Book of Instruction

Chalmers "30"

Model 11

1912

Be sure to lubricate your machine thoroughly before putting it into ser

OWNER'S REPORT

_____ 191__

THIS blank properly filled in and mailed immediately after receipt of your car to the Chalmers Motor Company, Detroit, Michigan, will constitute a registration of your address at the factory and will insure your receiving copies of all circular letters, instructions, suggestions and general communications of interest, as well as many courtesies upon the part of the Company. Please cover the following items:

Car No. (see plate upon dash) _____

Motor No. (see top of fly-wheel case) _____

From whom purchased _____

Address (of seller) _____

Does car operate satisfactorily? _____

_____

_____

Finish of car _____

REMARKS:

_____

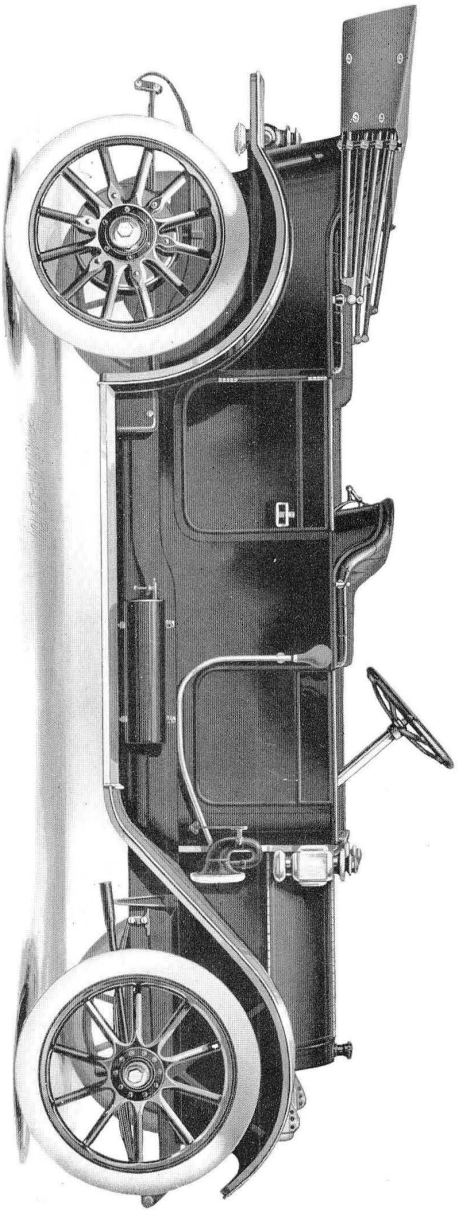
_____

_____

Name of owner _____ Occupation _____

Street and number _____

City _____ County _____ State _____



Chalmers "30" Touring Car

Book of Instruction

Chalmers "30"

Model 11

Chalmers Motor Company
Detroit. Mich.

Contents

Illustrations

INTRODUCTION

THE object of this book is to help Chalmers owners to get the most satisfaction with the least trouble from their cars. In it we have tried to make as clear as possible by words and pictures the operation and construction of the Chalmers "30".

We have tried to tell the owner how to drive his car and how to take such care of it as will keep it always in good condition—rather than how to take the car apart. We want you to have as little to do as possible with taking your car apart. This instruction book is a book of directions, not a repair man's manual.

If anything should happen to necessitate tearing down any part of your Chalmers, we advise you to take it to a competent repair man. It is cheaper in the end. But if you do have to make any repair yourself, do not act hastily. Study out what may be wrong before you begin to unfasten things.

If at any time you desire suggestions or instructions as to anything about your car not covered in this book, the Service Department of the Chalmers Motor Company will gladly furnish information, advice and assistance. This Department is maintained entirely for the benefit of our owners. Please feel free to write the Service Department regarding any point about which you may desire help.

This book begins by telling at once how to operate the car. It will pay you, however, if a new owner, to look over the entire book and gain some insight into the principle and the construction of a motor car before you begin to put into practice the "Directions for Operation."

Chalmers Motor Company

Repairs and Correspondence

We aim to build Chalmers cars so that repairs are the last thing an owner has to think about. Accidents happen, however, and lack of proper care or hard usage sometimes necessitates replacements.

To make it possible for owners to get needed repair parts quickly, the Chalmers Motor Company has established repair stock depots in Kansas City and San Francisco besides the stock at the factory. By writing or telegraphing to either of these points, any needed repair parts can be secured with all possible expediency.

Following are the addresses of these branch repair stock depots:

Chalmers Motor Company Stock Depot,
1524 Grand Ave.,
Kansas City, Mo.

Chalmers Motor Company Stock Depot,
515 Van Ness Ave.,
San Francisco, Cal.

When possible, parts should be ordered through Chalmers dealers. Otherwise supplies will be sent C. O. D. unless cash accompanies the order. We are compelled to make this rule to avoid opening a lot of small accounts on our books.

To insure prompt attention to correspondence, whether relating to the shipment of repairs or not, always give your car number, which will be found upon the brass plate on dash.

Please write a separate letter about each subject. Mail is distributed to different departments at the factory according to the subject covered and if one letter refers to several topics, it may take a long time for it to make the rounds.

Correspondence should be addressed to the company, not to individuals.

GENERAL DIRECTIONS FOR OPERATION

Putting the Car in Service

Fill radiator with clean water.
Directions on page 33.

Fill gasoline tank.
Directions on page 19. See that the cock in the gasoline pipe is open.

Fill motor crank case with oil to the level of the top try cock.
Be sure there is plenty of oil in the clutch, transmission, differential housing on rear axle and all other parts.

Put oil in oil holes and turn down grease cups.
The car when shipped from the factory is sufficiently lubricated for at least 15 miles of road work. We do not, however, assume responsibility for any damage due to lack of attention to this matter on the part of the owner. Complete oiling directions are given, beginning on page 11. The motor oiling system is described in the section on "Lubrication System," on page 29.

Before Starting the Motor

See that the gear shifting lever is in neutral position.
Full instructions regarding this lever are given on page 37.

Advance the throttle lever (the longer lever on top of wheel) about 1 inch on the quadrant.
If the motor does not start readily upon cranking, open the throttle a little more.

Set the spark lever (the shorter lever on the top of the steering wheel) one-half inch below "0" on the quadrant.
Never advance this lever as far as "0" in starting, as there will be danger of injury from a "kick back" of the starting crank.

To Start the Motor on the Battery

Turn the switch on the coil box to the point marked "Bat" (battery).

Crank the motor, giving a brisk pull upward with left hand. Motor should start. If not, see page 47.

To Start the Motor on the Magneto

In case the battery has "run down" the motor may be started on the magneto.
Throttle should be open about 1 inch on the quadrant.

Turn the switch on the coil box to the point marked "Mag" (magneto).

Advance spark lever two-thirds of the way up the quadrant.

Crank the motor by "spinning" the crank rapidly.

When the Motor Starts

Turn the switch on the coil to "Magneto."

It will be in this position already if the motor has been started on the magneto.

Advance the spark lever about two-thirds up the quadrant.

It will be in that position if the motor has been started on the magneto.

Close the throttle until the motor runs slowly.

To Start the Car

After taking seat at the steering wheel, release the hand brake.

Never forget to release this brake.

Disengage the clutch by pushing the pedal with the left foot.

This will require only a slight movement of the pedal—about an inch. Do not push the pedal further or the foot brake will be applied. The one pedal controls both clutch and brake. See pages 35 and 44.

Increase the speed of the motor slightly.

This may be done by advancing the hand throttle lever a little way along the quadrant, or by pressing on the accelerator pedal with the right foot. An inexperienced operator will probably obtain better results in shifting gears by keeping the hand throttle lever part way open—say one inch or more on the quadrant—during the shifting operation. After having mastered the use of the gear shifting lever the skillful driver will learn to control the motor speed during gear shifting by means of the accelerator pedal. See page 51.

Be sure the spark lever is advanced two-thirds up the quadrant.

Pull the gear shifting lever in toward you and then draw it quickly backward into first speed position.

Explanation of the gear shifting mechanism will be found on page 37.

Let clutch in gently by gradually releasing pressure on foot pedal.

The car will now move forward. Allow it to gain speed.

Again disengage the clutch.

Move gear shifting lever forward to neutral, then over to the right; thence, with a quick movement, forward into second speed position.

This shift is most successful if made quickly. If made slowly or timidly the gears will probably clash or chatter.

Open the throttle to increase the speed of the motor and engage the clutch. As stated above, the beginner will probably obtain the best results by leaving the hand throttle lever set part way open while shifting gears.

Allow the car to gain headway to about 10 or 12 miles an hour.

Again disengage the clutch.

Pull gear shifting lever straight backward into third, or high, speed position.

Let the clutch in slowly.

Increase the speed of the motor, until the car is traveling at the desired rate of speed, by pressing with the right foot on the accelerator pedal or by advancing the hand throttle lever. Keep the spark lever advanced as far as possible up the quadrant without causing the motor to "knock".

To Change Back Into Lower Speeds

If in going up a steep hill or through heavy going, the car is slowed until the motor labors, the gears should be shifted at once into the next lower speed.

Disengage the clutch; quickly move the gear shifting lever back into the next lower speed; let the clutch in gently and open the throttle to gain speed.

To Stop the Car

Push pedal with left foot beyond the point where the clutch is disengaged until the brake begins to be applied, gradually increasing the pressure until the car is stopped.

At the same time reduce the motor speed by moving the hand throttle lever backward or releasing the pressure on the foot accelerator.

When the car has stopped, while still holding out the clutch, place the gear shifting lever in neutral position, and then let in the clutch.

If the car is to be left standing set the hand brake.

To Reverse the Car

Push out the clutch, move the gear shifting lever from neutral position in toward you, then push it forward into reverse speed position. Let the clutch in gently.

Never attempt to go into reverse while the car is still moving forward or into a forward speed while the car is moving backward.

To Stop the Motor

Turn the switch on coil box to "Off" position, and while motor is still running on its own momentum, open the hand throttle about one-third—two inches—on the quadrant.

This draws into the cylinder a rich mixture of gas which is desirable for starting the motor the next time.

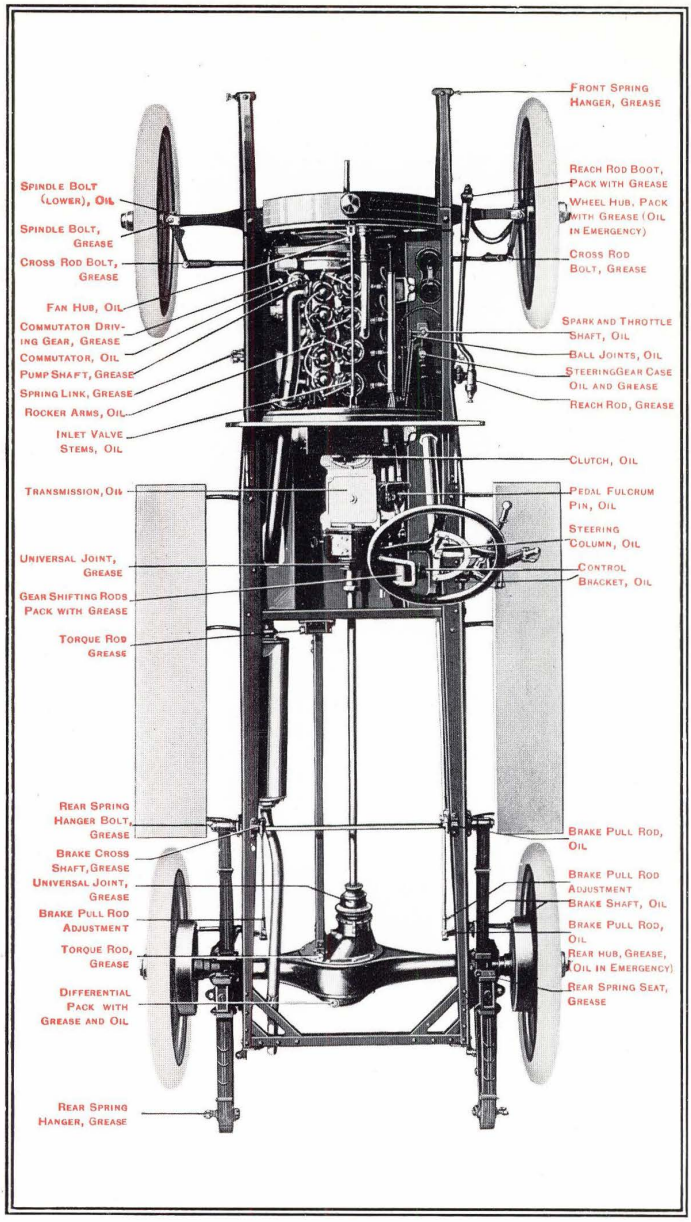


Fig. 1. Plan View of Chalmers "30," showing where to lubricate and what to use, oil or grease

CARE OF THE CAR

Directions for Lubrication

Oiling the Motor

A complete description of the motor oiling system and its operation, with instructions for its care and adjustment will be found beginning on page 29.

Every Day Car is in Use, or Every 100 Miles

Part	Quantity	Lubricant
Crank case	Keep oil at level of top try cock	Motor oil
Steering knuckle grease cups	One complete turn	Cup grease
Steering knuckle oil cups	Fill	Motor oil
Steering cross rod grease cups	One complete turn	Cup grease
All spring bolt grease cups	Two complete turns	Cup grease

Twice a Week, or about Every 200 Miles

Part	Quantity	Lubricant
Fan hub bearing	Few drops	Motor oil
Commutator grease cup	Two complete turns	Cup grease
Pump shaft grease cup	Two complete turns	Cup grease
Rocker arms	Thoroughly	Motor oil
Steering gear case oiler	Fill	Motor oil
Steering gear case grease cup	Two complete turns	Cup grease
Steering wheel oil hole	8 or 10 drops	Motor oil

Every Week, or about Every 300 Miles

Part	Quantity	Lubricant
Starting crank bearing	Few drops	Motor oil
Commutator oil hole	Few drops	Motor oil
Inlet valve stems	8 or 10 drops	Motor oil
Spark and throttle shafts	Few drops	Motor oil
Spark and throttle ball joints	Few drops	Motor oil
Control bracket bearings	Thoroughly	Motor oil
Transmission case	Enough to cover lower shaft	Motor oil

Part	Quantity	Lubricant
Clutch casing	Should contain 1½ pints	Motor oil
Pedal fulcrum pin...	Thoroughly	Motor oil
Brake pull rods and connections	Thoroughly	Motor oil
Brake cross rod grease cups (inside frame)	Two complete turns...	Cup grease
Torque rod grease cups, front and rear	Two complete turns...	Cup grease
Brake shafts on rear wheels	Thoroughly	Motor oil
Rear spring seat grease cups.....	Two complete turns...	Cup grease

Twice a Month, or Every 500 Miles

Part	Quantity	Lubricant
Magneto bearings (3 oil holes).....	3 drops each (no more).....	High grade light machine oil
Clutch case.....	Drain, flush with kerosene, refill with 1½ pints	Motor oil

Every Month, or Every 1000 Miles

Part	Quantity	Lubricant
Crank case	Drain off dirty oil, clean oil screen, fill to level of top try cock	Motor oil
Gear shifting rod case	Pack thoroughly.....	Cup grease
Reach rod boots.....	Pack thoroughly.....	Cup grease
Spring leaves (jack up frame and pry leaves apart).....	Thoroughly	Graphite grease
Hub caps	Pack thoroughly.....	Cup grease
Universal joints.....	Remove grease hole plug and fill.....	Cup grease

Every 2000 Miles

Part	Quantity	Lubricant
Differential housing..	3 pints	A mixture of two-thirds grease and one-third motor oil.
Transmission case...	Drain thoroughly, flush with kerosene, refill to just cover lower shaft	Motor oil

Semi-Monthly Inspection of Car

Compression in Motor Cylinders

Test compression. For directions see page 39.

Inspect inlet valve cage and exhaust valve plugs (for possible compression leaks).

Ignition System

Inspect wiring, terminals, spark plugs.

See that all connections are tight and insulation perfect.

Water Circulation System

Inspect pump and connections (for possible leaks), fan and fan belt, carburetor water connections.

Gear Shifting Mechanism

Inspect levers, slide rods, etc.

Brake Adjustment

Tighten transmission brake if necessary.

See that rear hub brakes pull equally and do not drag.

Steering Connections

Inspect steering connections for loose nuts and bolts.

Springs

Keep spring clips tight.

Inspect spring bolts and hangers.

Storage Battery

Test the battery for voltage.

If it drops to 5.40 volts have it recharged.

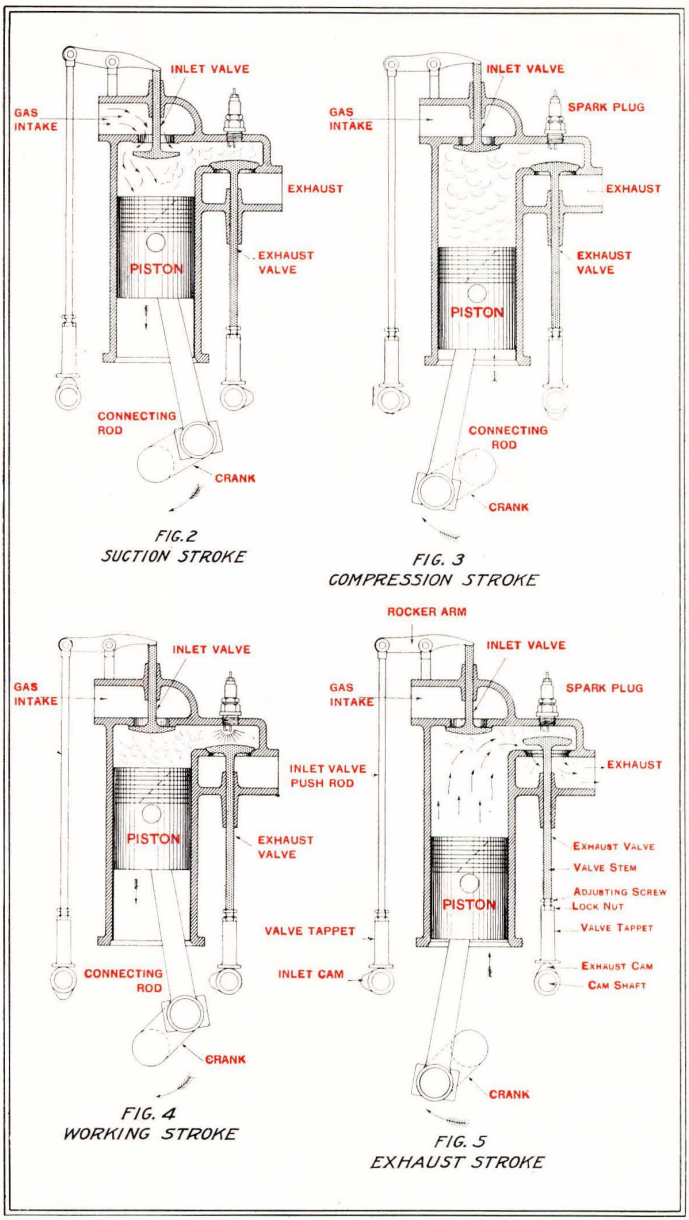


Diagram of the Four Strokes of a Four-Cycle Motor

To make the illustration clearer, the inlet valves and exhaust valves are shown as if operated by separate cam shafts. In reality, both sets of valves on the Chalmers "30" are operated by a single cam shaft at the left side of motor.

PRINCIPLE OF FOUR CYCLE GASOLINE MOTOR

The easiest way to understand the operation of a gasoline engine is to compare it with the shooting of an old-fashioned, muzzle loading rifle. Both derive their power from the explosion of gases within a confined space. In the one case the explosion drives out a bullet. In the other case, it pushes upon a piston.

In shooting a gun the powder and bullets are put into the muzzle, rammed down or compressed by a ram-rod, fired by a cap placed under the hammer, and finally the barrel is cleaned with a rag on the end of the ram-rod. Thus we have four steps:

(1) Introduction of charge.
(2) Compression of charge.
(3) Explosion of charge.
(4) Cleansing of barrel.

The same series of events takes place in the operation of a gas engine, each step corresponding with a stroke of the piston.

(1) Introduction of gas - - - - - - Suction stroke.
(2) Compression of gas - - - - - - Compression stroke.
(3) Explosion of gas - - - - - - - - Working stroke.
(4) Removal of burned gases - - - Exhaust stroke.

Carrying the comparison a little further, let us suppose we were able to connect the bullet with some sort of a rod so that its energy could be converted into rotary motion and used to turn a wheel. Then, instead of using all the force of the explosion to carry itself through the air, it would travel only a short distance, and would store up its energy in the revolving wheel. This is what happens when we have substituted for our bullet the piston of a gas engine. If now, we could supply a simple mechanism which would introduce and fire new charges at regular intervals, our wheel would be kept in motion and the power developed could be used for driving purposes. Thus we should have practically a single cylinder gas engine.

The accompanying figures illustrate such an engine, showing the four strokes explained above.

Fig 2, the "suction stroke," shows the introduction of gas into the cylinder. At the beginning of this stroke, the intake valve in the top of the cylinder opens, the exhaust valve at the side being closed. As the piston descends, gasoline vapor mixed with air is sucked into the cylinder just as water is drawn into a pump or syringe when you draw out the plunger.

As the piston begins to ascend, ("compression stroke," Fig. 3), both intake and exhaust valves are closed. The piston traveling upward compresses the gas in the upper part of the cylinder, called the combustion chamber.

Just as the crank shaft passes over "dead center," the highest point in the piston's travel, an electric spark is discharged between the terminals of the spark plug (Fig. 4). This explodes the gas, pushing down the piston with great force. This is the "working stroke." During it the valves are, of course, closed.

At the end of the working stroke, the exhaust valve at the side of the motor opens (Fig. 5). The piston, forced up by the momentum of the crank shaft and fly wheel, pushes out the burned gas through the exhaust valve and the motor is ready for a repetition of the four strokes. Such is the operation of every "four cycle" motor.

It will be readily understood from the above that the "working stroke" occupies only one-quarter of the total operation of the motor, yet the three extra strokes are required to prepare the engine for a duplicate set of operations. If now we arrange four cylinders in a row to operate on the crank shaft, timing their explosions so that they will follow in suitable order, we shall have four "working strokes" following each other so closely that power is being exerted on the crank shaft practically all the time. This is what we have in a four cylinder motor, such as the Chalmers "30."

THE FIVE SYSTEMS OF A MOTOR CAR

The engine of an automobile is, of course, the most important part of the entire machine. But in order that the power of the engine may be applied to driving the automobile along the roads, various other factors are necessary. The mechanism of a motor car may be divided into five different systems, each of which is explained separately in the pages following. These systems correspond, in a general way, with the different systems—circulation, respiration, nervous, etc.—of the human body.

1. In the motor car there is a respiration or breathing system—gasoline vapor is the car's breath of life.

2. There is a circulation system—water is circulated through the motor to keep it cool.

3. There is a nervous system—ignition system—which discharges the electric spark that explodes the gas.

4. There is a lubrication system—the car must be regularly fed with oil or it cannot run.

5. The transmission system corresponds with the muscular system of the body. It is the means by which the energy of the machine is transformed into useful work.

In this book we have attempted to explain each of these systems and to show what sort of care is necessary in order to keep each one in perfect working order. Remember that an automobile is a wonderful piece of machinery. It is probably the most wonderful piece of machinery ever constructed, for no other machine involving so many parts and such careful adjustment is expected to stand the hard usage to which an automobile is subjected.

In taking care of your car, try to remember that each one of the five systems must be in perfect order for you to get the most satisfactory service. You would not neglect your body to the extent of failing to feed it, or doing anything to impair its circulation, its respiration, its nervous apparatus or its muscles. Try to give your automobile something of the same care and you will be amply repaid in faithful and uninterrupted service.

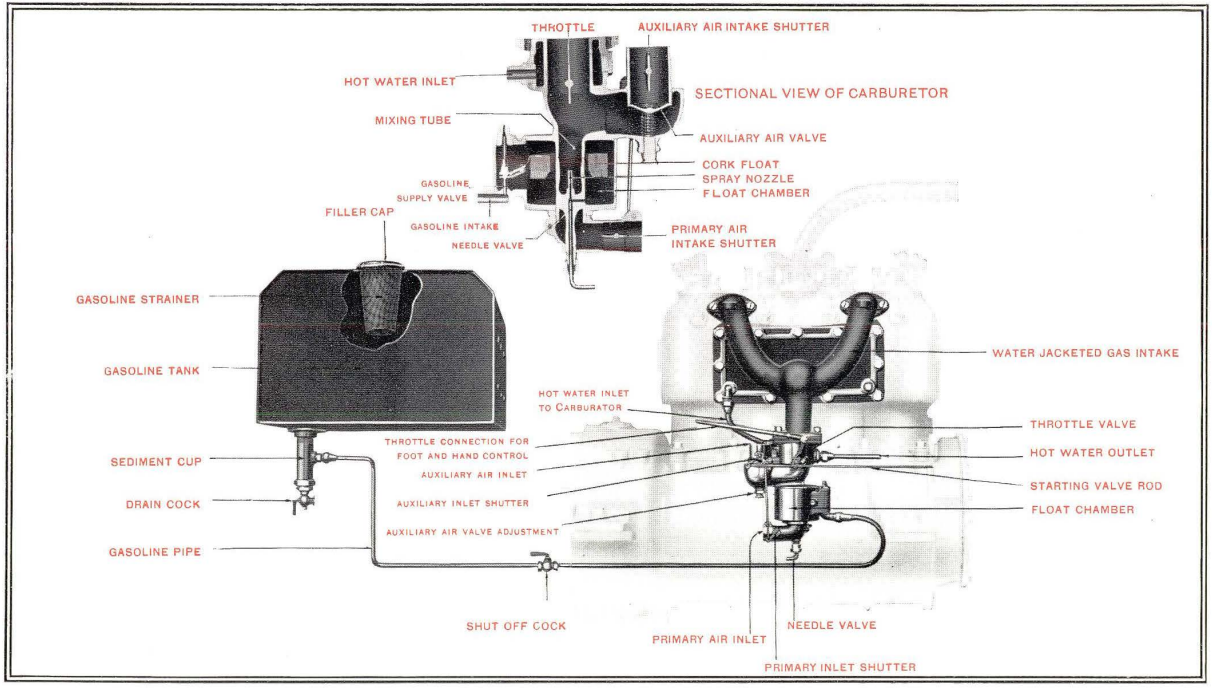


Fig. 6. Gasoline System of the Chalmers "30"

GASOLINE SYSTEM

General Principle

The gasoline system consists of (1) the gasoline tank, with sediment cup at the bottom, (2) the gasoline pipe, (3) the carburetor and (4) the intake manifold (Fig. 6). Liquid gasoline flows from the tank through the gasoline pipe to the carburetor. Here it is vaporized and mixed with air. The mixture is drawn by the suction of the descending pistons into the cylinders where it is exploded by the spark.

Gasoline Tank

The gasoline tank is located under the front seat. Capacity—touring car, 19 gallons. Pony tonneau and roadster—15 gallons.

In filling the gasoline tank always strain the gasoline through chamois skin to free it from water and impurities.

Gravity Feed on Touring Cars

On the touring cars the flow of gasoline from the gasoline tank to the carburetor is by gravity.

Pressure System on Roadster and Pony Tonneau

The flow of gasoline from the tank to the carburetor on the roadster and pony tonneau is insured by pressure in the gasoline tank.

This feature is due to the fact that on these types the low front seat necessitates carrying the tank at a lower level than in the touring car. Consequently, air pressure in the tank is needed to insure the flow of gasoline to the carburetor when the car is ascending a grade or when the gasoline is low.

Pressure in the gasoline tank is secured by diverting into the tank from the exhaust manifold a small portion of the exhaust gases, which pass out under considerable pressure. These gases after passing through a tapered brass pipe are strained through a fine screen in the "pressure regulator" (on dash under hood) from which the cleaned gases pass into the gasoline tank.

Pressure Regulator

The pressure in the gasoline tank is regulated by a small milled screw at the top of the pressure regulator on front of dash under the hood.

Turning down the screw increases the pressure in the tank: turning it up reduces the pressure.

Pressure Valve

At the lower end of the hand air pump, located on the outside of the driver's seat on the right side of the car, is a three-way valve. Its operation is as follows:

Turning the handle upward admits air to the top of the gasoline tank and allows the gasoline to be fed by gravity to the motor.

In this position the pressure system is not in use. This position is proper for driving in level country where the motor obtains sufficient gasoline by gravity feeding.

Turning the handle downward closes the air-vent and allows the pressure from the exhaust to form a pressure in the gasoline tank.

This is the proper position for driving in hilly country or other conditions requiring pressure in the "regulator" system.

Turning the handle to a horizontal position permits the use of the hand pump for securing pressure.

This is the position for the valve in case pressure is required quickly. With the valve turned to this position, six or eight strokes with the hand pump will give sufficient pressure in the gasoline tank, after which the handle may be turned downward and the pressure obtained from the exhaust.

In using the pressure system take special care to see that the filler cap of the gasoline tank is air-tight.

Occasionally remove and clean the screen in the pressure regulator by unscrewing the aluminum cap on the bottom.

Sediment Cup

Beneath the gasoline tank is placed the sediment strainer and cup from which the gasoline pipe leads to the carburetor (Fig. 6).

The drain cock should be opened occasionally for withdrawing any water which has settled in the sediment cup. It may also be used for draining off the gasoline slowly.

Should it be desired to drain the gasoline tank quickly, the plug at the bottom of the sediment cup may be unscrewed, permitting an inch stream of gasoline to flow. With this plug out the strainer may be readily removed for cleaning.

Shut-off Cock

Beneath the front floor boards close to the right side of the car is a cock by which the gasoline can be shut off from the carburetor, if necessary.

In the running position, the handle of the cock is turned lengthwise of the pipe.

Carburetor

The carburetor is a device for producing a mixture of gasoline vapor and air in the correct proportion for complete combustion.

The carburetor consists of

1. The float chamber, which regulates the flow of the gasoline so as to have a regular, constant supply for all engine speeds.

2. The mixing chamber, in which the gasoline vapor is mixed with air in the proper proportions.

Carburetor Float Chamber

The float chamber (Fig. 6) maintains a constant level or supply of gasoline for the carburetor.

Gasoline flows from the gasoline pipe into the float chamber through the "float valve". A cork float, fastened to a short lever, raises or lowers this valve and thus regulates the incoming flow of gasoline.

Carburetor Mixing Chamber

After leaving the float chamber the gasoline passes through a nozzle from which it is sprayed in a fine stream into the mixing chamber. The quantity of gasoline passing through the nozzle is regulated by the "needle valve".

The mixing chamber (Fig. 6) is simply a cylindrical chamber inside the float chamber and surrounding the spray nozzle. It is jacketed with warm water from the cylinder water jacket. This maintains a uniform temperature and insures a complete vaporization of the liquid gasoline.

Action of the Carburetor

The action of the carburetor is as follows:

The suction created by the downward motion of the motor pistons draws air into the mixing chamber through both the primary and auxiliary air inlets. This air flows into the mixing chamber around the nozzle and picks up the gasoline which leaves the nozzle in the form of a spray. Thus the action of the mixing chamber is not unlike that of an ordinary atomizer in which the air forced from the rubber bulb picks up a certain amount of the liquid in the bottle and sprays it out in the form of a fine vapor.

In order that the proportion of air and gasoline in the mixture may be correct for all motor speeds, two air inlets are provided. The lower one, or "primary air inlet" (Fig. 6), is open at all times, except when starting the car—as explained below. The upper or "auxiliary air inlet" is controlled by a spring. At low speeds when only a small amount of air is being drawn through the carburetor, the spring holds this valve almost shut. As the speed increases and more air is needed, the suction, operating against the tension of the spring, draws the valve further and further open, thus giving an increased supply of air exactly proportioned to the amount needed for the increased speed. The carburetor thus automatically produces the correct mixture for all motor speeds.

Do not adjust the carburetor.

When the carburetor has once been satisfactorily adjusted by the dealer from whom you purchased your car there is little chance of its getting out of adjustment.

The only adjustments are:

(1) The "needle valve," for regulating the amount of gasoline admitted to the mixing chamber.

(2) The "adjustment for auxiliary air valve," for regulating the amount of air in the mixture.

If there is any question concerning the proper action of the carburetor consult a Chalmers dealer.

Starting Valves

To assist in starting, there is a shutter in both the primary and auxiliary air inlets at the rear of the carburetor.

These shutters are normally open and are not used when running. They are operated together by a rod running through the radiator to the front of the car. Pulling this wire forward completely closes the auxiliary air inlet and partially closes the primary air inlet. This allows a "rich mixture"—almost pure gasoline vapor—to be drawn into the cylinders.

As soon as the motor is in operation, the starting valves should be opened by pushing back the starting valve rod.

Throttle Valve

The throttle valve, which is of the "butterfly" or shutter type, is placed just above the mixing chamber. It is connected by a rod with the hand throttle and foot accelerator mechanism.

Hand Throttle

The longer of the two levers on top of the steering wheel controls the throttle.

Moving this lever upward around the quadrant increases the speed of the car by admitting more gasoline mixture, and moving it downward decreases the speed by admitting less.

Foot Throttle or Accelerator

In the floor board to the right of the clutch pedal is a small brass foot throttle or accelerator which is operated by the right foot.

By sliding the foot forward or pressing down upon this foot throttle the same control over the speed of the car can be obtained as by manipulation of the hand throttle lever.

Use of Hand Throttle and Accelerator

The accelerator pedal or foot throttle is the usual means of controlling the speed of the car.

Pressing it downward, for increased speed or releasing it for decreased speed gives instantaneous action.

When the accelerator is released, the motor immediately resumes the speed determined by the position of the hand throttle lever on the steering wheel.

Although either the hand throttle or the accelerator pedal may be used to control the speed of the car, beginners are advised to confine themselves to the use of the hand lever. After the operator has gained confidence in his ability, the more quickly acting foot throttle will be preferred.

IGNITION SYSTEM

General Principles

The purpose of the ignition system is to furnish an electric spark in each of the four cylinders in their order of firing, the spark being so timed as to explode the compressed charge of gas in the combustion chamber at just the right instant. The electric current may be furnished by a battery or a magneto.

In the case of the Chalmers "30," what is known as the "dual ignition" system is used. This system provides a magneto which serves as the source of a spark in regular running; a storage battery which generates the spark in starting the car, a transformer coil, a dash kick switch and a single set of four spark plugs.

For starting on the switch and for reserve, there is the storage battery. This furnishes a low tension current which is transformed into a high tension current by the spark coil located on the sub-frame.

The Battery

The voltage of the storage battery is 6 and it has a capacity of 60 ampere-hours.

The charging rate is 5 amperes.

The battery is contained in a water-tight metal box beneath the floor of the tonneau. From the battery (Fig. 7, page 24) the wires run forward inside the left frame to the coil fastened to the sub-frame.

The battery should be re-charged whenever its voltage drops to 5.40.

It is advisable to test the battery with a volt meter twice a month.

To secure maximum efficiency a storage battery should be discharged and re-charged at least once in six weeks.

Ordinarily it is wisest to have the battery charged and cared for by a Chalmers dealer or by someone else thoroughly familiar with such work. If, however, you wish to attend to the charging and other care of the battery yourself, complete instructions will be furnished upon request, by the Service Division of the Chalmers Motor Company.

After charging, wash the top of the battery with water to remove traces of acid. Be careful not to get any of the solution upon the clothing.

The metal terminals by which the battery wires are attached to the battery should always be kept clean and tight.

The Battery Coil

The object of the coil located just beneath the front seat on the sub-frame, is to convert the low tension current into a high tension current strong enough to make a hot ignition spark.

(Each time the primary circuit is made and broken, a stronger high tension current is induced in the secondary coil.) From here a high tension current flows through the wire (Fig. 7) to the distributor block on the magneto,

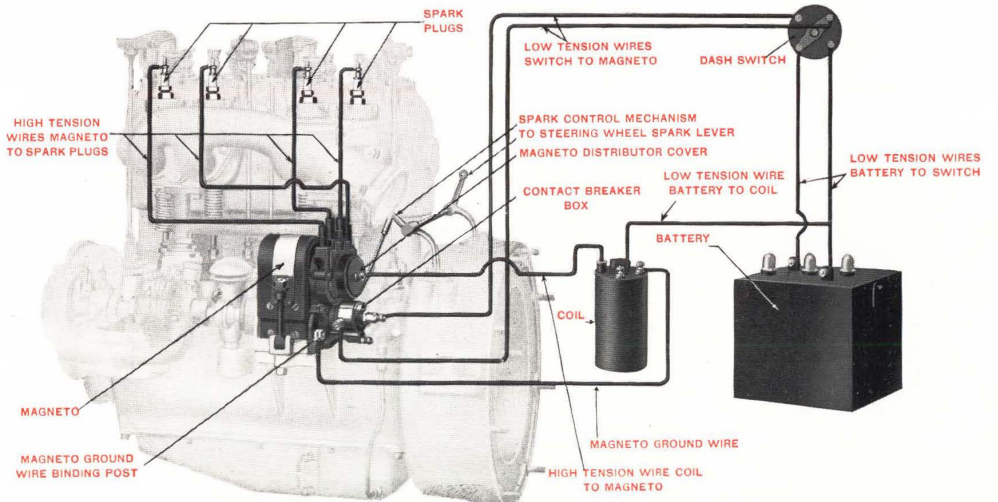


Fig. 7. Ignition System of the Chalmers "30"

whence it is distributed through the wires to one of the four spark plugs. The final result is a brief arc of flame in the motor cylinders, causing the explosion of the compressed gas in the combustion chamber.

Magneto

The magneto is on the left side of the motor toward the rear. (Fig. 7). It is bolted to a platform especially designed to carry it and is driven by the same shaft that operates the water pump. The magneto is, in effect, a small dynamo. By its magnets and armature it develops through the coil a high tension current when the motor is running.

Action of Magneto Current

A low tension current is produced in the armature winding by the rotation of the armature. By the interruption of the primary circuit, by means of a "contact breaker" at the rear end of the armature, a high tension current is induced in the secondary winding of the coil.

The distributor on the rear end of the magneto sends the high tension current through the spark plugs of the respective cylinders in succession, firing them in the order, 1, 3, 4, 2.

Care of the Magneto

The magneto furnished for Chalmers cars requires very little attention. It should never be tampered with unless you are sure something is wrong. For lubrication see Page 12.

The circuit breaker mechanism on the armature shaft should always be kept clean and with the contact points flat, parallel and accurately adjusted.

If the platinum contacts after much usage become pitted so that a bad contact results, they can be filed flat with a fine file, taking care not to file off any more than is necessary. Then re-set the screw so that the brake is no more than a thick piece of tin or about 1/32 of an inch.

The distributor should be kept clean and needs no oiling.

Setting the Magneto

To replace the magneto after removal, proceed as follows:

Crank the motor until the piston in No. 1 cylinder has reached the end of the compression spark or its uppermost position.

(The compression stroke may be determined by holding the finger on top of the No. 1 cylinder relief cock).

The motor is then in the proper position to fire.

The distributor block should then be removed from the magneto. This is done by pressing the two small springs at the side and by removing one thumb nut at the top of the distributor block. The distributor mechanism will then be revealed.

Next revolve the armature until the distributor segment comes in contact with the left-hand lead, looking toward the distributor block from the back of the magneto. This

is the wire which carries the current to No. 1 cylinder. (See Fig. 7).

The armature should then be retarded slightly until the breaker points just begin to open with the breaker box in full retard.

Set the magneto in place and connect the couplings. Connect the spark control rod. Adjust this rod and its connections so that the contact points in the "contact breaker box" just start to open when the spark lever on the steering wheel is placed about one inch from full retard, with the motor on "dead center."

Be sure that the magneto of the "30" is set with the breaker box in full retard when motor is on dead center. When breaker box is in full retard spark lever should be at bottom of quadrant. This is to give the maximum amount of advance on the magneto. If the make and break does not occur at the proper time, go over the above directions again.

Magneto Connections

The wiring connections of the magneto are shown in Fig. 7.

After setting the magneto the high tension wires should be connected up as follows:

No. 1 post (counting the posts on the back of the magneto from left to right) is connected to No. 1 cylinder.

No. 2 post is connected to No. 3 cylinder.

No. 3 post is connected to No. 4 cylinder.

No. 4 post is connected to No. 2 cylinder.

The "magneto-to-switch" wire goes from the binding post on the "contact breaker box" to the post on the back of the dash kick switch marked ..... (Fig. 7).

Timing the Spark

The time at which the spark occurs in the cylinders relative to the travel of the piston is controlled by the contact breaker at the rear end of the magneto armature.

Although combustion of the gasoline vapor under compression in any cylinder occurs rapidly, it is not absolutely instantaneous. There is a certain point in the travel of the piston relative to the motor speed at which the occurrence of the spark will give the maximum efficiency.

Ordinarily the spark occurs and the combustion of the gasoline vapor begins just before the piston reaches the highest point of its stroke. If, however, the spark is too far advanced for any given motor speed the maximum effect of the combustion is exerted so long before the piston reaches its highest point that there is a tendency for the motor to run backward.

If the motor is running fast enough this tendency is overcome by the momentum of the fly wheel. If, on account of low speed, the momentum of the fly wheel is not sufficient, there will be a tendency for the car to run with a jerky motion and the motor may be "stalled."

This premature ignition is likely to occur if the engine is cranked with the switch on "battery" and the spark lever

in too far advanced position. In such a case the starting crank will "kick" backward with possible injury to the operator.

IMPORTANT—Never crank the engine with the switch on battery unless the spark lever is fully retarded.

If the spark is too far retarded for the speed of the motor the maximum effect of the combustion is exerted so long after the piston has passed its highest point that some of the energy is wasted, and not being converted into mechanical work, remains in the cylinder as heat, tending to over-heat the motor.

The regulation of the spark is by means of the spark lever (the shorter lever at top of steering wheel), as explained on Page 7.

In ordinary driving, carry the spark lever as far advanced as possible without causing the motor to knock.

Spark Plugs

The gap between the points of the spark plugs should be about 1/32 of an inch or approximately the thickness of a dime.

Too wide or too narrow a gap will impair the efficiency of the motor, and mis-firing will result.

The adjustment given above gives a good spark for slow running and hard pulling as well as for high speed driving.

Spark plugs should be kept clean to prevent short circuiting.

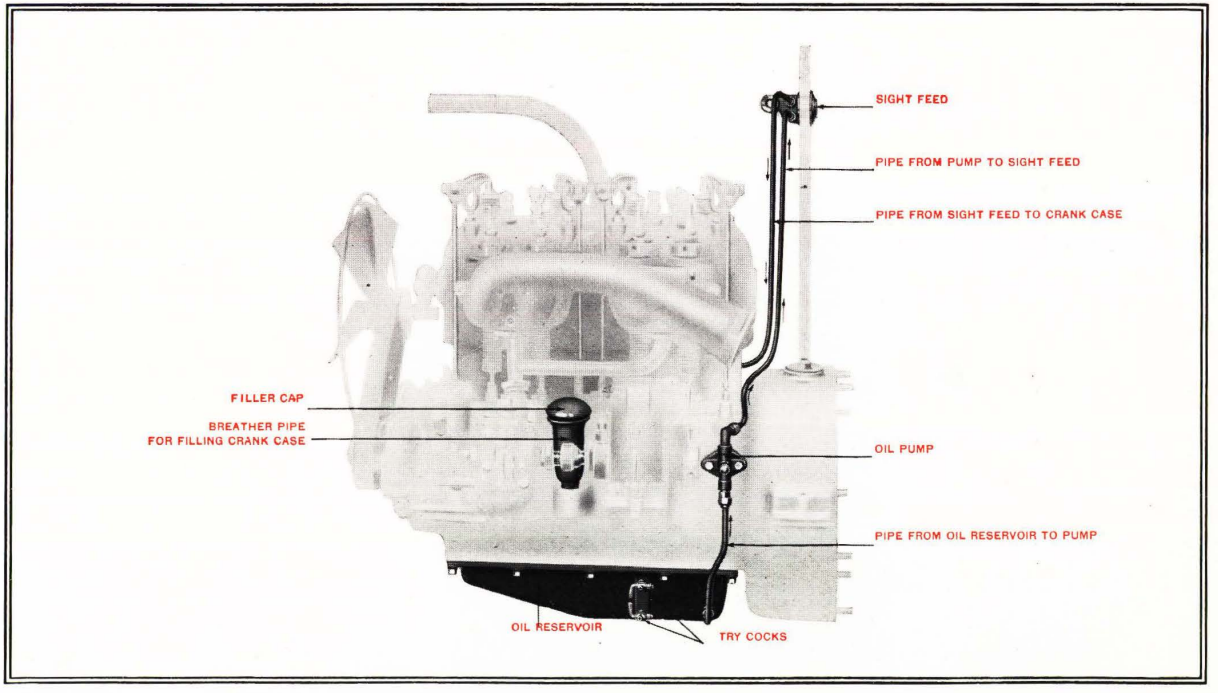


Fig. 8. Motor Lubrication System of Chalmers "30"

LUBRICATION SYSTEM

General Principle

The Chalmers "30" motor is lubricated by what is known as the constant level splash system. The bottom of the crank case is filled with oil into which, as the crank shaft revolves, the ends of the connecting rods dip, splashing the oil all over the interior of the motor, lubricating every part. The level of the oil in the crank case is regulated by overflow holes which open into the oil reservoir below (Fig. 8, and Fig. 9, page 30). From this reservoir fresh oil is continually supplied to the crank case by a pump. In passing from the pump to the crank case the oil goes through the "sight feed" on the dash, which enables the driver to tell whether the oil is flowing properly.

The transmission gears and clutch run in oil contained in their respective casings. Universal joints are packed in grease; differential driving gears in grease and oil.

All other working parts are lubricated by means of grease cups, oil cups, or oil holes.

Importance of Lubrication

Proper lubrication of a motor car is more important than any other one item in its care.

Full instructions telling how often to oil the different parts and what kinds of lubricant to use are given in the "Directions for Lubrication", beginning on page 11.

Lubricants

It pays in the long run to use only the best quality of lubricants. Money saved by buying cheap oils or grease will be lost in worn-out bearings or cylinders.

There are many good oils on the market. Our own experience has shown that the following are well suited for use on Chalmers cars:

Chalmers Cylinder Oil	Havoline
Polarine	Floyd's Anti-Carbon
Monogram "V"	Standard Light Auto

For grease cups use a good grade of cup grease of medium consistency.

Oil Reservoir

The height of oil in the oil reservoir (Fig. 8) is determined by the two try cocks on the left-hand side. Oil should be poured into the crank case through the "breather pipe" or funnel until it just begins to flow out of the top try cock. The level must never be allowed to drop below the lower try cock.

The oil reservoir may be removed from below when it is necessary to get at the inside of the crank case (Fig. 9, page 30). Be sure to drain out the oil before removing the reservoir (See page 31).

Capacity of oil reservoir, one gallon.

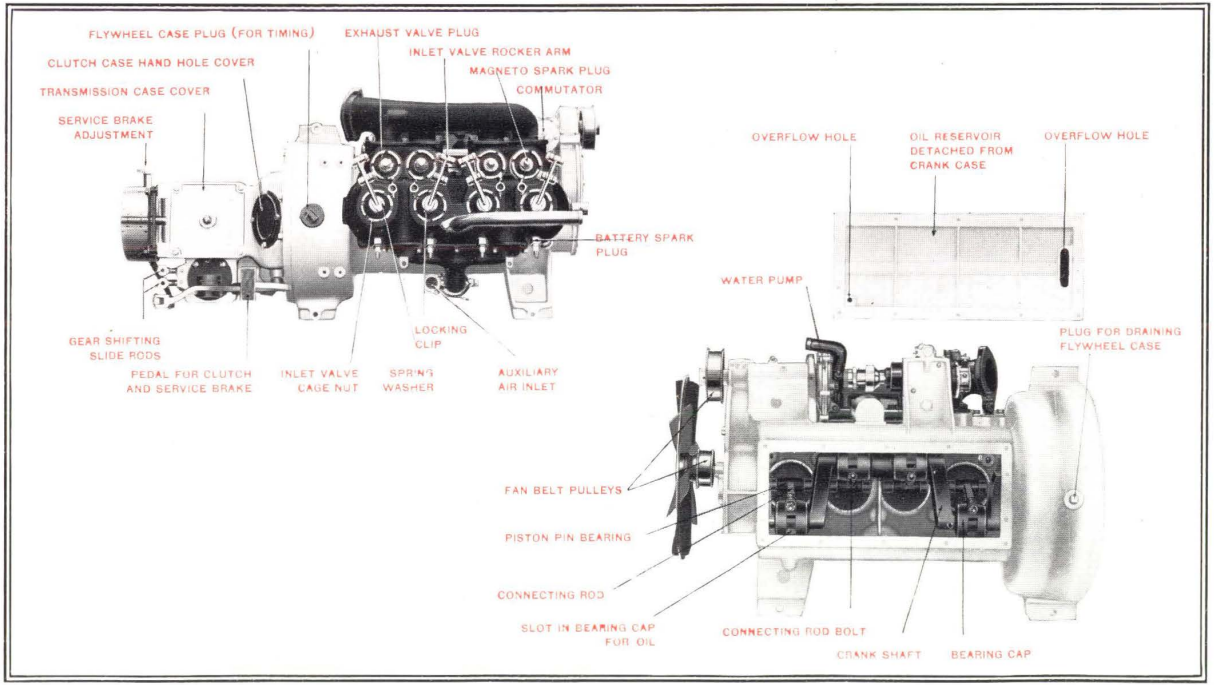


Fig. 9. Top and Bottom Views of Chalmers "30" Motor

Oil Pump

The oil pump is on the left side of the crank case near the rear end. It is a simple force pump of the plunger type.

The plunger runs back and forth in a horizontal direction, being operated by the inlet cam on No. 4 cylinder.

Ordinarily, this pump will require no adjustment or other attention.

Oil Sight Feed

The sight feed on the dash is a small bull's eye with a white enameled back.

So long as the pump is throwing oil properly the little compartment of the sight feed will be full and the white back cannot be seen when the motor is running. If the white bull's eye does show, inspect the oiling system at once, as the motor should not be run at all if the oiling system is not working properly.

Increased Lubrication for Fast Running or Touring

Fast running or touring over heavy and hilly roads uses up oil much faster than city use. The wise motorist, remembering this, will add oil frequently on a tour or fast drive.

It is not much trouble to put in an extra pint of oil every 100 miles or so and will avoid chances of trouble with worn bearings or cylinders.

Draining Off Old Oil

Every 1,000 miles the old oil in the crank case should be drained off and a fresh supply poured in.

The old oil may be drained off by removing the drain plug at the rear end of oil reservoir on the right side (Fig. 16, page 42).

The oil screen will come out with the plug and should be thoroughly cleaned. This screen prevents dirt from being drawn through the pump back into the crank case.

If the oil drawn off is very dirty or heavy, it is a good plan to remove oil reservoir and clean thoroughly with kerosene. Replace reservoir and fill with new oil through breather pipe to the level of the top try cock.

Insufficient Lubrication

If, through oversight the motor has been allowed to run without sufficient lubrication and begins to heat or pound, it should be stopped immediately.

Allow the motor to cool, fill up the reservoir to the top try cock and then add a pint or two extra. Fill the radiator with water after the motor is thoroughly cooled.

If there is any apparent damage the motor should be thoroughly inspected before driving. If no apparent damage has been done the motor should be given a thorough examination at the earliest opportunity to see that no harm has resulted to the bearings.

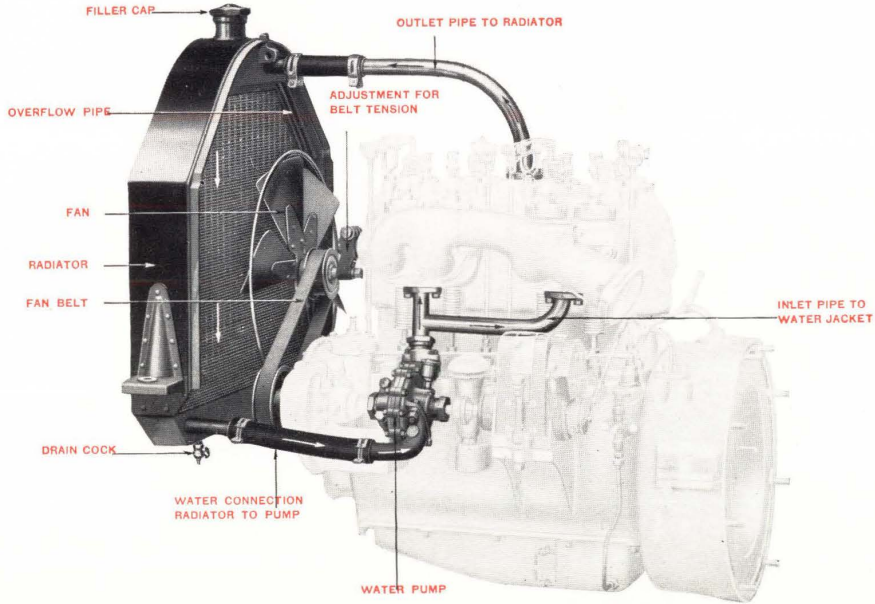


Fig. 10. Water Circulation of the Chalmers "30"

WATER CIRCULATION SYSTEM

General Principles

The repeated explosions of gasoline vapor in the motor cylinders develop a great deal of heat. It is necessary to cool the cylinders by circulating water around them through the "water jacket." The water, of course, soon becomes hot and it, in turn, is cooled by passing through the radiator. The radiator exposes a large surface to the air and thus permits of rapid radiation of heat. From the lower compartment of the radiator the cooled water is returned to the water jackets by way of the water pump, which keeps up a constant circulation (Fig. 10).

Filling the Radiator

Keep the radiator filled with clean water as free as possible from lime or other impurities.

In filling the radiator always pour the water through the screen provided. Never pour cold water into an empty or nearly empty water system when the motor is excessively hot as the result of having run it dry.

Occasionally, when filling, drain the dirty water out of the water system through the drain cock at the bottom of the radiator.

Steam or surplus water can escape from the top of the radiator through an overflow pipe which extends from beneath the filler cap down to the lower right corner of the radiator.

Water Pump

The water pump—centrifugal type—is attached to the left side of the crank case and is directly driven by means of gears in the gear case at the front of the motor (Fig. 15, page 40).

It draws water from the bottom compartment of the radiator, forces it up through the brass inlet connections into the water jackets of the cylinders. After circulating around the cylinders, where it becomes heated, it is forced through the outlet pipe on top of the cylinders to the top compartment of the radiator.

Fan

The fan draws a current of air through the radiator, thus insuring more rapid cooling.

This fan is supported on an arm fastened to a stud on the front of the cylinder casting. The tension of the belt is regulated by adjusting the position of this arm on the stud. The belt should be kept tight at all times. Care should also be taken to see that the clamp which fastens the supporting arm is tight.

Cleaning the Water System

The radiator, cylinder jackets and other parts of the water system should occasionally be cleaned.

To clean the radiator uncouple the hose connections and flush out by forcing water through it under city pressure from the bottom to the top. Flush the cylinder jackets in a similar manner, letting the water flow in at the top and out through the water pump; flush carburetor jacket. This need not be done frequently, but the careful owner will see to it that the water system is cleaned whenever the car is overhauled.

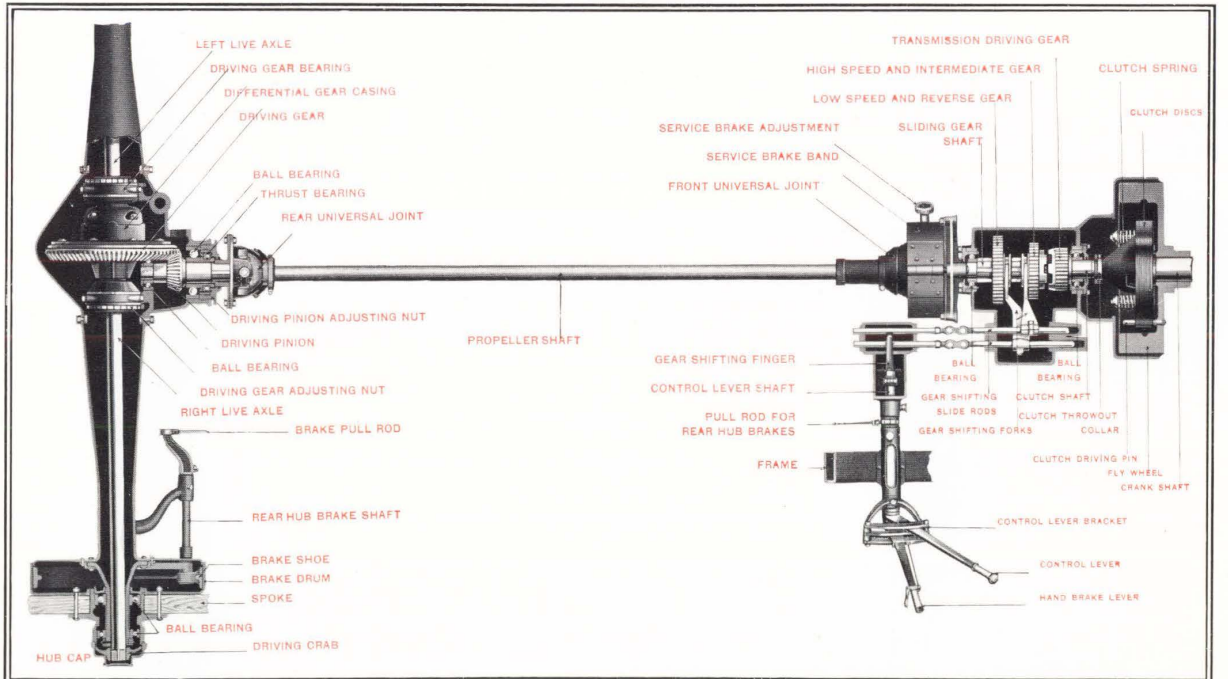


Fig. 11. Power Transmission System of Chalmers "30"

POWER TRANSMISSION SYSTEM

General Principles

The transmission system, by which power is transmitted from the motor to the rear wheels, consists of

(1) Clutch
(2) Transmission
(3) Front universal joint
(4) Propeller shaft
(5) Rear universal joint
(6) Differential driving gears
(7) Live axle shafts, which turn the rear wheels.

The Clutch

The Chalmers "30" clutch is of the multiple disc type, running in a bath of oil.

The multiple disc clutch consists of alternating discs of hard bronze and tempered steel (Fig. 12, page 36). The former are connected with three pins on the fly wheel (Fig. 15, page 40); the latter are keyed on the main driving shaft of the transmission. When the clutch is thrown out, these discs are allowed to separate, the bronze plates rotating with the fly wheel and the steel plates remaining still on the transmission shaft. When the clutch is "let in" the three "clutch springs" jam both sets of discs together and the whole combination rotates. The clutch is disengaged by a slight pressure on the pedal

Care of the Clutch

The clutch case should always contain about 1½ pints of light cylinder oil.

If the clutch slips or drags, drain out the old oil, through hole at bottom of case, replace the plug and pour in a quart of kerosene. Start the motor and run the car for a few minutes, working the clutch in and out to cut old oil off the plates. Now drain out the dirty kerosene and replace with 1½ pints of light cylinder oil.

If the slipping of the clutch cannot be cured by the above cleaning, the clutch springs may be tightened. Removing the "hand hole cover" upon the slanting portion of the case (Fig. 12, page 36) will bring the clutch springs into view. Care should be taken to tighten them equally.

For lubrication directions see page 12.

Transmission

The purpose of the transmission (Fig. 12, page 36) is to increase the power of the motor for pulling the car through heavy going or up hills—also to provide a mechanism for reversing the direction of the car's motion.

The Chalmers "30" transmission is of the selective sliding gear type. This means that the gears slide back and forth on the "sliding gear shaft" and that the operator, starting from neutral, can set his gears in any speed he selects without passing through intermediate speeds in order to get from one to the other.

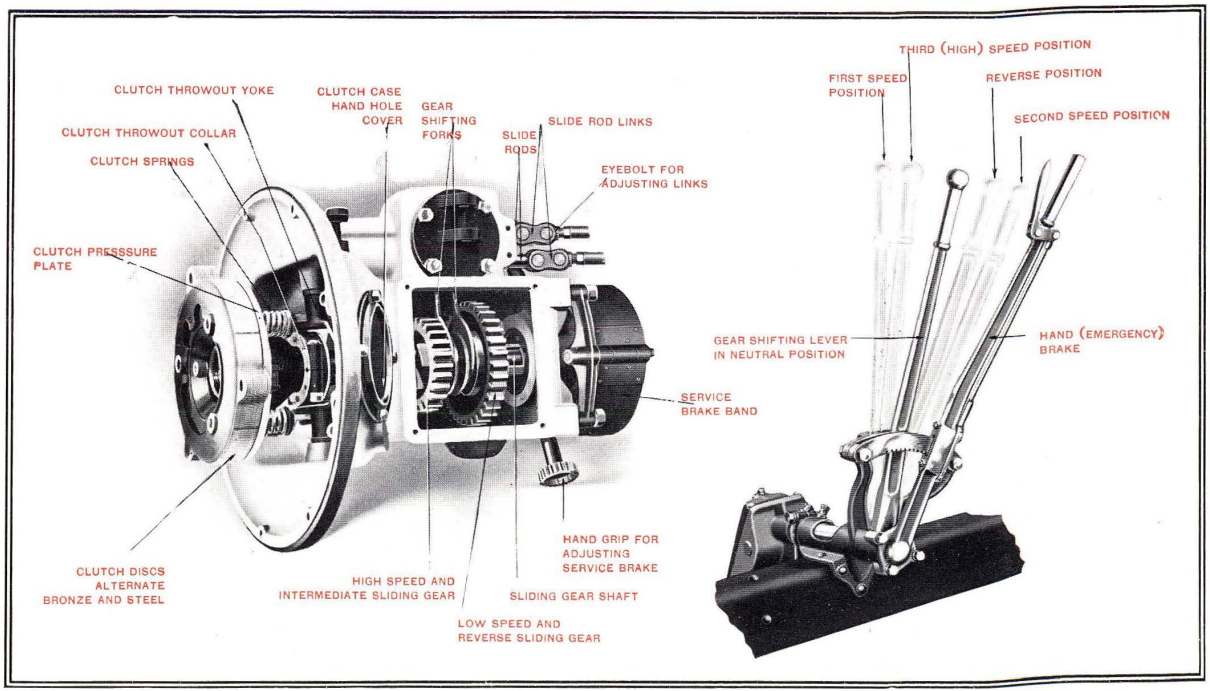


Fig. 12. Movements of Gear Shifting Lever and View of Transmission and Clutch of Chalmers "30"

The Action of Speed Changing Gears

The three forward speeds are obtained by the movements of two gears sliding upon the "sliding gear shaft" (A) and keyed to it (Figs. 11, 13 and 14).

These gears are moved back and forth by the "gear shifting forks" (F), fastened to the "slide rods" (C), which are in turn moved by the gear shifting lever.

Sliding the "high and intermediate gear" (2) forward engages it with a gear (1) on the end of the clutch shaft (B), and moves the car forward on high gear or direct drive.

Sliding the above gear (2) backward engages it with the second speed gear (5) and drives the car forward on second speed. The counter shaft (E) is driven by gear (4) which is always in engagement with (1).

Sliding the large "low speed and reverse gear" (3) forward engages it with the third speed gear (6) and drives the car forward at low speed.

Reverse drive is obtained by sliding the "low speed and reverse gear" (3) backward until it engages with an idler gear (not shown), which meshes with gear (7) and thus reverses the motion of the "sliding gear shaft" (A).

Movements of Gear Shifting Lever

The three forward speeds and reverse are obtained by movements of one change speed or gear shifting hand lever. The method of making gear changes is described under "General Directions for Operation," page 7. The lever moves in two directions—forward and back, in and out. The four positions of the lever to obtain the various speeds are shown in Fig. 12.

In neutral position, with no gears engaged, the lever is in the middle of the quadrant, its upper end pressed outward from the car by the action of a spring.

In first speed position the lever is brought in toward the car and back to the end of the quadrant slot.

In the second speed position the lever is pushed out from the car and forward to the front end of the slot.

In third or high speed position, the lever is out from the car and at the rear end of the slot.

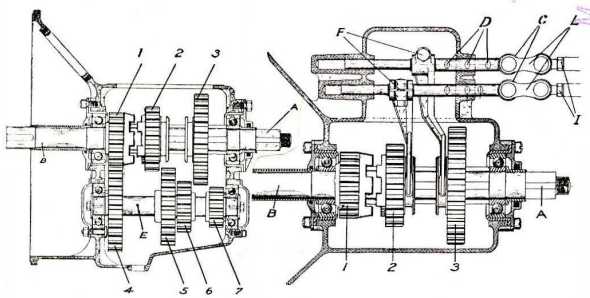


Fig. 13. Transmission—Side Elevation

Fig. 14. Transmission—Plan View

In reverse position the lever is brought in toward the car and then pushed forward to the front end of the slot.

By these movements of the hand lever, forward and back and in and out, one or other of the two "slide rods" (C) is pushed backward or forward (Figs. 11, 12, 14). Attached to these rods are the gear shifting forks which move the sliding gears.

Speed Changing Procedure

Always be sure to disengage the clutch before attempting to shift the gears.

Do not shift the gears forward too hurriedly but do not delay so long, after clutch has been disengaged, that car slows down.

Experience will teach the proper speed to acquire on one gear before changing into the next higher gear. This will, of course, depend upon road conditions and the load.

When changing from a higher to a lower speed make the shift quickly and do not allow the speed of the motor to decrease.

There should be little or no noise in making gear shifts. If you hear a clash or clatter, it means that the operation is poorly done. Unskillful gear shifting is hard on the transmission.

Always be sure to leave the gear shifting lever in neutral position when you stop the car.

Adjustment of Gear Shifting Mechanism

There should be little occasion to disturb the adjustment of the gear shifting mechanism. Such an adjustment should be made by a Chalmers dealer. In case an owner has to make the adjustment himself, the following directions are given.

Fig. 14, page 37, shows the sliding parts of the transmission. Slide rods (C) are threaded into the shifting forks (F) which are in turn clamped in place. Notches (D) in the slide rods engage a wedge-shaped catch which prevents the rod from working back and forth unless operated by the hand lever. The shifting forks (F) should be so located on the slide rods (C) that when the gears are properly in mesh, the little wedges will enter the notches and prevent the gears from shifting. To adjust the connecting links "L" place both the gears and the shifting lever in neutral position and then adjust the eye bolts (I) until the links (L) fit properly.

Adjustment of Differential Driving Gears

The function of the differential drivin[g. 11) is to allow the two rear wheels to turn at d[es of speed—as in going around corners or over bum[

This is accomplished by means [of small bevel gears inside the large "driving gear[

The differential gears should [attention. If, however, anything should arise ne[adjustment, be sure to have it done by a Chalmer[correct adjustment of these gears will mean troul[e.

If it becomes necessary for an [uke such an adjustment himself, he should commu[h Service Department of the Chalmers Motor Co[

Cleaning and Oiling Transmission [rer

Complete directions for drainin[and oiling transmission and differential gear ca[in the "Directions for Lubrication", beginnin[

PROPER CARE OF MOTOR

Running a New Motor

Do not, under any circumstances, run a new motor at high speed for very long.

Do not race the motor unnecessarily.

This is very hard on the mechanism and there is never any reason for it.

Maintaining Compression

It is important that the compression in all the cylinders should be equal and be up to the proper standard. Faulty compression may be shown by loss of power or missing of motor.

Compression should be tested occasionally by turning the starting crank (with switch turned off) until resistance is felt in each of the four cylinders successively. Compare the resistance in each of the cylinders.

If the compression of one cylinder is less than the others, or if all are weak, the valves may not be seating properly:

(1) On account of too little clearance between the valve stems and the valve tappets (see page 41), or

(2) Because there is a small deposit of carbon on the face of the valve.

Either of these faults may be quickly remedied. If they do not exist the valves need grinding.

Grinding the Valves

Leaky valves should be ground to fit properly in their seats, using some prepared valve grinding paste or mixture of oil with fine emery powder or ground glass.

Inlet Valves—To grind the inlet valves, disconnect the "rocker arm" (Fig. 15, page 40) by pressing down hard on one end of it and lifting the "push rod" clear of the "valve tappet." By unscrewing the large "inlet valve cage nut" (Fig. 9, page 30) the inlet valve and cage may be lifted out. If the valve is held while the "spring washer" is forced downward, the "locking clip" can be removed. The washer is then free to slip over the end of the stem and the valve can be removed from the cage by removing the cotter-pin from the valve stem.

Exhaust Valves—To remove these valves, the "exhaust valve" plugs (Fig. 9) should first be unscrewed. While holding the valve down from above, lift up the "spring washer" (Fig. 15) with the valve lifting tool provided for that purpose, and remove the "locking clip." The valve may then be lifted out without trouble.

Clean the valve, noting also whether the stem is clean and in good condition. Stuff rags or waste into the exhaust passage between the valve and the cylinder to keep grinding material out of the latter. Replace the valve upon its seat and grind by rotating with a screw driver, with the grinding paste between the valve and the seat.

The valve should be ground until it has an even bearing all around its face. Carefully remove all the grinding compound and the waste. Wash out the valves and cylinders with gasoline when through grinding.

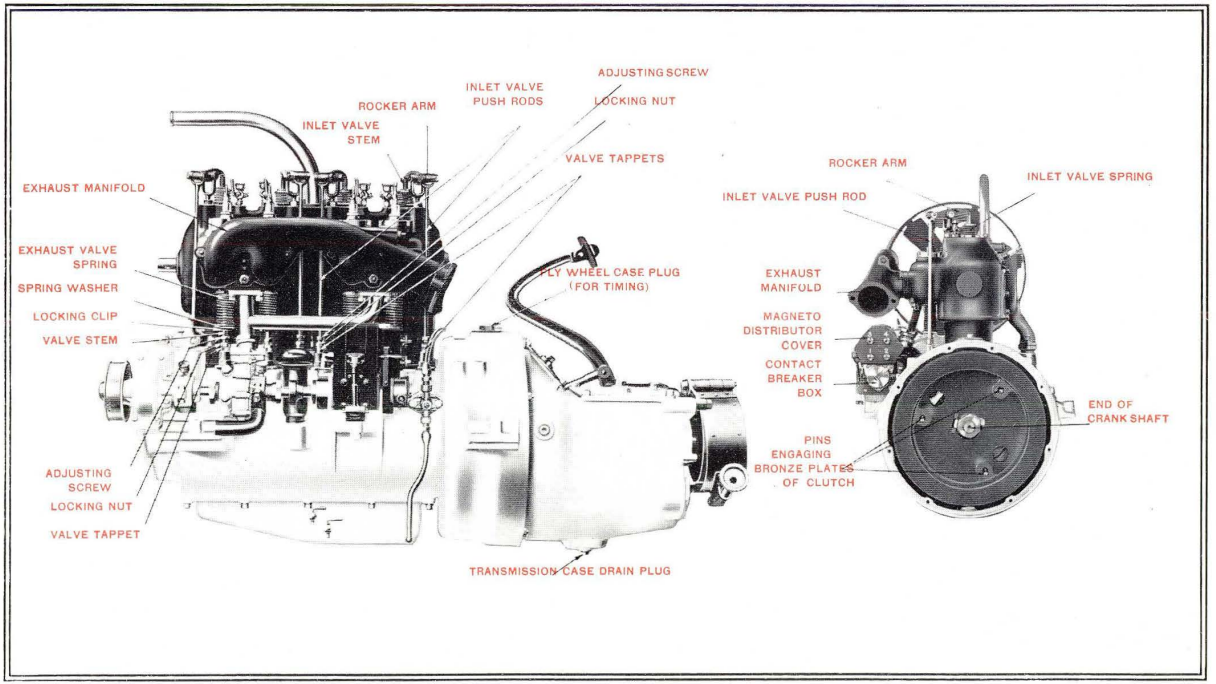


Fig. 15. Exhaust Side and Rear View of Chalmers "30" Motor

Valve Timing

The time and amount of opening of the valves depends upon the adjustment of the valve tappets (Fig. 15), which bear upon the cams of the cam shaft (Fig. 5, page 14). To adjust the timing, proceed as follows:

Remove the plug in top of fly wheel case (Fig. 15), through which one may see the marking on the fly wheel. Crank the motor until the exhaust valve of cylinder No. 1 just closes. This point is reached when you are just able to turn the "valve tappet" under the "valve stem" with your fingers.

At this point the mark "Ex. Cl." (Exhaust Closes) on the fly wheel should be across the center of the hole on top of the fly wheel case. If the closing is not correct, rotate the fly wheel to bring this mark directly under the hole and adjust the valve tappet so that it will be just freeing itself at this point. This adjustment is made by loosening the "lock nut" and screwing the "adjusting screw" up and down (Fig. 5).

Upon turning the fly wheel 9/32 inch further in the same direction, the mark "In. Op." (Inlet Opens) will appear. The inlet valve on No. 1 cylinder should just start to open, when this mark is opposite the center of the hole. If not, adjust as above. This operation should be repeated for each cylinder.

Carbon in Cylinders

If the motor knocks when the spark is not retarded, keeps on firing after the ignition switch has been turned off, and does not seem to develop the normal amount of power, it is probable that the cylinders have become carbonized.

This can be prevented by the regular use of kerosene. Pour two or three tablespoonfuls of kerosene through the "compression relief cock" (Fig. 16) into each cylinder once a week when the motor is warm, and let stand over night. This will remove a large part of the carbon and improve compression.

About once in three weeks, after carrying out the above instructions each night, repeat the dose in the morning. Start the engine, letting it turn over at medium speed, and pour slowly about half a pint of kerosene into the air intake of the carburetor. This should be done slowly so that it will not stall the motor.

An even better liquid to cut carbon than kerosene is a mixture of one-fourth alcohol and three-fourths kerosene. This should be put in through the "relief cocks" only.

If treatment with kerosene does not remove the carbon, it will be necessary to remove the cylinders and scrape it off the piston heads and from the walls of the combustion chambers. After this operation it is desirable to grind the valves.

Adjusting the Connecting Rod Bearings

These are practically the only bearings in the car that require any adjustment. This work should be done by a Chalmers dealer but an owner or chauffeur may proceed, if necessary, as follows:

Remove the sod-pan; drain out the oil from the crank case by removing plug (Fig. 16).

Remove the oil reservoir from beneath the motor, thus exposing the interior of the crank case (Fig. 9, page 30). After loosening the "connecting rod bolts," one or more liners (thin

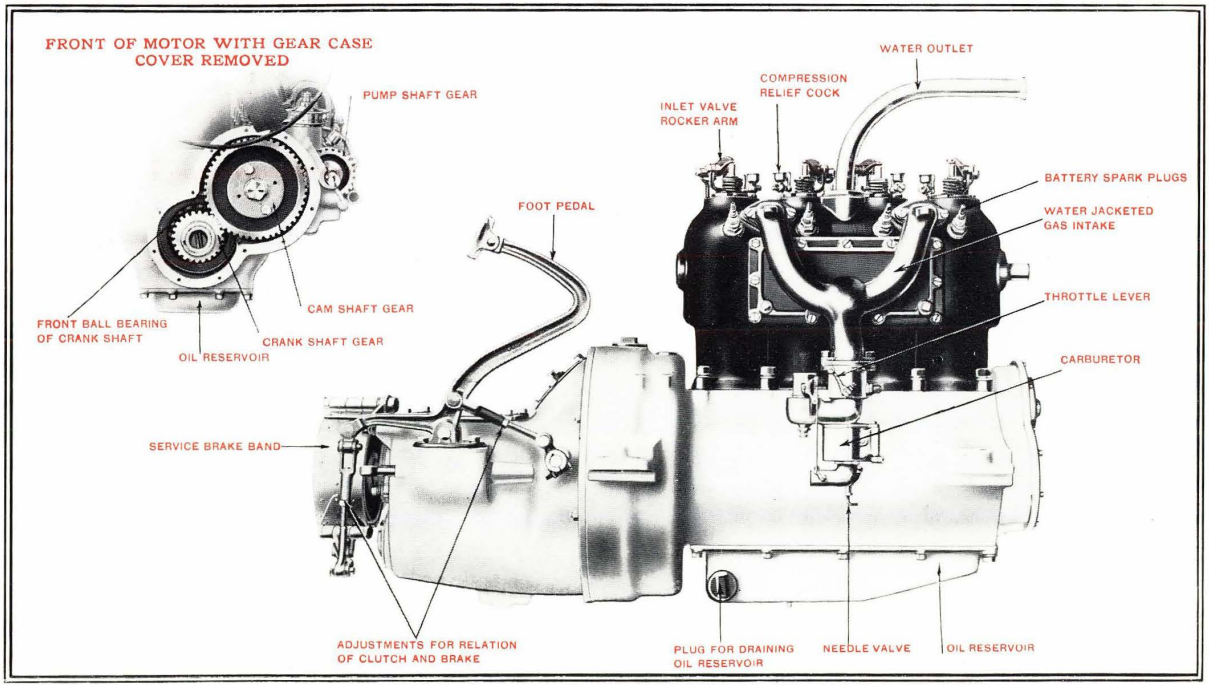


Fig. 16. Intake Side of Motor and View of Gear Case—Chalmers "30"

metal strips) may be removed from beneath the "bearing caps" until the proper adjustment is reached. Be careful not to make the bearings too tight.

Cranking the Motor

Continued cranking of the motor is never necessary.

If the motor does not start readily, look for the reason and correct the trouble instead of tiring yourself out by continued cranking.

Except when warm, a new motor always "turns over" stiffly. This is because all the bearings and working surfaces are snugly fitted to insure long life.

It is better to crank with the left hand, as there is less likelihood of personal injury in case the motor should "kick back." The correct methods of starting the motor are given under "General Directions for Operation," on page 7.

RUNNING GEAR

Foot Brake or Service Brake

The foot brake, or service brake, is on the drive shaft immediately behind the transmission (Fig. 16, page 42). It is of the contracting type, consisting of a steel band lined with a heat-proof material. All ordinary adjustments of the brake are made by means of the "hand grip" to be found beneath the foot board (Fig. 15, page 40).

Ample opportunity is permitted for the release of the clutch before the brake begins to act. An adjustment is provided both upon the clutch mechanism and the brake, so that any desired relation may be had between the two (Fig. 16). Do not get the brake band so tight that the clutch may not be thrown out without applying the brake. There should be a very perceptible amount of movement in the foot pedal between the time of the clutch throw-out and the brake action.

The steel band can be readily relined when necessary by cutting off the old rivets, and applying new lining.

Hand Brake or Emergency Brake

The emergency brake, placed upon the rear wheels, is of the metal to metal internal expanding type, operated by a hand lever.

Adjustment of these brakes is made by shortening or lengthening the two "brake pull rods," by means of the threaded "brake pull rod adjustment" (Fig. 1, page 10). By this adjustment the wear of the cast iron brake shoes may be taken up until they are completely worn out. The entire shoe may then be replaced at less expense than is usually necessary for relining the ordinary hub brake.

In adjusting the rear wheel brakes care should be taken to see that they are adjusted evenly, so as to apply the same resistance to each rear wheel.

Using the Brakes

Apply the brakes gradually. This is not only easier on the brakes but saves the tires and applies the minimum strain to the car.

When slowing down the car or stopping, rounding corners, or approaching crowded traffic, reduce the speed as much as possible by closing the throttle and then apply the brakes. Do not throw on the brakes unnecessarily when your car is moving fast.

When descending very steep hills, lessen the strain on the brakes by shifting the gears into second speed, letting in the clutch and allowing the motor to run with the spark only slightly advanced. In this way the motor itself will serve as a brake, as the car cannot run faster than the motor is running.

Steering Gear

The steering gear is of the worm and gear type. Directions for its lubrication are given on page 11.

Adjustment of the steering gear is required only at long intervals and should, if possible, be made by a Chalmers dealer. There are only two points which can require adjustment:

(1) The bearing at the point where the steering post enters the steering gear case (Fig. 1, page 10). Should end-play of the steering column develop, the adjusting nut can be screwed down a little and locked in place by the locking spring.

(2) Adjustment of the bearing on the "ball arm shaft" takes up lost motion in the steering wheel. To adjust this it will be necessary to remove the steering gear from the car.

The exterior steering connections, including the various joints between the reach rod, steering knuckle, cross rod, etc. (Fig. 1, page 10), should be frequently inspected, kept in good condition and properly lubricated.

Spring Clips

Tighten up the spring clips hard and often to avoid spring breakage.

The object of the spring clips is not only to hold the springs firmly to the axles, but also to prevent movement of the spring leaves between the clips. Breakage of springs at the middle is almost entirely caused by loose spring clips.

When the car is new, the spring clips should be examined and tightened every day until the stretch of the metal has been taken up. After this the clips need not be examined oftener than once a week.

Spring Hangers

Keep hangers well greased and tight. (Fig. 1, page 10).

See that the bolts work in the bearing of the spring and not in the hangers.

COLD WEATHER PROCEDURE

In General

When the motor is cold, the gasoline vaporizes slowly, ignites slowly and burns slowly; hence to start a cold motor requires a richer mixture and earlier spark than when the motor is warm. To insure a rich mixture:

Be sure the gasoline is of good quality and has no water in it.
Drain sediment cup at bottom of gasoline tank to get rid of water and sediment.
Do not open throttle more than one-third.
Be sure carburetor is adjusted to give sufficient gasoline.

Stopping the Motor

Before stopping the motor close the starting valves (by pulling rod at front of radiator) and thus choke the motor instead of turning off the switch. After the motor stops turn off the switch.

Closing these valves produces a mixture which is too rich to ignite and thus leaves the cylinders full of a rich charge.

Starting the Motor

To start the motor in cold weather, always close the starting valves.

Crank in the usual way. Spin the motor, if necessary.
After motor starts, open the starting valves.

Priming the Motor

If the motor is too cold to start by the above method, place a small quantity of gasoline in each of the cylinders through the priming (relief) cocks.

This provides an initial charge of gas for starting the motor, after which there should be no difficulty.

Draining the Car

If the car is not to be used during freezing weather, the water circulation system should be thoroughly drained.

Open the cock underneath the radiator, remove the pipe plug from the bottom of the water pump and also the small plug in the water jacket cover, open the cock in the carburetor hot water pipe. Radiator filler cup should be removed. Rock the body a few times to get out all the water.

The motor may be started and run for a minute to evaporate any moisture remaining. Be careful not to run motor long enough to overheat it, as there is no cooling water in jackets.

Anti-Freezing Mixture

In freezing weather the water circulation system should be filled with one of the following anti-freezing solutions:

For temperature not lower than 5 degrees below zero:

Wood Alcohol	15 per cent
Glycerine	15 per cent
Water	70 per cent

For a temperature not lower than 15 degrees below zero:

Wood Alcohol	17 per cent
Glycerine	17 per cent
Water	66 per cent

About three gallons are required for the Chalmers "30."
Alcohol should be added occasionally to make up for evaporation.

TROUBLES

Important Advice

Do not touch any adjustments or tamper with any parts until you know what causes the trouble. Otherwise you may get everything out of adjustment.
When in doubt, don't do anything. Sit down and analyze the problem.

Motor Fails to Start

(1) Lack of gasoline.
See that tank is full and cock in gasoline pipe open.

(2) Lack of ignition current.
This may be due to neglect to turn on switch, run down storage battery, broken or disconnected wire or incorrect coil adjustment.

Lack of ignition current is shown by failure of the coil to buzz when the spark lever is moved to different positions around the quadrant.

(3) Dirty spark plugs.
These are due to excessive amount of oil in the motor and to long use whereby the points become coated with carbon. Dirty spark plugs should be removed and cleaned.

Motor Stops

(1) Lack of gasoline.

(2) Disconnected switch or wires.

(3) Short circuiting of magneto ground-wire.

(4) Lack of oil.

Motor Misses

(1) Weak battery.
Shift at once to magneto.

(2) Broken or disconnected wiring.
Shift to the other ignition system to see whether cylinders fire properly on it.

If the motor misses on the magneto, short circuit the magneto spark plugs, one after another, by touching a hammer or screw driver from the metal of the cylinders to the terminals of the spark plugs. When one is reached which makes no difference in the running of the engine, this is probably the plug at fault.

If the motor misses on the battery, you can locate the missing cylinder by holding down the vibrators on top of the coil, one after another. When one is reached which makes no difference in the running of the engine, this shows which cylinder is not firing.

(3) Dirty spark plugs.
Shift to the other ignition system to see if the cylinders fire on it, and test as per paragraphs above.

(4) **Points of spark plugs improperly set.**
If these points are too close together or too far apart, missing may result. Battery spark plug points should be set a scant 1/32 inch apart, about the thickness of a dime. Magneto spark plug points may be set closer—about 1/64 inch.

(5) **Imperfect contacts in the commutator.**
Open the cover of the commutator to see if there is any dirt in it.

(6) **Incorrect coil adjustment.**
Directions for coil adjustment will be found on page 26.

(7) **Defective carburetor adjustment.**
Consult Chalmers dealer. See page 21.

(8) **Loss of compression in any cylinder.**
Valve may be stuck or there may be dirt under it. Examine the valve tappet to see whether the valve seats properly. To locate cylinder that is weak on compression, turn over the motor by hand, testing each one in turn. See page 39.

(9) **Air leak around inlet valve cage.**
Can be detected by putting oil or water around the inlet valve cage nut (Fig. 9, page 30).

(10) **Water in gasoline.**
Indicated by motor running and stopping and running again, by fits and starts.

Motor Overheats

(1) **Lack of proper lubrication. See page 11 and page 29.**

(2) **Defective water circulation.**
Inspect all water passages making sure that the gaskets (washers) at flanged joints have not swollen in such a way as to cut down the opening.

(3) **Running with open throttle and retarded spark.**
The spark lever should be kept as far advanced on the quadrant as possible without causing the motor to knock. This saves fuel besides avoiding overheating.

(4) **Slipping fan belt or bent fan plates.**
Belt should be tightened and plates bent to the proper angle.

(5) **Too much gasoline.**
Too rich a mixture is indicated by black smoke at the exhaust.

The motor will sometimes continue to fire after the switch has been turned off even though the water is not hot enough to indicate overheating.
This firing is caused either by a carbon deposit in the cylinders which becomes incandescent or by some metallic edge or point within the combustion space which becomes red hot. Such sharp points should be located if possible and smoothed down.
For carbon in cylinders see page 41.

Motor Knocks

(1) **Connecting rod bearings too loose.**
Loose bearings give a light knock at high speed. If you are

sure that faulty bearing adjustment is the cause of the trouble it is best to have these bearings adjusted by a Chalmers dealer. If you do it yourself, directions will be found on page 41.

(2) **Carrying the spark too far advanced.**
See above under "Overheating."

(3) **Lack of proper lubrication within the motor.**
See page 11 and page 29.

(4) **Faulty carburetor adjustment.**
Consult Chalmers dealer. See page 21.

(5) **A loose piston in one of the cylinders.**
Remedying this trouble should by all means be intrusted to a Chalmers dealer.

(6) **Carbon in cylinders.**
This carbon becomes heated and may cause premature ignition.
For cleaning cylinders see page 37.

(7) **Motor speed too slow when pulling up hill on direct drive.**
Shift into second speed.

(8) **Crank shaft bearing loose.**
Heavy pound at slow motor speed under heavy load.
The adjustment of this bearing will have to be made by a Chalmers dealer.

(9) **Dirt or a broken ball in crank shaft bearing.**
Proper lubrication with good oil will prevent dirt in bearings. A broken ball is an exceedingly rare possibility.

Motor Will Not Stop

(1) **Short circuit in switch.**
Disconnect the battery wire, or "ground" the magneto by touching a screw driver to "breaker box" and frame at the same time.

(2) **The wire connecting magneto and switch or the "ground wire" from coil to commutator may be disconnected.**
"Ground" the magneto as above.

(3) **Overheating.**
Motor runs with some pounding and slowly. Close throttle completely. See above under "Overheating."

Loss of Power

The motor will run, but will not pull the car under a heavy load. May be due to:

Loss of compression.

Too rich a mixture, through carburetor flooding.

Valves not seating properly and not holding compression.

Weak ignition.

Lack of oil or water.

Lack of gasoline.

If this is due to stoppage of the gasoline pipe, the motor will spit back through the carburetor when the throttle is open.

Dragging brakes.

See if the car can be rolled by hand easily or if it will coast down hill with clutch released. Feel the brakes to see if they are hot.

Flat tire.

Clutch Slips

A slipping clutch can be detected by the engine's running away from the car when the throttle is open.

For remedy see page 35.

Clutch Grabs

If the clutch takes hold too suddenly this may be due to

(1) Lack of proper lubrication of clutch.

(2) Too tight an adjustment of the clutch springs. For remedy see page 35.

Lack of Good Compression

This is generally due to leaky valves. These should be adjusted or reground. See page 39.

A very likely place for loss of compression is around the inlet valve cage. This can be remedied by washing the seat in the cylinder head, and seeing that the copper gasket (washer) is in good condition. Be sure that the "inlet valve cage nut" (Fig. 9, page 30) is tight.

Popping Back Through Carburetor

This usually indicates too weak a mixture and may be caused by:

Faulty needle valve adjustment.

Dirt in gasoline passage or nozzle.

Air leak in the intake passage or around the inlet valve cage.

Inlet valves holding open.

Water in the gasoline.

Excessive temperature of the water jacket of the carburetor, especially in hot weather.

This can be remedied by shutting off the water from the carburetor.

Squeaks

Squeaks in the motor and running gear are generally due to lack of lubrication, which should be remedied at once.

If the springs squeak pry the leaves apart and apply graphite grease between them. See page 12. See that all nuts and bolts are tight—especially spring clip nuts.

DRIVING SUGGESTIONS

Starting

In starting an automobile, the object to be striven for is to have the car pass from a stationary position into rapid motion with a minimum of strain on the motor and other parts. A skillful driver aims to create a steady pull on the driving mechanism from the moment he begins to slip into first speed until the car is under full headway.

Starting with a jerk or passing unevenly from one speed to another, strains the motor, racks the frame and causes various troubles in the driving mechanism. The proper way to start, after you have learned the rudiments of gear-shifting, is as follows:

Having started the engine, with the gears in neutral, throw out the clutch, advance the spark lever two-thirds of the way up the quadrant, throw in first speed, let in the clutch gently and increase the motor speed gradually with the foot throttle or accelerator until the motor picks up the load of the car.

As you throw out the clutch to shift into second speed release the accelerator, thereby throttling down the motor. With the motor thus throttled and the clutch out shift to second speed, let in the clutch and again accelerate.

Repeat this operation in going into high gear.

By throttling down the motor just before shifting gears you cause the two gears which are to be meshed to run at about equal speed. This permits a smooth shifting of gears and avoids racing the motor. More important than all, it creates a steadily increasing pull from the first application of power until the car is fully under way.

Speeding

Upon receiving a new car do not allow your delight in the swift motion and easy control to run away with you. Above all do not get so enthusiastic that you take your car out on the road and run it at top speed. Wait until you are perfectly sure of your ability to drive.

Not only this, but wait until you have given your car a chance to settle. Any new piece of machinery, no matter how carefully adjusted or thoroughly tested in building, needs to be run awhile before it reaches its maximum efficiency. Give your bearings a chance to wear down to a nicety and all your working parts a chance to get into proper harmony.

Remember that a touring car is not a racing car.

Its oiling facilities are designed for touring and not for racing.

A few miles of racing at top speed is harder on the bearings of a car than days or even weeks of steady touring at a reasonable speed.

Hill Climbing

The wise driver will use his intermediate gear on steep hills even where he could climb them on high.

It is only the novice who wants to climb every hill on high.

If you watch the expert drivers who handle cars in endurance

runs and other contests, they will teach you to use the intermediate gear on hills or heavy roads.

The intermediate gear was put into the car to use and the wise driver will use it on hills, in mud or in sand just as soon as he sees that the high gear is beginning to tax his motor.

When approaching a hill which you see must be taken on high speed, get a good start on high and rush the hill—provided the road is good and you can see where you are going.

As soon as the motor begins to labor, shift at once to second or first speed, while the car still has good momentum. Don't let the car slow down.

Bad Roads

In coming to a bad piece of road, full of ruts, bumps or holes, it is best to shift immediately into second speed.

With this gear you have much better control of the car, you can stop more quickly and can pick up more readily than on high gear. Using second speed you can control the car almost entirely with the throttle, letting yourself down easily into holes and over bumps, without having to slip the clutch.

In going over abrupt bumps, high water-breaks or ridges, slow up and cross them obliquely instead of hitting them squarely.

This will break the jolt, because the springs receive the jar successively instead of all at once.

In going through sand it is better to let the car find its own traction rather than to use energy holding the car in line and forcing it to make a track for itself.

If you do not try too hard to guide it, the car will always find the easiest track to follow.

In Traffic

In going through the crowded down-town streets of cities it is wise to use the second speed instead of attempting to run on high and continually shifting to second in tight places.

The Chalmers second speed is high enough to use continously in slow driving without noise or inconvenience to the driver or harm to the motor from racing.

In coming to a crossing where he sees that he will have to stop. the good driver begins to slow down gradually instead of waiting until he is close to the crossing and then jamming on the brakes.

It is just as important to avoid straining the car in stopping as it is in starting. Smooth, easy starting or stopping saves tires.

Skidding

In passing over wet pavements or slimy roads avoid sudden turns or changes of direction. Avoid also sudden application of the brakes.

To avoid skidding—when you feel the rear end of the car starting to slip, make a quick turn toward the same side and the car will right itself.

When a car starts to skid on account of the sudden application of the brakes or of the power, throw off the power or brakes and let the car coast free. In this condition the car will skid the least.

MISCELLANEOUS SUGGESTIONS

Washing the Car

Great care should be exercised in washing the car, especially during the first few months that it is in use.

Varnish requires some time to season thoroughly, and while seasoning is easily affected. Gasoline or soaps injurious to varnish should never be used. Castile or Ivory soap is best for removing grease.

Use plenty of lukewarm water and rinse the body thoroughly. Never use extremely hot or cold water for washing the body.

Mud should not be allowed to dry on the car if it is possible to avoid it. Use plenty of water to soak the mud off rather than rubbing it off.

For drying the car after washing, use a clean chamois skin. Wring this frequently out of clean water.

It is better to remove a thick coat of dust by washing rather than by dusting. For ordinary light dusting, a woolen duster is preferable to a feather duster.

Tires and Their Care

The tires should be kept pumped up hard all the time. A soft tire may ride easier, but will cause much tire trouble.

Soft tires are liable to punctures and blowouts.

Cuts in the outer casing should be promptly revulcanized to prevent water and dirt from working in and rotting the fabric.

Never allow oil to remain on the tires as it rots the rubber.

Do not allow car to stand with tires in water.

If the car is allowed to stand for long intervals, it should be jacked up so that the weight will not rest on the tires.

In general, all tire troubles should be taken up directly with the tire makers.

Don'ts

Don't start on a trip without attention to oil, gasoline and water.

Don't go on an extended trip without testing your battery.

Don't fail to keep your brakes adjusted. It is more necessary to be able to stop the car than to start it.

Don't neglect to keep your lamps filled. You may need the light badly some time.

Don't leave the car alone with the motor running.

Don't stop the car on the wrong side of the street.

Don't drive faster than the law allows.

Don't fail to release the hand brake before attempting to start.

Don't "jump" the car by quick opening of the throttle.

Don't forget, above all else, that an automobile is the finest piece of machinery in the world and that you will be repaid in excellence of service many times over for the care and attention given it.

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