Chalmers Book of Instructions

"Master Six"

Model 29

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

Please tear off and mail to Chalmers Motor Company, Detroit, Mich.

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 on frame—right side—beneath front floor board)_____

Motor No. (See right rear foot of motor)_____

From whom purchased_____

Address (of seller)_____

Does car operate satisfactorily?_____

_____

_____

Finish of car_____

REMARKS

_____

_____

_____

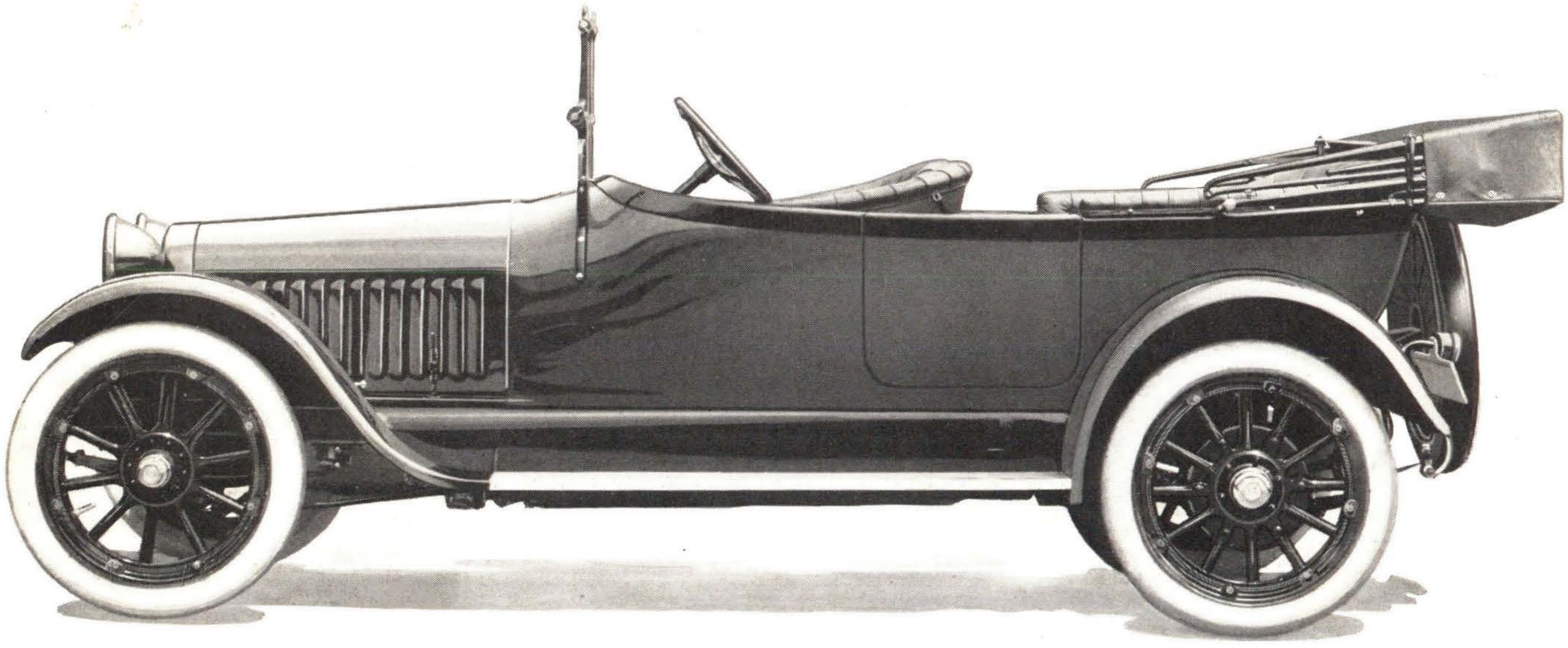
Name of Owner_____ Occupation_____

Street and number_____

City_____ County_____ State_____

Quality First

All Chalmers Dealers carry in stock repair parts for Chalmers Cars. Chalmers owners are requested to purchase all such parts from the nearest Chalmers dealer. Such a course will greatly facilitate service to owners in case of emergency

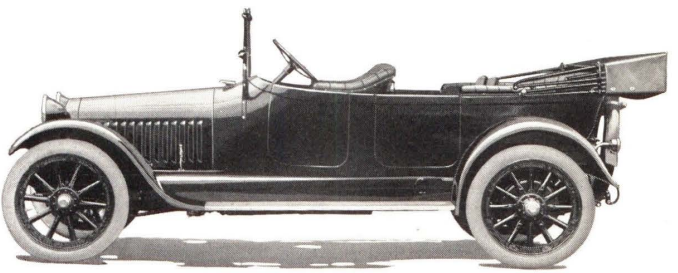


Chalmers "Master Six" (Model 29) 5-passenger Torpedo

Book of Instructions

Chalmers "Master Six"

Model 29



Chalmers "Master Six" (Model 29) 7-passenger Touring Car

Chalmers Motor Company
Detroit, Michigan

Table of Contents

Illustrations

Introduction

WHILE it is the object of the Chalmers Motor Company to build Chalmers cars as nearly trouble-proof as expert mechanics, the most modern automobile machinery and rigid inspection can make them, complete freedom from trouble can come only through a thorough understanding of the car and proper care of its various parts.

It must be remembered that a motor car is a machine, and, like all machines, it will not work properly if misused. The handling of a car, how to lubricate it and how to keep it clean, are things which must be understood if satisfaction is to be assured.

The object, then, of this book of instructions is to help Chalmers owners get the most satisfaction with the least trouble from their cars by giving them a proper understanding of the principles upon which a motor car operates and as thorough a knowledge as possible of how to care for a car. No effort has been made to tell how to take the car apart. The car, properly cared for, will require very little taking apart; and when such an operation is necessary we want you to have as little as possible to do with the work. This is a book of directions, not a repair man's manual.

If anything should happen to necessitate tearing down any part of your Chalmers car 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 repairs yourself, do not act hastily. Study out what may be wrong before you begin to unfasten things. At all times the Service Division of the Chalmers Motor Company stands ready to furnish you information, advice and assistance. This department is maintained entirely for the benefit of Chalmers owners. Its experts will be glad to give you assistance in every difficulty. Please feel free to write the Service Division regarding any point about which you may desire help.

We advise every driver of a Chalmers "Six" to read this book carefully before putting his car in operation. You may understand motor cars, but you cannot know too much about the particular car you are driving. New owners are especially requested to read the entire book thoroughly before putting into practice the "Directions for Operation."

Chalmers Motor Company
Detroit, Mich.

Repairs & Correspondence

It is our effort to build Chalmers cars so that repairs will be unnecessary. Accidents, lack of proper care or hard usage, sometimes, however, necessitate replacements.

To facilitate the making of needed replacements, all Chalmers dealers carry ample stocks of repair parts in addition to the stock carried at the factory. To secure prompt service all communicate with the nearest Chalmers dealer.

When possible, parts should be ordered through Chalmers dealers, otherwise they will be sent C. O. D. unless cash accompanies the order. We are compelled to make this rule to avoid opening a large number 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 right side of the frame beneath the front floor board) and the type of body.

Please write a separate letter about each subject. Mail is distributed to different departments at the factory according to subjects 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 35.

Fill gasoline tank.

Directions on Page 25. See that shut-off cock in gasoline pipe is open. (See Figure 4, Page 24.)

Fill motor crank case with oil to level of top try cock. (See Figure 7, Page 36.)

Directions on Page 37.

Be sure that transmission (see Page 17) and universal joints (see Page 18) are well lubricated. Fill transmission case with motor oil to level of try cock.

Put oil in oil holes and turn down grease cups. (See Figure 2, Page 16.)

The car when shipped from the factory is sufficiently lubricated for at least fifteen miles of road work. We do not, however, assume responsibility for any damage due to lack of attention in this matter on the part of the owner. Complete oiling directions are given, beginning Page 17. The motor oiling system is described in the section on "Lubrication System," Page 37.

Before Starting the Motor

See that the gear shifting lever is in the neutral position.

Full instructions regarding this lever are given on Page 43.

The auxiliary gasoline tank in the cowl (see Pages 24 to 27) should contain gasoline.

To make doubly sure that this is the case give the hand pressure pump, located on the cowl of the dash, a dozen strokes. (Full directions for operating the hand pressure pump given on Page 25.)

Advance throttle lever (the longer lever on steering wheel quadrant), from one-half inch to one inch from base of quadrant.

Set spark lever (the shorter lever on steering wheel quadrant) at two inches advance, or more, up to half way.

In cold weather, adjust carburetor for "rich" mixture. (Directions for operating dash carburetor adjustment on Page 28.)

In cold weather the cylinders should also be primed with gasoline. On the cowl of the dash is a priming cock. Always turn this cock back to off position before starting motor.

Move starting switch on cowl of dash to the point marked "start." As soon as motor starts, adjust spark and throttle levers till motor "idles" quietly; advance spark lever two-thirds of the way up quadrant; retard throttle lever to point where motor does not "race."

When crank is used to start motor, follow directions as above, then give starting crank a few brisk spins in clockwise direction. If motor does not start, see Page 64.

When the Motor Starts Do Not Forget

To advance spark lever about two-thirds way up quadrant.

To close throttle until motor runs slowly.

To readjust dash carburetor lever until motor fires evenly and smoothly.

To Put Car in Motion

After taking seat at steering wheel, release hand brake. (See Figure 11, Page 45.)

Never forget to release this brake.

Disengage the clutch by pushing the pedal at left with left foot. (See Figure 1, Page 11.)

Increase the speed of the motor slightly.

This may be done by advancing the hand throttle lever a short way along the quadrant or by pressing on the accelerator pedal (Figure 1, Page 11) 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 and one-half inches from base of 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 11.)

The gear shift quadrant on the Chalmers "Six" Series A is of the sliding gear type, with four speeds forward and reverse. (See Figure 11, Page 45.)

A spring catch operating from the top of the gear shifting lever prevents accidental shifting of gears into REVERSE. In starting the car FORWARD, be sure that the hand is not pressing down on the button at the top of the gear shifting lever.

Pull the gear shifting lever to left and push it forward into FIRST speed position.

Explanation of the gear shifting mechanism will be found on Pages 41 to 46.

The clutch must be fully disengaged during gear shifting operation.

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.

Pull gear shifting lever straight back through neutral into SECOND speed position.

This shift should be made quickly. If made slowly or timidly the gears will probably not engage at once. The car will then lose momentum and it will be necessary to return to first speed.

Open throttle to increase the speed of motor, using either throttle lever at top of steering wheel or foot accelerator, and engage the clutch as before.

As stated above, the beginner will probably gain the best results by leaving the throttle lever part way open while shifting gears.

Allow the car to gain headway to about ten or twelve miles an hour.

Again disengage clutch.

Push gear shifting lever forward to neutral position; then over to the right; then with a quick movement forward into THIRD speed position.

This operation takes but an instant when the driver has learned to shift gears with confidence. This shift should always be made quickly to avoid clashing the gears.

Again accelerate speed of motor and engage clutch.

Again disengage clutch.

Pull gear shifting lever back into FOURTH 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 always advanced well up the quadrant. This gives a hot and fast spark. Tendency of the motor to fire unevenly or pound under "load" will indicate if spark lever is too far advanced. Retard to point where motor pulls smoothly.

To Change Back Into Lower Speed

If, in going up a steep hill or through heavy going the car is slowed until the motor labors unusually, the gears should be shifted at once into the next lower speed. For ordinary grades it will not be necessary to go below third speed. On steep hills change to second or first speed, according to the requirements.

Disengage clutch; quickly move the gear shifting lever back into the next lower speed, being careful not to allow the car to lose momentum in shifting gears; let the clutch in gently and accelerate to gain speed.

To Stop Car

Push clutch pedal with left foot until the clutch is disengaged. Then apply service brake by gradually pushing down brake pedal (the one at the right) with right foot. At the same time reduce the motor speed by moving the hand throttle lever backward.

If you have been controlling the speed of the motor with the foot accelerator, it will, of course, be released when foot is removed to apply service brake.

When the car is stopped, while still holding out the clutch, place the gear shift 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. Push down on the button at top of gear shifting lever and move lever from neutral position in toward you to slot at extreme left. Then pull it backward into REVERSE position. Let 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

Move starter switch from running position to position at extreme left.

Close throttle entirely before stopping motor.

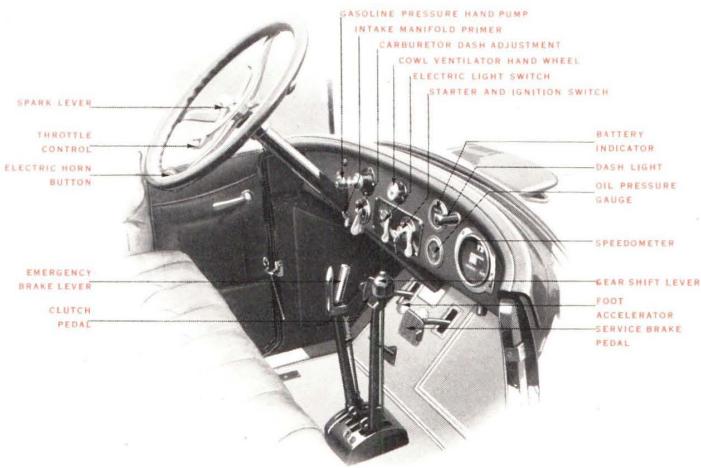


Fig. 1—Dash Arrangement Model 29

How to Drive

There is "good form" and "bad form" in driving a motor car, the same as in anything else that you do.

One-half the pleasure of motoring comes from learning to drive your car gracefully and easily—in other words, with "good form."

Right driving also means minimum strain on the mechanism of your car. Smooth handling from starting to stopping saves unusual stress on the motor, on the clutch and transmission, on the axles, on the tires; it saves gasoline and oil. It enables you to get the utmost service from your car with the least amount of wear and tear.

"Form" in driving a motor car may be compared to "manners" in eating.

The man who "eats with his knife" gets the food to his mouth beyond a doubt. But he who uses the fork and spoon gets it there much more easily and gracefully, without danger to himself and without offending the sensibilities of beholders.

A well-made motor car is a sensitive thing. Like a horse, it will resent "sawing the bit." But it will respond readily to gentle handling.

Remember that your car is a fine piece of machinery. Treat it as such.

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, advance the spark lever two-thirds of the way up the quadrant, throw out the clutch, 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.

Study to accelerate simultaneously with letting in the clutch. The mechanical act of gear shifting can be learned in five minutes. Some drivers ***never*** learn to shift gears well. That is a matter of learning to perform the operation rightly.

Handle the accelerator instinctively. As you engage the gears for any speed and begin to let in the clutch, give the motor more gas

at the same time. Once you have learned to do this, you will never have to give it a thought—right acceleration when shifting gears will be as natural as breathing.

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 third and fourth speeds.

By throttling down the motor just before shifting gears you cause the two gears which are to be meshed to be 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.

Driving

As soon as you have the car in high speed, assume a naturally comfortable position, which will enable you to control your car most easily. But do not slouch down in your seat, sit sidewise, or take your hands from the steering wheel.

Driving a car is not tiresome if one sits in an easy upright position. Such a position also gives the driver full control of his car. A driver who slouches in his seat must be constantly moving. He cannot apply the brakes without sitting erect. If he is in this position always, he saves much tiresome extra effort.

In addition, bear in mind always that an erect and alert driver makes a much better appearance than one who slouches in his seat and handles his car carelessly.

Using the Brakes

It is quite as important to know how to stop your car quickly and smoothly as it is to know how to start it. The operation of braking is one of the most important in driving. Learn how to use your brakes.

The best results with the brakes are not obtained by stopping the wheels, but by compelling them to travel slowly.

Do not wait until you are within 15 or 20 feet of a necessary stop and then jam on the brakes hard. Begin to pull up your car early enough to allow of your applying the brakes gently, bringing the car to a gradual stop without jolting yourself and passengers, and without straining the mechanism of the car.

Applying the brakes hard is also ruinous to tires. When the brakes are set tight enough to stop the wheels, the pavement or road simply acts as a file which wears down the tires unnecessarily.

Apply the brakes gradually.

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.

Use Your Gears

Your Chalmers "Six" is equipped with intermediate gears for the purpose of relieving the strain on the motor on hills, on bad roads or in traffic where it is impossible or undesirable to drive "on high" or fourth speed.

If the intermediate gears had no use, they would not be put in the car. So use them.
While it is true that the Model 29 can be driven from 2 to 50 miles an hour on high speed, there is no reason why you should strain the mechanism by compelling your car to negotiate steep hills or bad roads "on high."

Hill Climbing

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

To attempt to climb every hill on high marks the amateur driver always.
If you watch the expert drivers who handle cars in endurance runs and other contests, they will teach you to use the intermediate gears on hills or heavy roads.

When approaching a hill which you may wish to take 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 third or second speed, while the car still has good momentum. *Don't let the car slow down.* It is a good rule to shift gears just before you need to when climbing hills.

Bad Roads

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

Thus you have much better control of the car, you can stop more quickly and can pick up more readily than on high gear. Using the lower speeds 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.

In Traffic

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

Using the Throttle

Never race your motor unnecessarily. This not only burns up gasoline excessively but it is hard on the motor. It indicates amateurish handling and makes your car sound noisy.

Racing the motor can be avoided by learning to use the foot accelerator in the right way. As soon as you have learned to handle your car, use the accelerator instead of the throttle lever on the steering wheel.
When you start the car, adjust the throttle lever to a position where the motor idles quietly. Then use the accelerator to regulate the gas. This accelerator is controlled by a spring, and removing your foot will instantly reduce the motor speed to the point indicated by the lever on the steering wheel.
Controlling the speed of the motor to get the most satisfactory results will also be found much easier—because instinctive—when the accelerator is used.

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.

Be sure you understand the operation of the Electric Starter. See Page 47.

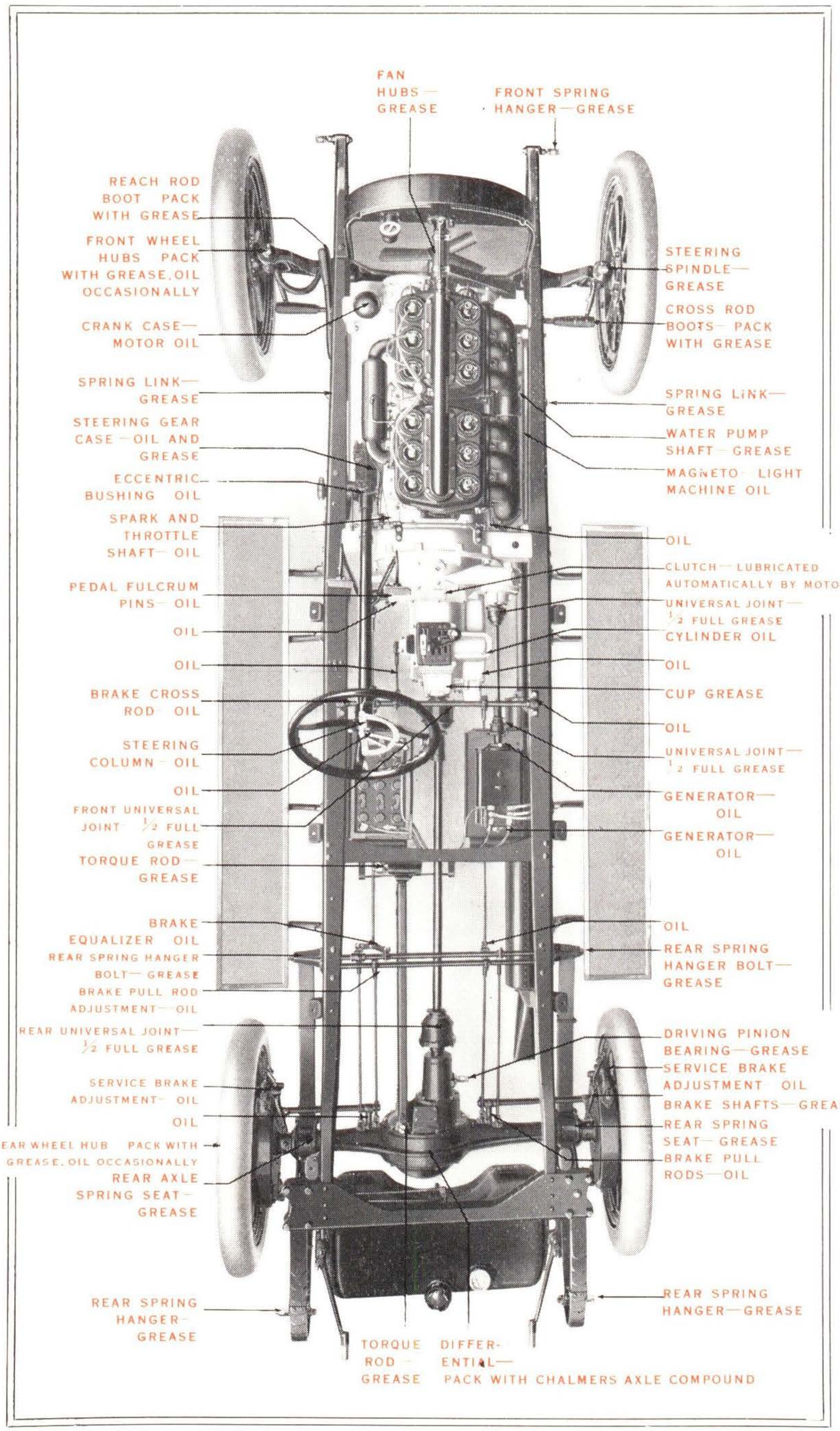


Fig. 2—Plan View of Chalmers "Master Six" Chassis, showing where to lubricate and what to use—oil or grease

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 Page 37.

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 cross rod grease cups.	One complete turn.	Cup grease.
All spring bolt grease cups.	Two complete turns.	Cup grease.
Speedometer driving gears.	One complete turn.	Cup grease.
Wheel hub oilers.	10 drops.	Motor oil.
Reach rod boot grease cups.	One complete turn.	Cup grease.

Twice a Week, or About Every 200 Miles

PART	QUANTITY	LUBRICANT
Pump shaft grease cups.	Two complete turns.	Cup grease.
Steering gear case grease cups.	Two complete turns.	Cup grease.
Steering wheel oil hole.	8 or 10 drops.	Motor oil.
Steering column.	10 or 15 drops.	Motor oil.
Steering gear worm shaft.	Two complete turns.	Cup grease.

Every Week, or About Every 300 Miles

PART	QUANTITY	LUBRICANT
Generator.	3 or 4 drops.	Motor oil.
Spark and throttle shafts.	Few drops.	Motor oil.
Control bracket bearings.	Thoroughly.	Motor oil.
Transmission case.	Enough to cover lower shaft.	Motor oil.
Pedal fulcrum pin.	Thoroughly.	Motor oil.
Brake pull rods and connections.	Thoroughly.	Motor oil.
Brake cross rod grease cups.	Two complete turns.	Cup grease.

PART	QUANTITY	LUBRICANT
Torque rod grease cups, front and rear.	Two complete turns.	Cup grease.
Brake shaft grease cups on rear wheels.	Two complete turns.	Cup grease.
Rear spring perch grease cups.	Two complete turns.	Cup grease.
Generator.	3 or 4 drops.	Motor oil.

Twice a Month, or Every 500 Miles

PART	QUANTITY	LUBRICANT
Magneto bearings (3 oil holes).	3 or 4 drops each.	High grade light machine oil.
Dynamo drive shaft universal joints.	Fill one-half full.	Special Spicer joint grease.

Every Month, or Every 1000 Miles

PART	QUANTITY	LUBRICANT
Crank case.	Drain off dirty oil; clean oil screen at left of motor thoroughly; fill to level of top try cock.	Motor oil.
Reach rod boots.	Pack thoroughly.	Cup grease.
Spring leaves. (Jack up frame and pry leaves apart.)	Thoroughly.	Graphite grease.
Wheel hub caps.	Pack thoroughly.	Cup grease.
Speedometer cable.		Heavy oil.
Gasoline pressure hand pump.	4 or 5 drops on leather plunger.	Light machine oil.

Every 2000 Miles

PART	QUANTITY	LUBRICANT
Differential housing.	Drain thoroughly, flush with kerosene and refill with one gallon.	Special Chalmers axle compound.
Transmission case.	Drain thoroughly, flush with kerosene, refill to cover top lower shaft try cock.	Motor oil.
Fan hub bearings.	Pack thoroughly.	Cup grease.
Propeller shaft universal joints.	Fill one-half full.	Special Spicer joint grease.
Steering gear case.	Pack thoroughly.	Cup grease.

When Changing Tires

Put a little dry flake graphite between the shoe and the rim to insure easy detaching.

Semi-Monthly Inspection of Car

Compression in Motor Cylinders

Test Compression. For directions see Page 57.

Inspect both inlet and exhaust valve bonnets for possible compression leaks.

Ignition System

Inspect wiring, terminals and 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

See that service brakes and emergency brakes, both located on rear hubs, 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. Be sure rear spring perches are free to move on axle housing.

Bolts

Tighten body and fender iron bolts.

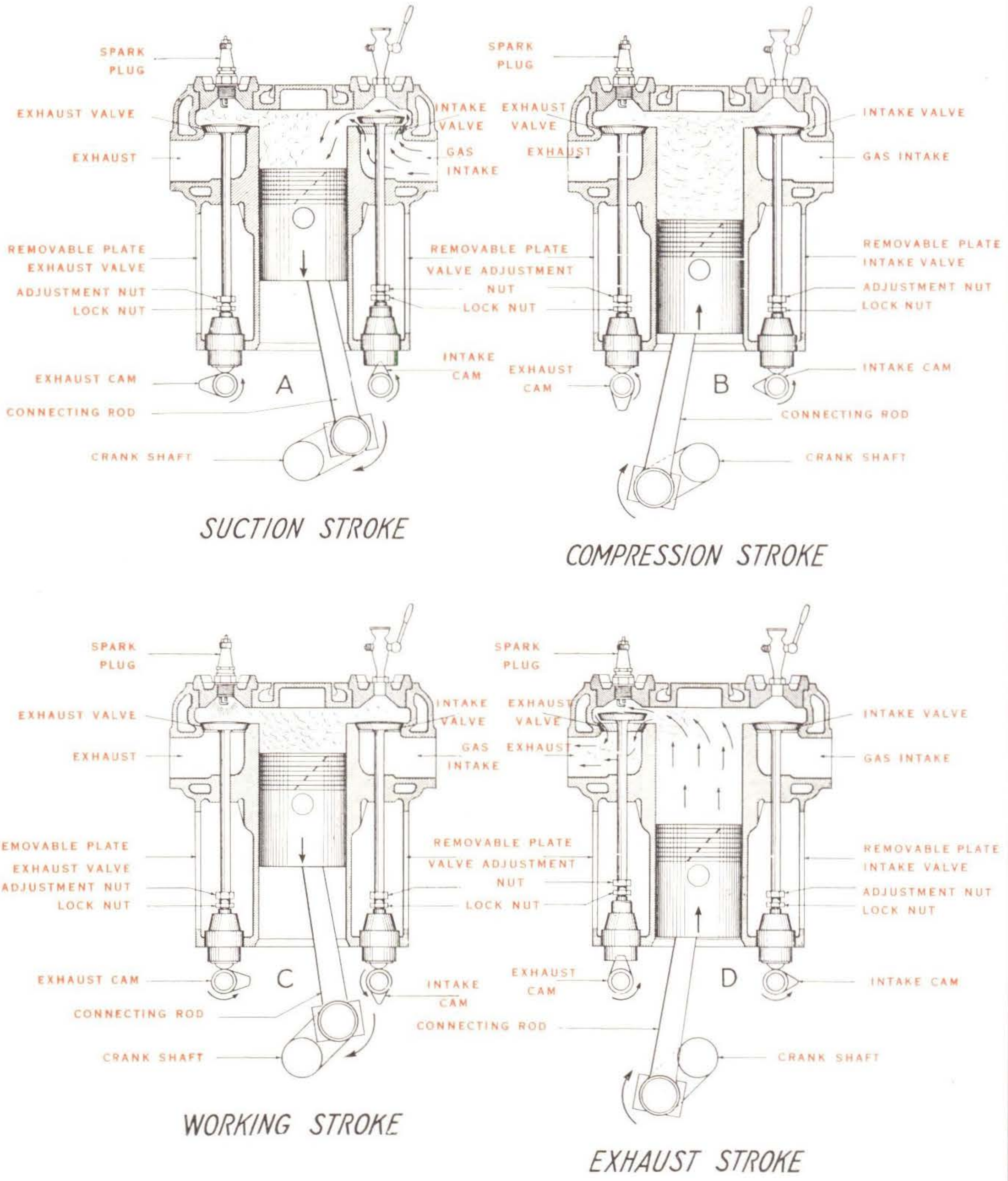


Fig. 3—Diagram of the Strokes of a Four-Cycle Motor ("T" head Type). Water Jacket, Valve Springs and Other Motor Details are Not Shown in this Diagram

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 ramrod, fired by a cap placed under the hammer, and finally the barrel is cleaned with a rag on the end of the ramrod. 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. 3-A, 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-B), 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 the highest point in the piston's travel, an electric spark is discharged between the terminals of the spark plug (Fig. 3-C). 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. 3-D). The piston, forced up by the momentum of the crank shaft and flywheel, pushes out the burned gas through the exhaust valve and the piston 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 six cylinders in a row to operate on the crank shaft, timing their explosions so that they will follow in suitable order, we shall have six "working strokes" following each other so closely that they overlap, thus applying power on the crank shaft all the time. This is what we have in a six-cylinder motor, such as the Chalmers "Master Six."

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 the 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 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.

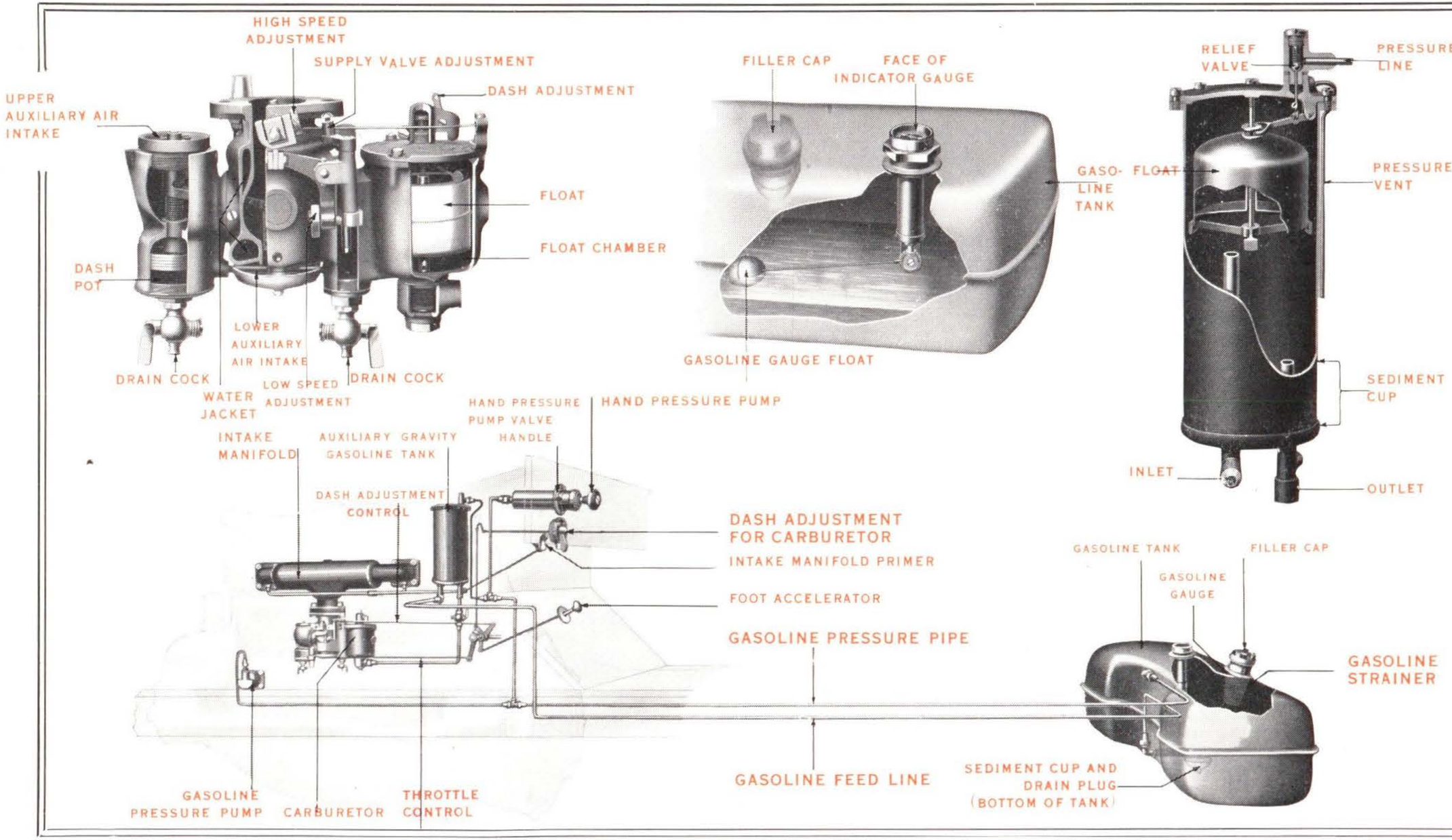


Fig. 4—Gasoline System of the Chalmers "Master Six" (Model 29)

Gasoline System

General Principles

The gasoline system consists of (1) the main gasoline tank at the rear of the car and the pressure pump; (2) the gasoline feed pipe; (3) the auxiliary gravity tank with its constant level float valve; (4) the carburetor; (5) the intake manifold. (See Figure 4.) Gasoline flows under pressure from the main tank at the rear of the car through the gasoline feed pipe to the auxiliary gravity gasoline tank under the hood in which a constant level is maintained by means of a float valve, and from the gravity tank the gasoline flows to the carburetor. Here it is vaporized and mixed with air. The mixture is drawn by the suction of the descending piston into the cylinder, where it is properly compressed and exploded by the magneto spark.

Gasoline Tank

The main gasoline tank, which is located at the rear of the car, has a capacity of 22 gallons.

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

After filling be sure gasoline tank filler cap is absolutely TIGHT.

Pressure System on All Types

The flow of gasoline from the main tank at the rear to the auxiliary gravity tank under the hood is insured by air pressure in the gasoline tank.

Pressure—How Secured

When the motor is not running, by means of a small hand pump located on the cowl of the dash just to the right of the steering column. When the motor is running, by means of an air pressure pump on the carburetor side of the motor and operated from the cam shaft.

See Figure 4 for general diagram of gasoline system.

Use of Pressure System

When the motor is running pressure is maintained in the main tank at the rear by the air pump on the engine and this pressure is kept constant by means of a relief valve

controlled by the float valve in the auxiliary gasoline tank under the hood.

Before starting be sure to give the hand pressure pump on the dash a dozen strokes to insure the presence of gasoline in the auxiliary gravity tank.

Hand Pump Pressure Valve

At the lower end of the hand air pump is a two-way valve. This is controlled by a handle which extends through the dash beside the pump. When this handle is in a horizontal position the hand pump is ready for operation. When it is down in a vertical position, the hand pressure pump is disconnected, allowing the motor pressure pump to provide air pressure to the gasoline tank.

When pressure is required quickly in any circumstance, hand pressure pump valve handle should be in horizontal position. Hand pressure pump will not work with any other valve position.

Motor Pressure Pump

The pressure pump is attached to the forward end of the crank case on the carburetor side. It is a simple plunger pump and is operated by an eccentric on the inlet valve cam shaft. As the cam shaft revolves, a spring forces down a plunger. This creates a vacuum in the pump, which is filled by air rushing in through a port. Continued revolution of the cam shaft drives the air out of the pump through the other ports and so into the gasoline tank.

Care of Pressure System

The air pressure pump is lubricated from the crank case. No adjustments are necessary.

Should there arise a necessity for removing the pressure pump, simply remove four bolts in the base. The pump is very simple to disassemble and reassemble.

The success of the pressure system depends largely upon keeping all joints and fittings tight.

Be sure the gasoline tank filler cap (see Figure 4) is always air-tight.

Lubricate hand pressure pump about once a month with 4 or 5 drops of thin oil. Oil hole will be found at top of pump.

Sediment Cup

Included in the gravity gasoline tank is provision for sediment.

The drain cock should be opened about once a week for withdrawing any water which may have settled in the sediment chamber. Allow a small quantity of gasoline to run out. Never do this when the motor is running.

Gravity Gasoline Tank

Under the hood is the auxiliary gasoline tank which feeds to the carburetor by gravity. The gasoline in this tank, which has a capacity of about three pints, is supplied by pressure from the main tank at the rear and maintained at a constant level by an automatic float valve which relieves pressure from the main tank as soon as the auxiliary tank is full and applies pressure to the main tank again when the gasoline in the auxiliary tank falls below the proper level.

Shut-off Cock

At the left side of the car, inside the frame and beneath the front floor board, is a cock by which the gasoline may be shut off from the carburetor, if necessary.

In the running position the handle of the gasoline cock is turned lengthwise of the frame. When the gasoline is shut off, handle of cock should be at right angles to the frame.

Carburetor

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

The carburetor consists of:

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

2—The mixing chamber in which the gasoline is mixed with air in the proper proportion.

Carburetor Float Chamber

The float chamber (see Figure 4) maintains a constant level or supply of gasoline for the motor.

Gasoline flows from the feed pipe through an intake plug, thence through the float valve and into the float chamber. A hollow copper float of the concentric type raises or lowers the inlet valve, thus regulating the incoming flow of gasoline in proportion to the supply in the float chamber.

Carburetor Mixing Chamber

After leaving the float chamber the gasoline passes through a nozzle (see Figure 4) 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 "supply valve" and a metering pin under the automatic air valve. The supply valve of the Rayfield carburetor is adjustable both from the dash and by the throttle. The dash adjustment of the carburetor (see Figure 1, Page 11) gives a

"lean" or "rich" mixture simply by turning a thumb lever to the right or left. This makes the carburetor adjustable for all conditions of weather and altitude. In addition to this dash adjustment, the supply valve opens as the throttle is opened. This is a purely automatic operation and maintains the proper mixture for all motor speeds.

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 the primary and auxiliary air inlets. (See Figure 4.) This air rushes through the mixing chamber around the nozzle and the metering pin and picks up the gasoline which leaves the nozzle and jet 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.

That the proportion of air and gasoline in the mixture may be correct for all motor speeds, one fixed air inlet and two variable auxiliary air inlets are provided. The lower "auxiliary air inlet" opens and closes with the main or upper auxiliary air inlet, giving a greater volume of air in proportion to the greater amount of gasoline to be vaporized. In other words, at high motor speeds or when the throttle is fully opened, the motor requires more gas and consequently a greater volume of air to vaporize the gasoline which comes through the supply valves; at low motor speeds less gas is required and consequently less air is necessary to vaporize the gasoline.

At the front end of the carburetor is the main auxiliary air inlet. This is controlled by a spring and dash pot. (See Fig. 4.) At low speeds, when only a small amount of air is being drawn through the carburetor, the spring and the dash pot hold 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 in proportion to the need for the increased speed. The carburetor thus automatically produces the correct mixture for all motor speeds.

Do not unnecessarily adjust the carburetor.

While the carburetor of the Chalmers "Six" is especially easy to adjust, the operator should not make adjustments that are not absolutely required. Once the carburetor has been satisfactorily adjusted, there is little chance of its getting out of adjustment. In ordinary circumstances only an extreme change in weather conditions will make adjustments necessary. Look elsewhere for trouble.

Adjustments

If the weather is cold or extremely humid, turn the dash adjustment of the gasoline supply valve to the right while the motor is running until it fires evenly under load or while the car is in motion. Too rich a mixture will be distinguishable by black smoke from the exhaust.

Too light a mixture will cause uneven firing of the motor.

On the throttle lever of the carburetor and at the base of the dash supply valve adjustment lever (See Fig. 4) are two nickel-plated screws for the permanent adjustment of the gasoline supply

valve. Do not touch these except under the direction of a Chalmers dealer.

If difficulty is found in securing the proper mixture for the carburetor, consult a Chalmers dealer.

To insure thorough and rapid carburetion at all times, the carburetor of the Chalmers "Master Six" is heated by hot water which is taken from the motor water jacket and passes through a jacket about the float chamber; and by hot air which is drawn through a pipe from the exhaust.

In extremely hot weather it may be found desirable to shut off both the hot water jacket and the hot air intake. Under ordinary circumstances neither of these carburetor heating devices should be touched.

Throttle Valve

The throttle valve, which is of the "butterfly" or "shutter" type, is located just below the inlet manifold. (See Figure 4.) It is connected by a rod with the hand throttle and the foot accelerator. (See Figure 1, Page 11.)

Hand Throttle

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

Moving this lever upward around the quadrant increases the speed of the motor, and moving it downward decreases the speed.

Foot Throttle or Accelerator

In the floor beneath the clutch pedal and the service brake pedal is a small foot throttle or accelerator, which is operated by the right foot.

By pressing down upon the foot throttle, the same control over the speed of the car can be obtained as by the 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 down 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 on the steering wheel quadrant.

Although either hand throttle or accelerator 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 quick-acting foot throttle will be preferred.

Intake Manifold Water Jacket

To insure complete vaporization, the intake manifold of the Chalmers "Master Six" is provided with a hot water jacket of unusual size. The carburetor also has a hot water jacket and provision for taking warm air heated by the exhaust manifold.

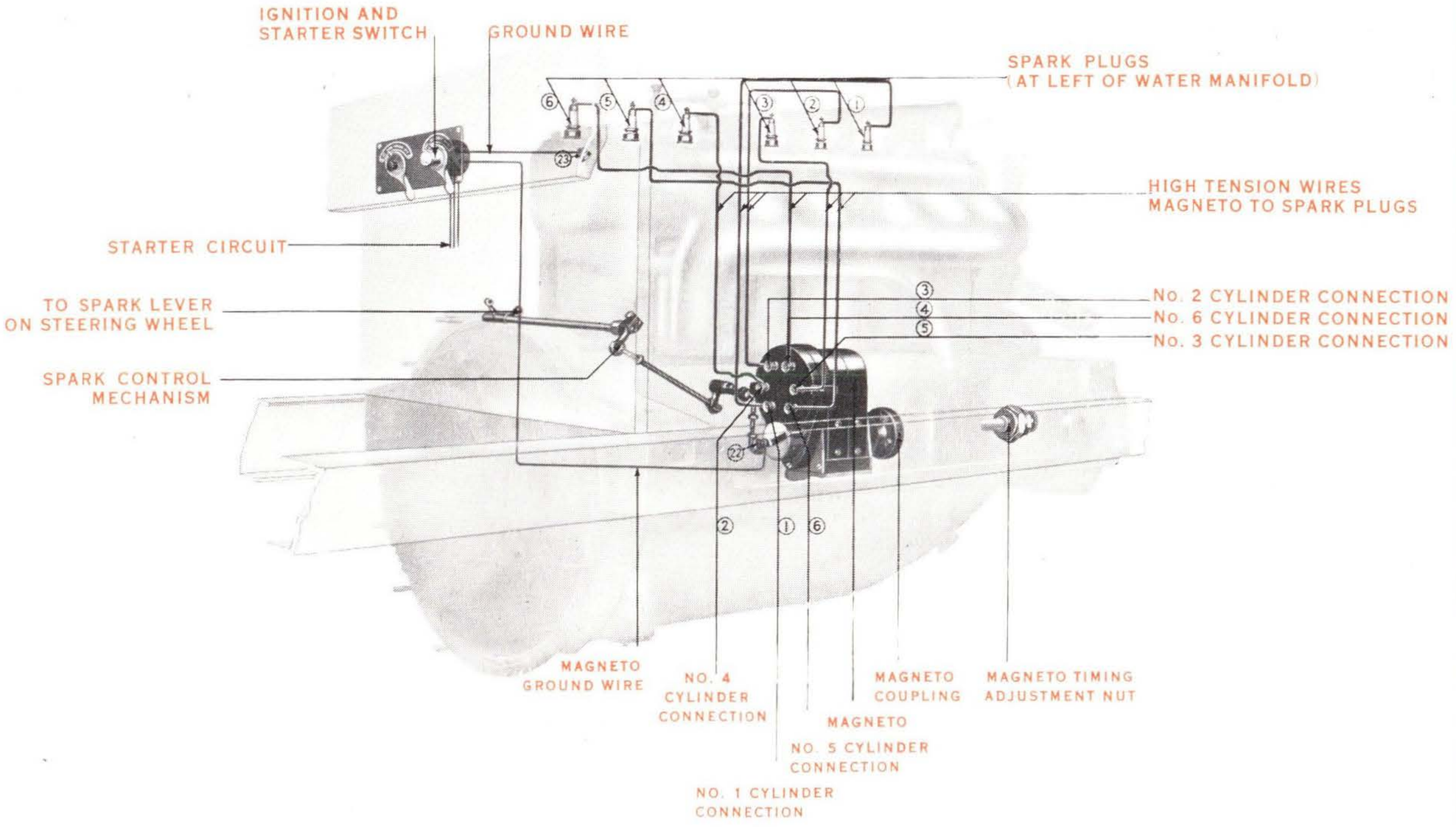


Fig 5—Ignition System of Chalmers "Master Six" (Model 29)

Ignition System

(Complete wiring diagram in tool box)

General Principles

The purpose of the ignition system is to furnish an electric spark in each of the six cylinders in their order of firing, the spark being so timed as to explode the charge of gas in the combustion chamber at just the right instant.

On the Chalmers "Master Six" (Model 29), the electric current is furnished by a high tension independent Bosch magneto. This system provides an unusually hot and regular spark and at the same time greatly simplifies the ignition, doing away with all ignition batteries, transformer coils, etc.

This system furnishes direct to the spark plugs a high tension current. The entire system involves only the magneto, the dash switch integral with starter switch and wires—a ground wire for the magneto, a single wire from the switch to the magneto, and a wire from the magneto to each of the spark plugs.

Magneto

The magneto is on the right side of the motor. (See Figure 5.) 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 the Magneto Current

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

The distributor on the 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, 4, 2, 6, 3, 5.

Care of the Magneto

The magneto on the Chalmers "Master Six" requires very little attention. It should never be tampered with unless something is wrong. For lubrication see Page 18.

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 reset the screws so that the break is not more than a thick piece of tin, or about $\frac{1}{32}$ of an inch. The distributor should be kept clean and needs no oiling.

Setting the Magneto

To reset the magneto after removal, proceed as follows:

Crank the motor until the No. 1 piston has reached the top of the compression stroke, or its uppermost position.

Remove the inspection plug on top of clutch case and find flywheel mark, 1 & 6 "D.C." One and one-half inches to the left of this will be found a mark, "M.M."

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 spring latch on either side of the distributor block and pulling block out. The distributor mechanism will then be revealed.

Next revolve the armature until the distributor segment comes in contact with the lower 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 Figure 5.)

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 adjust. (See next paragraph.) 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 fully retarded with the motor on "dead center." When the motor is on "dead center" the breaker box should always be in full retard with the spark lever at the bottom of the 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 Adjustment

At the forward end of the shaft which drives the pump and the magneto of the Chalmers "Six" will be found a large, hexagonal nut. (See Figure 5.) Loosening this nut by turning in an anti-clockwise direction frees the magneto shaft. It is then possible to turn the shaft and so rotate the armature of the magneto until exactly the right adjustment is secured.

Once the adjustment is accurately made, hold the shaft steady and again tighten the nut at the forward end of the magneto and pump shaft.

Magneto Connections

The wiring connections of the magneto are shown in Figure 5.

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

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

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

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

No. 4 post is connected to No. 6 cylinder.

No. 5 post is connected to No. 3 cylinder.

No. 6 post is connected to No. 5 cylinder.

The "magneto-to-switch" wire goes from the binding post (22) on the "contact breaker" to the post (21) on the back of the dash switch. (Figure 5.)

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 flywheel. If, on account of low speed, the momentum of the flywheel is not sufficient, there will be a tendency for the car to run with a jerky motion, and if the electric starter be disconnected the motor may be "stalled."

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 overheat the motor.

The regulation of the spark is by means of the spark lever (the shorter lever at the top of the steering wheel), as explained on Page 8.

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 a motor and misfiring 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.

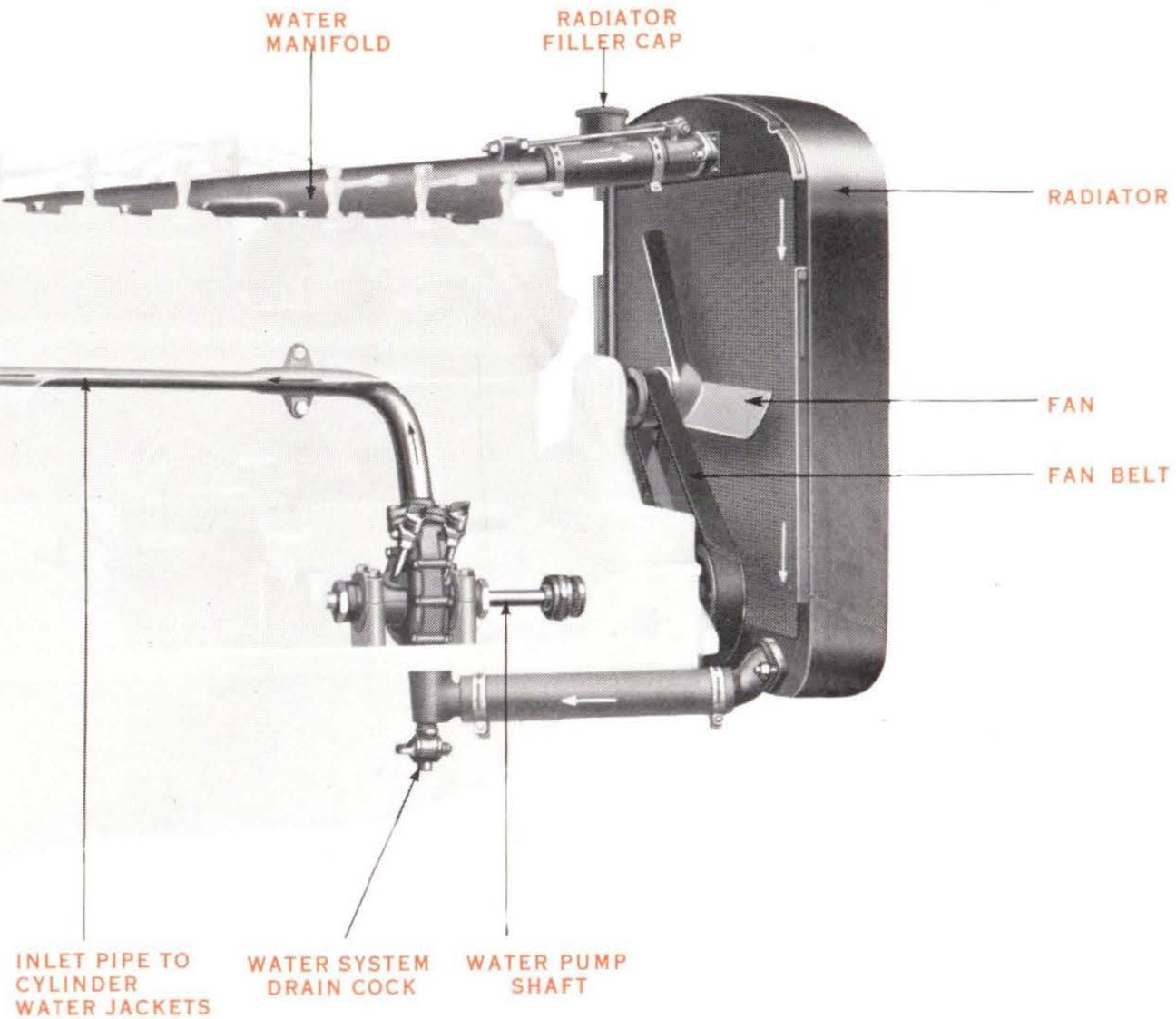


Fig. 6—Water Circulation System of the Chalmers "Master Six" (Model 29)

Water Circulation System

General Principles

The repeated explosions of gasoline vapor in the cylinders of the motor 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, in turn, is cooled by passing through the radiator. The radiator is composed of a large number of cells which expose to the air a large surface, which permits of the rapid radiation of heat. From the lower compartment of the radiator, the cool water is returned to the water jackets of the cylinders by a water pump, thus keeping up a constant circulation. (Figure 6.)

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 plug at the bottom of the water pump. 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. (See Figure 6.)

Water Pump

The water pump—centrifugal type—is attached to the right side of the crank case and is directly driven by means of gears in the gear case at the front of the motor (Figure 15, Page 58).

It draws water from the bottom compartment of the radiator, forces it up through the inlet connections into the water jackets of the cylinders. After circulating around the cylinders and becoming heated, the water 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.

The fan is supported in an eccentric bracket which is held by a special locking clamp. The tension of the fan belt is regulated by adjusting this eccentric bracket. The belt should be kept tight at all times. Care should also be taken to see that the clamp which holds the eccentric bracket is tight.

Cleaning the Water System

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

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 water jacket of carburetor. 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.

Do not use any anti-freeze mixtures except those recommended on Page 63 of this book.

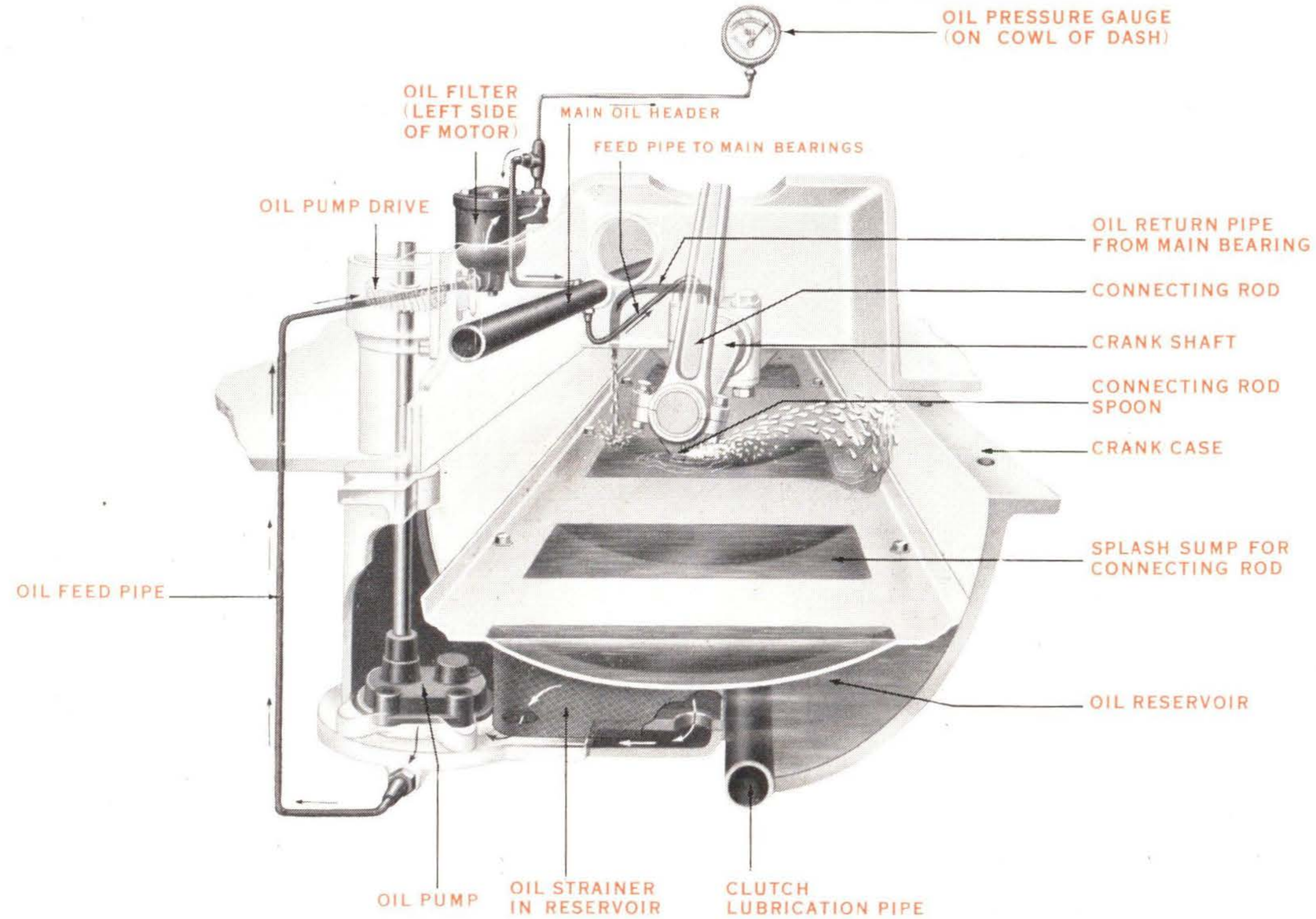


Fig. 7—Motor Lubrication System of the Chalmers "Master Six" (Model 29)

Lubrication System

General Principles

The Chalmers "Master Six" (Model 29) motor is lubricated by a combination force feed and splash system. A reservoir at the bottom of the crank case contains motor oil. A gear pump throws the oil through a fine screen to a header or pipe which runs the full length of the crank case. From the header the oil is carried in copper pipes directly to each main bearing. The discharge from the three main bearings flows into the connecting rod sumps. From the front main bearing the oil flows through the timing gears before going to the No. 1 connecting rod sump. As the crank shaft revolves, spoons on the end of the connecting rods dip into these sumps, splashing oil all over the interior of the motor and lubricating every part.

The level of oil in the crank case is regulated by overflow holes which open into the reservoir below.

Oil pumped from the reservoir to the bearings and the crank case is fed under pressure which is indicated on a gauge located on the cowl of the dash, thus enabling the driver to know at all times whether or not the oil is feeding properly.

The clutch runs in oil contained in its own casing and fed to the clutch casing from the crank case.

The transmission gears run in motor oil supplied directly to the transmission case. (See Page 17.)

The universal joints are packed in grease. (See Page 18.)

Differential driving gears are packed in Chalmers Special rear axle compound. (See Page 18.)

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 lubricants to use, are given under "Directions for Lubrication," Page 17.

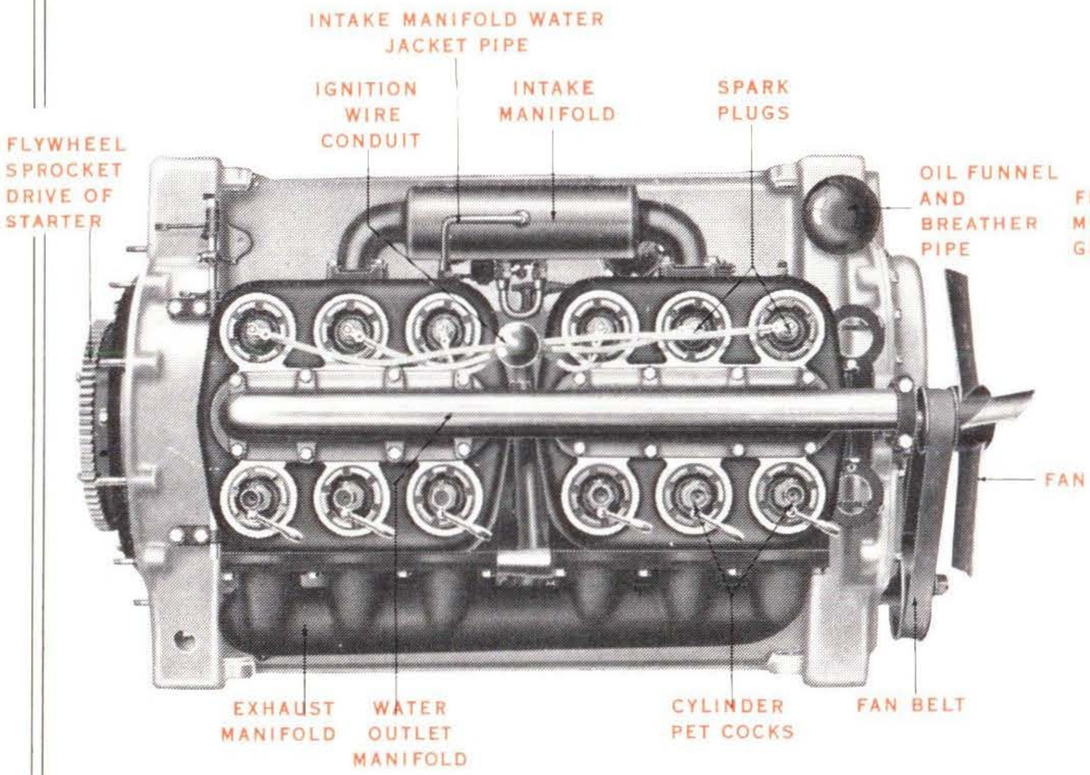
Lubricants

It pays in the long run to use 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	Mobiloil Arctic	Standard Light Auto
Polarine	Havoline	Mobile "A"
Monogram "V"	Floyds' Anti-Carbon	Texico

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



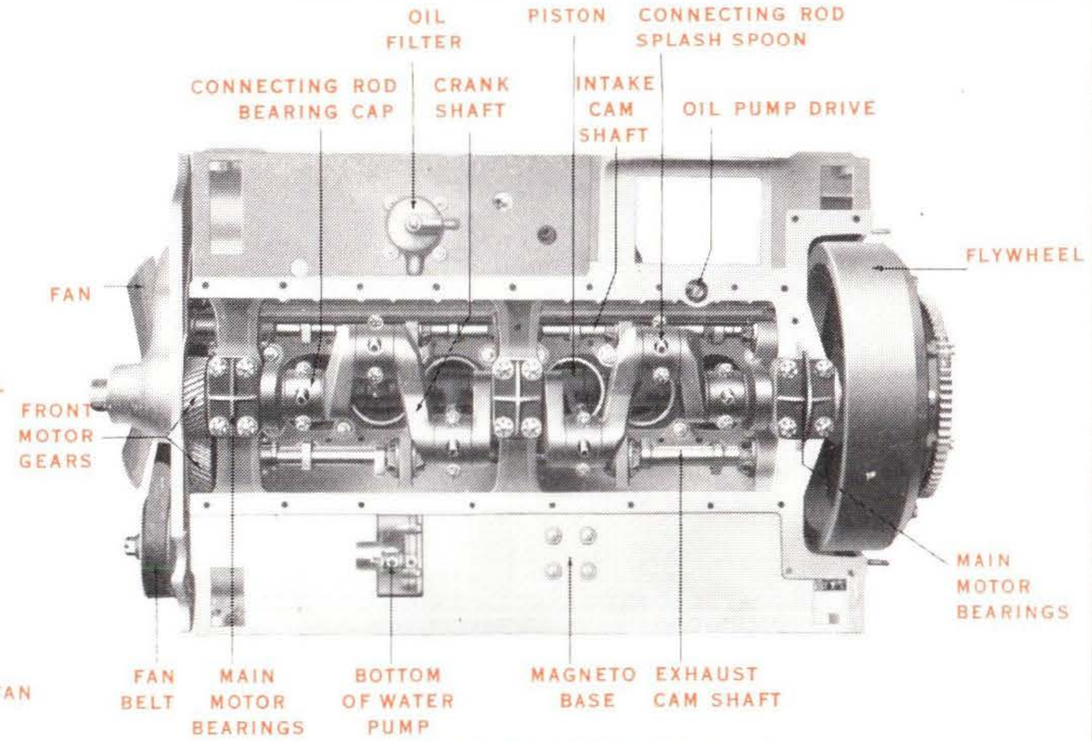


Fig. 8—Top and Bottom Views of Motor, Chalmers "Master Six" (Model 29)

Oil Reservoir

The height of oil in the oil reservoir (Figure 15, Page 58) is determined by two try cocks on the left hand side. Oil should be poured into the "breather pipe" or oil funnel on the front of the left hand side of the motor (Figure 15, Page 58) 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.
Capacity of oil reservoir, 10 to 12 quarts.

Oil Pump

The oil pump is located near the rear end of the crank case on the left side and is of the gear type.

The oil pump consists of two simple gears, the spaces between the teeth of which act as cups, to force the oil from the reservoir through the pump to the "header" within the crank case.
The oil pump is driven by spiral gears from the intake cam shaft. Ordinarily this pump will require no attention. It should, however, be thoroughly cleaned once each season.

Oil Pressure Gauge

On the cowl of the dash within easy reach of the driver is a gauge which indicates the pressure of oil fed by the pump to the bearings of the motor.

At high speed this gauge should show a pressure of 3 to 10 pounds. At slower speeds it will drop to 1 or 2 pounds, almost reaching zero when the motor is idle. Failure of the gauge to show pressure in ordinary running indicates that the oil screen is clogged and should be cleaned at once.

Oil Screen

On the left side of the motor toward the front will be found a cap bearing the words "Clean Often."

At least twice a month, and whenever the oil pressure gauge fails to record any pressure while running, remove this cap and take out screen cup which will be found beneath it. Lifting this screen brings out all of the sediment. Wash screen thoroughly in gasoline, removing all sediment and obstruction. Replace cap, screwing down tightly. Pressure gauge will then indicate that oil is flowing freely.

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 when on a tour or for fast driving.

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

Draining Off Old Oil

Every thousand 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 the oil reservoir. (See Figure 8.) If the oil drawn off is very dirty or heavy, it is a good plan to remove the oil reservoir and clean thoroughly with kerosene. Replace oil reservoir and fill through breather pipe with new oil 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 reservoir to 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.

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.

Clutch

The clutch of the Chalmers "Master Six" is of the multiple disc cork insert type, running in a bath of oil.

The clutch consists of 17 alternating cork insert bronze and steel discs (Fig. 9, Page 42) 9 of which are keyed to the flywheel and 8 of which 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 flywheel and the steel plates remaining still on the transmission shaft. When the clutch is "let in," the clutch springs (Fig. 9, Page 42) force both sets of discs together and the whole combination rotates. The clutch is disengaged by pressing on the left foot pedal.

Care of the Clutch

The clutch of the Chalmers "Master Six" will require practically no attention from the driver. This clutch is automatically lubricated from the motor. As long as the motor reservoir contains sufficient oil, the driver will have to give no attention to the matter of lubrication.

Whenever the oil reservoir of the motor is drained for cleaning, the clutch case should also be cleaned. Old oil may be drained out through a hole in the bottom of the clutch case. When the oil reservoir of the motor is filled with new oil, the clutch will again be lubricated as before.

Should the clutch slip under load, it may be remedied by tightening the clutch springs. Adjust clutch springs through "hand hole" on slanting portion of clutch case (Fig. 10). Care should be taken to tighten the springs equally.

Transmission

The purpose of the transmission is to increase the revolutions per minute of the motor for any given car speed, thereby increasing its pulling ability in heavy going or up hills; also to provide a mechanism for reversing the direction of the car's motion.

The Chalmers "Master Six" transmission is of the selective sliding gear type. This means that the gears slide back and forth on a shaft and that the operator, starting from neutral, can set his gears at any speed he selects without passing through intermediate speeds.

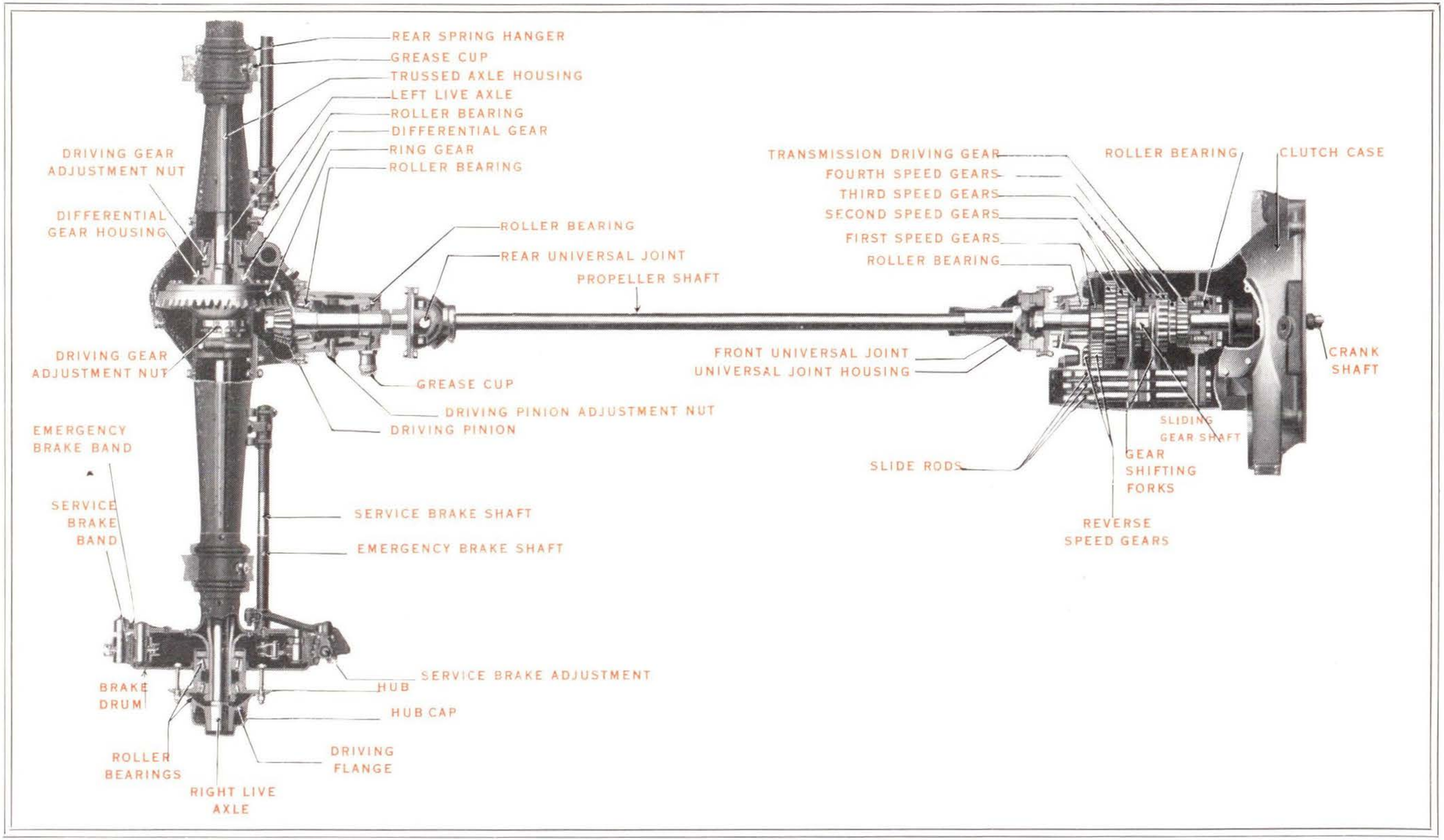


Fig. 9—Power Transmission System of the Chalmers "Master Six" (Model 29)

Action of Speed Changing Gears

The four forward speeds are obtained by the movements of two gears sliding upon the "sliding gear shaft" (see Figure 10, Page 44) and keyed to it.

These gears are moved back and forth by the "gear shifting forks" (Fig. 10) fastened to the "sliding rods" (Fig. 10), which are in turn moved by the gear shifting lever which slides back and forth in the "gear shifter blocks" (Fig. 10).

Sliding the "first speed gear" (Fig. 10) backward, engages it with a gear on the lower transmission shaft and moves the car forward on first speed.

Sliding the "second speed gear" (Fig. 10) forward on the shaft, engages it with a gear on the lower transmission shaft and drives the car forward on second speed.

Sliding the "third speed gear" (Fig. 10) backward on the shaft, engages it with a gear on the lower transmission shaft and drives the car forward on third speed.

Sliding the "fourth speed gear" (Fig. 10) forward on the shaft, interlocks it with the transmission driving gears (Fig. 10) and drives the car forward on fourth or high speed.

The reverse speed is obtained by sliding forward the "reverse speed gear" (Fig. 10) so that it meshes with a gear on the lower transmission shaft.

Movements of Gear Shifting Lever

The four forward speeds and reverse are obtained by the movement of one change speed or gear shifting hand lever. The method of making gear changes is described under "General Directions" (Pages 7 to 10). The lever moves in two directions, forward and back, and to right and to left. The five positions of the lever to obtain the various speeds are shown in Figure 11.

The gear shifting lever of the Chalmers "Six" moves in a quadrant of the "sliding gate" type.

In neutral position, with no gears engaged, the lever is in the middle of the quadrant (see Fig. 11).

The gear shift lever is provided with a spring catch which prevents the driver from throwing his gears into reverse accidentally. In changing gears to secure any of the four **forward** speeds, care should be taken not to press the button at top of gear shifting lever. In the first speed position the lever is moved to the left or to the slot nearest the driver and pushed forward to the end of the quadrant slot.

In second speed position the lever is moved to the long slot nearest the driver and back to the end of the quadrant slot.

In third speed position the lever is moved to the slot at the extreme right, or outward from the driver, and forward to the end of quadrant slot.

In fourth speed position the lever is moved outward from the driver and backward to the end of quadrant slot.

In reverse speed position the lever is moved to the extreme left in the short slot nearest the driver and pulled back to the end of the slot. Be sure to push button at top of gear shift lever when shifting to reverse speed.

By these movements of the hand lever, three "slide rods" are moved backward and forward. Attached to these rods are the gear shifting forks which move the gears.

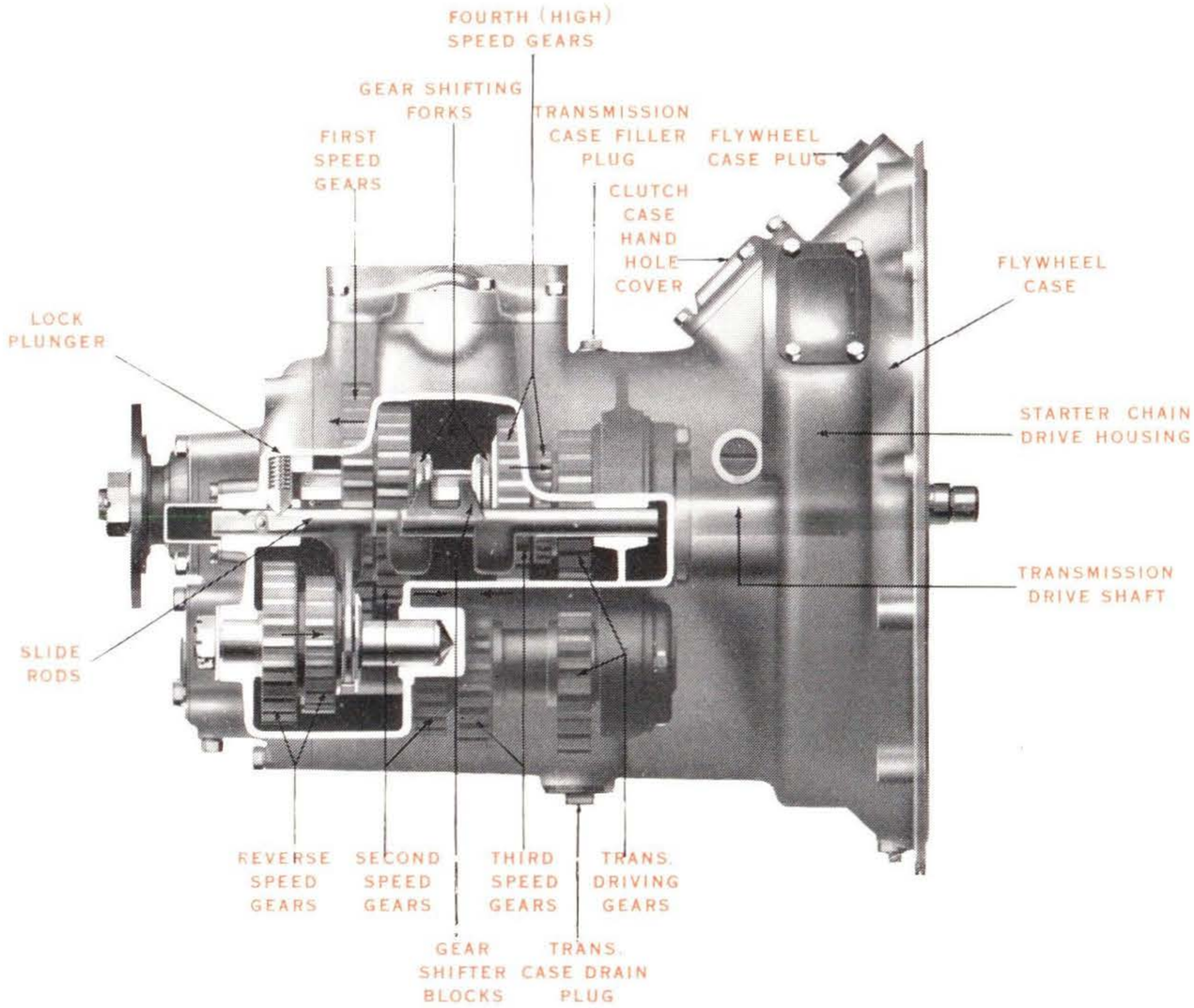


Fig. 10—Four-Forward Speed Transmission of the Chalmers "Master Six" (Model 29)

Speed Changing Procedure

Be sure always to disengage the clutch before attempting to shift 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 speed will depend upon road conditions and the load.

When changing from a higher to a lower speed, shift gears quickly; do not allow the speed of the motor to decrease.

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

Be sure always to leave the gear shift 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 adjustments should be made by a Chalmers dealer. In case an owner has to make the adjustment himself, the following directions are given:

Figure 10, Page 44, shows the sliding parts of the transmission. A notch (Fig. 10) in each slide rod engages a "lock plunger" or wedge-shaped catch which prevents the rod from working back and forth unless operated by the hand lever. When the gears are properly intermeshed, the little wedges will enter the notches and prevent the gears from shifting.

When cars are in neutral position the "transmission gear shifter blocks" at the rear ends of the slide rods should be in line so that the hand lever slides freely from one slide rod to another. These blocks are held in position by a nut at the rear end of each slide rod.

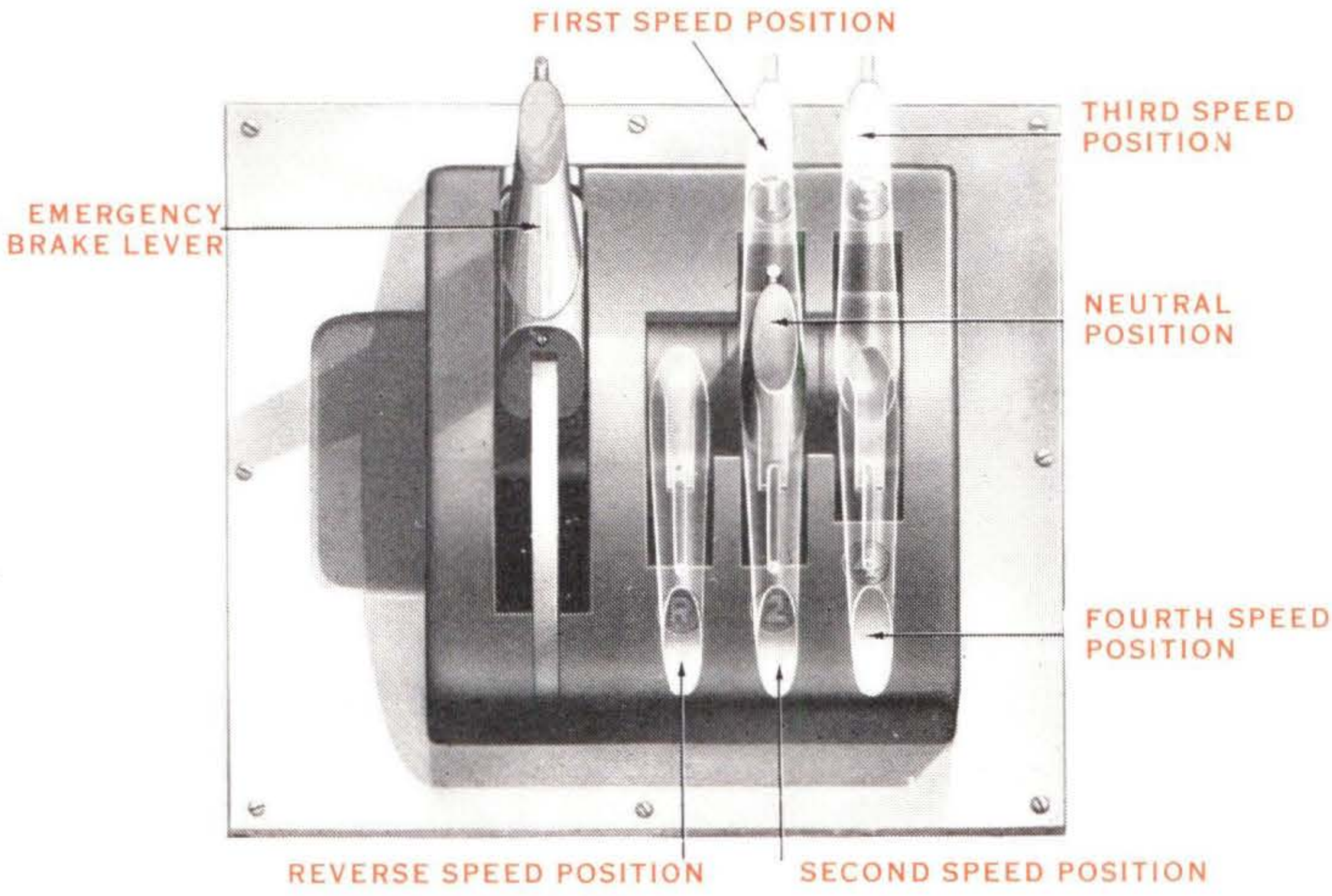


Fig. 11—Movements of the Gear Shift Lever in Changing Speeds

Adjustment of Differential Driving Gears

The function of the differential driving gears (Figure 9) is to allow the two rear wheels to turn at different rates of speed, as in going around corners or over bumps.

This is accomplished by means of a series of small bevel gears inside the large "driving gear."

The differential gears should require no attention. If, however, anything should arise necessitating adjustment, be sure to have it done by a Chalmers dealer. Incorrect adjustment of these gears will mean trouble and noise.

If it becomes necessary for an owner to make an adjustment himself, he should communicate with the Service Division of the Chalmers Motor Company.

Cleaning and Oiling Transmission and Differential

Complete directions for draining, cleaning and oiling transmission and differential gear cases are given in the directions for lubrication, beginning on Page 17.

Electric Starting System

(Complete wiring diagram in tool box)

General Principles

The Chalmers "Master Six" electric starting device supplants the ordinary hand cranking.

While the Chalmers self-starter is simple and positive in its operation, it should be thoroughly understood by the operator. To comprehend the functions of the various parts of the Chalmers self-starter, the operator should study this chapter and the accompanying wiring diagrams thoroughly. It is obvious that when the motor is standing still it has to be given an impulse before the explosions in the cylinders occur. The simplest method of accomplishing this is by means of a starting crank by which the motor is turned over or "spun," allowing it to take up its various functions. In the case of battery ignition, a second but less positive method is starting on the spark. The Chalmers self-starter supplants these methods, turning over the motor by electrical power until the explosions of gasoline take place in the cylinders. The parts of the Chalmers self-starter are as follows (see Figure 12): A highly efficient storage battery, which is carried beneath the left front seat; two wires which carry current from the storage battery to the combined electric motor and generator, carried beneath the right front seat; a small propeller shaft with two universal joints connecting the motor and generator with a sprocket located in the clutch case just back of the flywheel; a silent chain running in oil, which connects the driving sprocket with the driven sprocket bolted to the rear of the flywheel; a switch on the cowl of the dash, which makes and breaks the circuit between the battery and the starting motor.

Operation of Self-Starter

The operation of the Chalmers self-starter requires only one movement on the part of the driver—the movement of the starting switch from the extreme left to the extreme right.

Switch

The starting switch is of the rotary type and controls the ignition as well as the self-starting current. A single movement of the switch in starting completes a circuit and causes current to flow from the storage battery into the starting motor, which in turn mechanically spins the motor of the car. The same operation also removes the ground from the ignition circuit, so that the revolutions of the motor generate a spark in the magneto.

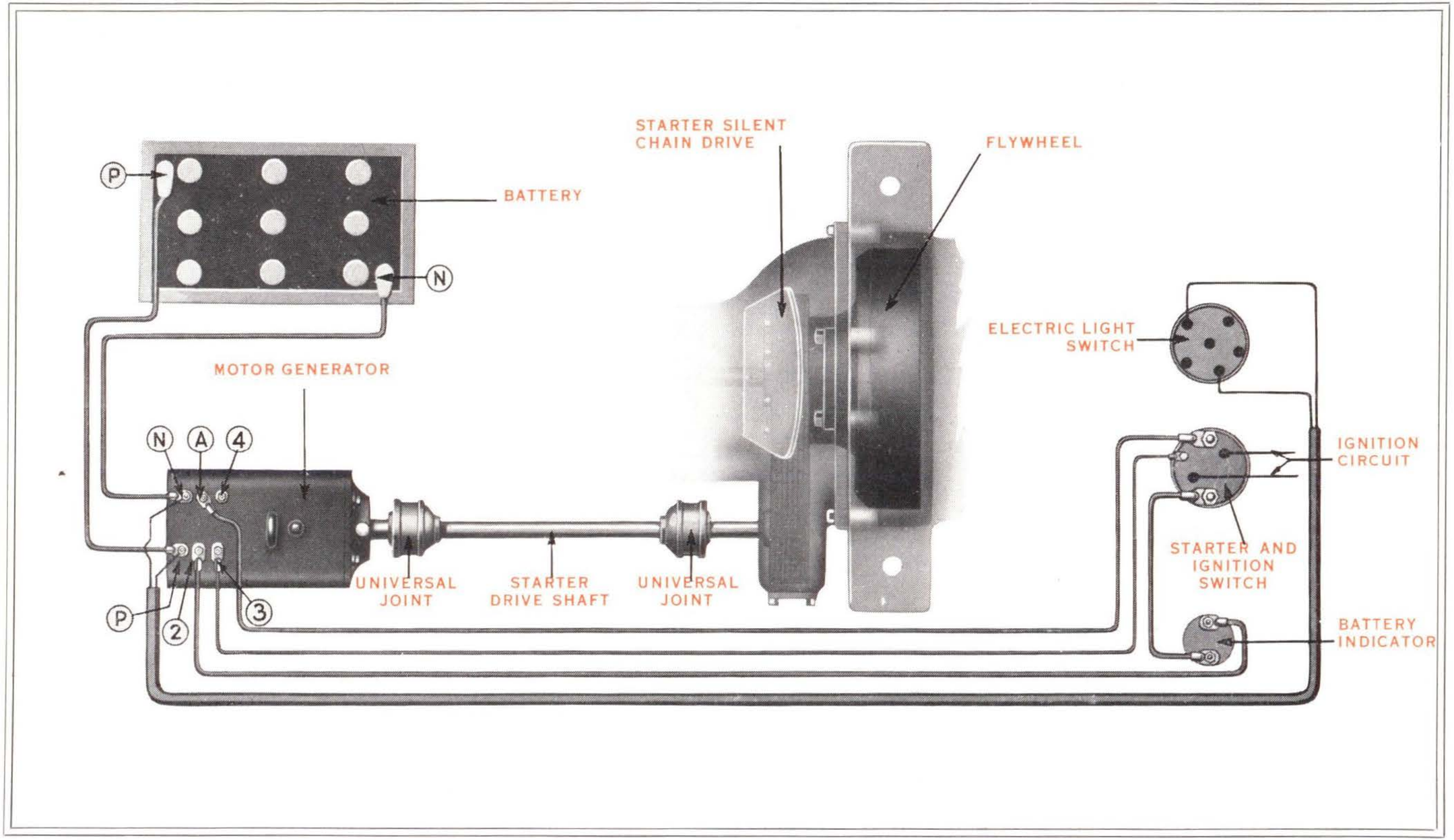


Fig. 12—Diagrammatic View of the Starting System of the Chalmers "Master Six" (Model 29)

Batteries

The battery of the Chalmers Starting System is of the heavy duty type, especially designed. It is practically impossible to injure it by overcharging when the supply is taken from the generator. This battery carries one-sixth more fluid than other batteries.

The battery requires more attention than any other item of equipment because it is electro-chemical, rather than mechanical, in nature. Most battery trouble comes from insufficient charging which may result from a variety of causes.

The undercharged condition may be the result of abnormal or extravagant use of current. Short runs and frequent stops, as in the case of a physician or salesman, may make heavy demands on the battery for starting while the mileage and speed are insufficient to replace the current used. The same condition may follow when the car is used largely at night so that the lamps use up more current than is replaced by the generator in case the speed and mileage are low. If the battery is not too badly undercharged the remedy is to drive the car for a long distance at a good rate of speed.

Exhausting the battery may also be avoided by not spinning the motor for starting unless everything is ready, by not blowing the horn unnecessarily and by using the lights economically. At twilight it is easier to see without lamps at all, and lighting only the ordinance and tail lights will save electricity and prevent lamp depreciation. The big lamps are often unnecessary and can be turned off with economy for ordinary city driving and during stops. Besides, this will prevent blinding others with the headlight glare.

Neglect of the system may also be responsible for trouble. The battery should be examined, tested, filled and wiped off once a week. The fluid should be maintained at a level just below the bottom of the vent tube—about ¾ inch above the top of the plates—BY ADDING DISTILLED WATER. Acid should not be added. The weekly test should be made with the hydrometer furnished with the car. If a specific gravity of from 1.275 to 1.300 is not indicated in every cell the battery should be charged from some outside source. Never read specific gravity after adding distilled water until after the battery has been charged by the generator for at least one-half hour.

Short circuits or grounds may cause failure if the insulation has been rubbed off the wires through chafing due to vibration. If trouble of this nature seems possible, have the Chalmers dealer go over the system and test it for short circuits. Loose connections may also give trouble. See that they are kept absolutely tight.

When the car is not used for some time there is a constant discharge from the battery and in a week or ten days it will become nearly exhausted. Under such circumstances the current furnished by the generator under average driving conditions is not sufficient to supply every-day needs and at the same time build up the battery to the proper state of charge. Under such circumstances the battery should be turned over to a battery expert to build up to full efficiency.

When the car is to be laid up for some time, the battery should be discharged and fully recharged at least once a week or else the

liquid may be emptied into a clean glass or stone jar and the battery allowed to dry out. When put into service the liquid should be poured back and battery fully charged, in accordance with the special instructions furnished with the battery.

Starting Generator

The combined motor and generator of the Chalmers electric starting system is the simplest type built, known as differentially wound motor-generator, special winding being in the field. The series and shunt field coils are connected so they operate compounded as a motor, differentially as a generator. All automatic cutouts and other complicated electrical devices have been eliminated from the starting system.

When the dash switch is thrown to the "on" position, current flows from the battery to the motor generator, which as a motor revolves at about 100 revolutions per minute. As soon as the motor attains a speed of approximately 600 revolutions per minute, 6 to 8 miles per hour, the direction of the current, due to way the switch is connected to fields and arm, is reversed and the electrical machine then becomes a generator, which in turn charges the battery.

The only attention which the generator should require is lubrication. Lubricating oil should be put in each oil hole at least every 5000 miles. The universal joints and the starting motor drive shaft should be packed with fresh grease at least once a month.

Starting Switch

The design of the Chalmers electric starting system gives a non-stallable engine.

For all ordinary driving the dash switch is left in the "start" position. When the motor is not running, moving the switch to this position immediately starts the electrical machine, which spins the engine of the car at about 100 revolutions per minute. As previously explained, as soon as the car gains speed, the starting motor becomes a generator and in turn recharges the battery. In case the supply of gas is cut off, or the motor is forced to labor at so slow a speed that it would ordinarily stall, the motor action is immediately taken up by the starting system, for as soon as the motor of the car is reduced in speed below 600 revolutions per minute the starting system immediately and automatically resumes action. In other words, in any circumstances where the motor of the car would ordinarily be stalled, immediately upon pushing the clutch pedal the starter becomes operative.

Keep the starter switch in charging position, except when driving for more than one-quarter mile below eight miles per hour. In this case, set the switch in neutral, throwing the switch back to charging immediately the car increases its speed to over eight miles per hour. Under all other running conditions, regardless of speed, keep the switch in charging position.

If the car is left standing for any length of time, do not idle your motor, but stop it. If for some unusual reason it is necessary to keep the motor running, set the switch in neutral, while the car is standing still.

After idling the motor, or running slowly for a considerable length of time, don't forget to put the switch back in charging position, as soon as the speed of the car picks up.

On the Model 29 there is provided an electric indicator on the dash. Under all conditions keep the switch in charging position as long as the indicator shows "charging" but if the car is to be handled for five minutes or more, so that the indicator shows "discharge," then set the switch in neutral, but remember to throw it back in the charging position as soon as the speed of the car is sufficiently increased to make the indicator show charging. The indicator changes from charging to discharge at about seven or eight miles per hour.

Do not put the switch in neutral when running at high speeds.

In General

Do not tinker with the starting system. If at any time it should fail to start the motor, carefully study out the trouble before you begin taking it apart. All wires are plainly indicated in the wiring diagram.

In case of failure to start first look at the gasoline gauge. If pressure is sufficient, look at the carburetor. Be sure it is not flooding. If trouble appears to be with the starting system, the first thing to do is to see that all connections are tight, and that wires are not touching in non-insulated spots, which would cause a short circuit. Second, test the battery with the hydrometer—be sure it has a specific gravity of from 1.275 to 1.300 and is delivering current. Third, test the bearings of the starting motor—be sure that they are properly lubricated. Fourth, be sure that the connection between the starting system and the motor is not broken. Fifth, consult a Chalmers dealer.

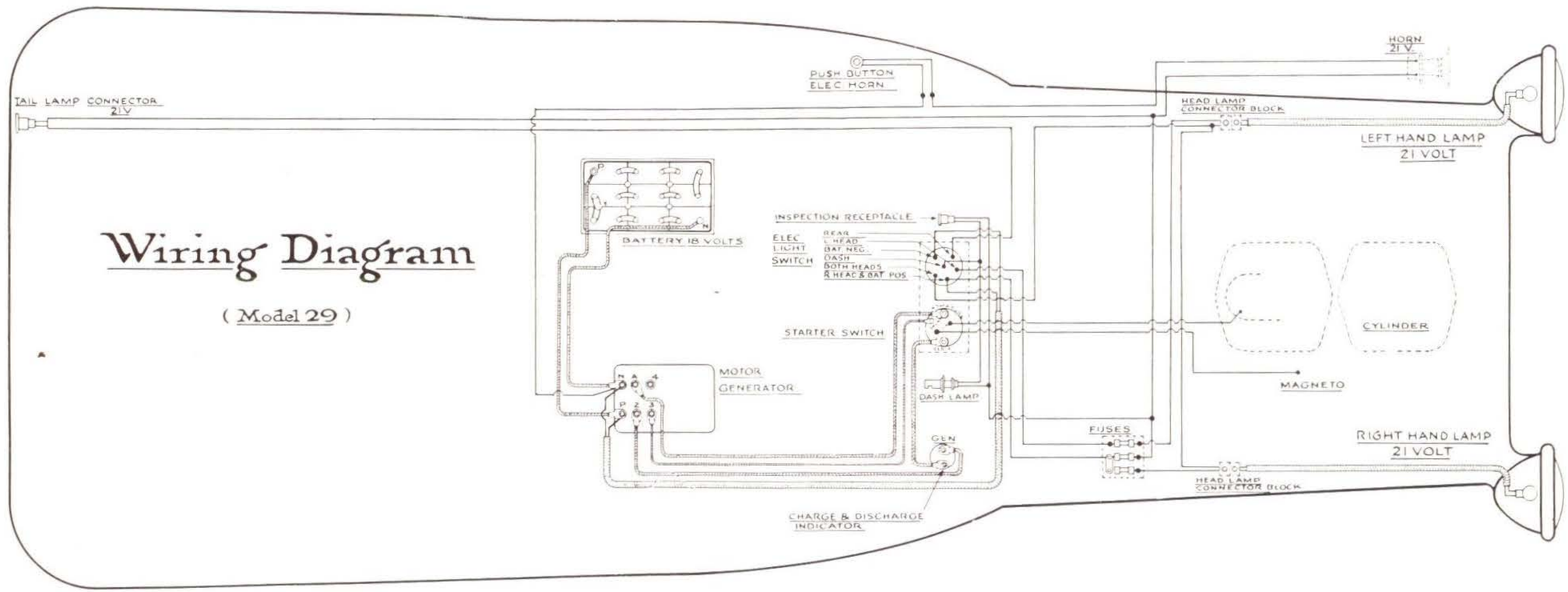


Fig. 13—Diagram of Wiring for Starting and Lighting Systems of the Chalmers "Master Six" (Model 29)

Electric Lighting System

(Complete wiring diagram in tool box)

Chalmers cars are electrically lighted, current being supplied to all lamps by the battery of the starting system.

This lighting system is extremely simple and will require practically no attention.

General Principles

The purpose of this system is to furnish current for the combination city and touring headlights, tail lamp, dash lamp, electric horn, and for the interior lights and step lights in the case of the enclosed cars.

The lighting system consists simply of a storage battery, which also furnishes current for the starting system; the necessary wires, and the lights of the car.

Operation

On the cowl of the dash is a rotary switch. By rotating this back and forth you can light any combination of lights marked on the edge of the lighting switch. Dash light is turned on by pulling out button in center of lighting switch.

Headlights

The headlights used on Chalmers cars are of an especially designed type. In the center of each reflector is carried a 21-candlepower 21-volt incandescent globe used in connection with an 18-volt system. When turned on full for country driving they throw ahead of the car a long beam of light which will illuminate the road for from 400 to 500 feet. A dimming device provides a softer, more diffused light for city driving.

Focusing

The large electric headlights must be focused accurately to give the best results. Touring headlights are properly focused when car leaves factory.

To focus Chalmers headlights set the car (after dark) in such position that there is room to throw a light ahead for from 400 to 600 feet. Throw a coat, or some other material through which the light will not penetrate, over one of the headlights. If the light thrown by the other lamp is not in focus, open the headlight; take hold of the socket supporting

the lamp; press the little spring that holds it in place and the lamp may be moved forward or backward until the proper focus is obtained.

Repeat the operation with the second headlight.

The best method of setting a focus depends upon the individual driver. Chalmers headlights can be focused so as to throw a spot-light in the distance; but if they are set just a shade out of focus the light will also be diffused close to the car.

Some drivers prefer to have one lamp throw a spotlight and the other a diffused light.

If the lamps are burning brightly and at the same time the light is not good, it is generally an indication that the lamps are out of focus.

Electric Horn

A deep-toned electric motor driven horn is carried under the left front lamp. The button which operates this horn is placed inside the left hand front door near the top molding.

Inspection Light

Beneath the cowl of the dash, at the extreme right hand side, will be found an extra electric socket. This is the provision for an electric inspection lamp, cigar lighter, or other electrical apparatus.

Dash Light

The hood of the dash light is adjustable. To illuminate any part of the cowl board, simply turn on the dash light and turn the hood so that the light is thrown to the part of the cowl you desire to illuminate.

In General

Do not attempt to take the Chalmers electric lighting system apart. While this system is extremely simple, electric systems in general are little understood by laymen, and it is best not to experiment with them. If for any reason one of the lamps fails to burn, first inspect the filament and be sure that the lamp is not burned out. Next be sure that the lamp is tight in its socket, making the necessary contact. If the lamps appear to be in perfect condition, next inspect the wiring and be sure that all connections are properly made. Then

examine fuses to see if any are burned out. (See Figure 13, or wiring diagram in tool box.) Sometimes small particles of dust work down between the fuses and fuse clips so that simply rotating the fuse in the clips will often restore the circuit. Fuses should be given attention about once a week. Once every six weeks or two months the inside of the clips and the ends of the fuses should be cleaned with No. 00 or No. 000 abrasive paper or cloth in order to keep them in first class condition. If for any reason the horn fails to operate, inspect the wiring and connections the same as for lights. Finally, if you do not locate the trouble at once and do not understand the trouble, consult a Chalmers dealer or some good electrician.

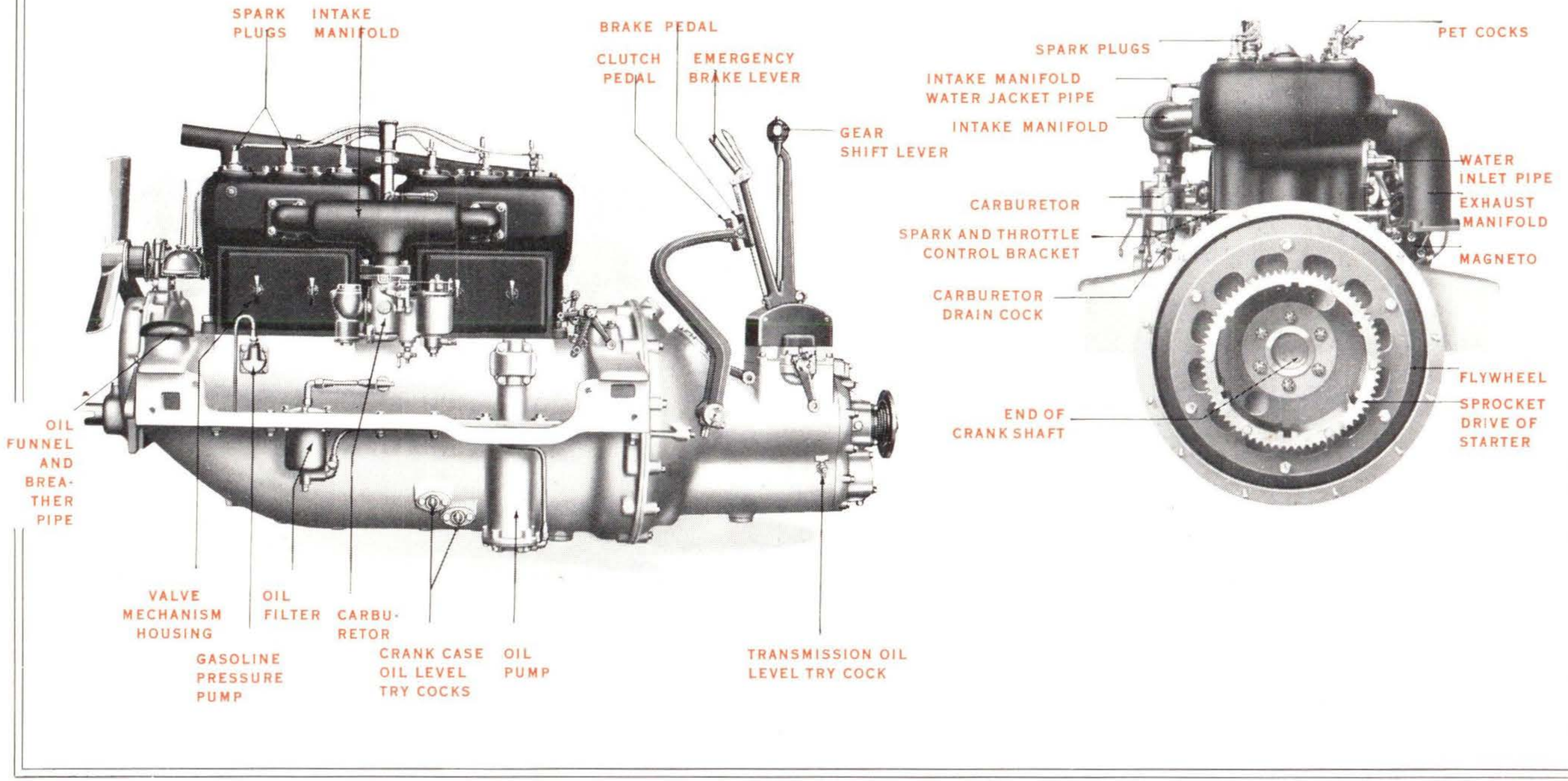


Fig. 14—Intake Side and Rear of the Chalmers "Master Six" (Model 29) Motor

Proper Care of Motor

Running a New Motor

Do not in 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 of 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 motor (with switch off) until resistance is felt in each of the six cylinders successively. (Starting crank is carried in tool box beneath front seat and may be readily adjusted to front end of crank shaft.) Compare the resistance in each of the cylinders.

If the compression in one cylinder is less than in 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; or (2) because there is a small deposit of carbon on the seat of the valve. Either of these faults may be quickly remedied.

Cleaning the Valves

The exhaust valves of the Chalmers "Master Six" are of Tungsten steel, the hardest kind of steel which is made, and will not warp or pit. The hardness of the valves also obviates the necessity for grinding the valves in all ordinary circumstances. Leaky valves may occasionally occur through the collection of a carbon deposit on the valve seat. When this occurs the valves should be lifted from the seats and the seats ground with some prepared grinding paste or a mixture of oil with fine emery powder or ground glass.

To remove the valves: First unscrew the "valve bonnets" (Fig. 8, Page 38). While holding the valve down from above, lift the "spring washer" (Figures 14 and 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 that the stem as well as the head is free from dirt or gummed oil. Stuff rags or waste into the passage between the valve and the cylinder to keep grinding material out of the latter. Replace the valve upon its seat, with piston at beginning of firing stroke, and grind seat by rotating valve head with a screw driver, with grinding paste between the valve and its seat. The seat should be ground until the valve has an even bearing all around its face. Carefully remove all the grinding compound and waste. Wash out the valves and cylinders with gasoline when through grinding.

Valve Timing

The time and amount of opening of the valves depends upon the adjustment of the valve tappets (Figure 3)

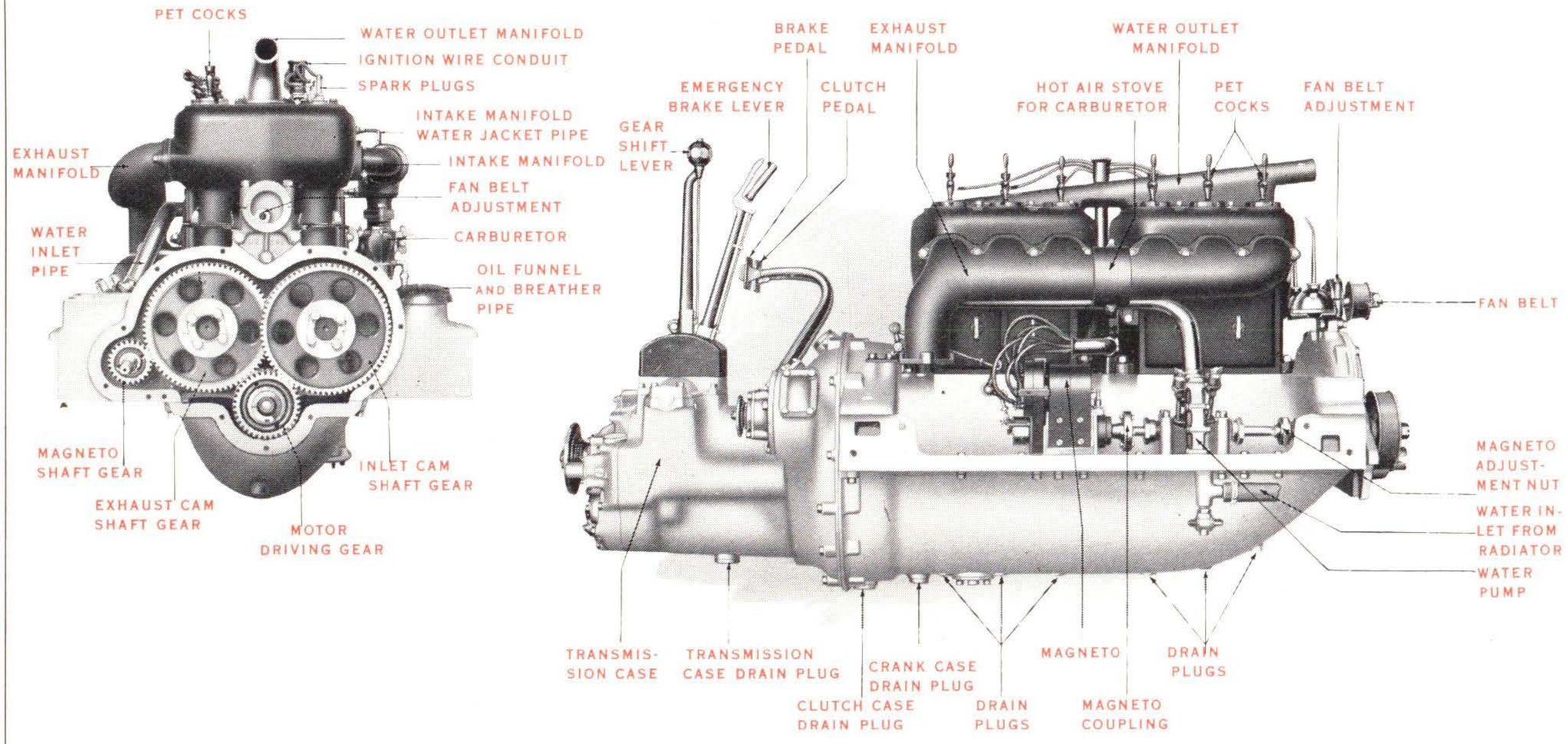


Fig. 15—Exhaust Side and Front of the Chalmers "Master Six" (Model 29) Motor

which must bear upon the cams of the cam shaft (Figure 8, Page 38). To adjust the timing, proceed as follows:

Remove plug of clutch case (Fig. 8, Page 38). This will reveal the beveled steel edge of the flywheel with its markings. Crank the motor until the exhaust valve of cylinder No. 1 just closes. This point is reached when you are able to turn the "valve tappet" under the "valve stem" with your fingers.

At this point the mark "Ex. Cl." (exhaust closes) on the flywheel should be exactly centered with reference to the opening in the clutch case. If the closing is not correct, rotate the flywheel to bring this mark directly on center 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. 3).

Turn the flywheel a short distance in the same direction, bringing the mark "In. Op." (inlet opens) to the center with reference to the hand hole opening. With flywheel mark in this position, the inlet valve on No. 1 cylinder should just start to open. If not, adjust inlet valve tappet as described above. This operation should be repeated for each cylinder.

Carbon in Cylinders

If the motor keeps on firing when the ignition switch has been turned off; if it should knock even when the spark has been sufficiently retarded, or if the motor 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. 15) 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 at night, repeat the dose in the morning.

An even better liquid than kerosene to cut carbon 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 scrape the carbon from the piston heads and walls of the chambers.

Do not use patent carbon removers that contain injurious acids.

To Remove Carbon from Cylinders

First drain the water from the radiator and water jackets of the motor. Next unscrew the large "water head" (Fig. 8) or water outlet from the top of the motor. Removing the water head will reveal a plug in the top of each cylinder. Removing this plug gives an opening into the cylinder large enough to admit the hand. Scrape carbon from walls of combustion chambers and piston heads with a blunt instrument. Use a piece of tin or dull knife. Never use a hard steel scraper which will scratch the walls of the combustion chambers.

After removing carbon, clean combustion chambers with kerosene. Always remove carbon and grind valve seats at same overhauling. Remove the carbon before grinding valve seats.

Adjusting Connecting Rod Bearings

Adjustment of connecting rod bearings should be done by a Chalmers dealer. If it should be necessary to do the work yourself, proceed as follows:

Drain the oil from the crank case by removing the plug.
Remove the lower half of the crank case from beneath the motor, thus exposing the interior of the motor (Fig. 8, Page 38).
After loosening the "connecting rod bolts," one or more "liners" (thin 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.

Adjusting Crank Shaft Bearings

Adjustment of the crank shaft bearings should always be made by a Chalmers dealer, except in case of extreme necessity. If it should be necessary to do the work yourself, proceed as for making adjustment of connecting rod bearings.

After removing lower half of crank case, block up the flywheel or support it upon your jack. Remove nickel steel bolts from "bearing caps." Remove one or more "liners" until proper adjustment is reached. Be sure that bearings are not made too tight. Be sure also that bearing caps are securely bolted in place. A loosening of one of the main bearing caps would probably do considerable damage to your motor. Make main bearing adjustment with extreme care, and unless case is urgent have this work done by a Chalmers dealer.

Running Gear

Service Brakes

The service brakes, so called because they are controlled by a foot pedal and are the brakes generally used, are on the hubs of the rear wheels (Figure 16, Page 62). These brakes are of the contracting type, consisting of a steel band lined with asbestos. All ordinary adjustments of the service brakes are made by means of a lock nut adjustment at the front of the brake band (Figure 16, Page 62).

The steel brake bands can be relined when necessary by cutting off the old rivets and applying new lining.

Emergency Brakes

The emergency brakes or hand brakes are also located on brake drums bolted to the hubs of the rear wheels. They are of the internal expanding type and are lined with asbestos. The emergency brakes are operated by a hand lever operating on a toothed quadrant (Figure 1, Page 11).

Both service brakes and emergency brakes operate on pressed steel brake drums.

Adjustment of the emergency brakes is made by drawing in or lengthening the two brake pull rods by means of the threaded "brake pull rod adjustment" (Fig. 2, Page 16).

In adjusting brakes care should be taken to see that both brakes of the same set are adjusted evenly, so as to apply the same resistance to each of the rear wheels.

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 speed as much as possible by closing the throttle. Then apply brakes. Do not throw on brakes unnecessarily when car is moving fast.

When descending steep hills, lessen strain on emergency brakes by shifting gears to a lower speed, letting in the clutch and allowing the motor to run with 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 full gear type (lubricating directions on Page 17).

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. 2, Page 16). Should end play of the steering column develop, screw adjusting nut down a little and lock in place by the locking spring. (2) Adjustment of the bearing on the "ball arm shaft" takes up lost motion in the steering gear. To adjust this it will be necessary to remove steering gear from the car.

Do not adjust steering gear unless you are sure the trouble is there. Look at reach rod adjustments.

The exterior steering connections, including the various points between the reach rod, steering knuckle, cross rod, etc. (Figure 2, Page 16), frequently should be 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 clip is not only to hold the springs firmly to the axle, but also to prevent movement of the spring leaves between the clips. Breakage of the springs at the middle is caused almost entirely by loose spring clips. When the car is new spring clips should be examined and tightened every day until the stretch of the middle has been taken up. After this clips need be examined no oftener than once a week.

Spring Hangers

Keep hangers well greased and tight. (Figure 2, Page 16.) See that the bolts work in the bearings of the springs, and not in the hangers.

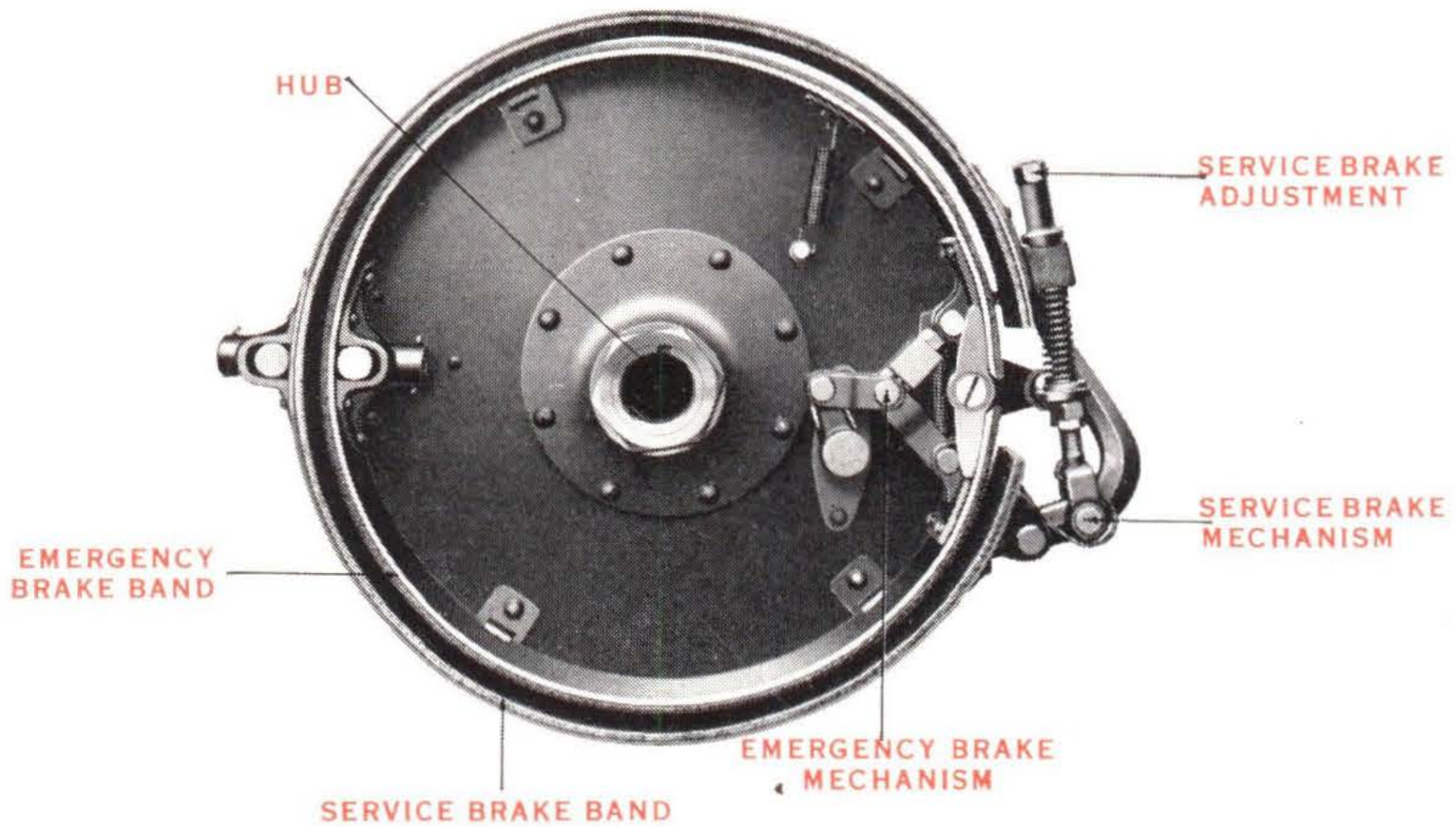


Fig. 16—Brake Construction of the Chalmers "Master Six"

Cold Weather Procedure

In General

When motor is cold, 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 the best quality procurable and has no water in it; drain sediment cup at bottom of gasoline tank to get rid of water and sediment; be sure dash lever for adjustment of carburetor is moved over toward "R."

Stopping the Motor

Close the throttle entirely before shutting off motor.

Starting the Motor

For cold weather adjust the curburetor to feed an extremely rich mixture when starting. Rich mixture is secured by moving carburetor adjustment lever to extreme right.

A special priming device which sends a small charge of gasoline direct to the inlet manifold is also provided. Priming cylinders in this way will facilitate starting in cold weather. Handle controlling this special priming valve will be found on the cowl of the dash at the right of the steering column. (Figure 1, Page 11.)

Draining the Car

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

In the water inlet pipe at the bottom of the pump will be found a small faucet. Opening this faucet will drain all water from the radiator. Open the cock in the carburetor hot water pipe. Radiator filler cap should be removed. Rock the body a few times to get out all of the water.

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 temperature not lower than 15 degrees below zero:

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

About 6 gallons are required for the Model 29.
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 shut-off cock is open. Is gasoline line free of clogs? A convenient gasoline gauge will be found at the top of the gasoline tank. Never start on a trip of any length without consulting the gasoline gauge.

(2) Lack of ignition current.
This may be due to neglect in throwing the switch or to a broken or disconnected wire.

(3) Dirty spark plugs.
These are due to an 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 and the points adjusted.

Motor Stops

(1) Lack of gasoline.
(2) Disconnected switch or wires.
(3) Short circuiting of magneto ground wire.
(4) Lack of oil.
(5) Carburetor flooding.

Motor Misses

(1) Broken or disconnected wiring.
If the motor misses, short circuit the 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 motor, this is probably the plug at fault. Be sure that magneto secondary terminals do not touch at distributor. Be sure that spark plug connections give a perfect contact.

(2) Dirty spark plugs.
Remove and clean. Be sure porcelain insulation is not cracked.

(3) Points of spark plugs improperly set.
If these points are too close together or too far apart, missing may result. Spark plug points should be set a scant $\frac{1}{32}$ inch apart—about the thickness of a dime.

(4) Defective carburetor adjustment.
See page 27.

(5) 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 cylinder in turn. (See page 57.)

(6) Air leak around inlet valve cage.
Can be detected by putting oil or water around the inlet valve cage nut. (Fig. 8, Page 38.)

(7) 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 17 and page 37.)

(2) Defective water circulation.
Inspect all water passages, making sure that the gaskets (washers) at flange 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.
Belt should be tightened.

(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 hot. Such sharp points should be located if possible and smoothed down. For carbon in cylinders, see page 59.

(6) Too little gasoline.
Too lean a mixture is indicated by lack of acceleration, popping in the carburetor or back-firing when the throttle is suddenly thrown open.

Motor Knocks

(1) Connecting rod bearings too loose.
Loose bearings give a light knock at high speed or when the motor is laboring. 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 must do the work yourself, directions will be found on page 60.

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

(3) Lack of proper lubrication within the motor.
See page 17 and page 37.

(4) Faulty carburetor adjustment.
See page 27.

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

(6) Carbon in cylinders.
This carbon becomes heated and may cause premature ignition. For cleaning cylinders see page 59.

(7) Motor speed too slow when pulling up hill on direct drive.
Shift into third, or if necessary into second, speed.

(8) Crank shaft bearing loose.
Heavy pound at slow motor speed under heavy load. The adjustment of this bearing should by all means be made by a Chalmers dealer. If you must do it yourself, see directions on page 60.

Motor Will Not Stop

(1) Open circuit in switch.
"Ground" the magneto by touching a screw driver to "breaker box" and frame.

(2) The wire connecting magneto and switch 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 or late 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 tires.

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 41.

Clutch Grabs

If the clutch takes hold too suddenly, this is probably due to too tight adjustment of clutch springs or insufficient throw on the clutch pedal. For remedy, see Page 41.

Lack of Good Compression

This is generally due to leaky valves. These should be adjusted or their seats should be reground. (See Page 57.)

A very likely place for loss of compression is around the inlet valve cover plug. 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 cover plug (Fig. 8, Page 38) is tight.

Popping Back Through Carburetor

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

Faulty supply valve adjustment.
Dirt in gasoline passage or nozzle.
Air leak in the intake passage or around the inlet valve cover plug.
Inlet valves holding open.
Water in the gasoline.
Excessive temperature of the hot water jacket of the carburetor, especially in hot weather. This can be remedied by shutting off the water from the carburetor jacket and cutting off the hot air supply.

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 18.) See that all nuts and bolts are tight—especially spring clip nuts.

Miscellaneous Suggestions

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. Maintain a pressure of twenty pounds per inch of cross section in your tires when they are hot; that is ninety pounds on 4½ inch tires when hot.

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.

Windshield

Be sure that the windshield hinges are kept tight. This not only prevents rattling, but insures against breakages of the glass through a sudden collapse of the windshield.

Examine the windshield anchor bolts from time to time and see that the nuts are well tightened.

Speedometer Drive

Be sure that the worm gear speedometer drive in the right hand steering spindle is well lubricated. Should the speedometer fail to record, first examine the speedometer itself. The Stewart-Warner representative in your city will fix it up. Should the trouble be located in the speedometer drive, consult a Chalmers dealer.

Don'ts

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

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 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.

How to Wash Your Car

1—When a car comes in from a run, wash it, if possible, before the mud has a chance to dry and harden. If you cannot wash it then, it is better to rinse it off, and let it stand in that condition, than to allow the mud to bake on. A car is usually hot when it comes in, and the mud will dry up quickly and bake very hard, and wherever the mud does bake on it hurts the surface of the paint.

2—Never dust off a finished surface dry. Don't use a feather duster, or any kind of a duster, to remove dust from a car. Have it washed.

3—In washing a highly finished painted surface, never rub the surface with a sponge, cloth or chamois, or anything else, until the mud and grit have been thoroughly rinsed off. The car should first be gone over with the open end of the hose, with the water running partially turned off. That is, use a big stream, but little pressure. Always begin at the top and work downward. By the time the entire car is gone over, unless it is an unusual case, the dirt should be loosened up sufficiently to rinse off by going over the car again. In case of very stubborn mud, take a soft sponge, and keep it thoroughly saturated and just touch the surface to be cleaned. Under no circumstances rub it.

4—If, after getting all the dirt and grit off, you find greasy places on the panels, use an old chamois and Ivory soap, rinsing the chamois often. Never wipe the body panels with a chamois or sponge which has been used on the running gear, as it is almost certain to hold grease, which will spot the highly finished surface. After the grit and grease have been thoroughly removed, rinse the entire car thoroughly to insure that every bit of soap is removed. After this, wet a good, clean chamois and wring dry, and go carefully over all painted surfaces, wiping them dry. This will remove practically all the water, but the car should be kept in the shade until it is thoroughly dried.

If you will follow the above rules, your car will look just about as well at the end of months of usage as when new. But, just as sure as you use harsh washing soaps or soft soap, and do not wash your car properly, it will be a matter of only a few weeks before the best finished car on earth will look old.

Index

Index (continued)

Quality First

A 104-2500-9-14 JM