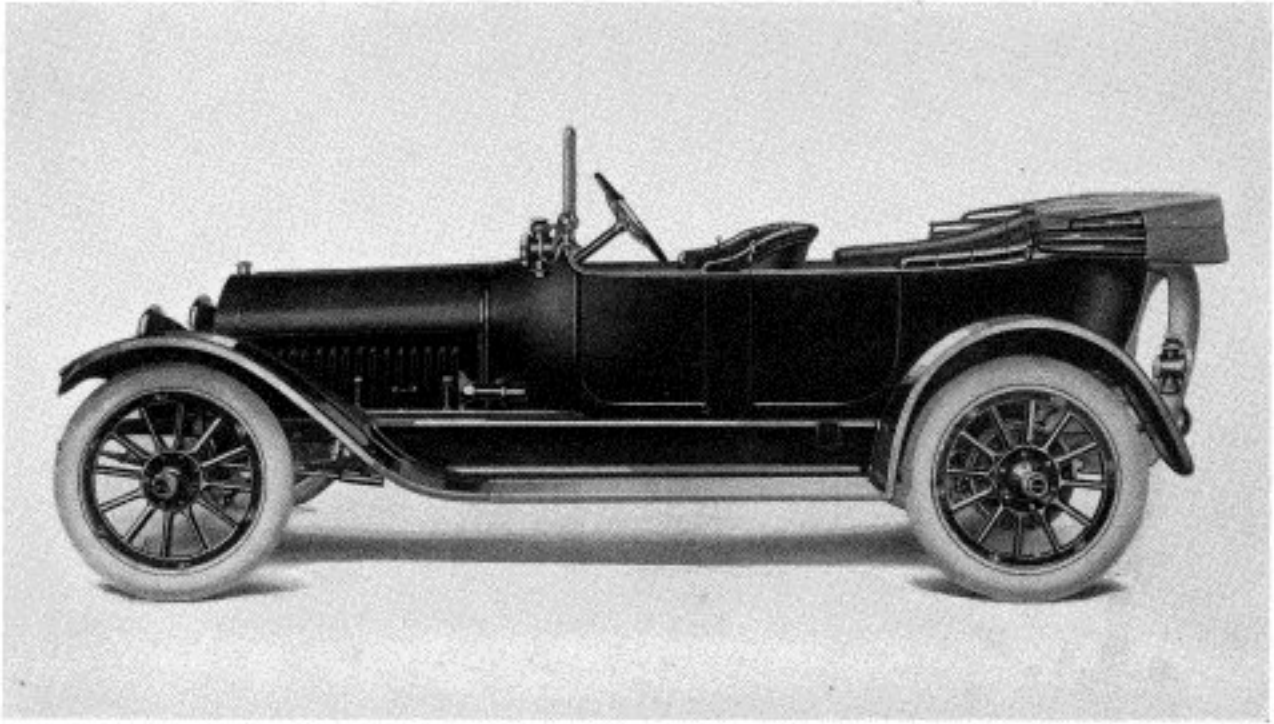
Figure 3.
Gear shift lever showing positions for different speeds.

SECOND SPEED

When the car has gained good headway, quickly disengage the clutch, at the same time releasing the pressure on the accelerator pedal to prevent the motor racing, and with a quick firm movement, shift the gear lever forward and to the left as far as it will go. Engage the clutch again immediately but not too suddenly, at the same time accelerating the motor. The car is now in second or intermediate speed.

HIGH SPEED

Again accelerate the motor until the car is moving forward at a brisk gait, then, operating the clutch and accelerator pedal as before, quickly shift the gear lever straight back as far as it will go. Engage clutch and accelerate motor as above. The car is now in third or high speed which is the normal



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driving position. The speed of the car should now be governed entirely by the use of the accelerator pedal. The hand throttle on the steering wheel may be used if desired, but as the right hand is used for shifting the gears, the foot will generally be found the more convenient for operating the throttle.

NOTE—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 which are to be meshed together will be running at approximately the same speed. The proper handling of the clutch pedal and foot accelerator so as to make the motor "pick up" its load easily and at the same time prevent it racing when the clutch is released, requires considerable practice, but experience is the only teacher in this case, and the driver soon "gets the hang of it."

Always let the clutch pedal come back gradually and steadily. Never remove your foot suddenly, as this will let the clutch in with a jerk and throw an enormous strain on the entire driving mechanism.

SHIFTING GEARS

In shifting gears from one speed to another, the motions should be made firmly and without hesitation. See diagram, Figure 3, for the different positions. If the gears fail to mesh exactly the first time don't continue to pull or push on the lever as this only grinds away the teeth. It is better to release the pressure for a moment and immediately make another attempt as this will give the gears a chance to shift their relative positions.

SHIFTING DOWN

Shifting from a higher to a lower gear or "shifting down" is accomplished in exactly the same way as shifting up—i. e., by releasing the clutch, moving the gear lever quickly to the proper position, and re-engaging the clutch—except that in this case the motor is slowing down instead of being accelerated just before the change.

USE OF LOW SPEEDS

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

Your Buick car will climb any hill "on high" that any other car will climb, but after you have demonstrated this to your satisfaction, we suggest that you make use of a lower gear which does not cause quite so great a strain on the motor.

STEERING

Steering is a matter of practice more than anything else. Go slow at first. Don't try to turn corners too sharply or too fast. Always slow down or stop before crossing railroad or street car tracks. In a short while you will "get the

feel" of your car and then you will handle the steering wheel unconsciously, so that you can give all your attention to the road.

KEEP COOL

Don't let yourself get nervous or excited. Always remember that **you** control every move of the car and that it cannot do anything without your aid. If in doubt about anything, stop and start over again. Remember that you have plenty of time. Don't take chances.

WATCH THE ROAD

In driving, learn to keep your eyes on the road 100 to 300 feet ahead of the car, depending on the speed at which you are running. Never try to watch the road just ahead of the wheels, for you would not have time to avoid a bump or stone if one should appear at that range. By watching the road some distance ahead, you always have time to prepare for anything that may turn up.

HANDLING THE SPARK

Proper handling of the spark control lever calls for the exercise of considerable judgment. A good rule is to keep the lever advanced just as far as possible without causing the motor to knock. Keep moving the lever down until you hear a slight metallic knock in the motor, and then push it back half an inch or so until the knock disappears. As the car slows down in ascending a hill or negotiating a rough road, keep retarding the spark 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 and has a tendency to overheat the motor.

STOPPING THE CAR

To stop the car, first slow the motor down by removing the foot from the accelerator pedal. Then release the clutch by pushing it in with the left foot. If the car retains too much headway, apply the service brake by gradually pressing down on the right pedal. After the car has come to a stop, and while still holding the clutch out with the left foot, shift the gear lever into neutral, or the vertical position. Then you can remove your foot from the clutch pedal.

REVERSING

To reverse the motion of the car, first come to a full stop, release the clutch and shift the gear lever into the right forward position as shown in the diagram, Figure 3. Engage the clutch gently and accelerate the motor as before.

CAUTION—Never attempt to reverse the motion of the car before it has come to a dead stop. The car cannot travel in two directions at once, and something serious may happen 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 at the right of the gear shift lever. The car should never 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 the brakes and clutch as little as possible and endeavor to control the car with the throttle.

STOPPING THE MOTOR

To stop the motor, throw the ignition switch on the dash to the "off" or vertical position, 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 to start easily the next time. Also move the spark lever back to the starting position, and set the emergency brake before leaving the car.

Never leave the car with the motor running as this is a useless waste of gasoline, and there is always the chance of children or others throwing it into gear. With the electric starter to do your cranking, there is no excuse for letting the motor run.

SKIDDING

Never apply the brakes suddenly, especially when turning a corner or on slippery pavement, as it is almost sure to cause the car to "skid." Skidding is caused by the rear wheels suddenly losing their tractive effort while the car is under the influence of centrifugal force from turning. The result is that the rear end of the car swings suddenly toward the outside of the curve. The best way to avoid skidding is to drive slow. If skidding occurs, release the brake for an instant and turn the steering wheel in the same direction the car is skidding. This will help to straighten it up.

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

RULES OF THE ROAD

Every driver of a motor car should understand and obey the rules of the road. Briefly stated they are as follows:

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 a corner to the left, always continue on past the center of the intersection of the two roads or streets before making the turn.

5. In stopping the car, always stop at the right hand curb.

USING THE LIGHTS

All Buick cars are provided with a full set of electric lights, operated by a small switch board located on the dash. When leaving the car standing at the curb, the headlights should be turned out, but the side and tail lights left on. It is dangerous to leave car standing in the street without lights, as some one may run into it and either get hurt or damage the car.

Do not leave the car standing at the curb for any length of time with the headlights burning, as they require a large amount of current and if left on for a long time may run the storage battery down.

Keep the oil lamps filled and trimmed so you will not be left entirely without light should some accident happen to your electric plant.

SPEEDING

Don't try any speeding. Drive slowly at first and be sure that you have learned to handle your car properly under all conditions of road and traffic before attempting any high speed. Fifteen miles an hour is plenty fast enough for the new driver.

While driving, glance occasionally at the oil sight feed on the dash to make sure that the oil is flowing freely and regularly. Make a habit of looking at this every time you start the car.

PART II

MAINTENANCE

To keep your car constantly in the best of condition and insure yourself against delays and possible accidents on the road, you will find it to your advantage to give the mechanical parts of the car a slight amount of attention from time to time. A good system is to make a brief inspection of all the vital parts of the car every morning before taking it out of the garage. Such an inspection takes a surprisingly small amount of time once you get used to it, and generally reveals the loose nut or bolt in time to prevent possible breakage or accident.

In the following pages of this book you will find described and illustrated the different parts of your car, and the manner in which they should be adjusted to secure the best results in operation. A careful study of the text should make you competent to intelligently handle all minor adjustments and repairs and save you many trips to the shop.

LUBRICATION

In caring for your car, the first thing to receive your consideration should be the lubrication of the various parts of the mechanism. Wherever two parts move in contact with each other, constant and thorough lubrication is required. With proper lubrication the parts will run for years and show but little sign of wear. But once let them run dry, even for a few hours, and they are liable to be ruined.

The more important parts of the car, such as the motor, gearset and rear axle, are provided with automatic systems of lubrication, so that aside from adding fresh oil from time to time, they require practically no attention. Other parts which do not require such a constant supply of lubricant have been provided with oil wells and grease cups, and these must be filled or turned down periodically to make sure that the parts are always supplied.

The location of the various oil holes and grease cups will be found on the accompanying charts, together with the kind of lubricant required.

ROUTINE

As an aid in taking care of the lubrication of the various parts of the car, the following routine has been developed, and we suggest that the owner or driver follow out some such system in making a brief daily inspection. This will soon become a habit and it will require only a minute or two each morning to make sure that everything is in proper order.

THE MOTOR

As long as the oil can be seen flowing through the sight feed on the dash, the motor will be lubricated, but fresh oil must be added when the supply commences to run low.

Occasionally open small pet cock on left side of lower half of the crank case. If oil does not appear remove cap of breather tube on left forward leg of crank case and add cylinder oil until it appears at pet cock. Close pet cock and replace breather tube cap.

Do not add more oil after it begins to flow from the pet cock as it will only cause the motor to smoke and be wasted through the exhaust, besides forming a carbon deposit in the cylinders. Always make sure, however, that the pet cock has not become stopped up with dirt which might prevent the oil appearing when it is opened.

EVERY DAY

1. With the oil can apply a drop or two of cylinder oil to each of the rocker arm ball-joints through the oil holes on top.

2. Give each of the grease cups on top of the rocker arm shafts half a turn to the right.

3. Give grease cup on fan spindle one or two turns.

4. Give grease cup on starting gear half a turn to the right.

5. Give grease cup at upper end of steering pitman on left side of frame, half a turn.

6. Give grease cups on front spring shackles half a turn each. There are three cups to each spring, one at the forward and two at the rear end of the spring.

7. Give grease cups on king bolts of steering knuckles each a turn. There is one on each knuckle.

8. Give grease cups on tie rod bearings a half turn each. There is one cup at each end of the tie rod.

9. Apply a drop or two of cylinder oil to the steering wheel bushing, first pushing in the top of the oiler on the steering wheel hub with the end of the oil can spout.

10. Raise front floor board and give grease cup on clutch pedal shaft a half turn.

11. Raise rear floor board and give grease cups on ends of brake shaft one turn.

12. Give grease cups on driving ring a half turn.

13. Give two turns to grease cups on forward propeller shaft housing bearing.

14. Give grease cups on rear spring seats each one turn. There are two cups, one on each spring seat.

15. Give grease cups on brake operating shafts one half turn each. There are four of these cups, two located on the brackets at the inner ends of the rods, and two on the outer ends just inside of the brake drums.

16. Give grease cups on rear spring shackles a half turn each. There are eight of these grease cups, four on each rear spring.

A drop of oil applied occasionally to the small joints of the brake rods and the spark and throttle control rods and levers, will keep them working freely and prevent rusting.

This is also a good time to see that the radiator and gasoline tank are both filled and ready for business.

EVERY WEEK

At least once each week, after thoroughly washing and cleaning the car, attend to the points which require lubrication as follows:

1. Raise left side of hood and remove pipe plug on top of steering gear worm housing. With grease gun fill the housing with cup grease.

2. With grease gun apply a small amount of cup grease to forward and rear sockets of steering gear drag link.

3. Remove cover of fly wheel housing and give clutch collar a couple squirts of cylinder oil through oil hole on top.

4. Turn clutch around until grease cup on cone appears, then give it one or two turns to the right.

5. Turn clutch over until pipe plug in clutch sleeve appears Remove pipe plug and fill with cup grease from grease gun.

6. Unscrew filler cap on right side of transmission gear case, and fill with cylinder oil until oil stands at level of flange inside of cup. Replace cap.

7. Remove pipe plug on right side of differential housing and fill with cylinder oil until level with opening.

EVERY MONTH

Once each month the wheels should receive attention as follows:

1. Jack up front axle, and remove front hub caps by unscrewing them to the left. Remove cotter pins and unscrew spindle nuts by turning the left hand nut to right, and right hand nut to left. Notice that these are right and left hand threads. Do not get them mixed.

Slip off wheels and smear spindles and ball races with cup grease.

Replace wheels and tighten nuts until wheels have no perceptible shake on spindles, but are loose enough to spin freely, and will stop with the tire valves down. Replace cotter and hub caps.

2. Move car or jack up rear axle until pipe plugs in rear hubs appear on top. Remove plugs and fill with cup grease from grease gun. Replace plugs.

3. Remove pipe plug on left side of timing gear case of motor and with a grease gun introduce a mixture of cup grease and cylinder oil, about the consistency of heavy molasses.

About once a month the Delco generator will also require a slight amount of lubrication and cleaning. For proper method of attending to this see explanation in Delco instruction book.

Three or four times a year, all the old oil should be drained out of the crank case of the motor, the transmission, and the rear axle, and these parts washed out thoroughly with kerosene, before being filled again with clean oil. After a period of constant use, the oil will "burn" or wear away, leaving a dirty black residue which has little or no lubricating qualities, and unless this worn out oil is removed at intervals, it will work into the gears and bearings and prevent the good oil from getting to them.

ONCE EACH YEAR

At least once every year the car should receive a thorough overhauling, at which time the motor, clutch, transmission, steering gear and axles should be taken apart and all the old oil and grease washed out with gasoline or kerosene. All joints and housings should then be repacked before re-assembling.

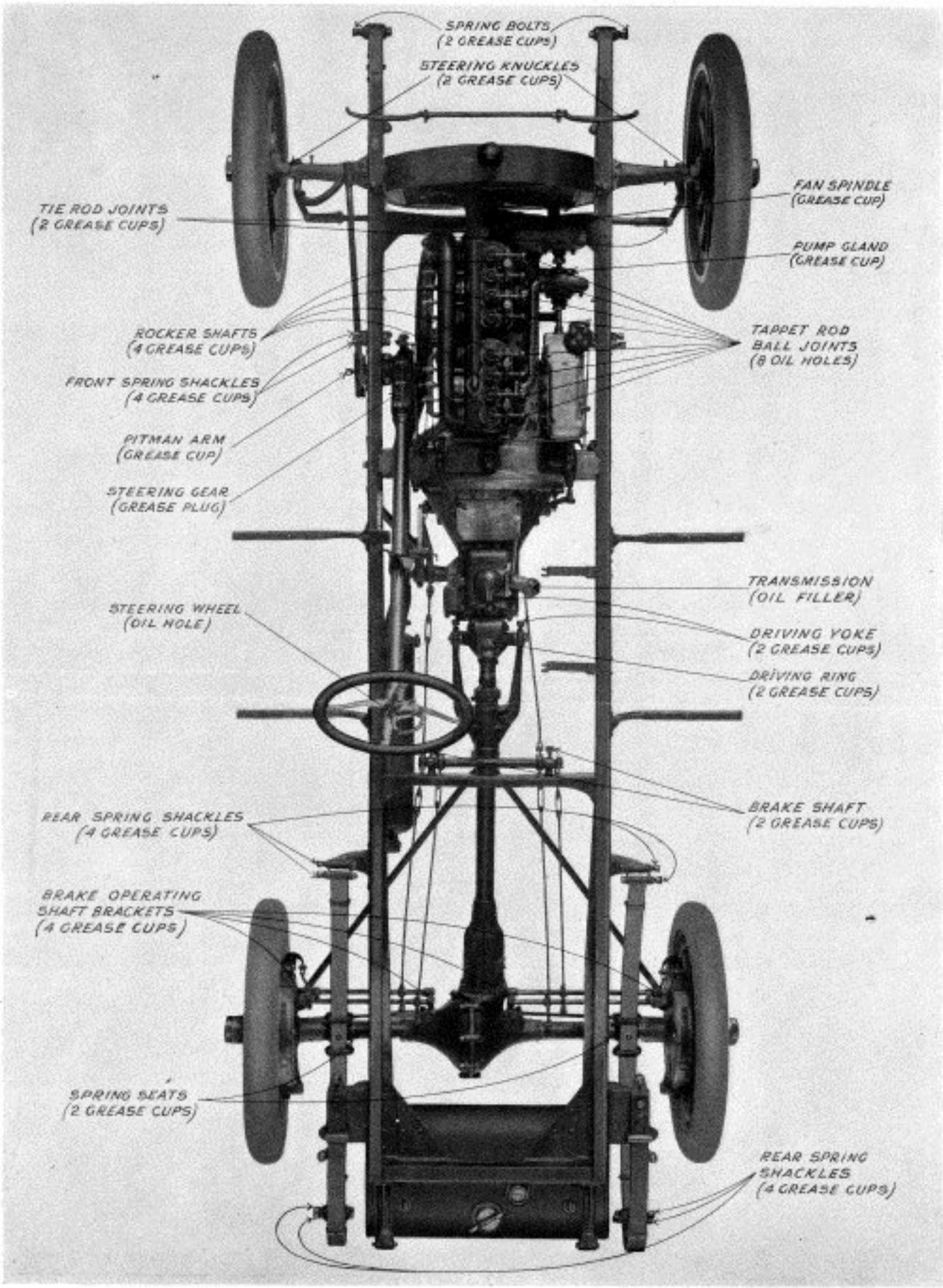

Figure 4, Plate 1
Plan view of chassis, showing lubrication

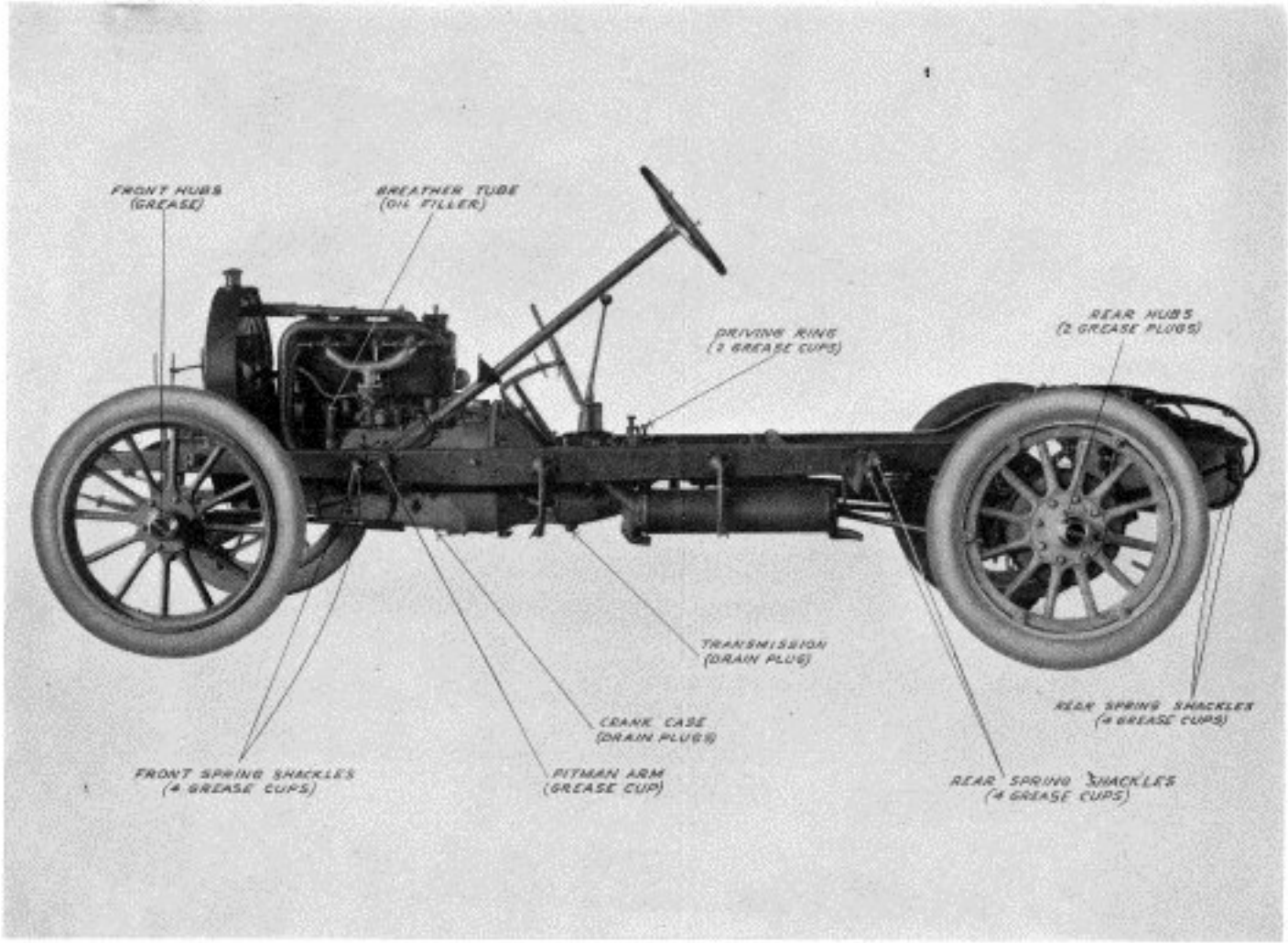

Figure 4, Plate 2
Side view of chassis, showing lubrication

The directions given here refer to the average car being driven at the average rate. If your car is doing more than the average amount of traveling it will take proportionally more lubrication. Before starting on a long tour or a hard trip it is wise to pay special attention to the condition and lubrication of the various parts.

KINDS OF LUBRICANT

Note that only two different grades of lubricants are used, so that the Buick owner is only required to provide himself with a supply of cylinder oil and cup grease to cover every requirement of his car.

Where cylinder oil is called for, we recommend the use of a medium heavy grade of "gas engine" cylinder oil. Never use a cheap oil on your car, as it is sure to cause more trouble than it will save expense. When touring it is well to carry an extra gallon can of oil in your tool box.

Never use a steam cylinder oil, or anything but a pure mineral oil in your motor, as vegetable oils contain acids which will decompose at the high temperatures, and attack the metal parts of the mechanism.

A copper oil can is provided with your car and you will find this convenient for applying oil to oil holes and other parts requiring a small amount of oil at a time. For the motor, transmission and differential, a small funnel will prove useful.

Where instructions call for cup grease, use a fairly heavy grade of non-fluid oil, hard oil, or vaseline. In winter this can be thinned out by mixing with a little cylinder oil.

Grease cups should be refilled immediately as soon as they have been turned down as far as they will go. Unscrew the cap and fill it with the grease, then replace.

Where the cup grease has to be introduced through a hole, make use of the grease gun which is furnished with your car. Fill the gun with the grease, place the nozzle in the hole and eject the grease by turning down the handle of the grease gun.

Don't use too much oil. Enough is just right and any more will simply run out of the bearings and collect grease and dirt on other parts of the car.

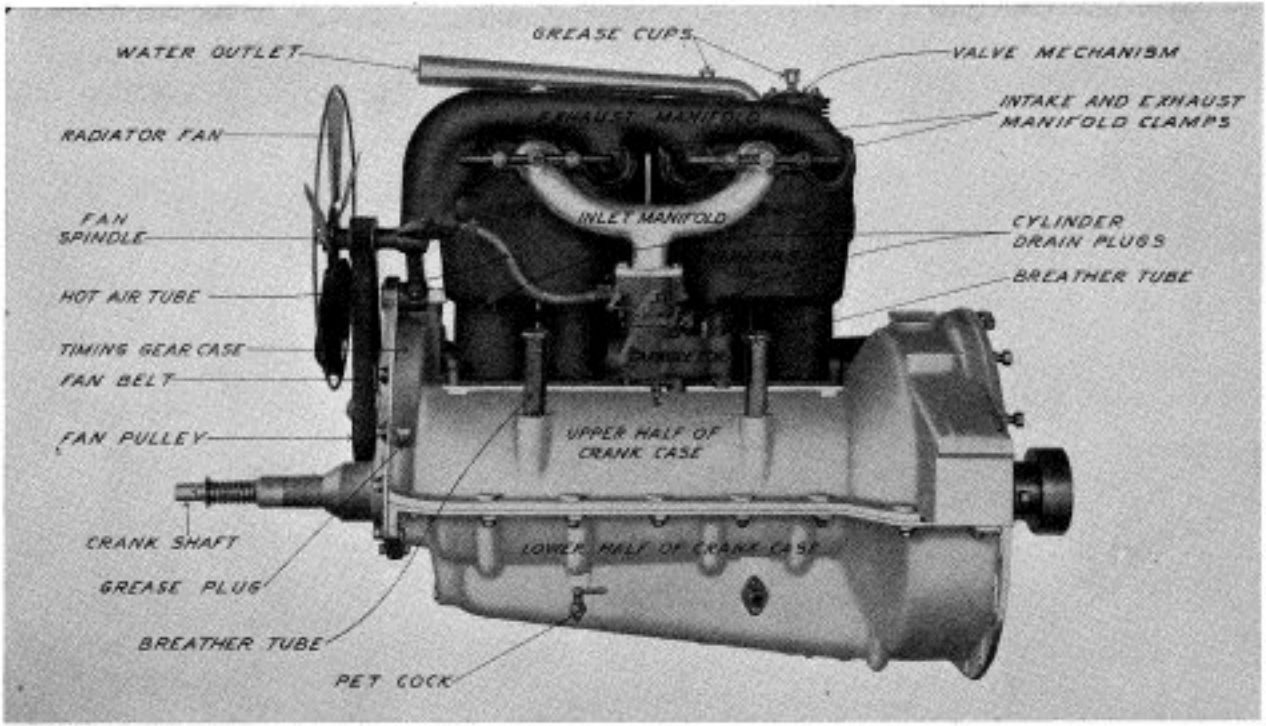

Figure 5. Plate I.
Left or carburetor side of B36 and B37 motor

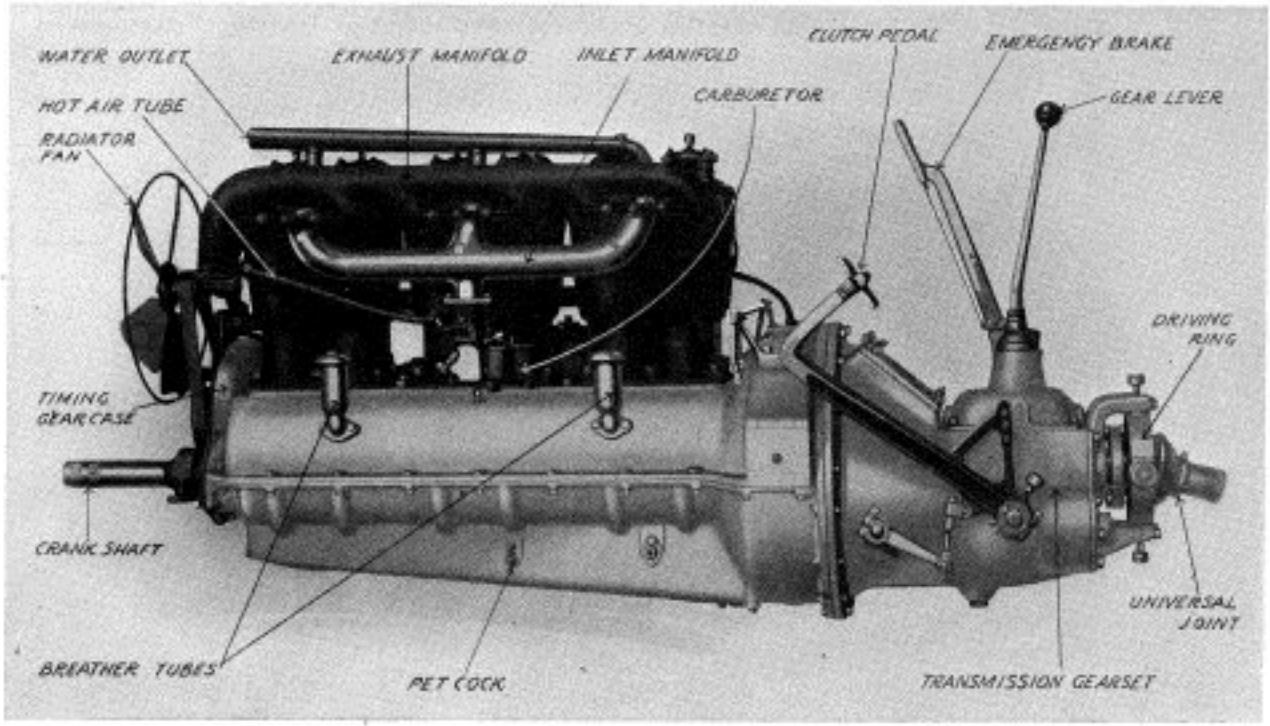

Figure 5. Plate II.
Left or carburetor side of B55 motor.

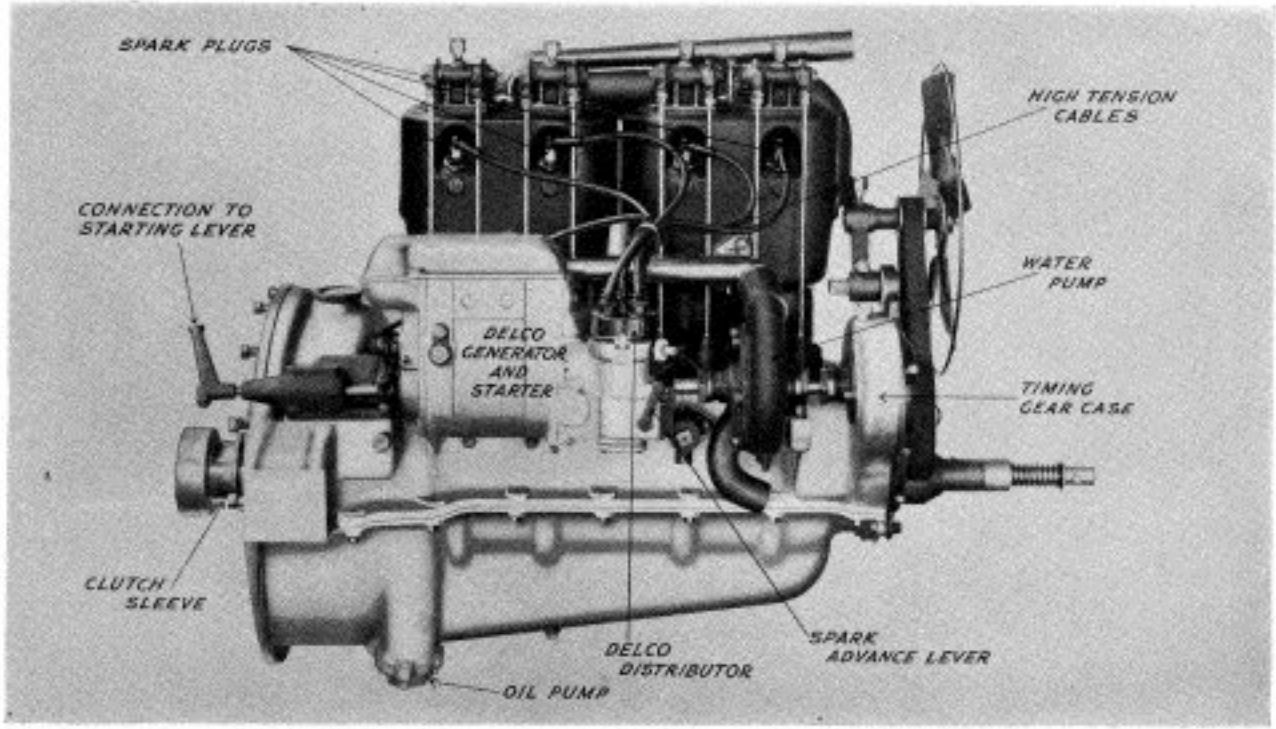

Figure 6. Plate 1.
Right or generator side of B36 and B37 motor

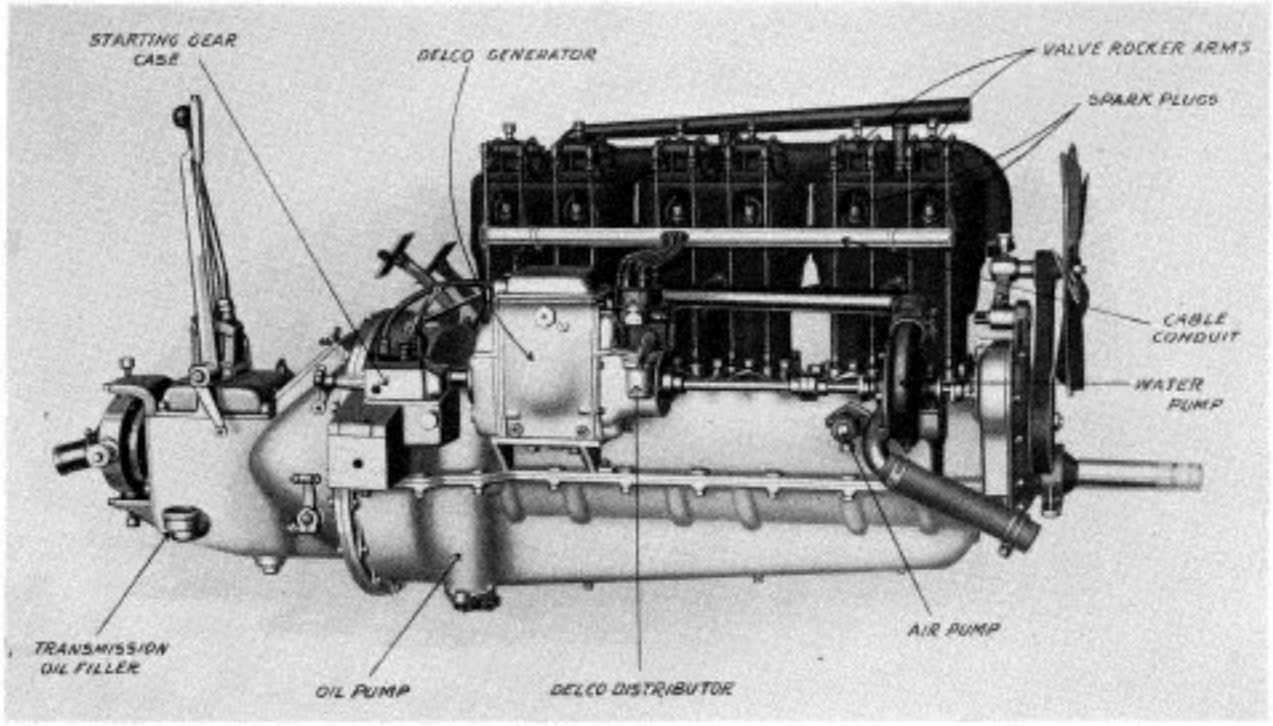

Figure 6. Plate II.
Right or generator side of B55 motor.

THE POWER PLANT

The power plant of an automobile is the most important part of the mechanism. Its function is to develop the necessary power for driving the car and to deliver it to the transmission system which in turn transmits it to the road wheels where it is finally converted into motion of the vehicle.

The power plant is made up of several parts, each of which is more or less independent of the others, but all of which must function perfectly together to develop the power. These parts are as follows:

The Motor
The Lubricating System
The Fuel System
The Ignition System
The Cooling System
The Exhaust System

The motor is the machine which turns the pressure of the exploding gases into rotary motion of the crank shaft.

The lubricating system supplies oil for the different parts of the motor automatically, varying the amount to agree with the speed and load at which the motor may be working.

The fuel system takes the raw gasoline from the fuel tank, vaporizes it, mixes it with the proper proportion of air and sends it to the motor in sufficient quantity for the work the motor is doing.

The ignition system develops the electric current, "steps it up" or raises its voltage sufficiently to make it jump the spark gaps with a hot flame, and then distributes it to the spark plugs in the proper order and at the proper time to explode the fuel just as the motor is ready for the new impulse.

The cooling system carries away the excess heat developed by the explosions in the cylinders of the motor, and diffuses it to the surrounding atmosphere.

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

Thus the several parts of the power plant act in conjunction with each other to make the operation of the motor entirely automatic and self sustaining as long as it is supplied with fuel, oil and electric current for ignition. But should the functions of any part be interrupted the motor will promptly stop.

THE MOTOR

The crank shaft, Figure 8, is the "backbone" of the motor, and to it all other parts of the machine are related. It runs in three bearings, one at each end and one in the middle between the two center cranks, which are all contained in the upper half of the crank case. To the crank shaft are connected the connecting rods, which on their upper ends carry the pistons hinged to them by the wrist pins. These pistons move up and down in the cylinders which are fastened over them and also bolted to the upper half of the crank case. The pistons are each fitted with three rings around their upper circumference, which makes them fit the cylinder bores very closely and prevents the gases from leaking past them.

On its front end the crank shaft carries a spiral gear which meshes with the cam shaft gear, and beyond that a fan pulley and starting ratchet; on the rear end is a flange to which is bolted the fly wheel. The fly wheel has gear teeth cut around its forward edge to mesh with the small gear on the Delco generator or starting motor.

The crank shaft runs in bearings in the upper half of the crank case, which is bolted to the frame by legs on each side. Breather tubes are inserted in the two legs on the left hand side to relieve any pressure which might accumulate in the crank case, and the removable caps on them permit the introduction of oil.

The cylinders are entirely open at their lower ends and are bolted down to the top of the crank case over the pistons and connecting rods. The cylinders are cast in pairs and around the upper portion of each pair there is a double wall or "water jacket," through which the cooling water is circulated.

In the upper end of each cylinder are three small openings, two of which are closed by poppet valves, while a spark plug is inserted in the third. The valves, with their seats and springs, are contained in cages, which are held in place in the head of the cylinder by threaded rings.

The valves are ground on their chamfered edges to fit the seats on the lower rims of the cages, and when closed they are held against their seats by springs. One valve in each cylinder opens into the intake manifold and the other into the exhaust manifold.

A rocker arm, pivoted at its center to a bracket on top of the cylinder, rests with one end on the valve stem. The other end is actuated by a push rod or tappet which extends up from the crank case on the right side of the cylinder.

Within the crank case the valve tappets have an enlarged end, provided with a roller which runs on a cam. As the cam turns around the roller rises and falls, and through the tappet rod actuates the rocker arm on top of the cylinder, thus opening and closing the valve.

The cams which actuate the valves are all carried on a shaft enclosed in the crank case and known as the cam shaft, Figure 9. The cam shaft is geared to the crank shaft of the motor by means of the large spiral gear in front, and runs at one-half the speed of the crank shaft.

Another and smaller gear meshes with the cam shaft gear on the right, and with its shaft drives the water pump and the Delco generator mounted on top of the crank case on the right side of the motor.

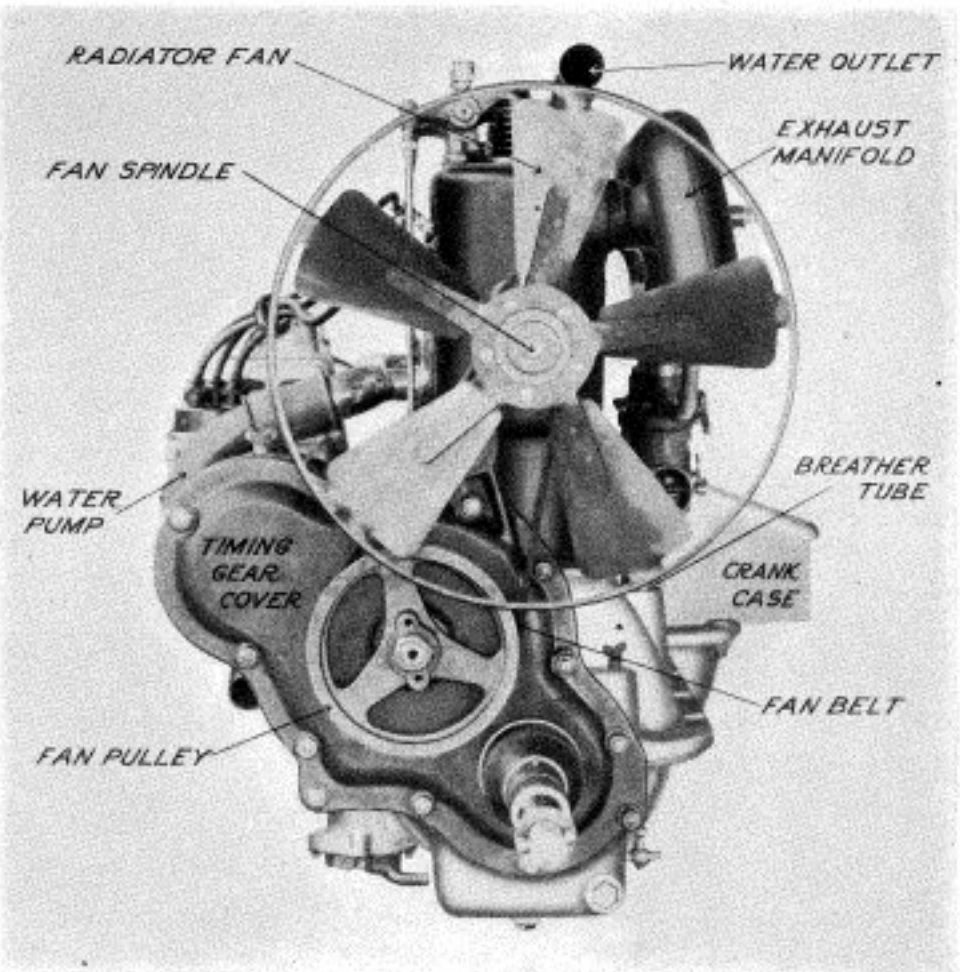

Figure 7.
Front view of motor

A fan spindle is bolted to the timing gear cover to carry the radiator fan and its pulley, the fan being operated by a small belt from the pulley on the cam shaft.

The lower half of the crank case is bolted to the upper half by a flange and carries the splash trays into which the little scoops on the connecting rods dip. It also acts as a reservoir for the motor oil supply and encloses the oil circulating pump on the right side just in front of the fly wheel. The pump is driven by a short vertical shaft and worm gears from the cam shaft.

Figure 10 is a photograph of a motor which has been partly cut open showing the interior construction and the arrangement of the parts.

HOW THE MOTOR WORKS

The power of the motor is, of course, produced by burning or "exploding" charges of gas in the cylinders above the pistons, which, in expanding, force

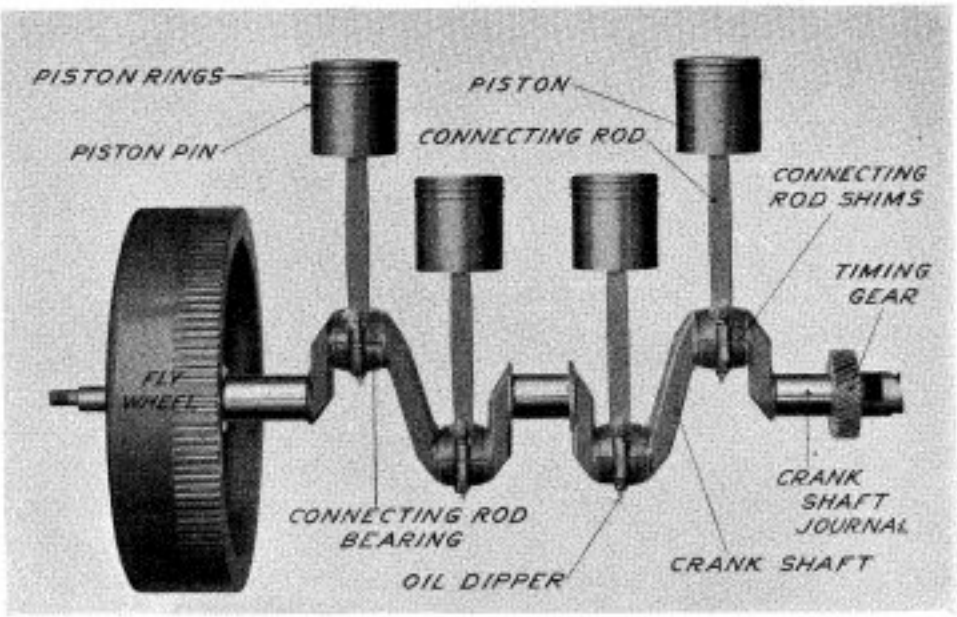

Figure 8.
Crankshaft with fly wheel, connecting rods and pistons

the pistons down and so act to turn the crank shaft. But in the four cycle engine, of which the Buick motor is an example, it takes four strokes of the piston, or two complete revolutions of the crank shaft, for each explosion or working stroke in any one cylinder. This will be more readily understood by reference to Figure 11.

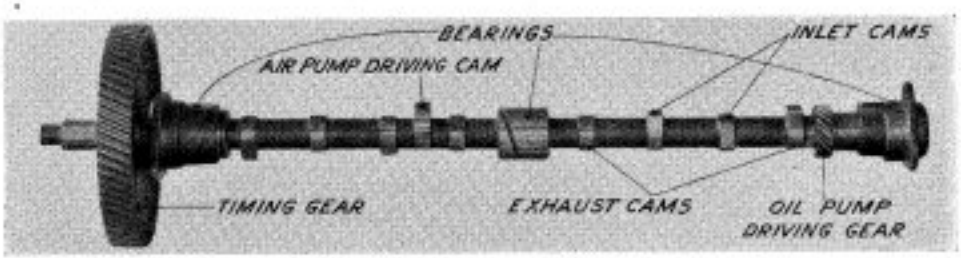

Figure 9.
Cam shaft with timing gear and oil pump driving gear

As the piston starts down on the first stroke of the cycle, as in A, Figure 11, 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 gas from the carburetor through the intake valve.

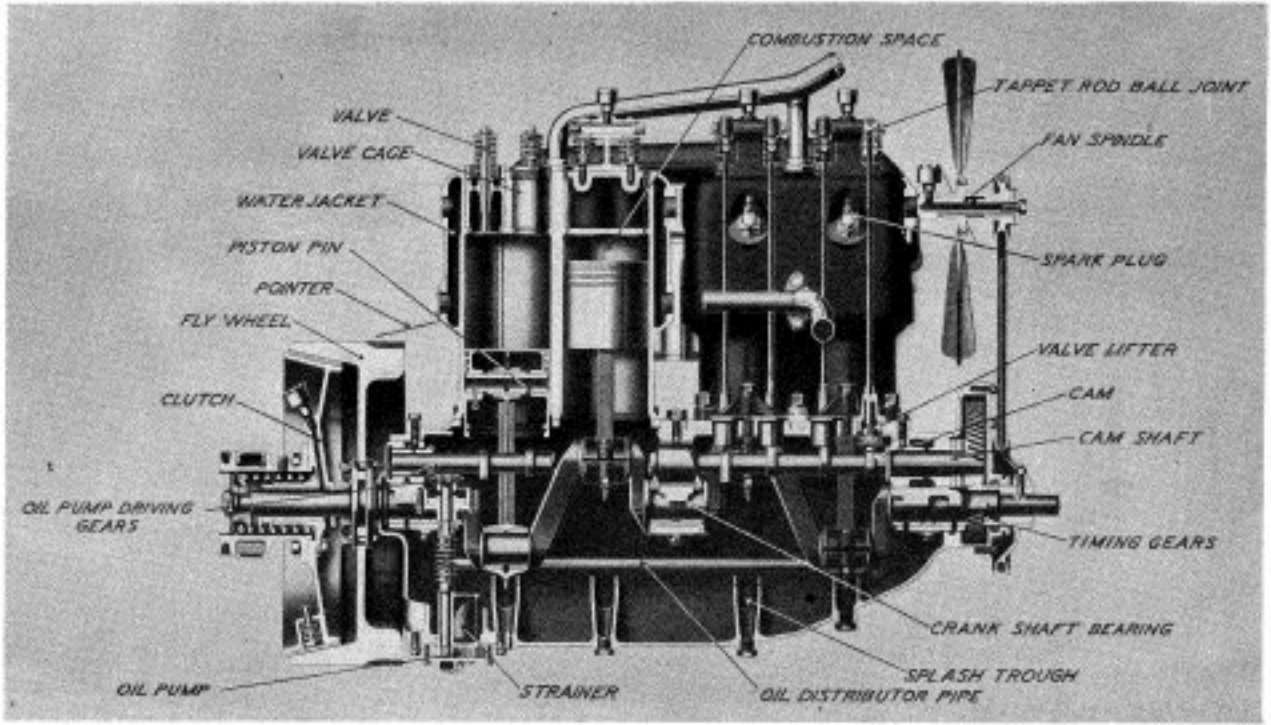

Figure 10.
Section through four-cylinder motor showing internal construction.

When the piston has reached the bottom of its stroke and starts back as B, Figure 11, the intake valve closes and the piston compresses the gas it has taken in, into the space at the top of the cylinder.

Just before the piston reaches the end of its upward stroke, as C, Figure 11, the gas is exploded by an electric spark which occurs at the points of the spark plug. The 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, Figure 11, the exhaust valve is opened and the piston pushes the remaining burnt gas out of the cylinder, leaving it 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 for each cylinder, but as there are four cylinders to each engine, the crank shaft really receives two impulses every revolution.

TIMING THE VALVES

If, for any reason it should become necessary to remove the cam shaft or crank shaft from the motor, care must be taken in replacing them to see that they are in the right relation to one another or the valves will be out of time.

When replacing the crank shaft set the tooth on the cam shaft gear which has a single punch mark in the space on the crank shaft gear marked to correspond. Then set pump shaft gear so that the space marked with two punch marks coincides with the correspondingly marked tooth on cam shaft gear. See Figure 12.

TIMING THE IGNITION

We do not advise the average owner to attempt the removal of the cam shaft, as this is more properly a repair shop job and there is nothing connected with it that will ordinarily need adjustment. But if either the cam shaft or the pump shaft is removed it will be necessary to retime the ignition.

To time the spark, first make sure that the marks on the crank shaft and cam shaft gears coincide. Then set the piston in cylinder No. 1, which is the first cylinder immediately behind the radiator, on the upper dead center. This can be done by turning fly wheel until the line marked "1 & 4" is opposite the mark on the fly-wheel housing. See that both valves are closed by testing the rocker arms. If not, turn crank shaft through one complete revolution to dead center again.

After making sure that you have found the dead center before working stroke instead of the one before the intake stroke, turn the fly wheel to the right as you stand in front of the motor, until the line marked 40° appears directly under the pointer attached to the rear cylinder.

With the spark lever on the steering wheel in the closed or "retarded" position, remove the cover of the Delco distributor which carries the spark plug cables, and the distributor disc just under it. This should expose the breaker mechanism to view. The cam on the vertical shaft should now be just leaving the breaker point. If not, loosen screw in breaker shaft and turn cam. Then tighten screw. Replace distributor disc and note that the contact button on the brass strip is just beginning to make contact with No. 1 terminal.

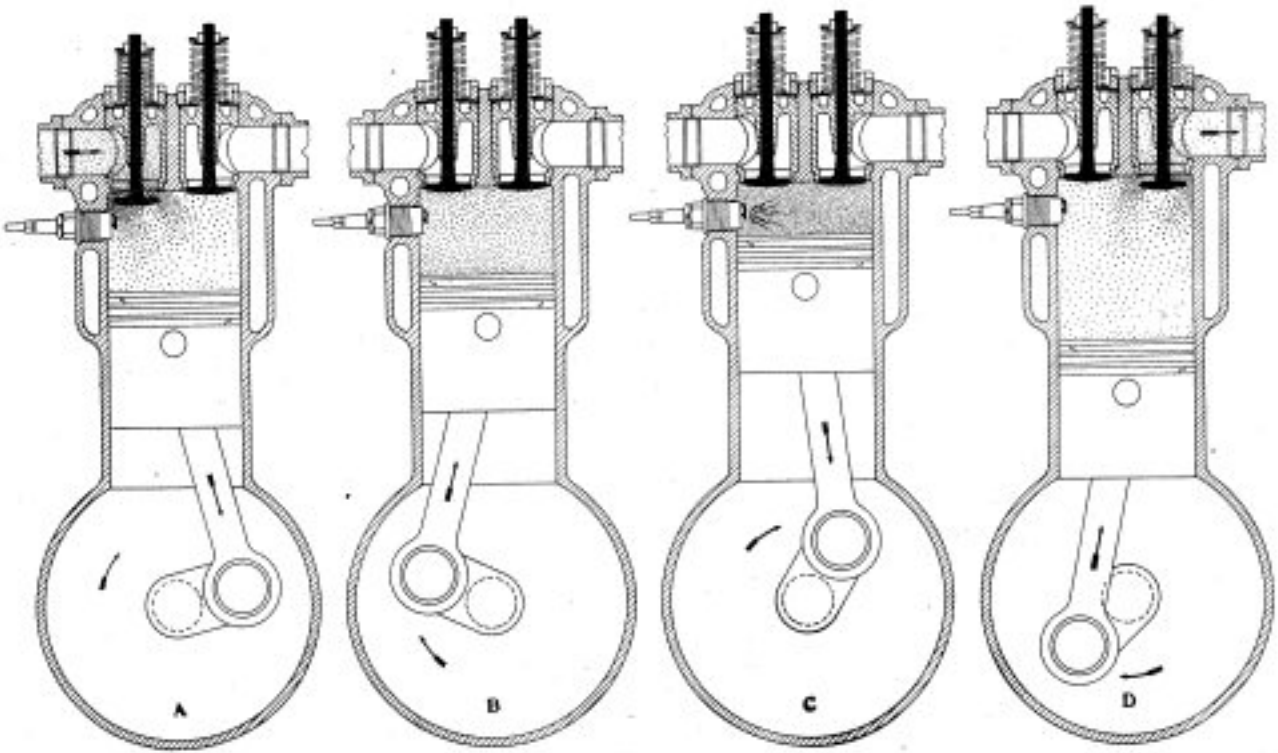

Figure 11.
Diagram showing different strokes of the cycle.

This is the firing position for cylinder No. 1, and all the other cylinders should fire in order if the cables have not been disturbed. If they have, attach them to fire the cylinders, beginning with the one next the radiator, in the following order: 1, 3, 4, 2.

Note:—The firing order of the six cylinder motor is 1, 4, 2, 6, 3, 5, and will be found marked on the inlet manifold.

GRINDING VALVES

To grind the valves of the motor, first remove cotter pin and washer on the end of the rocker arm shaft. Next press down on the valve stem to compress the spring, then lift the tappet rod out of its socket in the push rod on the crank case. If rod will not clear at first, turn motor over to get the push rod off of its cam. The ball on the upper end of the tappet rod will now slip out of its socket in the rocker arm and the rocker arm will slip off over the end of the shaft. See Figure 13.

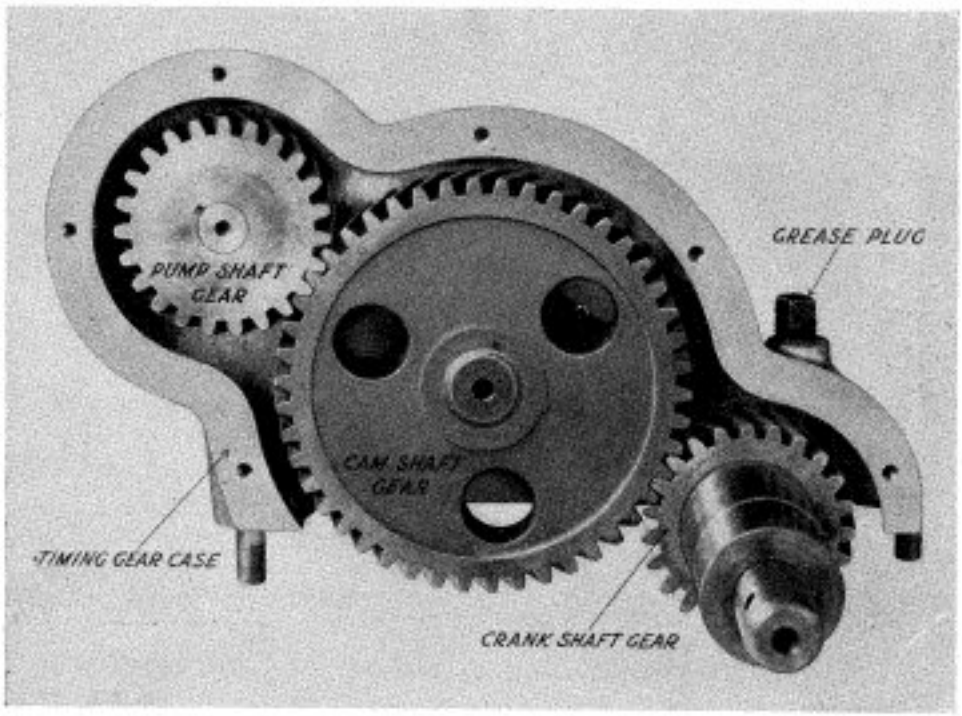

Figure 12
Timing gears showing position for setting valves

With the special spanner which will be found in the tool box, unscrew the notched ring which holds the valve cage in the cylinder head. With a hammer, strike the end of the valve stem a light sharp blow. This will loosen the cage and it may easily be withdrawn. Be careful not to injure the small gasket which fits around its top. The valve and its cage are shown in Figure 14.

Grip the valve cage in a vise, first lining the jaws with strips of copper or wood to prevent marring the cage. Remove the wire which is threaded

through the key and press down on the spring until the key can be slipped out. Remove the spring and washers. This should leave the valve free to slide up and down in the guide.

Now lift the valve from its seat and after carefully cleaning off all carbon or dirt, smear the chamfered edge of the valve with a little emery flour mixed with oil, or with one of the valve grinding compounds now on the market. Replace the valve and with an oscillating motion turn the valve back and forth on its seat. Don't turn too long in one place but keep continually lifting the valve from its seat and replacing it in another position to thoroughly distribute the abrasive material. Don't put too much pressure on the valve.

Remove the valve and wipe it clean frequently, and as soon as the valve and valve seat both show a bright ring $\frac{1}{32}$ of an inch wide all the way around, stop the grinding. Be careful to clean out all traces of the abrasive material with gasoline before replacing the valve.

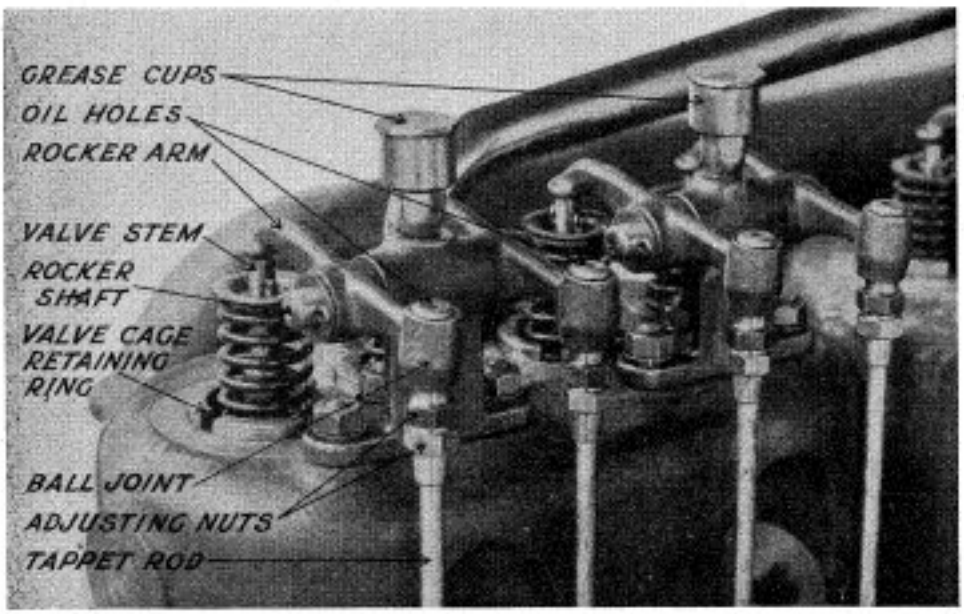

Figure 13.
Valves action details showing adjustment of tappets.

Replace spring, washers, key, etc., and replace valve cage in the cylinder by reversing the operation described above for removing it, but be careful to see that the round hole in the circumference of the cage registers with the opening in the manifold.

Remove only one valve at a time from the cylinders and there will be no danger of getting valves or tappet rods mixed in returning them.

Be sure to replace the small gasket before screwing down the ring. See that it is put in right side up.

Valves should be ground about once for every thousand miles the car travels, but a compression leak should be investigated at once as soon as it occurs.

ADJUSTING TAPPETS

After grinding the valves it will usually be found necessary to readjust the valve tappets to compensate for the wear on the valve seat. To adjust the tappets, loosen the lower of the two nuts just below the ball joint, Figure 13. Turn the crank shaft over until the valve is completely closed and the rocker arm has its greatest amount of play.

Now insert a fairly heavy piece of paper or very light card between the rocker arm and the end of the valve stem and adjust tappet by turning the upper nut until the paper can just be withdrawn without tearing. This should leave a clearance of about 5-1000 of an inch which is sufficient to offset the expansion of the tappet rods without causing undue noise in the valve action. Fix the adjustment by tightening the lower or lock nut on the tappet, being careful not to disturb the upper one.

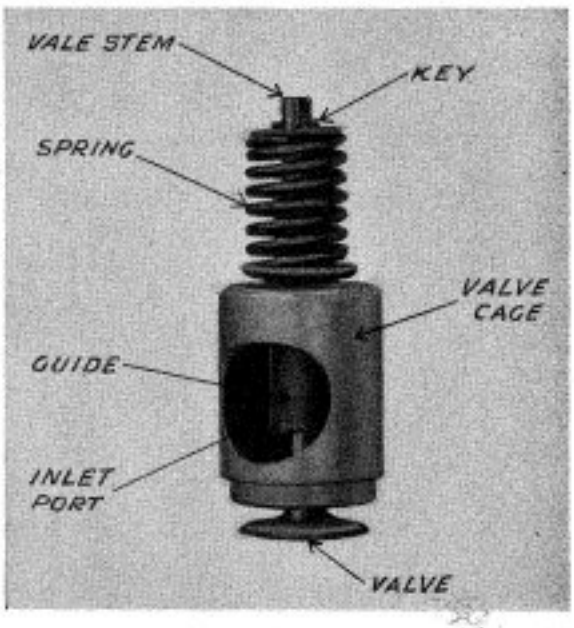

Figure 14.
Valve and valve cage.

REMOVING CARBON

If you have been using too much lubricating oil or oil of a poor grade, or if you have been running on too rich a mixture, a hard black coating of carbon will form over the interior of the combustion space and on the head of the piston. This carbon deposit frequently retains the heat until it becomes incandescent and ignites the charges before the piston has finished the compression stroke, resulting in a bad knocking noise in the motor and perhaps overheating.

To remove the knock it is necessary to remove the carbon and this can be most easily accomplished when grinding the valves. Remove the cages and with a bent scraper, carefully scrape all deposits off of the piston head and interior of the combustion space, blowing the dust out with a bellows or air blast, see that none of this dust gets into the valves or cages, and carefully clean out the interior of the valve cage openings before replacing the valves.

Some motorists guard against the formation of carbon by introducing two or three spoonfuls of kerosene into each cylinder while the engine is still warm, and allowing it to stand over night. This will frequently loosen up the carbon so that it will be blown out the exhaust valve when the motor is started the next day. Don't use too much kerosene or you will thin out the lubricating oil and probably cause a piston to overheat and stick the next time you start the motor. The kerosene can be introduced into the motor by unscrewing the spark plugs.

ADJUSTING BEARINGS

If, after a long period of severe service your motor should develop a sharp metallic knock, audible every revolution of the crank shaft, and removing the carbon from the cylinders does not seem to help it, you will probably find that one of the connecting rod bearings has worn loose.

To get at the connecting rod bearings it is necessary to remove the lower half of the crank case, after carefully draining out the oil through the drain

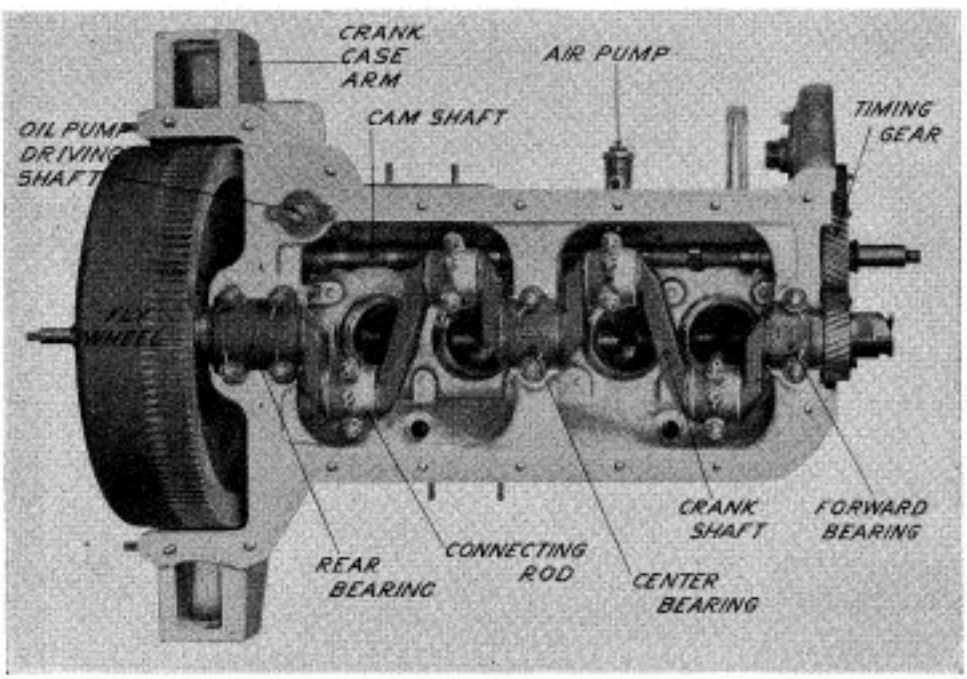

Figure 15.

Bottom view of crank case showing crank shaft and connecting rod bearings.

plug at the bottom. Turn the crank shaft over until the cranks lie in a nearly horizontal position. Now have some one grasp the fly wheel and oscillate it sharply back and forth while you hold your hand first on one bearing and then another. The loose one will quickly become apparent.

To tighten, remove cotter pins and nuts from the bolts and drop the cap. See Figure 15. This will expose the shims which fit between the two halves of the bearing. Note that the journal is bright and free from scratches or shows no other indications of a lack of lubrication.

From one of the shims remove a single thin leaf of the laminated metal, and replace the shims and cap, tightening the bolts up as much as possible with an ordinary wrench. If the knock is gone fasten the nuts with the cotters. If a knock is still apparent remove a leaf of metal from the other shim. Never take off more than one leaf at a time.

FITTING PISTON RINGS

Most motors run for years without a single piston ring breaking, but once in a while this accident will happen, and when it does, it becomes necessary to replace the broken ring immediately to prevent scoring of the cylinder walls.

New piston rings should always be ordered from the factory or through a regular Buick dealer as you have no guarantee that any others will fit.

To replace a ring, first remove the cylinder casting from the crank case. If the broken ring is the first one, the new ring can easily be slipped over the end of the piston and into its groove, but if it happens to be the second or third, the rings above will have to be removed.

Get three or four narrow strips of sheet metal about four inches long and insert across the grooves under the rings. The rings can then be easily slipped off without snapping back into every groove they pass, and they can be replaced in the same manner, removing the metal strips after all are in place.

In replacing the cylinders, see that the rings enter the bore evenly all around or you may break another one.

KEEP YOUR MOTOR CLEAN

Nothing will add more to the appearance of your car when the hood is raised than a clean motor, and by keeping the motor clean you prevent the dust and dirt which gather on it from working into the bearings and adjustments where it may cause trouble.

Clean the motor with a soft cloth or piece of waste moistened with a little gasoline. A stiff brush will be found handy to get into the difficult corners. Never squirt or spray gasoline over your motor to clean it as this proceeding removes all the lubricating oil as well as the dirt.

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 sucked through a strainer into the gear pump housed at the rear end of the reservoir. The pump forces it through a pipe to the sight feed on the dash, where the circulation can be observed by the driver. From the sight feed, the oil returns through a distributor pipe to the splash trays or troughs cast in the lower half

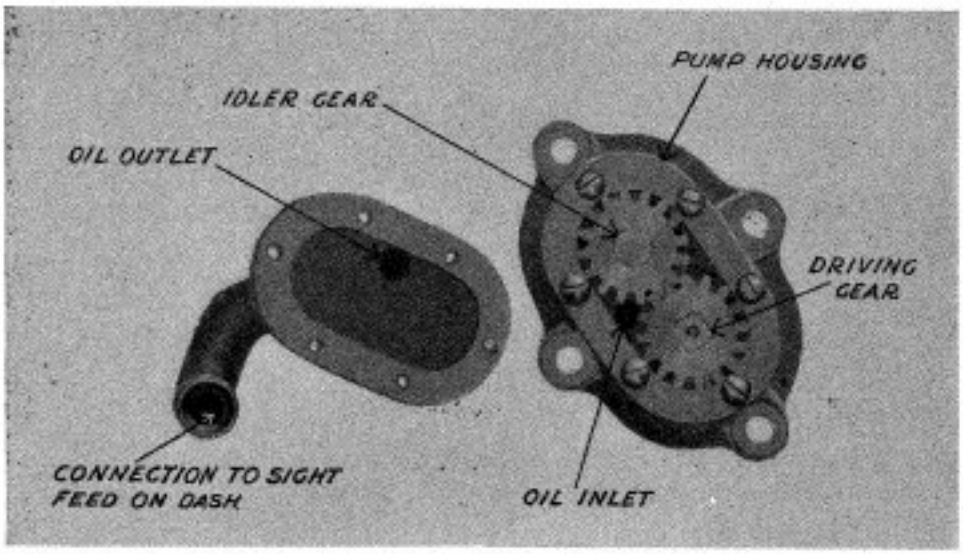

Figure 16.
Oil pump with cover removed to show gears

of the crank case, into which the scoops on the connecting rods dip. Overflow passages cut in the splash trays maintain the oil in them at a constant level.

As the connecting rods dip into the splash trays they splash the oil over the interior of the crank case and up into the lower part of the pistons and cylinders. As it drains back down the sides of the crank case, it is caught in ducts and lead to all the bearings of the motor, the excess falling back into the reservoir to be used over again.

OIL CIRCULATING PUMP

The oil circulating pump, Figure 16, consists of two small gears enclosed in a close fitting housing, and driven by a vertical shaft and worm gears from the cam shaft. As the gears turn, they take the oil into the spaces between their teeth and carry it around between the gears and the housing 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 sight feed on the dash and then on around.

About once a month the old oil should be drained out of the crank case and fresh oil put in. First, drain the case through the drain plug in the bottom, then remove the pump by taking out the four large screws which hold its housing to the crank case. The pump will now slip out from below, the squared end of the shaft pulling out of the gear.

Clean the strainer with gasoline or kerosene, and be careful to see that the driving shaft fits into place when the pump is replaced. Close the drain plug and fill the case with fresh oil until it begins to flow from the pet cock on the left side.

Outside of cleaning, the lubricating system is entirely automatic and requires no attention.

THE FUEL SYSTEM

The fuel system of the Buick automobile consists of a gasoline tank, piping, carburetor and intake manifold and air pump.

There is nothing connected with the tank or piping to get out of order or require much attention on the part of the driver. The chief consideration is to carefully strain all gasoline through a chamois skin and keep all dirt and foreign matter out of the tank.

The piping should be examined from time to time for leaks, as they are sometimes caused by the road vibration. If a leak occurs in the gasoline line it can be temporarily repaired with a piece of adhesive tape and some chewing gum. Smear the plastic gum over the leak and then bind in place with the tape. Gasoline will quickly leak through the tape alone. If chewing gum is not available, soap is the next best packing. Keep all joints tight.

AIR PUMP

The gasoline is driven from the tank to the carburetor by air pressure created by a small air pump located on the right side of the motor. The pump, Figure 17, consists of a small cylinder bolted to the crank case, and a piston which is held against a special cam on the cam shaft by a spring inside the pump cylinder. Ports are cut through the piston in such a manner that when it is as far as possible out of its cylinder it takes a charge of air from the inside of the crank case. As the cam turns around the piston is pushed in and compresses the air it contains until it reaches the end of its stroke when the exhaust port opens and allows the compressed air to flow to the gasoline tank where it exerts its pressure on the surface of the liquid and forces the fuel to the carburetor.

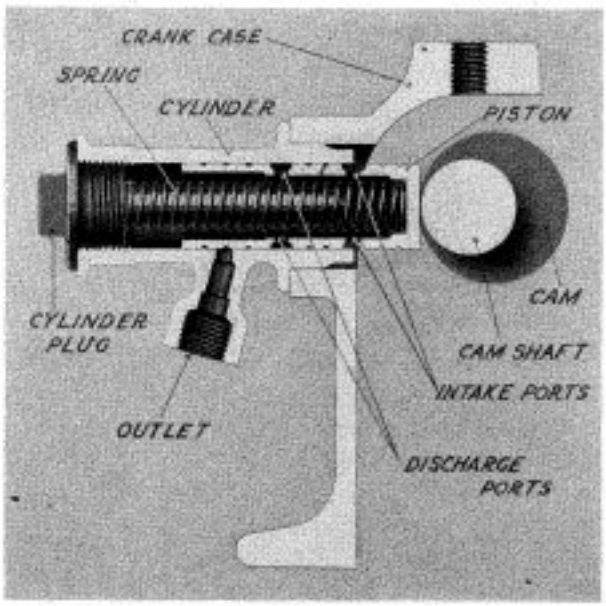

Figure 17.
Section through air pump.

THE CARBURETOR

The carburetor is the instrument that takes the raw gasoline and mixes it with the proper amount of air to form the explosive gas which is supplied to

the motor. It is located on the left hand side of the motor and connected by a flange to the intake manifold.

Complete instructions for the operation and adjustment of the carburetor will be found in the carburetor booklet which accompanies this.

MANIFOLDS

Both intake and exhaust manifolds are held on the left side of the motor by yokes. To remove, loosen the nuts and turn yokes slightly around, when manifolds will slip out easily. In replacing be sure to see that copper gaskets are in place first.

THE IGNITION SYSTEM

The charge of gas introduced into the cylinder by the fuel system is ignited by an electric spark which jumps across the gap between the points of the spark plug, located in the cylinder head on the right hand side.

The spark plug consists of a steel shell which is threaded to screw into the cylinder and a porcelain core containing a wire molded in its center. The wire ends in a terminal at its outer end and forms one of the points at the bottom. The other point is set in the steel shell and is in contact with the cylinder. To secure the best results, the points of the spark plug should be about $\frac{1}{32}$ to $\frac{3}{64}$ of an inch apart.

The electric current which is taken from the dry cell battery when starting and from the Delco generator, when running, is conducted first to a coil which "steps it up" or increases its voltage until it has enough energy to jump the gap at the plug, and is then sent through the distributor which times the point of ignition in each cylinder to the proper moment in the cycle.

The exact point in the cycle at which the spark occurs is governed by the spark lever on the steering wheel, and it may be either "advanced" or "retarded" depending on the speed of the engine.

For a complete explanation of the ignition starting and lighting system used on Buick cars, see the Delco Instruction Book.

COOLING SYSTEM

Buick automobiles are water cooled by what is known as the pump circulating system. Its operation is as follows:

Cool water is sucked from the lower portion of the radiator by a centrifugal pump located on the right side of the motor and driven by the pump gear meshing with the cam shaft gear in front of the crank case. The pump forces the cool water through the water inlet pipe to the bottoms of the cylinder jackets, where it absorbs the excess heat from the explosions. As the water becomes heated, it rises to the top of the jackets and finally flows off through

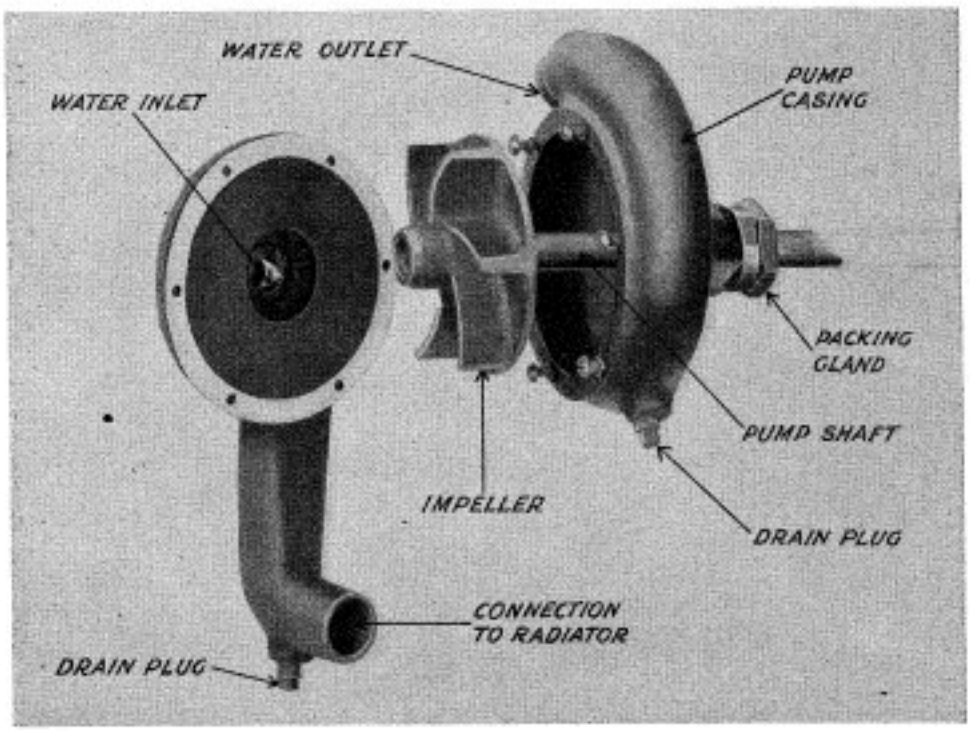

Figure 18.
Water circulating pumps with casing opened to show impeller

the water outlet pipe back to the radiator. Here it is circulated through small tubes around which a draft of air is maintained by the radiator fan, and rapidly loses its heat to the atmosphere. As the water becomes cooler it settles to the bottom of the radiator, is drawn off, and begins its circuit afresh.

WATER CIRCULATING PUMP

The pump, Figure 18, is of the centrifugal type and consists of a runner or impeller keyed to the shaft, and a loose fitting, air tight casing, with inlet and outlet passages cored in it. As the impeller revolves it sucks water from

the radiator to its center, and then by centrifugal force throws it off at the outer edges of the vanes and out of the casing to the cylinder jackets.

PACKING PUMP GLANDS

In order to keep the casing air tight, the pump shaft is carried in glands filled with wick packing. These glands should be tightened from time to time as they show indications of leaking, but care must be taken to keep them from binding the shaft. When the packing becomes worn out it is an easy matter to remove the nuts and renew it with prepared packing or candle wicking soaked in grease.

The grease cup on the forward gland should be given half a turn at frequent intervals.

RADIATOR FAN

In order to keep a draft of air blowing through the radiator, even when the car is standing still, a radiator fan is mounted on a spindle attached to the timing gear cover. The fan consists simply of a six bladed, sheet metal propeller driven by a leather belt. When the belt becomes too loose, it can be tightened by removing the wire staple, cutting off ⅛ inch of the leather belt and replacing. The grease cup on the fan spindle should receive daily attention.

THE RADIATOR

The radiator should always be kept full of clean water. Soft water is best when obtainable. If the car is to be laid up for any length of time, the radiator should be drained by opening the drain cock on the bottom, especially if there is any danger of freezing. The cylinder jackets should also be drained by removing the pipe plugs at the bottom of the jackets on the left hand side. Two drain plugs are also provided on the pump for this purpose. See Figure 18.

ANTI-FREEZE

In cold weather or the winter time, it is good policy to fill the cooling system with anti-freeze. A simple and effective anti-freezing mixture consists of half denatured alcohol and half water, with 4 to 6 ounces of glycerine added to prevent the alcohol evaporating too rapidly. This mixture will prevent freezing at a temperature of 20 degrees below zero.

CLEANING RADIATOR

A saturated solution of common soda in clean warm water introduced into the radiator once or twice a year will thoroughly clean it of all scale and sediment. Fill radiator with soda solution and allow motor to run for a few minutes to circulate it. Then drain and rinse carefully with clean water before filling again.

EXHAUST SYSTEM

The exhaust system begins with the exhaust manifold on the left side of the motor, and includes the exhaust pipe, cutout valve and muffler. The hot gases coming from the motor are led through the exhaust pipe to the muffler, Figure 19. The muffler is composed of three concentric sheet metal drums, so arranged that the gases are forced to travel the full length of each drum in turn, before reaching the atmosphere, thus losing their velocity and reducing the noise.

CUT-OUT VALVE

At the forward end of the muffler is located the cut-out valve. It is simply a large poppet valve opening from the exhaust pipe into the atmosphere, and operated by a foot pedal on the forward floor board. When the pedal is

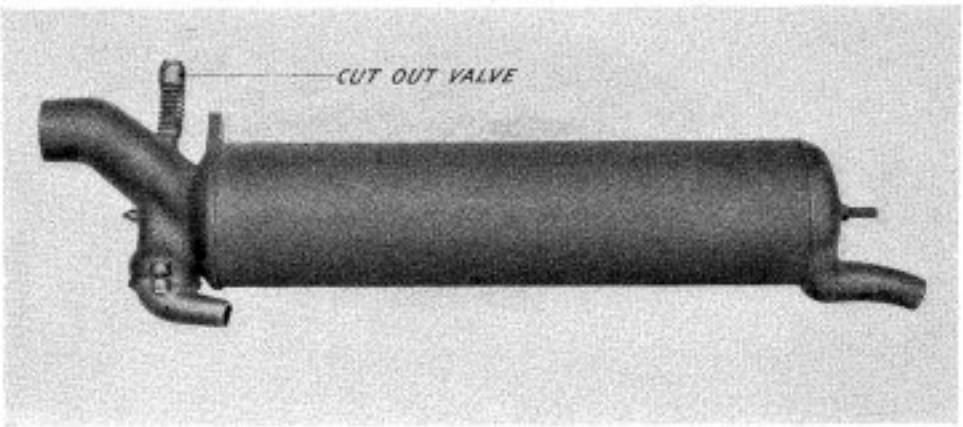

Figure 19.
Muffler showing cut-out valve

depressed the valve is lifted from its seat and the hot gases are allowed to escape directly to the atmosphere instead of first passing through the muffler.

The cut-out valve is provided principally to test the firing of the motor, and it should not be used as a warning signal or for amusement. When the motor is running at extremely high speeds, opening the cut-out valve relieves the slight back pressure caused by the muffler, but its use will not increase the power of the motor to climb hills on high gear.

No part of the exhaust system requires any particular attention on the part of the driver, and it should cause no trouble. If after long use the muffler should become filled with soot, it can easily be cleaned by first removing the rear end casting, which is held by a single bolt in the center.

THE CLUTCH

Because the gasoline motor cannot start under a load, it becomes necessary to provide it with some means of applying the load after the motor has been started and reached its normal speed. In the automobile this is accomplished by the clutch.

Buick automobiles are provided with leather faced, cone clutches, operating on the motor fly wheel, and actuated by the left foot pedal in the driver's compartment.

The clutch, Figure 20, consists of an aluminum cone, carried on a spindle attached to the fly wheel. The outer circumference of the cone is tapered and faced with leather. Three small coil springs, placed in sockets around the face of the cone, press the leather out slightly at these points. A large, heavy coil spring, enclosed in a sleeve behind the cone, forces the facing into contact with the fly wheel. At the rear end of the sleeve is a coupling which connects the clutch with the clutch shaft of the transmission. A bronze collar fits around a groove in the sleeve, and is connected by means of a yoke and levers to clutch pedal.

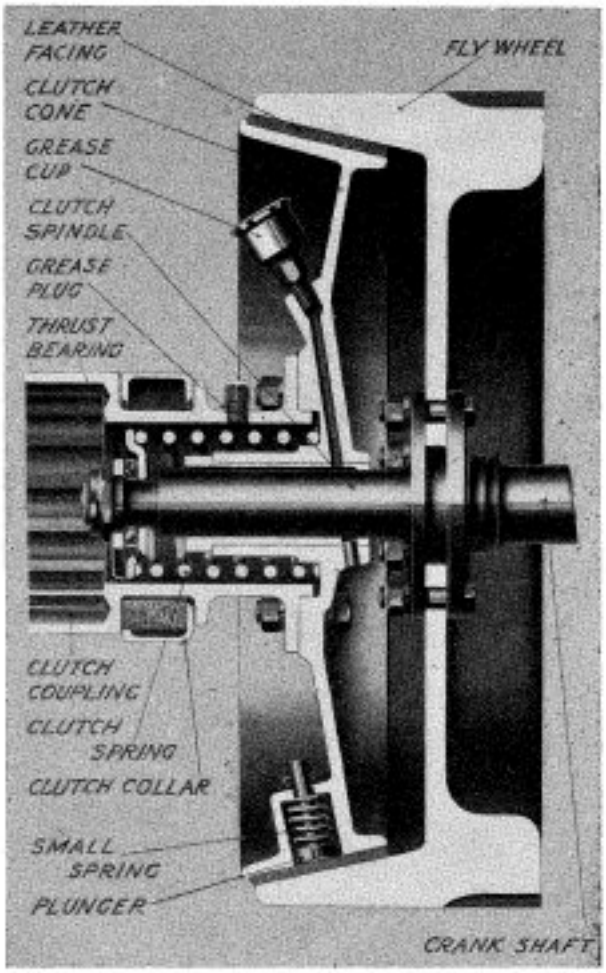

Figure 20.
Section through clutch showing construction.

The operation of the clutch is as follows: When the foot pedal is depressed it acts through the levers and yoke on the clutch collar, compressing the large spring and drawing the leather facing out of engagement with the fly wheel. The clutch now stands still and rides on the clutch spindle, while the motor is free to run without its load. As pressure on the foot pedal is released the cone moves back into engagement with the fly wheel, the raised portion

of the leather facing over the three small springs coming into contact first, and starting the clutch to revolve. Thus the motor gradually picks up its load.

When in full engagement the clutch and fly wheel turn as a unit, the clutch transmitting the power through the change speed gear and so on to the rear axle and road wheels.

SLIPPING THE CLUTCH

When the motor is picking up its load and starting the car, the clutch will always slip a little before taking hold, but under other circumstances, slipping the clutch intentionally should be avoided. Frequent slipping of the clutch tends to wear away the leather facing or else heats it until it becomes hard and brittle.

Except when driving in crowded traffic or maneuvering the car in close quarters, it is better to keep your foot off of the clutch pedal; otherwise there is a constant tendency to slip the clutch. Learn to control the car with the throttle, and keep your foot on the floor beside the clutch pedal where you can reach it instantly if necessary.

Access to the clutch for lubrication or inspection may be obtained by removing the cover of the aluminum housing immediately behind the fly wheel.

CAUTION—Do not put oil or grease in the clutch housing, as there is nothing for it to lubricate and it will simply cause the clutch to slip.

If, through abuse or neglect, the leather facing becomes hard and dry, a few drops of neats-foot oil applied at frequent intervals will soon soften it up and make it hold much better. If oil or grease gets on the clutch facing and causes it to slip, apply a little fuller's earth ground very fine.

There are no adjustments provided for on the clutch, and it will need none, as the heavy spring will automatically take up the wear on the facing. When the facing becomes entirely worn out, a new one can be applied by any Buick repairman. The position of the clutch pedal may be adjusted by withdrawing the cotter, slipping out the pin, and tightening or loosening the yoke on the link between the clutch pedal and the lever on the clutch release shafts. See that the lock nut is set back before completing the job.

A grease cup is provided on the clutch cone to lubricate the spindle when the clutch is withdrawn, and this should be turned down at frequent intervals. A pipe plug in the clutch sleeve permits the introduction of cup grease to lubricate the sleeve and the thrust bearing at its end.

THE TRANSMISSION SYSTEM

Properly speaking, the transmission system of a motor car includes all those parts which transmit the power from the engine to the rear wheels, such as the clutch, the gearset, the propeller shaft, the differential and the rear axle. Usually, however, the gearset alone is spoken of as the "transmission."

THE GEARSET

The gearset or change speed gear, is made necessary by a peculiarity of the gasoline motor. The power developed by a gasoline engine is almost directly proportional to the speed. In other words if a given engine develops 10 horse power at 500 revolutions per minute, it will develop approximately 20 horse power at 1000 revolutions. Hence, the higher the speed the greater the power.

On the other hand, the car frequently requires the most power when it is moving slowest, as when pulling up a steep hill or through sand or mud. At such times the requirements of the car for power to be delivered at a low rate of speed are directly opposed to those of the motor which will deliver more power only at a higher speed.

It is the transmission gearset or change speed gear which overcomes this apparent discrepancy by changing the ratio between the speed of the motor and the speed of the rear wheels.

Buick Models B36, B37, B38 and B55 are equipped with a selective sliding gearset, mounted as a unit with the motor. It consists essentially of two shafts, mounted one above the other, in an oil tight casing as shown in Figure 21. On the lower, or counter shaft, are four gears of different sizes, B, C, D, and E, Figure 21, all of which revolve together. The upper shaft is divided between gears G and A, and the two parts are free to turn independently of each other. The part to which gear A is attached connects with its forward end to the clutch, and the squared part to which gears F and G are attached is connected at the rear to the propeller shaft. Gears F and G are fitted to the squared part of the shaft and have grooves turned in their hubs to receive the shifter forks by which they are moved back and forth along the shaft. At one side of the lower shaft is mounted another gear H, which is constantly in mesh with gear E on the lower shaft.

NEUTRAL POSITION

As shown in Figure 21, the gearset is in the neutral position and neither of the sliding gears F or G is in mesh with another gear. When the clutch is engaged with the fly wheel, gear A turns to the **right** with the engine. Gears A and B are always in mesh and are known as the fixed reduction gears. Since all the gears on the lower shaft are connected to gear B they all turn to

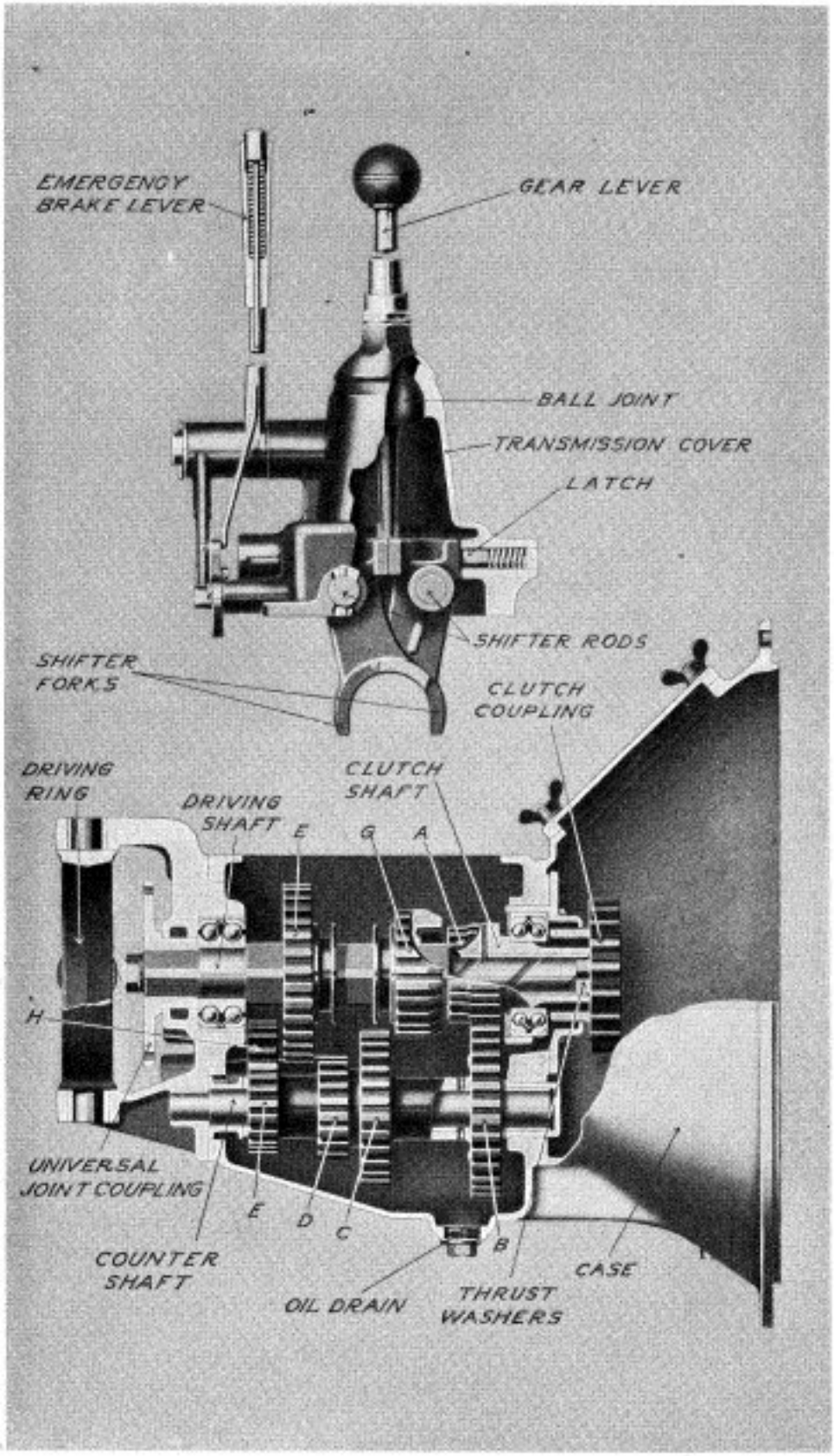

Figure 21
Transmission gearset, showing interior construction

the **left.** These gears and gear H run all the time the clutch is engaged, but gears F and G are stationary as long as the gearset is in the neutral position.

FIRST SPEED POSITION

To cause the engine to turn the rear wheels and start the car, it is necessary to shift the gears and the operation is as follows:

When the gear lever is shifted into first speed, gear F is drawn forward on the squared shaft until it meshes with gear D. Now the power of the motor is transmitted through gears A, B, D, and F to the propeller shaft and rear axle, and both A and F turn to the **right,** though at different speeds. In this position the total gear ratios of the B37 are such that the engine turns over 13.44 times for every revolution of the rear wheels. Hence the motor can run at a high speed and develop a large amount of power while the car may be just starting or moving very slowly.

INTERMEDIATE SPEED POSITION

As the car gains speed and less power is required to drive it, the gear lever is shifted to the intermediate or second speed position, and gear F is moved back **out** of mesh with gear D to the position shown in the cut, while gear G is moved **into** mesh with gear C. The power is now transmitted through gears A, B, C, and G, and the engine makes six revolutions for every revolution of the rear wheels.

HIGH SPEED POSITION

Gear G is provided with teeth on the **inside** of its rim in front, as well as on its face, and when the car has gained sufficient headway, the gear lever is shifted to the high or third speed position, gear G is drawn **out** of mesh with gear C and slipped **over** the teeth on the rear end of gear A. This locks the two parts of the upper shaft solidly together and both turn to the **right** at the same speed, transmitting the power straight through from the engine to the propeller shaft. The gears on the counter shaft continue to turn but without doing any work. In this position the car is said to be in direct drive, and the engine of the B37 only turns over 4 times for each revolution of the rear wheels, which is the fixed gear ratio of the rear axle.

REVERSE POSITION

To reverse the motion of the car the gears are all set back to neutral, and then gear F is slid back to mesh with gear H, which is already meshed with gear E. Power is now transmitted through gears A, B, E, H, and F in the order named. Gear A revolves to the **right,** gears B and E to the **left,** gear H to the **right** again, and gear F now to the **left,** thus reversing the motion of the propeller shaft. In this position the engine revolves 17.28 times for each revolution of the rear wheels and this extreme reduction makes it possible to back the car out of places where it cannot be moved forward.

The transmission gears are made of chrome nickel steel and have very short, strong teeth. The teeth are also sharpened on the edges to make them

slide into mesh with each other more readily, but care must be taken to always withdraw the clutch before shifting to prevent the rapidly moving edges of the teeth from grinding against each other before they go into mesh.

GEARSET LUBRICATION

The lower part of the gear case is always kept filled with oil, and the gears on the counter shaft, which run in it all the time, splash it over the interior of the gear case and onto all the gears and bearings.

THE GEAR LEVER

Movement of the sliding gears in the gearset is controlled through the gear lever, which, with the shifter rods and forks, is attached to the cover of the gear case. The gear lever is pivoted on a ball joint and projects down to the shifter forks which are carried on two rods set side by side in the gear case cover and arranged so that they can move back and forth with the gears. The forks extend down into the gear case and fit into the grooves cut on the hubs of the sliding gears.

When the gearset is in the neutral position, the gear lever stands perfectly vertical with its lower end held by a spring latch in a transverse slot cut across the tops of the shifter forks, as in Figure 21. The operation is as follows:

As the top of the gear lever is moved side ways, the lower end swings across the transverse slot into a notch in one or the other of the shifter forks. Then, as the lever is moved forward or back, it carries this shifter fork with it, which in turn slides one of the gears on the squared shaft. The spring latch locks behind the forks when the gears are in mesh and prevents them from jumping out until the lever is moved again.

EMERGENCY BRAKE LEVER

An extension on the right side of the gear case cover carries the emergency brake lever and its ratchet. It is locked in position by a spring operated pawl engaging with the ratchet, and is released by pressing the button in the top of the handle.

DRIVING RING

In models B-36, B-37, B-38 and B-55, the rear end plate of transmission case carries a yoke, Figure 21, to which is attached the driving ring. This is a heavy forged steel ring having four studs formed on its outer circumference at 90° angles. Two of these studs fit in bearings on the yoke, while the rear axle is attached by another yoke to the two opposite studs. The driving ring thus absorbs the torque reaction of the rear axle and also transmits the tractive effort of the rear wheels to the frame of the car.

UNIVERSAL JOINT

The transmission gearset is held directly to the motor, but the rear axle is hung on springs and must be free to follow the inequalities of the road.

In order to allow a steady and continuous transmission of power between the stationary and moving parts, a universal joint, Figure 22, is inserted in the transmission line just behind the gearset.

The universal joint consists principally of a cross, the arms of which constitute four bearings. A yoke attached to the squared shaft of the gearset is connected to two of these bearings on opposite sides of the cross, while another yoke fits over the other two. The second yoke has a squared hole in it into which the squared forward end of the propeller shaft fits.

The whole mechanism is enclosed in a sheet metal case which is kept packed with cup grease through a hole in its circumference ordinarily closed with a plug.

The joint allows motion of the propeller shaft in any direction without interruption of the turning effort.

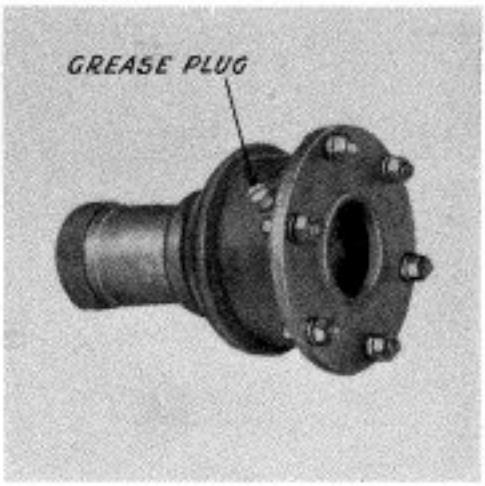

Figure 22
Universal joint showing plug for grease

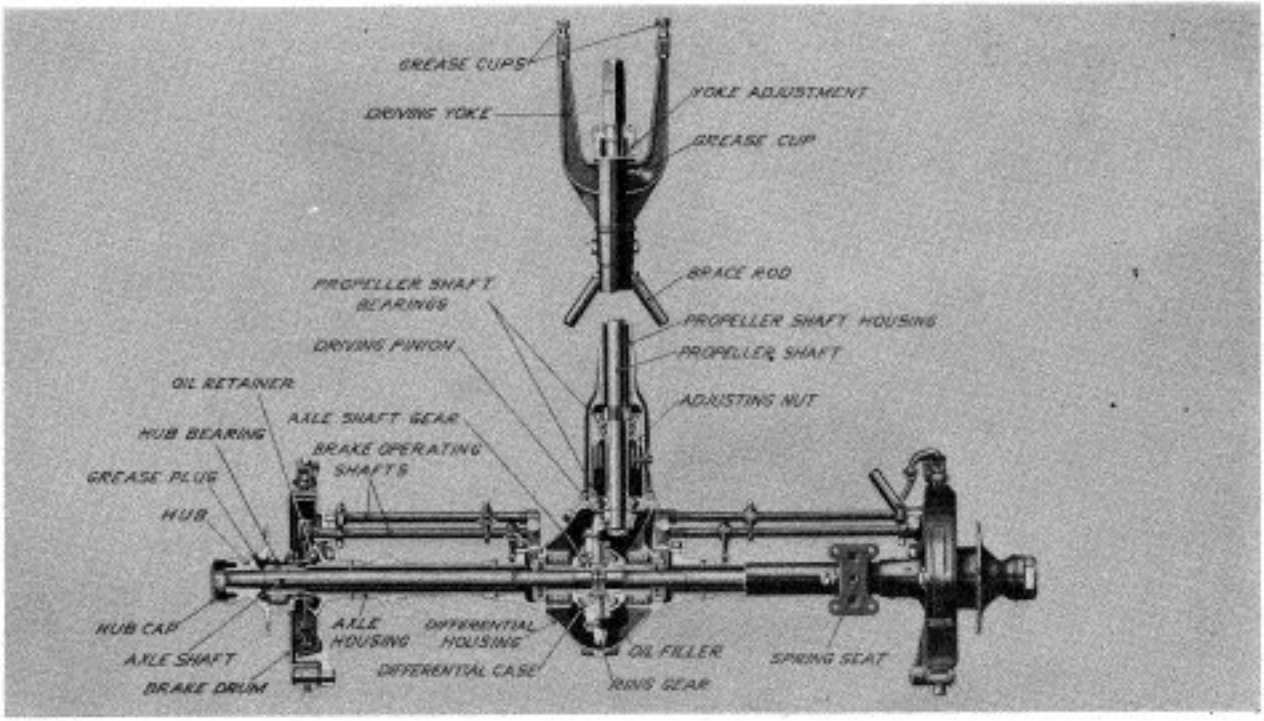

Figure 23 Plate I
Section through B36-B37 rear axle and propeller shaft, showing construction

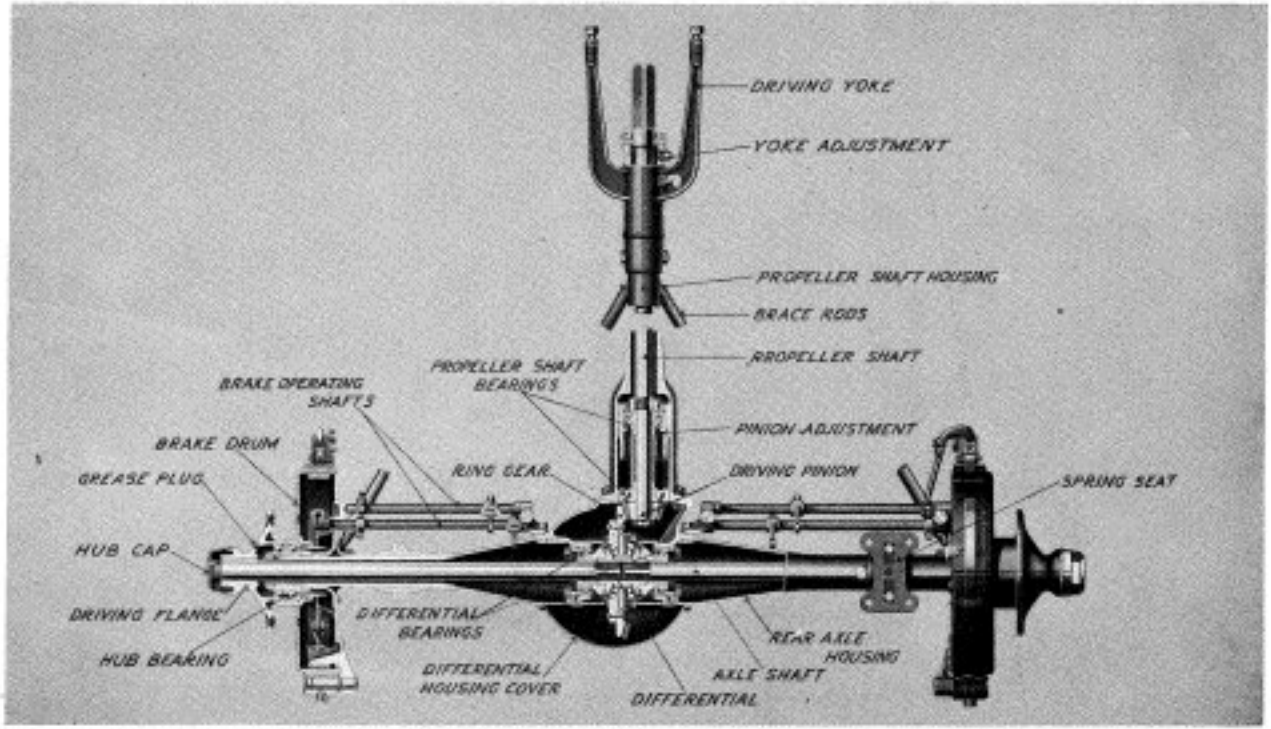

Figure 23. Plate II.
Section through B55 Rear Axle, showing construction

THE REAR AXLE

The rear axle assembly, which includes the propeller shaft, axle shafts, differential, brakes, and bearings, constitutes the final element in the transmission system, and applies the power to the rear wheels.

The rear axle used on Buick cars, Figure 23, is of the floating type, and consists essentially of the parts named above, most of which are enclosed in an oil tight housing and suspended from the frame by springs.

PROPELLER SHAFT

The propeller shaft is a heat treated alloy steel shaft, the forward end of which is squared to fit the universal joint. On its rear end is keyed the bevel driving pinion which meshes with the ring gear of the differential. The shaft runs on ball bearings and is provided with thrust bearings to take the thrust of the bevel gear drive. The shaft and its bearings are tightly enclosed in a heavy steel tube fitted with flanges at each end, the rear one being bolted directly to the differential housing. This tube also absorbs the torque created by the bevel gear drive. See Figure 23. Plate I.

THE DIFFERENTIAL

The differential, or differential gearing as it is sometimes called, is the mechanism which allows one rear wheel to revolve faster than the other when the car is turning a corner, and equalizes the amount of power applied to the rear wheels, so that both will exert the same tractive effort in propelling the car.

The differential, Figure 24, consists essentially of a case, made in two halves and bolted together in the center. A bevel axle gear runs on a bearing in each half of the case, and four small bevel pinions, or differential pinions, arranged in a circle, mesh with both axle gears. The differential pinions are carried on four studs which project from a ring or spider which runs on the hubs of the axle gears, and the ends of the studs are clamped between the two halves of the case. The axle gears are provided with square holes in their hubs into which the ends of the axle shafts fit. The whole case runs on two roller bearings in the differential housing and is riveted to the ring gear which meshes with the driving pinion. Its operation is as follows:

When the car is moving straight ahead, the driving pinion turns the ring gear, case, axle gears, and differential pinions as a unit with the axle shafts and wheels, all the gears within the case remaining stationary in relation to the case. But when the car turns a corner, the axle gear attached to the inside wheel begins to lag in relation to the case, setting the small differential pinions in motion about their studs, and thus increasing the speed of the other axle gear and the outside wheel. Thus the case continues to turn at the same speed while one axle gear within the case turns slower and one faster, the difference being equalized by the small differential pinions.

This also explains why, when both rear wheels are jacked up, turning one wheel by hand will cause the other to revolve in the opposite direction; and also why, when one wheel is held with the engine driving the axle, the other wheel will double its speed in the same direction.

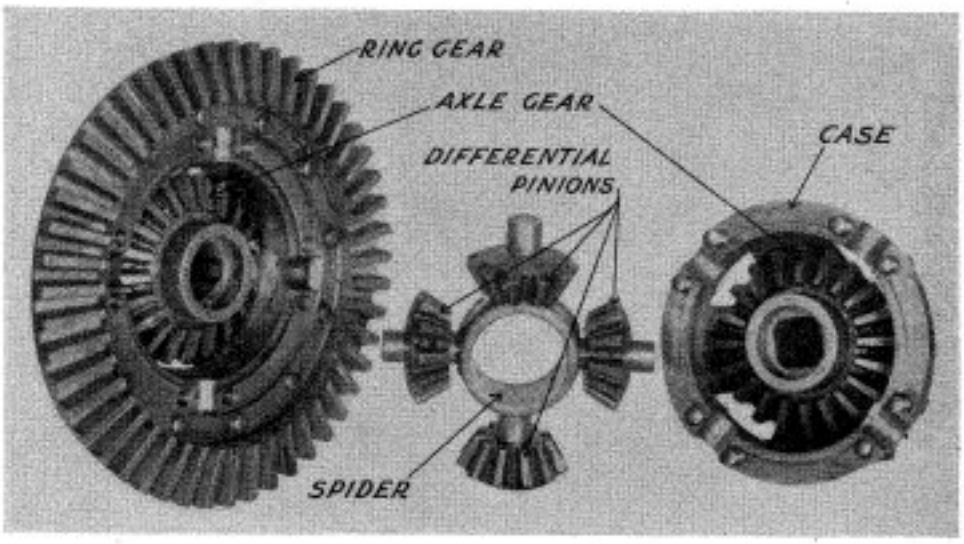

Figure 24
Differential case opened to show gears and bearings

The differential, differential bearings and axle shafts are all contained in the rear axle housing, and a plug on one side allows the introduction of oil, so that gears and bearings run in a continual bath of oil.

WHEEL HUBS

The outer ends of the axle shafts are tapered to receive the wheel hubs which are held in place by keys and lock nuts. Ball bearings on the inside of the hubs run on the tubes which form the outer ends of the rear axle housing, so that all the weight of the car is carried by this housing and the axle shafts transmit only the driving effort. The hub bearings are lubricated with cup grease introduced through a plugged hole in each hub.

On the Model B-55 the axle shafts may be removed by removing the nuts on the spoke bolts and drawing the driving flange and shaft straight out. It is not necessary to jack up the axle to remove these shafts.

BRAKES

Brake drums are attached to the inside of the wheels and the brakes are carried by brake flanges near the ends of the rear axle housing, Figure 25. There are two sets of band brakes, one of which contracts around the drums while the other set expands against the circumference of the drums from the inside.

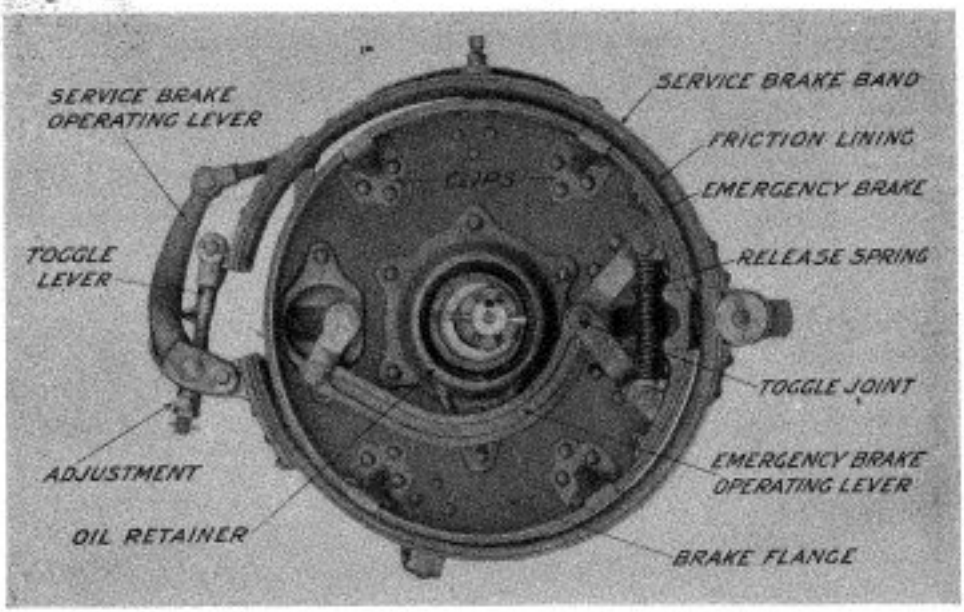

Figure 25
Brake flange, showing service and emergency brakes and adjustments

SERVICE BRAKES

The service brake is the external one and is composed of steel band, lined with an asbestos friction fabric, which extends around the outer circumference of the drum, Figure 25. A clip at the top holds the band in position on the flange and prevents its dragging on the drum when not in use. Opposite the forward portion of the drum the band is split and a toggle lever introduced, which is connected by links and levers to the brake rod from the foot pedal.

When the pedal is depressed the toggle lever is pulled forward, contracting the band and applying a heavy friction load to the drums and rear wheels.

An adjustment is provided at the toggle lever whereby the ends of the brake band can be brought closer together as the lining gradually wears away, and a threaded yoke on the rear end of the brake rod allows for adjustment of the pedal position. Care should be taken when adjusting brakes to see that both brakes are adjusted alike, or else one will do all the work and perhaps cause the car to skid.

EMERGENCY BRAKES

Another set of asbestos lined steel bands located inside the brake drums and acting on the inner circumference of the drums, constitute the emergency brakes. They are operated by toggle levers in much the same way as the external brakes, except that the action of the toggle is expanding instead of contracting. There are no adjustments on the emergency brake toggles as

they are seldom used and wear but little, but the length of the rods may be adjusted at the yokes to change the throw of the lever as in the foot brakes. The emergency brakes are operated by a hand lever which latches in position so that they will remain set when the driver leaves the car.

CARE OF BRAKES

The type of brakes used on Buick automobiles has been so carefully worked out that they require very little attention on the part of the driver. An occasional drop of oil on the joints of the rods and levers will prevent them from rusting and squeaking. When the brake linings become entirely worn out after long service they can easily be renewed by any Buick repairman.

The brakes are provided with oil guards so arranged that it is practically impossible for any oil or grease to get on the brake bands, but should this ever occur, a little fuller's earth introduced carefully between the bands and the drums will absorb the oil and make the brakes hold again.

SPRING SEATS

The spring seats are located on the axle housing tubes between the brake flanges and the differential housing. They consist of forged collars fitted to the tubes and held from working sideways by pins working in slots at the bottom. They are free to oscillate on the tube with the action of the springs, and grease cups are provided for their lubrication. The springs are bolted down to the pads on top of the collars with spring clips.

BRACE RODS

Three brace rods stiffen the axle against the road shocks. One of these passes between the brake flanges under the differential housing, stiffening the tubes. The other two join the brake flanges to the forward end of the propeller shaft, thus forming a triangular truss to keep the rear axle and propeller shaft at right angles to each other.

GEAR ADJUSTMENT

There is but one important adjustment in connection with the rear axle, and that governs the mesh of the driving pinion and the ring gear. If the gears make an unusual amount of noise or a peculiar growling sound arises from them, it is a sign that the gears are slightly out of mesh. Correcting them is really a repair shop job and the car should be taken to the nearest Buick repairman, unless the owner is an experienced mechanic, in which case the adjustment can be changed as follows:

On Models B36 and B37 remove inspection plate on left half of differential housing, just behind rear propeller shaft flange, or inspect by painting ring gear through oil filler hole. Determine which way pinion must be moved to correct mesh.

Next, remove small inspection plate on rear propeller shaft flange exposing capstan adjusting nut.

If pinion is to be moved toward center of ring gear, turn adjusting nut to left. If pinion is to be moved away from center of ring gear turn nut to right. Replacing inspection plate locks the adjusting nut in position so that it cannot jar loose.

On Model B-55, the position of the ring gear may also be adjusted by removing the differential gear cover at the rear, and turning the adjusting nuts thus exposed either to the right or left as the case may be. Be careful to turn both nuts an equal amount so as not to disturb thrust adjustment. Replace locking fingers before closing case.

YOKE ADJUSTMENT

The driving yoke on the forward end of the propeller shaft housing may be adjusted when it becomes warm or loose by means of the clamp nut on forward end.

FRONT AXLE

The front axle carries the weight of the forward part of the car, and at the same time allows the front wheels to turn in response to the action of the steering gear in order that the car may be guided along the road.

It consists essentially of a drop forged steel beam, Figure 26, with yokes at each end. The steering knuckles fit into these yokes and turn on king bolts which hold them in place. The wheels revolve on spindles attached to the knuckles and are carried on two rows of ball bearings in each hub. To

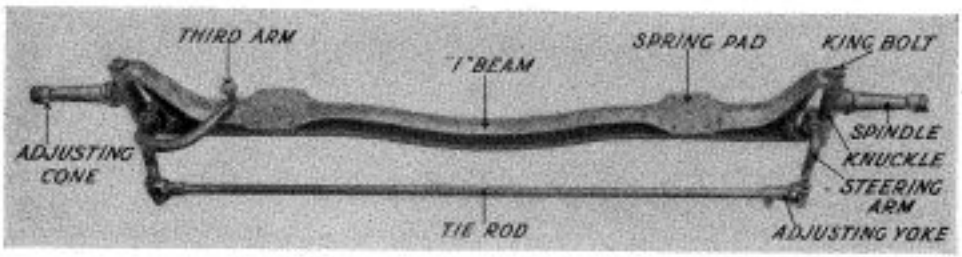

Figure 26
Front axle, showing steering mechanism and adjustments

the knuckles are attached short steering arms which are connected together behind the axle by the tie rod. The left hand knuckle has a third arm which ends in a steel ball and this is connected to the drag link of the steering gear. Grease cups are provided on the king pins and on the tie rod bearings. The operation is as follows:

OPERATION

When the steering wheel is turned, the drag link moves the ball ended third arm forward or back, at the same time swinging the steering knuckle, spindle and wheel in an arc about the king pin. As the left wheel swings it acts on the right one through the tie rod and compels it to swing in the same direction. On account of the steering arms being set at an angle, however, the two wheels do not swing an equal amount, because the outer one has to describe a slightly larger circle than the inner one.

The axle is suspended from the frame by the front springs, which are clipped to the spring pads on the beam.

CAMBER AND GATHER

It will be noticed that the front wheels do not stand quite straight, but that they are closer together at the bottom than at the top, and that they "toe in" slightly in front. The amount of divergence from the vertical is known as the "camber," and the amount they toe in as the "gather" of the wheels. The camber causes the points of road contact to fall more nearly under the centers of the king bolts and thus makes the car steer easier, while

the gather is given to the wheels to offset the effect of this camber and make the tires wear more evenly.

To get the proper amount of camber and gather the wheels in Buick Models B36-B37-B38 should measure 2¼ inches closer at the bottom than the top, and ½ inch closer at the front than the rear. On the B55, the wheels should measure 2½ inches closer at the bottom than the top, and ⅝ inch closer at the front than the rear. These measurements should be taken between the inner edges of the rims, and at diametrically opposite points on the circumference.

ADJUSTMENTS

If, through an accident, the tie rod or steering arms should become bent, the amount of gather may be adjusted by removing the pin in the right tie rod joint, and turning the yoke to the right or left on the tie rod before replacing it.

The wheel hubs contain a hollow space which is packed with grease, so that they require very little attention, but new grease must be introduced occasionally, and then it becomes necessary to remove the wheels. To do this, first remove the hub cap. Then draw cotter pin and remove the lock nut. Now the outer spindle cone may be removed by turning it with a pin. Note that the nut and cone on right hand wheel have right hand threads, while those on left hand wheel have left hand threads. Don't get them mixed.

In replacing the wheel, the outer cone should be turned up until the wheel has no perceptible shake or side play on the spindle, but still runs so freely that the weight of the valve stem is sufficient to turn it. Replace lock nut, cotter pin and hub cap.

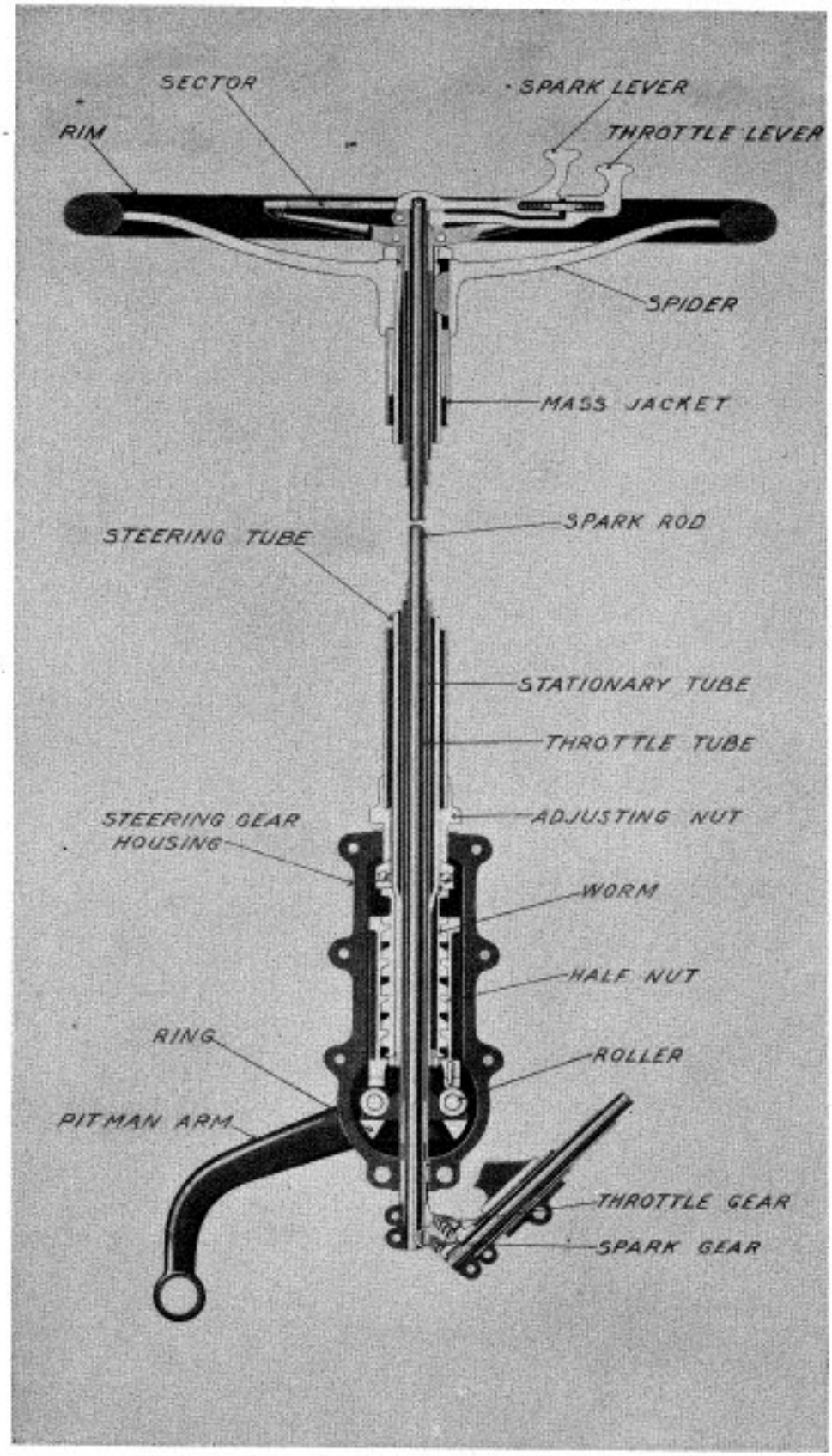

Figure 27
Section through steering gear showing construction

STEERING GEAR

The steering gear is the part of the car that operates on the front axle to turn the road wheels in response to the movements of the hand wheel. Buick automobiles are equipped with an irreversible steering gear of the worm and nut type.

The steering gear consists essentially of the steering tube, Figure 27, to the upper end of which is attached the hand wheel, while the worm is keyed to the lower end. The worm meshes with two half-nuts in the housing, one of which has a right hand thread and the other a left hand thread. The ends of the half-nuts bear against two rollers attached to a yoke on a short shaft which projects out beyond the frame, and to the other end of this shaft is attached the pitman arm, which is connected to the third arm of the front axle by the drag link. The operation is as follows:

Turning the hand wheel also turns the tube and worm in the same direction, and as the worm turns one half-nut rises while the other descends. This pushes one roller down and allows the other to rise, thus turning the shaft and imparting the desired motion to the pitman arm, and so on to the road wheels.

The steering gear is said to be irreversible because, while the motion of the hand wheel is readily transmitted to the road wheels, the jarring of the road wheels over rough and uneven surfaces does not affect the hand wheel.

The worm, yoke, rollers and half-nuts are all enclosed in an oil tight housing which is bolted to the left side of the frame, and a ball thrust bearing in the upper end of the housing takes the thrust of the worm. The housing is kept constantly packed with grease and a pipe plug is provided on top for its renewal. A grease cup on the outer end of the shaft helps to lubricate the long bearing on the left side.

SPARK AND THROTTLE

Between the housing and the hand wheel, the steering tube is enclosed in a large nickeled jacket, which is fastened by a bracket to the dash and floor boards.

The stationary sector, on which the spark and throttle levers operate above the steering wheel, is carried on a small stationary tube inside the steering tube. The throttle lever is fastened to another and smaller tube, while the spark lever operates a rod in the center of the group. Thus all the controls are enclosed in the steering column. At the bottom the motion of the spark and throttle levers is transmitted to the proper rods through small bevel pinions and gears carried on a bracket attached to the steering gear housing.

ADJUSTMENT

Besides keeping the housing packed with grease, there is just one adjustment on the steering gear. This is the nut which screws into the upper end of

the housing around the jacket. Tightening this nut acts on the ball thrust bearing and takes up all the back lash in the hand wheel. It should always be kept so tight that the wheel can move only an inch or so before affecting the road wheels. Too much back lash is dangerous.

SPRINGS

The springs are interposed between the axles and the frame to absorb the jars and shocks before they can be transmitted to the more delicate parts of the mechanism or to the passengers.

The springs consist of thin leaves of steel, graduated in length, and laid, one on top of the other, the longest leaf being attached to the frame by shackle bolts. The springs are held down on their seats by heavy clips passing around them at their centers, and a small bolt holds them from shifting longitudinally. Small clips hold the leaves together near their ends.

Semi-elliptic springs are used in front on Buick automobiles, but at the rear another half-spring is transposed over the whole one, making what is known as a three-quarter scroll elliptic rear spring. These springs are somewhat more flexible than the front ones.

Each bolt in the spring shackles is fitted with an individual grease cup by which the joints are lubricated, and if squeaks develop in spite of this constant lubrication, it is a good plan to introduce a little graphite and oil between the leaves. This can be done by jacking up the frame of the car and prying the leaves apart with a screw driver after removing the small clips near the ends, while the lubricant is introduced with a thin bladed knife.

BROKEN SPRINGS

The springs are carefully tested before the car leaves the factory, and aside from occasional lubrication should cause the driver no trouble. Careless driving is responsible for 99 per cent of the broken springs reported. Jumping the car over high culverts and across ditches while driving at a high rate of speed will break any spring that was ever made. If you don't want broken springs, don't drive fast over unfamiliar roads.

To repair a broken spring, it is necessary to jack up the frame of the car to remove the weight from the spring and axle. The spring can then be removed by taking off the shackle bolts and clips. If only one leaf is broken it may be replaced by removing the center bolts and small clips. In replacing springs, be careful to see that the clips are pulled up snug and tight as a loose clip will cause a broken spring very quickly.

Broken springs are usually the result of speeding. Don't speed.

WHEELS

The wheels used on all Buick cars are of the artillery type, in which the spokes all meet in the center and are bolted between the flanges of steel hubs. The front wheels have ten spokes and the rear wheels twelve. The rear wheels also carry steel brake drums, on the circumference of which the brakes act. On the outer rim of the wooden wheel is shrunk a steel band known as the felloe band, which forms the foundation for the demountable rim.

The wheels should be kept clean and free from mud and oil as much as possible, but otherwise they will require no attention.

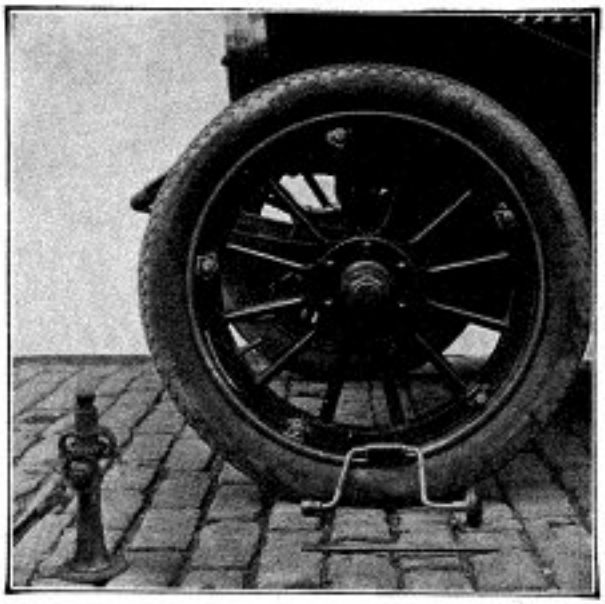

Figure 28

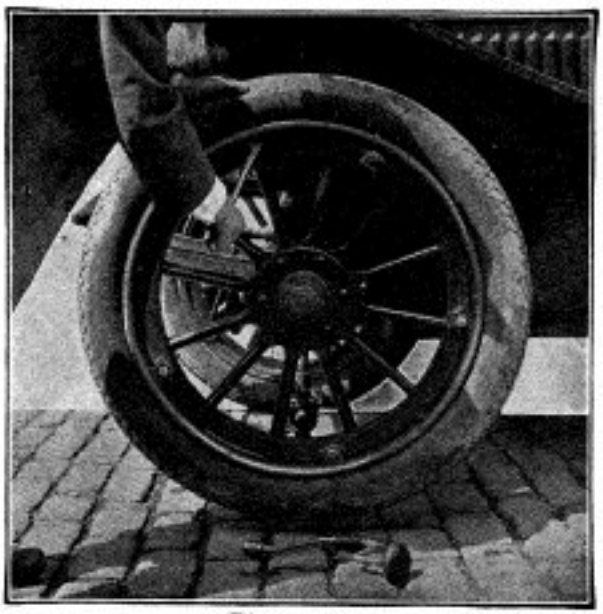

Figure 29

RIMS

The rims used on Buick cars are known as the Baker Bolted-On type, and are demountable; that is, rim, tire and all may be removed from the wheel without deflating the tire, and a fully inflated tire put on.

The rim consists essentially of a split steel band, flanged to fit the base of the tire, which is slipped on over the steel felloe band and held by five or six bolts and tapered lugs or wedges, located at equal intervals about the circumference. The advantage of this arrangement lies in the fact that a punctured tire may be removed, rim and all and replaced with a fully inflated

one already attached to its rim, without pumping or removing the tire from the rim. An extra rim is part of the car's regular equipment. The operation is as follows:

TO REMOVE RIM

Before jacking up the car, loosen all the bolts except the two nearest the valve stem(one on either side) until the wedges swing out of the way. Screw up the bolts in this position, Figure 28, enough to hold the wedges from swinging back. Loosening the bolts before jacking up the wheel simply causes the weight of the car to hold the wheel steady while you are working on it.

Figure 30

Then put the jack under the axle as in Figure 29. Insert the point of the tire tool between the rim and felloe band opposite the valve stem, and force the end held in the hand toward the hub of the wheel. This will pry the rim off the wheel at this point, and by revolving the wheel until the valve stem is down, the rim can be slipped off entirely without lifting it.

TO REPLACE RIM

To put the extra tire and rim in place, revolve the wheel until the valve stem hole is up; then insert valve stem and again revolve until the valve stem and the two stationary wedges are nearest the ground. Now remove the jack and throw the weight of the car on the rim at this point, Figure 30.

Back out all the bolts which were loosened far enough to allow the wedges

Figure 31

Figure 32

Figure 32, so that the end of the cut farthest from the valve stem is up. Remove the anchor plate, then, beginning at the short end of the rim which does not have the valve stem, insert the sharp end of the tire tool under the bead of the tire.

Figure 34

Now turn the rim and tire entirely over as shown in Figure 34, and force the tire tool between both beads of the tire and the rim. This entirely frees one end of the rim.

As in Figure 35, take the free end of the rim in the hands, and, holding the tire with the foot, pull the rim entirely out of the tire.

to be turned back into place. Then tighten the bolts until the little studs on the inside edge of the rim rest on top of the felloe band. If they do not slide on easily, insert the tire tool as in Figure 29 and pry the studs onto the band.

TO REMOVE TIRE FROM RIM

To take the rim out of the tire, lay the rim and tire flat as in

Figure 33

Force down the end of the tire tool held in the hand as in Figure 33. This pulls the end of the rim out of the tire. It will be noted that in this operation, the two short sides of the rim are brought together, thus reducing the circumference of the rim. Repeat the operation shown in Figures 32 and 33 as often as necessary, inserting the tire tool about six inches further around each time.

Figure 35

Figure 36

inserted, put both beads of the tire entirely into the end of the rim that has been raised up for a distance of about six inches. Be sure that the other end of the rim is still under both beads of the tire.

Being sure that the beads of the tire are properly started and that the tube is not being pinched, follow all the way round putting both beads en-

Figure 38

to the rim put the anchor plate in position and screw down the valve stem nut when the tire is ready to be inflated.

NOTE—Before putting the rim into the tire rub a paste made of powdered graphite and water on the beads of the tire. This prevents them sticking to the rim.

TO REPLACE TIRE ON RIM

To replace the tire on the rim first insert the new tube slightly inflated, and note that it lays smooth and even all around. Lay the rim flat on the floor with the tire on the rim as in Figure 36. Raise the end of the rim that has been drilled for the valve stem and after the valve stem has been

Figure 37

tirely 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 and hard to force on by hand use tire tool as shown in Figure 37.

Having fitted the tire properly

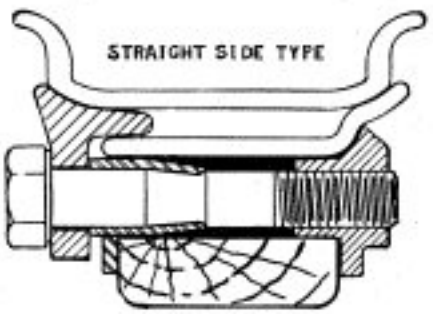

Figure 39
Showing construction of demountable rims.

When driving in the country an extra fully inflated tire should always be carried on the spare rim where it will be ready for instant use.

TIRES

The pneumatic tire has made the motor car possible by providing a shock absorbing medium next to the road which eliminates the greater portion of the road shocks and vibration before they can reach any of the mechanism. Air is an ideal medium for this purpose because a shock or blow applied to the tire at any particular point is distributed at once throughout the entire structure, the resulting pressure being equal at all points. No tire filler, airless tire, or spring wheel can duplicate this action of the air and we cannot guarantee Buick cars when any of these devices are used.

The tires used on Buick automobiles are of the straight wall type. They are constructed essentially as follows:

CONSTRUCTION

Around two circular wire cables or "beads" which form the foundation several layers of heavy cotton canvas or "friction" fabric is wrapped in the shape of the tire. The canvas is impregnated with rubber gum and forms the "carcass" of the tire. Next, an extra thickness of compounded rubber known as the "cushion" is applied around the outer circumference of the carcass and held firmly in place by a double layer of canvas known as the "breaker strip". Outside of this comes the heavy layer of tough rubber called the "tread" which is the portion of the tire that actually meets the road and takes most of the wear. The whole structure is then vulcanized together to make it virtually a solid unit.

Into this tire "shoe" or "casing" fits the "tube" which is simply a circular rubber bag with a check valve which allows the introduction of air. The tube and its casing are fitted over a flanged rim in such a way that when the pressure is applied the wire beads grip the rim securely and the flanges prevent the tire rolling off side ways.

CARE OF TIRES

Expert tire repair men contend that about 75 per cent of all tire waste may be traced to the practice of running tires without sufficient air in them. Under inflation is the immediate forerunner of early deterioration and the motorist who permits this abuse to become a habit is certain to find his tire bills far in excess of what they should be.

Bear in mind that the side walls of your tires are their thinnest part. A heavy strain is imposed at this point when the tires are under load. It is here that most of the bending action takes place. If a tire is only partially inflated this action becomes abnormally severe and when an obstruction is encountered, the carcass is broken down, the fabric being torn along both sides of the tread so that a blow-out is bound to occur.

USE A GAUGE

The only certain way to determine whether your tires have enough air in them is through the use of a reliable air pressure gauge. You cannot tell by

kicking, feeling, or observing the degree to which a tire flattens at the point of contact at the road. A tire may appear to be round and have only 45 pounds of air in it when it should have 90 pounds.

The following is a list of the proper inflation pressures for various sizes of tires:

2½ inch tires	50 pounds
3 inch tires	60 pounds
3½ inch tires	70 pounds
4 inch tires	80 pounds
4½ inch tires	90 pounds
5 inch tires	100 pounds
5½ inch tires	110 pounds

A simple way to remember the above table is this: twenty pounds of pressure per inch of tire.

PUNCTURES

Of course you cannot prevent punctures. They are bound to happen at least once in a while. You can, however, lessen the liability of getting a puncture by keeping plenty of air in your tires. An under inflated tire is far more apt to pick up a sharp object than one which remains perfectly round under load.

When you get a puncture, STOP! You can't run on a flat tire, even for a short distance without seriously damaging it or ruining it completely. The grinding that takes place between the road and the rim when a tire is deflated is too great for any combination of rubber and fabric to withstand.

BRUISES

A bruise is an injury to the carcass of a tire caused by violent contact with an irregularity which tears the fabric. Usually the injury does not show at once. However, the structure of the tire is permanently weakened at the injured spot and eventually a blow out will occur. Even the most careful and skilful driver cannot avoid bruises altogether. But if your tires are properly inflated and you strike an obstruction, the tire has the resiliency of the air behind it to aid in resisting the impact of the blow, and the effect is likely to be less serious.

OVERLOADING

Excessive weight on a casing will break down the fabric in the side walls and if persisted in a blow-out is apt to result. When this occurs the casing is likely to be so badly damaged as to be beyond repair. If your roads are are very rough and stony, or you are carrying heavy weights in your car, we suggest that you equip with a set of extra size tires. You can get larger tires which will fit your rims.

CUTS

No one has ever seriously questioned the statement that "a stitch in time saves nine". Therefore a few moments spent in examining your tires at odd times is sure to prove a good investment. Whenever small cuts appear in the tread they should be attended to immediately, and filled with cement before the hole admits sand and dirt which in time will bring about the separation of the tread from the fabric. The only way to guard against such trouble is to examine your tires from time to time, and when a cut is discovered, see that it is properly vulcanized at a reliable repair shop at once.

SAND BOILS

Every motorist is familiar with sand boils. When these develop it is a sure indication that the rubber tread and the fabric portions of the tire are being forced away from each other by dirt or sand picked up from the road. A sand boil should be punctured immediately before it has time to spread. Cut away all portions of the tread that show signs of having become loosened. Wash out the hole with gasoline and vulcanize.

MISALIGNMENT

When the wheels of your car do not run true your tires are subject to a form of abuse which is certain to shorten their life. If the wheel is out of line it runs at a slight angle to the car and produces a severe and harmful grinding action between the tread of the tire and the road. The front wheels are most likely to get out of alignment, and should be occasionally checked up according to instructions for camber and gather.

LAYING CAR UP

If your car is to be out of service for any length of time it is advisable to remove the tires. They should be washed with soap and water, wrapped in strips of paper or cloth, and stored in dark, cool place. If you leave the tires on when your car is out of service for only a month or so, jack up all four of the wheels and let the air pressure down to about 5 pounds. Then block axles to keep weight off of tires. This keeps the tubes in shape and they will remain soft and pliable. When the wheels are not jacked up and the car is to stand for a considerable time, the tires should be kept well inflated and the car moved occasionally so that the tires will not flatten from standing too long on one spot.

Keep the inside of your casings well dusted with soapstone or talc. There is bound to be some friction between the tube and the inside of the casing and as soapstone acts as a lubricant for rubber, its use reduces this friction to a minimum. Don't use too much of the powder, or it is likely to roll up in hard lumps and chafe the tube.

SHIFTING TIRES

A little attention devoted to shifting the position of the tires has been found to result in increased mileage service. Tires on the right side of your

machine receive harder usage as a rule, than those on the left side. Hence by reversing their position, the life of the tires may be considerably prolonged. Similar results may be obtained by reversing front and rear tires. Rear tires carry more than half the weight of the car, get the roughest usage, and are also the driving tires, so that they naturally wear more rapidly than the front tires.

Extra casings carried on the car should be covered to protect them from the sunlight, which has an injurious effect on rubber. Do not place your extra tubes where they will come in contact with tools or oil. Carry tubes in a tube bag. It is a good plan to tie a piece of cloth around the valve stem before placing tube in the bag. This will prevent the possibility of the stem injuring the rubber.

Bear in mind that heat, light and oil are natural enemies of rubber. When grease comes in contact with your tires it should be removed immediately with gasoline.

Fast driving and tire economy have absolutely nothing in common. High speed and high bills for tire maintenance usually go hand in hand. It stands to reason that the wear and tear on tires is far greater when a car is driven at a high rate of speed than when it is used at a moderate pace. In addition to the increased force with which a wheel strikes an obstruction, when rolling at an excessive speed, fast driving generates increased heat in your tires, causing disintegration.

THE BODY

The body is the passenger carrying part of the car and consists principally of a steel shell into which are fitted the seats and cushions. It is bolted to the frame and may be removed entirely without disturbing any of the mechanism of the chassis. The rear fenders are also attached to the body.

There are no operating parts attached to the body and it will require no attention or adjustment beyond an occasional inspection to make sure that all bolts are tight and in good order.

WASHING

The body will, however, get dirty and muddy and should be cleaned in such a manner as not to injure the highly polished surface. This may be done by hosing off first with cold water. Don't use warm water as it will injure the varnish.

Don't try to rub the dirt off as this is sure to rub the little particles of grit into the varnish and scratch the surface. The best way is to use a hose without a nozzle and simply soak the mud and dust off with a gentle stream of water. Mud should be removed before it has a chance to dry hard.

After the mud and dust have been removed, the grease may be taken off by soaping the body with a strong suds made by dissolving Ivory or Castile soap in lukewarm water. Apply with a soft sponge and do not rub any more than is absolutely necessary. Don't use any cleaning compound or a soap which contains a large amount of alkali, as alkali is very injurious to the varnish.

After soaping, rinse thoroughly with the hose and cold water, then rub dry and polish with a clean soft chamois skin.

UPHOLSTERY

The leather upholstery of the seats and cushions should be cleaned first with a damp cloth and after drying thoroughly should be rubbed down with a cloth which has had a few drops of sweet oil sprinkled over it. The sweet oil will preserve the leather and prevent it from cracking.

If these instructions are carefully followed the finish of your car will retain its high luster and look like new for a long time.

THE TOP

Raising the top is really a two man job as there should be one person on each side of the car to properly manipulate it. For this reason many people now drive with the top up all the time, and for all ordinary driving there is no objection to this practice.

Always leave the top up until it gets thoroughly dry before trying to fold it. When folding, be careful to see that the cloth is not pinched between

any of the bow spacers, or they will wear a hole in it very quickly. Always fit the slip cover when top is folded to keep out the dust and dirt.

When not in use the slip cover can be folded and placed under the seat with the storm curtains.

ELECTRIC HORN

Buick Cars are all equipped with electric horns, operated by a push button on the left side of the cowl. These horns are carefully tested before leaving the factory and should require no attention or adjustment. In case, however, the horn should have gotten out of adjustment in shipment, or from any other cause, it should be adjusted in the following manner:

Take off the back by removing the two screws holding it in place. The mechanism will then be exposed and adjustment can be made as follows:

Loosen the pinch screw which clamps the slotted bar to the adjusting screw and turn the adjusting screw carefully in or out, at the same time sounding the horn until the proper tone is secured.

Be sure that the pinch screw is tightened up again before leaving the horn.

ELECTRIC LIGHTS

The electric headlights used on Buick cars are adjustable as to focus, and a milled thumbscrew will be found at the back of the lamp which when turned will move the electric bulb in or out in relation to the parabolic reflector. The lights should be set so that the rays are always concentrated on the road about 200 feet ahead of the car.

If a bulb should break it can easily be removed by opening the lamp and turning it first to the left. Note that the sockets and base of the bulbs are of the "Ediswan" type, and that the lamps are all 7½ volts. Headlight bulbs are of 16 candle power, while side lights are 4 candle power and tail lights are 2 candle power. Be sure you obtain the right size and voltage for replacements.

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