

MARMON 34 INFORMATION BOOK



BOOK NUMBER 1834

Information Book

for Care and Operation of

Marmon 34 Motor Cars

*When Ordering Specify
Book No. 1834*

NORDYKE & MARMON COMPANY

Established 1851

INDIANAPOLIS, INDIANA

Warranty

"This is to Certify that We, Nordyke & Marmon Company, of Indianapolis, Indiana, warrant each new motor vehicle manufactured by us, whether passenger car or commercial vehicle, against defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall within three months after delivery of such vehicle to the original purchaser be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.

"This warranty shall not apply to any vehicle which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident, nor to any commercial vehicle made by us which shall have been operated at a speed exceeding the factory rated speed or loaded beyond the factory rated load capacity.

"We make no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signaling devices, starting devices, generators, batteries, windshields, speedometers or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers."

**NORDYKE & MARMON CO.,
Indianapolis, Indiana, U. S. A.**

The above is the standard form of warranty for motor vehicles adopted by National Automobile Chamber of Commerce, Inc.

STANDARD SERVICE POLICY

OF

NORDYKE & MARMON COMPANY

INDIANAPOLIS, INDIANA

(Approved by National Automobile Chamber of Commerce)

Nordyke & Marmon Company, through its dealers, aims to give all purchasers of Marmon cars uniformly fair, courteous and businesslike treatment and to assist them in every reasonable way to keep their cars in good running condition.

The principles of this policy are:

First—To fulfill the obligations assumed under the manufacturer's warranty.

Second—To furnish repair parts as promptly as possible at our current prices.

Third—To maintain facilities for making repairs, adjustments, and do general overhauling in a prompt and competent manner at reasonable charges.

Fourth—To make inspections and adjustments, not necessitated by neglect or abuse, free of charge for one month following delivery of a new car to purchaser, and thereafter at our regular prices.

Fifth—To furnish printed instructions in the operation and care of our cars.

Sixth—Service to be rendered does not include furnishing repair parts or labor without charge, except as provided in the warranty and in the following specific clauses of this Service Policy:

Replacement of Defective Parts

(a) Within ninety (90) days after delivery of a new car to purchaser, Nordyke & Marmon Company will furnish, free of charge at the factory, duplicate parts to replace any parts as covered by our warranty that are returned to the factory with shipping charges prepaid and which are determined by the company to have been defective in material or workmanship, or it will put such parts in condition as good as new without charge.

(b) Within ninety (90) days after delivery of a new car to the purchaser the dealer will install, free of labor charges, any parts that the factory furnishes free of cost to replace any parts determined by the factory to be defective, the purchaser to assume cost of parts and installation of same pending factory decision.

(c) The party returning the parts will be notified promptly of the decision of the factory regarding allowance of a claim for replacement or repairs of parts returned.

Inspection and Adjustment

(d) Cars brought to service stations maintained by factory, branch or dealer, will be inspected and all necessary adjustments will be made as in paragraphs (e) and (f), without charge during the first month after delivery of a new car to purchaser, provided the car has not been tampered with nor injured by accident or neglect. After the first month adjustments will be made at the regular charges of the service station.

(e) Inspection includes examination and report of the condition of the car.

(f) Adjustment includes only such adjustments as inspection has found necessary to put the car in good operating condition.

(g) Every dealer is expected to give the same inspection and adjustment service on the cars made by this company without regard to the territory in which they were bought.

Repairs, Replacement, Etc.

(h) All work not included in inspection and necessary adjustments during the first month, or installation of replacements under the warranty, will be charged for at regular rates.

(i) When any charge work is to be done and the cost can be estimated in advance, the owner, upon request, will be advised of the amount of the charges before the work is begun.

(j) When it is necessary, for the convenience of the owner, to render service at a distance from the service station, the time spent by employees going to and from the job will be charged for at the regular rates of the station, together with all proper expenses of making the trip, cost of shipping parts, if any, and other necessary incidental expense.

Overtime Work

(k) Any overtime, holiday or Sunday work done upon the request of the owner will be charged for at the regular overtime rate.

Instructions in Care and Operation

(l) Instructions in printed form regarding the care and operation of the car and its accessories, and proper method of ordering and returning parts, will be given to the purchaser upon the delivery of the car.

(m) Personal instruction will be given in accordance with the agreement between dealer and customer at time of purchase.

General

(n) For service and replacements on engine starters, batteries, magnetos, generators, lamps, carburetors, tires, rims or other trade accessories that are not made by the manufacturer of the car, application may be made direct to the nearest service station maintained by the maker of such accessory. Dealers will be provided with a list giving names and addresses of the manufacturers of said accessories.

(o) No promise of service, free repair work, inspection or adjustment, except as herein specified, given or made by the dealer, shall be binding on the manufacturer of the car.

(p) To help the dealer carry out the intent of this Service Policy, the owner is requested to furnish all information necessary to the prompt and proper filling of orders and issuing of credits and to observe the requirements regarding return of parts with claims for replacement.

PART I

Introductory

In presenting this book to Marmon 34 owners we have attempted the rather large task of dealing with *all* phases of the owner's experience with his car. Our aim has been to say more than is necessary rather than less, to give the owner that full detailed knowledge of his car without which the full pleasures of motoring cannot be enjoyed.

Beginning with the unloading from the freight car and ending with instructions for ordering parts, we go successively through all of the subjects most interesting and valuable to car users.

The book is divided into two parts, the first covering the obvious external conditions which would naturally come to the users' attention, while the second covers a detailed description of all the mechanism with instructions for adjustment, lubrication, repairs, etc.

The first chapter covers the preliminary instructions. The second chapter covers the garage care of the car, and the third, suggestions for driving. The fourth and fifth chapters are devoted respectively to the care of tires and special suggestions for cold weather running.

Part II begins on page 24.

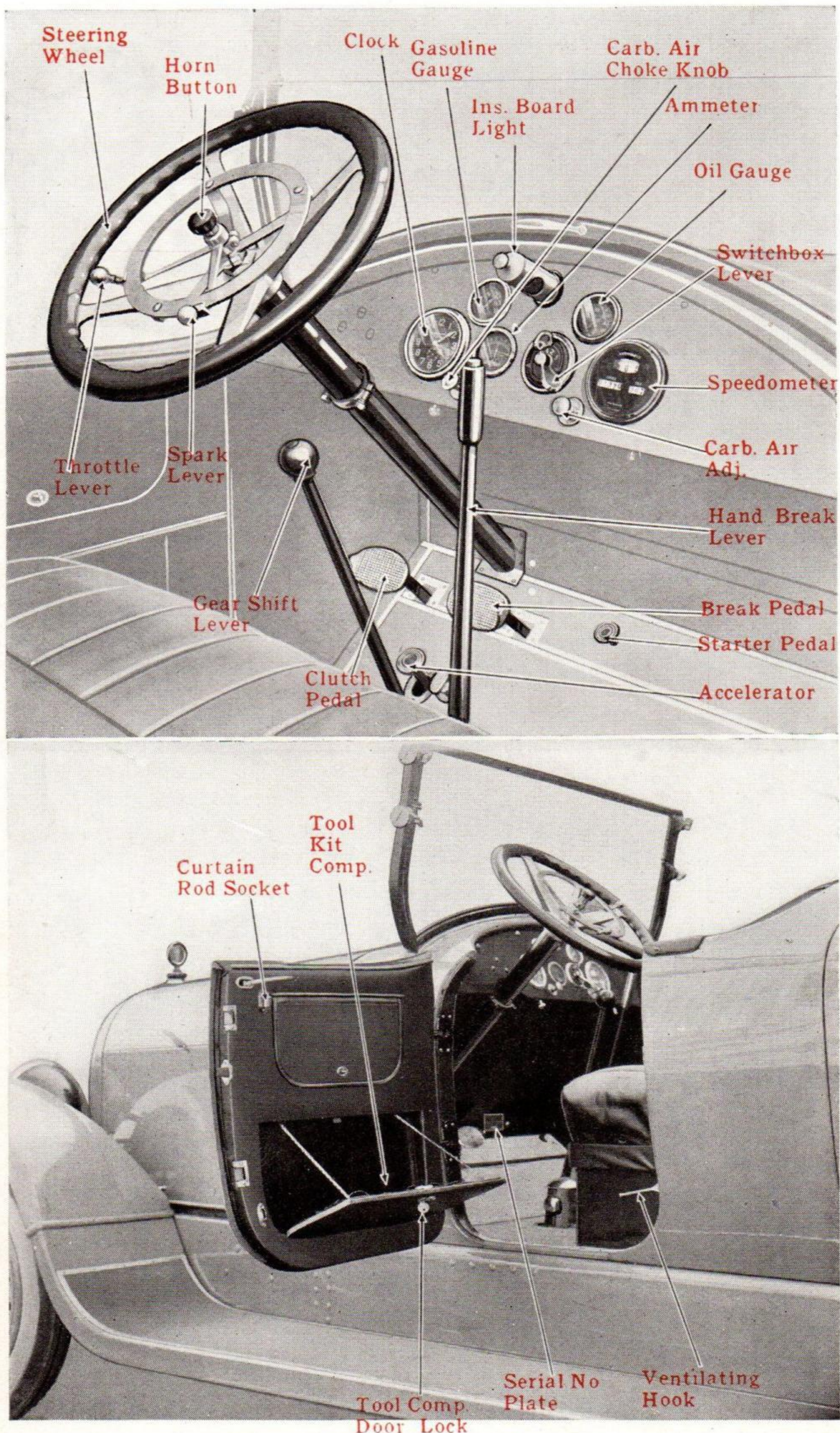


Fig. 1. Instruments and Controls

CHAPTER I

What to Do First

THE controls and instruments will be found grouped conveniently about the driver's seat, as shown in the illustration.

Clock The clock is stem wound and set the same as a watch by means of the stem extending below the instrument board.

Speedometer The speedometer trip mileage can readily be set at zero with the adjusting pin. The season mileage can only be changed by returning the instrument to the manufacturer.

Switch The switch on the instrument board controls all of the electrical circuits, that for the ignition being controlled by turning the switch key and the horn and lighting circuits being controlled by the switch lever. When the lever points to "0" all of the circuits are "dead"; when at "1" the dash tonneau and trouble lamps, also the horn, are placed on a "live" circuit, although the first two of these have individual switches and are not necessarily lighted when the switch lever points to "1." When the lever points to "2" the auxiliary head lamps and tail lamp are lighted and when at "3" the main head lamps and tail lamp are turned on.

Ammeter The hand of the ammeter when pointing to the right indicates the rate at which the battery is being charged and when pointing to the left indicates the rate at which the battery is being discharged.

Switch Key For shutting off the motor, when it is desired to use the lights or horn, the turning of the key in the switch preparatory to removing it from the lock, automatically cuts off the ignition, regardless of the position of the lighting switch.

Choke The left knob marked "choke" should normally be left all the way in, but should be pulled out to facilitate starting in cold weather. See page 21.

Carburetor Adjustment The right knob marked "in lean—out rich" may be pulled out if necessary to enrich the gasoline, but should be kept as far in as possible for smooth running.

The other controls illustrated in Fig. 2 are discussed elsewhere in the book.

Starting the Motor

See that the gear shift lever is in neutral position (so it can be rocked from side to side), that the hand brake is set locked, that the throttle lever is about one inch up from the lowest position, that the spark lever is advanced about one-third and that the switch key is in proper position.

Gear Shift
Lever

In cold weather the "choke" and "carburetor adjustment" knobs should be pulled out. See Chapter V.

Knobs

Then depress the starter pedal all the way down. This pedal will be found on the toe board just to the right of the brake pedal. If the starting motor pinion does not enmesh with the flywheel gear do not hold the starter pedal down. Release it and after a few seconds' pause depress the pedal

Starter
Pedal

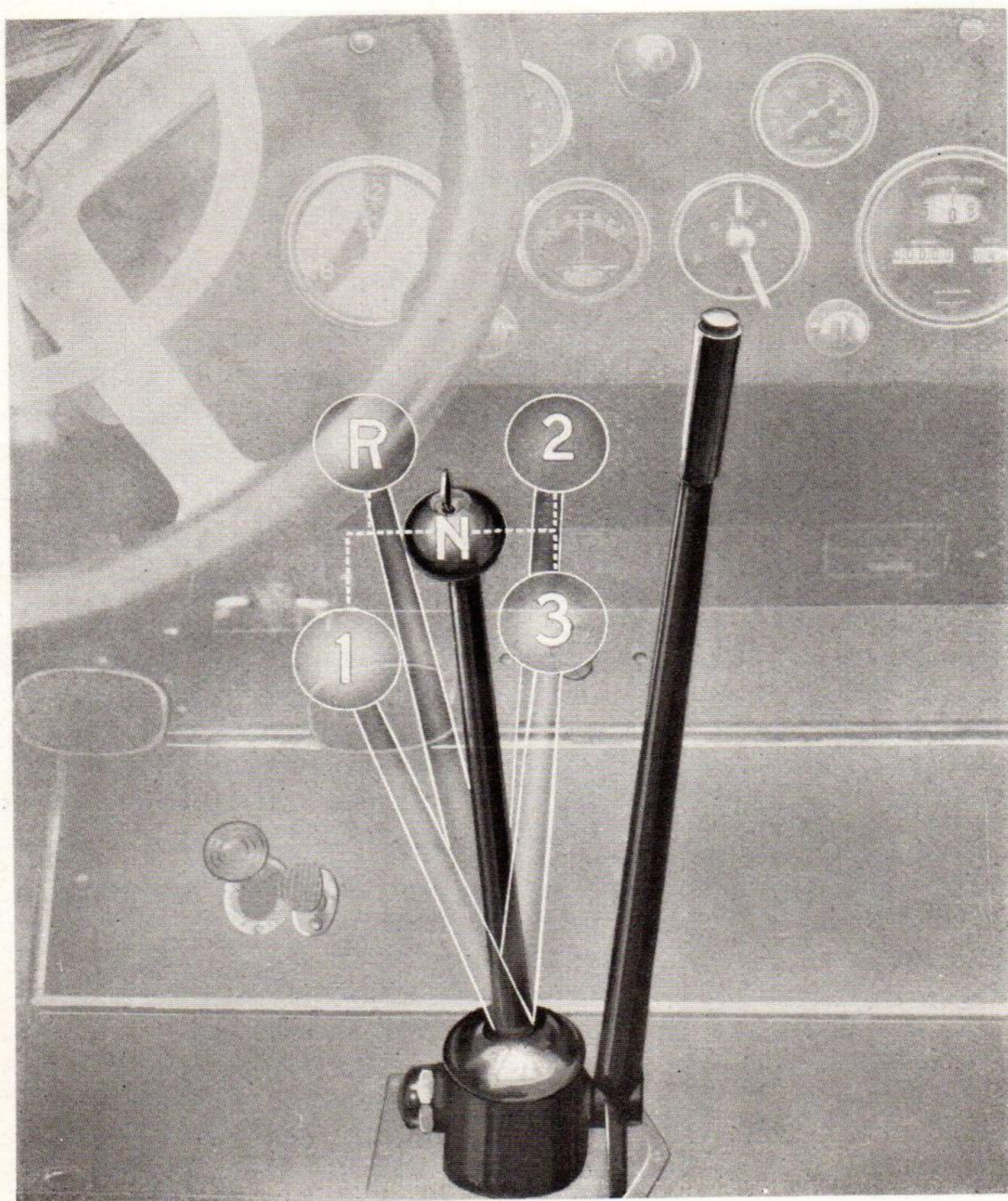


Fig. 2. Gear Shift Lever Positions

again. If trouble in starting is experienced see Detecting Faults, pages 79 and 80.

When the engine begins to fire, release starter pedal at once, and push in the choke knob. Lower the throttle lever so the engine will not race, advance the spark to about two-thirds the way up to quadrant, move the carburetor adjustment knob in and out until a position is reached where the motor runs evenly. As the motor warms up, gradually push the knob in, so that it is always as far in as smooth running of the motor will permit.

Starting the Car

Hand Brake You will note an intimate relation between the clutch pedal and the gear shift lever. This relationship is brought about by the fact that the transmission gears cannot be changed from one speed to another when the power of the engine is being applied, thus making it necessary to press down the clutch pedal to disconnect the power of the engine when shifting gears.

First Speed Draw the hand brake lever back slightly to release the pawl and then push forward. (Never fail to attend to this.)

Thus the first move in starting the car is to disengage the clutch by depressing the left foot pedal.

Move the gear shift lever to the left and backward into first speed position. (If it will not go, raise and lower the clutch pedal, when it will slide into gear easily.)

Slowly engage the clutch by lifting the left foot very gradually, at the same time increasing the motor speed slightly with throttle or accelerator. The car will start forward.

Second Speed If you have not had experience in driving, it is well to try the steering, brakes, clutch, starting and stopping, disengaging gear lever, etc.; that is, to become thoroughly familiar with the car operation in first speed, before attempting the higher speeds. The suggestions in Chapter III should be read before attempting to drive the car.

The shift to second is made preferably at a speed of six to eight miles per hour. Release the clutch and move the gear shift lever forward to neutral, to the right, and then forward again to second speed position. To do this without "clashing" gears may take practice, but when you have learned just the right time to slide in the gears, it can be done without difficulty. To disengage the first speed gear easily when making this change apply a little pressure against the gear shift lever before releasing the clutch. As soon as the lever is in gear, re-engage the clutch slowly, at the same time speeding the motor slightly as before.

The shift to third or high speed should be made at from ten to fifteen miles per hour ordinarily. This shift is made the same way, except that the lever is moved straight back into right rear position. Do this with a slight pause in neutral. See "Suggestions for Driving," Chapter III.

Speed
Reverse

To Stop the Car

Retard the throttle, disengage the clutch, and move the gear shift lever to neutral.

By braking with the right foot pedal or the brake hand lever, gradually bring the car to the desired stopping place. Applying the brake hard, except in emergencies, is a very bad practice, both on account of wear on tires and the danger of skidding.

Before re-engaging the clutch be sure the gear shift lever is in neutral. Then set the hand brake.

To Stop the Motor

Disconnect the spark by turning the switch key in the lock, thereby stopping the motor and locking the switch in whatever position is desired.

Running Backward

When the car is at rest, release the clutch and move the lever to the left, then *forward* into reverse position, and engage the clutch. Watch the steering carefully. Avoid backing rapidly, and always be ready to operate the clutch and brake pedals.

Third

Precaution

Unless the driver has had a great deal of experience in handling gasoline motor cars, he is almost sure to feel satisfied with his driving after having mastered the details above, but this is only the first step. The full pleasure of handling the car comes only with the complete confidence resulting from an intimate knowledge of the machine.

As a second step, the driver should become thoroughly familiar with the detailed functions of the various controls as fully explained in chapter 4. Then he should read carefully the balance of the book so that he understands the car in its entirety.

CHAPTER II

Periodical Care of the Car

Importance
of Regular
Attention

THIS chapter aims to give the owner a definite time-and-distance basis for the care-taking of the car, covering its whole life. By forming the habit of caring for the car on this basis, the owner will be most certain not to overlook vital attention necessary, and in return will secure a service which for constancy and economy will prove a grateful surprise.

Division
Into
Groups

Starting from the daily needs and ending with the periodic overhauling and repainting, the attention necessary may be divided into four groups. The first group represents the every-day duty of whoever handles the car. The second group is the weekly cleanup, work of the driver or garageman. The third group, or monthly inspection, is preferably performed by the Marmon dealer, but is within the ability of the garageman, professional driver or the owner if he is so inclined. The fourth group outlines in general terms the complete overhaul to be undertaken only in the well equipped repair shop—if at all possible, by a Marmon representative. The times and distances are taken as average conditions, and are such that they can be modified to suit each individual case. Generally speaking, if the car is driven more miles in the prescribed time than the schedule indicates, the mileage basis should govern; while if the car is driven less, the time basis should be followed. Thus, when on a tour, the monthly inspection should be given every 1,000 miles, but when not touring should be given every month, even though the car may not have traveled 1,000 miles during the month.

Group One—Every Day, 50 to 100 Miles

Four
Points
for Daily
Attention

Every time the car is to be used the driver should first assure himself of four simple but vital conditions.

1. That there is plenty of *gasoline* (gauge on dash).
2. That there is plenty of *motor oil* (gauge under hood at right).
3. That the radiator is full of *water* (see page 39).
4. That the *tires* are properly inflated.

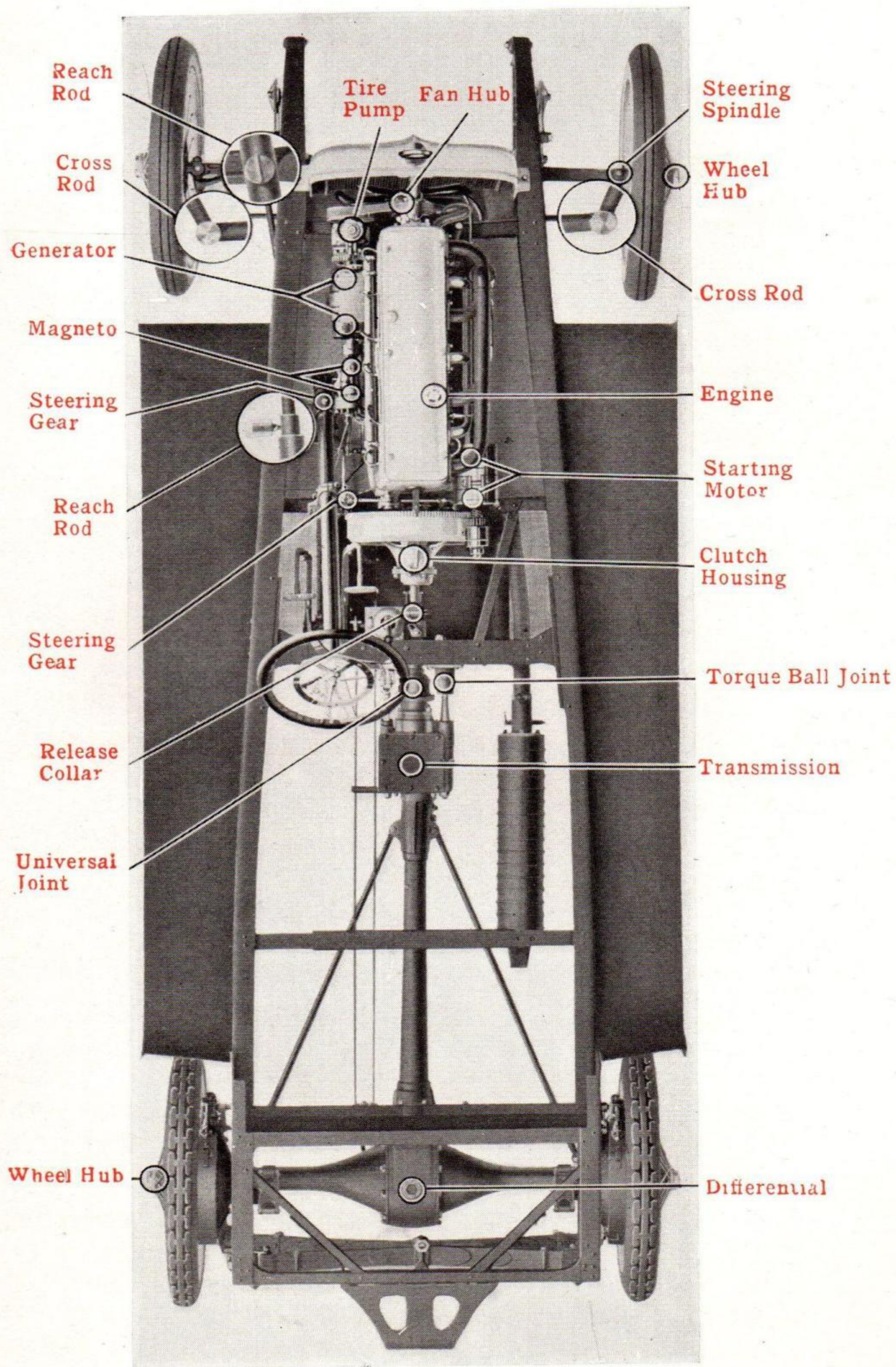


Fig. 3. Chassis Lubrication

How Often to Lubricate	Parts to Be Lubricated	No. of Places	How Applied	Grade of Lubricant (See Below)	Maximum Amount	See Page
Daily-Bi-weekly 100-200 miles	Engine oiling system.....	1	Filler	"B"	3½ gallons	61
	Steering reach rod.....	2	Grease cup	"D"	1 ounce	12
	Steering cross rod.....	2	Grease cup	"D"	½ ounce	12
Weekly-Bi-monthly 500-1,000 miles	Refill storage battery.....	1	Syringe	Distilled Water	2 ounces	76
	Drain and refill engine.....	1	Filler	"B"	3½ gallons	61
	General monthly inspection...	32				12
Bi-weekly-Monthly 1,000-2,000 miles	Magneto	2	Oil can	"A"	3 drops	75
	Generator	2	Oil can	"A"	5 drops	69
	Starter motor	2	Oil can	"A"	½ ounce	70
	Front wheel spindle.....	2	Oil can	"B"	4 ounces	99
	Torque ball joint.....	1	Oil can	"B"	1 ounce	83
	Clutch release collar.....	1	Grease gun	"C"	3 ounces	82
	Clutch main hub.....	1	Grease gun	"C"	½ pint	82
	Universal joint	1	Grease gun	"C"	¾ pint	83
	Fan hub	1	Oil can	"A"	1 ounce	67
	Gear shift oiler.....	1	Oil can	"A"	1 ounce	14
	Steering gear	1	Grease gun	"C"	½ pint	101
	Transmission	1	Fill	"C"	1 gallon	84
Quarterly 3,000-5,000 miles	Tire pump (when used).....	1	Fill	"D"	½ ounce	26
	Rear axle	1	Fill	"C"	1½ gallons	91
	Front wheel hubs.....	2	Pack	"D"	1 pint	99
Semi-annually 5,000-10,000 miles	Rear wheel hubs.....	2	Pack	"D"	1 pint	90

"A" Grade—Any good light machine or dynamo oil.

"B" Grade—Medium heavy automobile cylinder oil such as Oilzum Heavy (White & Bagley, Worcester, Mass.), Monogram Heavy (New York Lubricating Oil Co., New York), "Veedol" Heavy (Platt & Washburn Refining Co., New York City).

"C" Grade—Heavy oil or soft grease, such as "Mobiloil C" "Gredag 32" (Acheson Graphite Co., Niagara Falls, N. Y.), "Dixon's No. 677" (Jos. Dixon Crucible Co., Jersey City, N. J.).

"D" Grade—Hard grease, such as "K-000 Non-Fluid" (New York and New Jersey Lubricating Co., New York), "Gredag 63" or "Dixon's Graphitoleo."

Group Two—Every Week, 200 to 500 Miles

In addition to the daily inspection, the car should have the following weekly attention:

1. Give two turns to the four grease cups on the steering reach rod and cross rod.
2. Test and refill storage battery.
3. Wash and clean out car.
4. See that tire cuts are cleaned and filled and all the tire equipment in good shape.

Group Three—Every Month, 1,000 Miles

This is the important periodic lubrication and inspection which has a vital influence on the service of the car. If this attention is faithfully given, the car will be put in proper condition to operate perfectly throughout the next period, but if these matters are overlooked incipient trouble may develop with unpleasant results. Note
Carefully

Most of our dealers are equipped to offer this service without charge (except for tire repairs) during the first few months the car is used, and at a moderate expense thereafter.

1. Drain oil from engine, flush and refill with fresh oil; clean screen if necessary (see page 38).
2. See that all gaskets are oil tight, that there are no oil leaks (see page 27).
3. Oil can lubrication of generator, magneto, starter motor, fan, hub and gear shift lever (see page 43).
4. Remove cylinder head cover and examine valve mechanism. Check valve adjustment (see page 30).
5. Check oil pressure adjustment (see page 40).
6. Test compression in each cylinder, grind valves if necessary (see page 29).
7. Examine for water leaks. Tighten hose clamps and water pump packing nut if necessary (see page 41).
8. See that fan belt has proper tension (see page 40).
9. See that generator and magneto are in proper alignment. Check magneto timing (see page 45).
10. Remove and clean spark plugs; adjust spark plug gap. See that spark plug gaskets are compression tight (see page 49).
11. Examine generator brushes; see that generator is charging properly (see page 45). Clean starter motor shaft and commutator (see page 46).

12. See that all wiring is free from oil and not chafing. See that all connections are tight.

13. See that all lights are burning and that head lamps are properly focused.

14. Test and refill storage battery (see page 50).

15. Refill ball joint and clutch throw-out housings with heavy oil (see page 12).

16. Refill and adjust universal joint (see page 57).

17. Refill clutch hub.

18. See that transmission has lubricant.

19. Adjust brakes (see page 66).

20. Remove all wheels and see that contacts between wheel and hub are smooth and well lubricated.

21. Lubricate front wheel spindles (see page 74).

22. See that front wheel bearings are properly adjusted (see page 74).

23. Refill and turn down the four front steering connection grease cups.

24. Check over entire steering mechanism to see that it operates freely but without excess play.

25. Lubricate steering gear (see page 75).

26. See that tires are properly mounted on rims.

27. See that speedometer is working properly.

28. Make all necessary tire repairs (see Chapter IV).

29. Test tramming of front wheels (see page 19).

30. Clean out gasoline line.

31. Tighten any loose bolts or screws, such as shock absorbers, lamp bracket, hood, hood hold-down, windshield supports, wheel spokes, dash instruments, body bolts, extra seat bolts, door hinges, top supports, engine bolts, rear spring clip, universal joint, torque support, etc.

32. Adjust carburetor.

CHAPTER III

Suggestions for Driving

THE accelerator assembly is held by spring tension so as to return to the position determined by the hand throttle whenever the foot pressure is released. This provides a delicate adjustment, making it popular for city driving. Where it is found necessary to start and stop frequently this makes an ideal arrangement. The foot pedal also keeps the driver's right foot near the brake pedal, it being only a slight move from one to the other.

Foot
Throttle
Pedal

On the other hand, the throttle lever remains in whatever position it is placed and allows the constant running of the motor. This control will be found less tiresome and more convenient than the foot pedal in making any long country runs. For the benefit of the driver, both the accelerator pedal and the foot rest may be adjusted higher or lower to suit his requirements.

Hand
Throttle
Lever

An adjustable screw holds the throttle valve slightly open and thus allows a small amount of gas to reach the motor cylinders, although the hand throttle on the wheel is closed. The minimum amount of mixture for the slowest running is thus supplied. To increase the minimum speed turn in on the throttle valve lever adjusting screw, and to decrease the speed turn the adjusting screw out. There is, however, ordinarily no occasion to change the setting of the throttle valve adjustment screw.

Minimum
Adjustment

In order that the maximum efficiency be obtained from the motor it is necessary that the full force of the explosion of the compressed gas occur at the exact moment when the piston is starting its downward or firing stroke in the cylinder. On the other hand, whenever you crank a motor it is very essential that the explosion occur *after* the piston has reached its high point and started on its downward stroke. Because of these and other conditions under which the motor runs it is necessary that we have the spark that ignites the gas always under our immediate control. This function is performed by means of the right hand or spark lever on the quadrant of the steering wheel. At the time of starting the motor the spark lever should be moved to within about two inches of its lowest position and should be advanced with the motor speed until, at approximately twenty miles an hour this lever has reached a point about two-thirds of its entire distance of travel. This is known as the average running position. Never advance the spark

Spark
Control
Lever

fully except at very high speeds. On a hill; with very rapid acceleration, or in very hard traveling such as sand, gravel or mud, where the motor is subjected to considerable pull or labor, it will sometimes be noticed that there is a pronounced metallic knock coming from the engine. This is a warning that the spark is advanced too high and that the force of the explosion is occurring before the piston is at the high point of its compression stroke. The spark lever should then be lowered until a point is reached where the knock is no longer heard.

Clutch The clutch or connecting link between the motive power and the rear wheels being of the friction type must be fully engaged or fully disengaged with the flywheel cone in order to obtain a minimum amount of wear. If the foot is allowed to rest too heavily on the left-hand pedal the clutch is partly released, causing it to turn in the flywheel. This is called "riding the clutch pedal" and will very soon result in the continuous slipping of the clutch which can only be remedied with a new facing. The Marmon clutch facing is of the friction fabric type and should never be treated with oil, powder or any similar preparation.

Use Both Brakes The position of the hand brake on the Marmon 34 makes it fully as convenient for use as the foot brake, and the former should be used fully as much as the latter to prevent one from wearing out faster than the other. However, both should be used judiciously to prevent damage to facings, tires and possible skidding. If, at considerable speed, it is desired to stop the car, the motor, through the clutch, acts as an excellent brake. By closing the throttle of the motor and leaving the clutch engaged, the car will be slowed down to a speed where there is danger of stalling the motor, at which time the clutch must be released. On a steep hill there is no better brake than the motor itself. By shutting off the ignition, fully engaging the clutch and placing the gear shifting lever in the high, intermediate or low, almost any degree of braking may be obtained.

CHAPTER IV

Care and Repair of Tires

When a Tire Goes Flat

YOU should have an extra tire ready inflated on the spare wheel at the rear. You will readily know when a tire goes flat by the sudden bumping of the car. Stop at once. Don't attempt to run on the flat tire even for one hundred feet. Lift the wheel with the jack provided in the

Changing
Wheels

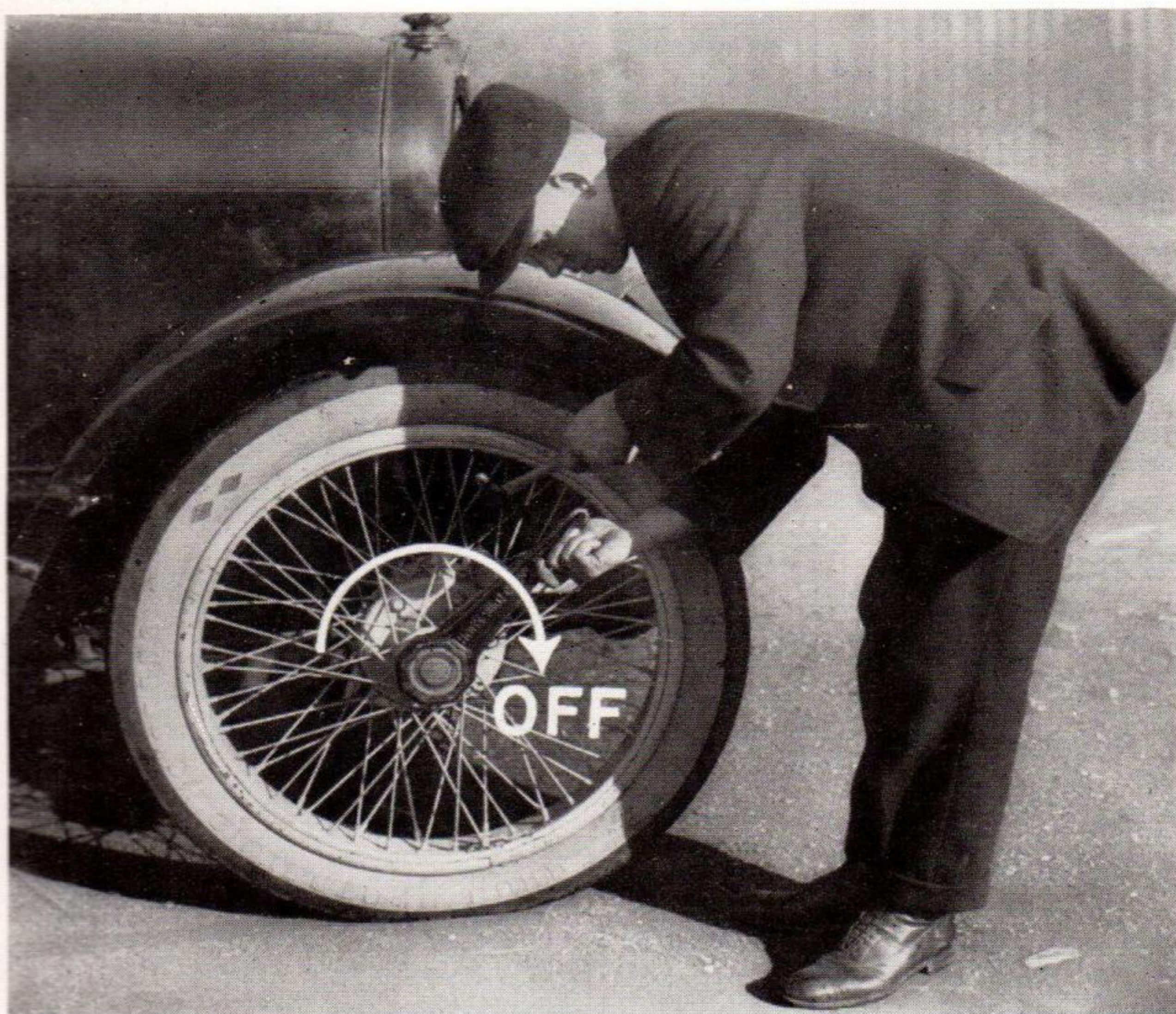


Fig. 4. "Off" Is Always Downward Toward the Front of the Car,
"On" Toward the Rear

tool kit. With the large box wrench provided, remove the wheel hub nut, turning as directed on the nut. Then slip off the wheel and mount the spare in its place, being careful to screw the nut very tight. Note carefully what is said in Chapter IX on this subject.

If for any reason you are without a spare tire and it is

**Changing
Tires on
Wheels**

necessary to repair or change a punctured tube, proceed as follows: With the screw driver, pry out the clincher ring. Next, pull the tire off gradually and evenly all around. Examine the inside of the casing carefully. If simply punctured, the casing needs no repair at the time—just repair the tube. Be sure, however, to fill up the hole in the casing with repair gum as soon as you get home. It will prevent moisture from getting in and rotting the cords. If the

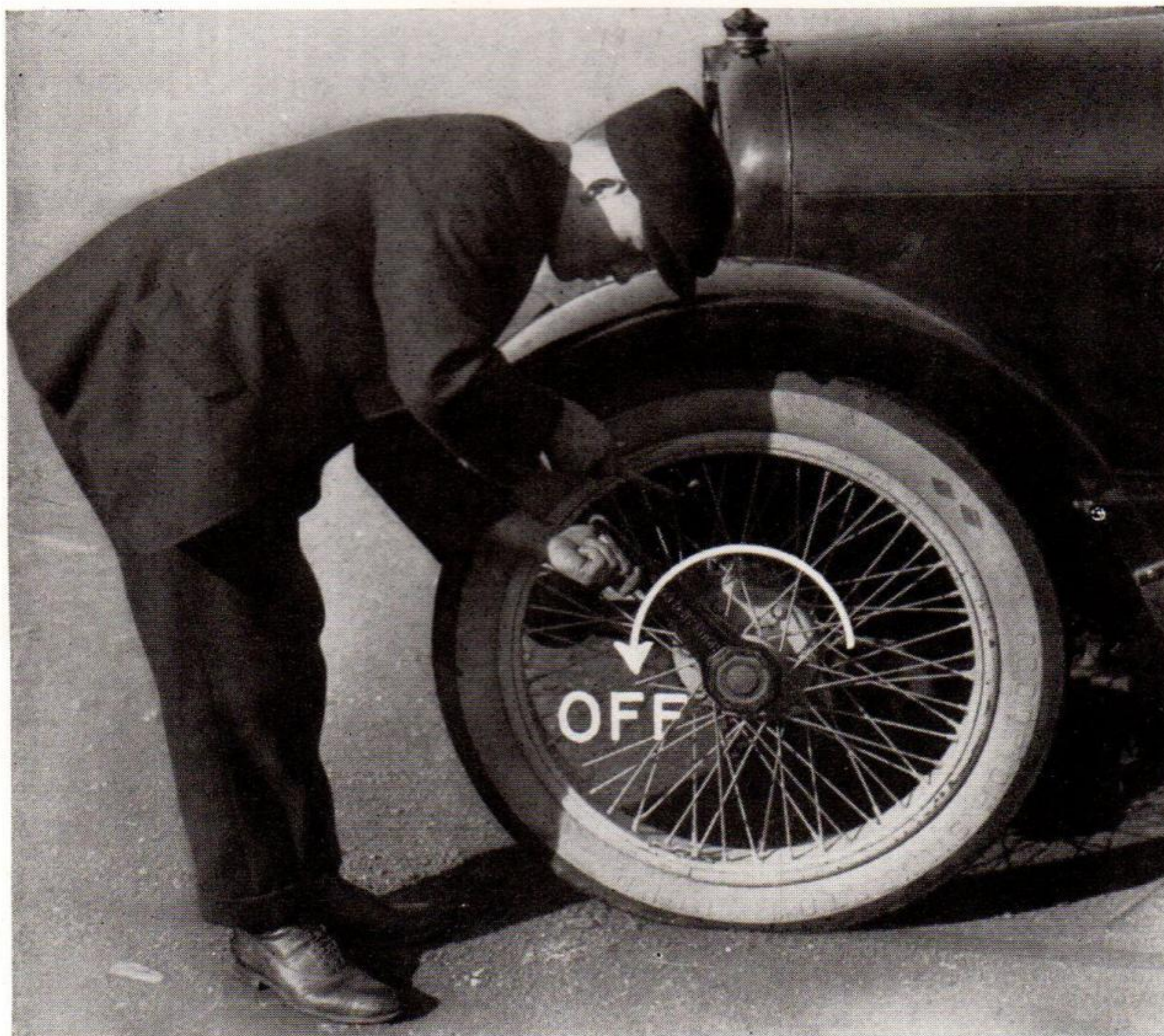


Fig. 5. Wheel Nuts Have Right-Hand Thread on the Left Side and Left-Hand on the Right Side

casing is cut through or broken, insert a blowout patch furnished in the tool kit, then when you get home have the break repaired promptly by a local vulcanizer.

How to Save Tires in Handling the Car

After calling attention as we have done above to the two important matters of keeping tires properly inflated and plugging up small cuts, it is hardly necessary to say that, in driving, all possible care should be used in avoiding sharp stones, glass or excessive bumps which are liable to injure your tires. With ordinary careful driving and care to see

that the tires are properly inflated and that cuts are filled, every Marmon owner should receive all the way from six thousand miles up out of each casing.

The following is a brief code for tire care, which should enable you to obtain the maximum amount of service from your tire equipment:

1. Keep tires properly inflated.
2. Be sure to repair little tread cuts regularly.
3. Prevent blowouts by avoiding severe jolts and by maintaining full air pressure.
4. Have mud boils cleaned out and repaired at once.
5. Be careful in applying tubes.
6. Avoid sudden stops, quick starts and skidding.
7. Keep front wheels in alignment.
8. Use French Talc in the casing, but not too much.
9. Avoid ruts and save the side walls.
10. Don't drive in car tracks.
11. Apply chains properly, if they must be used; chains always injure tires.
12. Avoid sharp obstructions.
13. Remove grease, oil and acids from your tires at once by using a cloth moistened in gasoline.
14. Examine clincher rims occasionally for irregularities and rust.
15. Prevent damage from rust by using rim paint.
16. Carry spare tubes in a bag.
17. Keep spare tires covered.
18. Be sure that nothing on the machine scrapes the tires as they revolve.
19. Avoid the use of any substitute for air.
20. Guard against overloading.

Tire "Do's"
and "Don't's"

If the front tires seem to be wearing off too rapidly, it is well to examine the wheels. If they are not properly trammed, the tire is being subjected to a diagonal grind as it passes over the road. The distance between the right and left wheel rims in front of the axle should be three-eighths of an inch less than the corresponding distance behind the axle. This may be adjusted by removing the cross rod right end and screwing one or more turns in or out. The wheels as a whole should slope very slightly in from top to bottom. A severe bump or jolt may at any time strain these parts so as to throw them out of line.

Vulcanizing
Tramming
Front

Sometimes owners wish to vulcanize their own tubes, or even occasionally small cuts and tears in the outer casing. For this work, a small Shaler Vul-Kit is recommended. Complete instructions as to vulcanizing can be obtained with these kits, which are sold at all reliable accessory houses at a small cost.

Wheels

CHAPTER V

Special Precautions for Cold Weather

ON account of the physical properties of many of the essential elements used in the gasoline automobile, ideal operation is only obtained in warm weather; but the great convenience of the motor car in cold weather is causing it to be used more and more in the winter season. By observing a few precautions consistently, it can be made to perform creditably in the coldest weather.

“Summer Under the Hood” As far as the engine is concerned, it is evident that, if we can imitate summer conditions under the hood the engine will give the same efficient service as in summer, and as the engine in operation is constantly generating heat, it is comparatively easy to bring this condition about.

Warming Air Intake The principal point is to warm the incoming air, so that it will vaporize the gasoline. The primary air intake of the carburetor is heated by being drawn through a tube from around the hot exhaust pipe. This tube is sometimes removed in summer or the vent opened. When the cold weather comes, it must be connected and the vent closed.

Radiator Covers The auxiliary air intake is not especially heated and may tend to condense the vaporized gasoline from the main intake, causing the engine to “spit” if suddenly accelerated when cold. On this account, and on account of the cold intake and water jackets, the whole engine compartment should be kept warm. Padded fabric radiator covers, having an adjustable opening, are good for this purpose, or the fan may be disconnected. In these cases care must be taken to prevent overheating if the engine is run long and hard or in moderate weather. The motometer furnished with this car is an excellent gauge of the engine heat and if the motometer is watched closely no trouble will be experienced through the engine becoming too hot.

When the engine is very cold, a very rich mixture must be used for starting and until it is warm, because the gasoline used nowadays has a large percentage of heavy fluid which will vaporize only when very warm. Thus, with an

excess of fuel, there will still be sufficient gasoline vaporized to give an explosive mixture, while the balance passes through the engine unburned.

In order to draw this rich mixture into the cylinders, there is an air choke damper valve closing which increases the carburetor suction and thereby the percentage of gasoline drawn into the cylinders. This valve (the one marked "Choke" on the dash) should be closed for starting in cold weather and opened when the engine warms up. In the interest of economy, this valve should be opened as soon as conditions permit, and this will be much sooner if there is special provision for keeping the hood compartment warm as recommended above.

Air Choke

The carburetor need not be readjusted for winter running. (See page 33 for detailed carburetor instructions.)

Lubrication

Beside the effect on the gasoline, cold makes all lubricants less fluid. If the engine is kept from being run too cool, as recommended above, no change in motor oil ordinarily need be made. But in extreme weather a lighter grade of oil may be employed. The lubricants in transmission, rear axle, wheels and other lubricant compartments will operate somewhat more stiffly than in summer, but need not be thinned. Care should be taken to change the oil in the motor base more frequently in the winter as the condensation in the cylinders, due to cold weather, will often result in the mixing of gasoline with the oil.

Prevention of Freezing

If a car is left standing for an hour or more after the engine has stopped, in weather below freezing temperature, special means must be taken to prevent damage to the water circulating system. The table herewith shows the percentage of alcohol which may be added to prevent freezing down the various temperatures. The merit of alcohol is that it is harmless and comparatively cheap, while it has the disadvantage of evaporating rather rapidly, and boiling below the boiling point of water. The virtue of glycerin is that it raises the boiling point and is not dissipated, but it has some action on the rubber hose connections and is quite expensive. We have found that by adding 20 per cent. wood or denatured alcohol (about one and one-half gallons) when freezing weather comes, and then adding about half alcohol and half water when refilling throughout the coldest

weather, the alcohol will be kept at about the right percentage for the average North Central states.

The freezing of the water, which sometimes occurs in other places, such as in the gasoline line and motor oil base, may cause trouble in extreme weather.

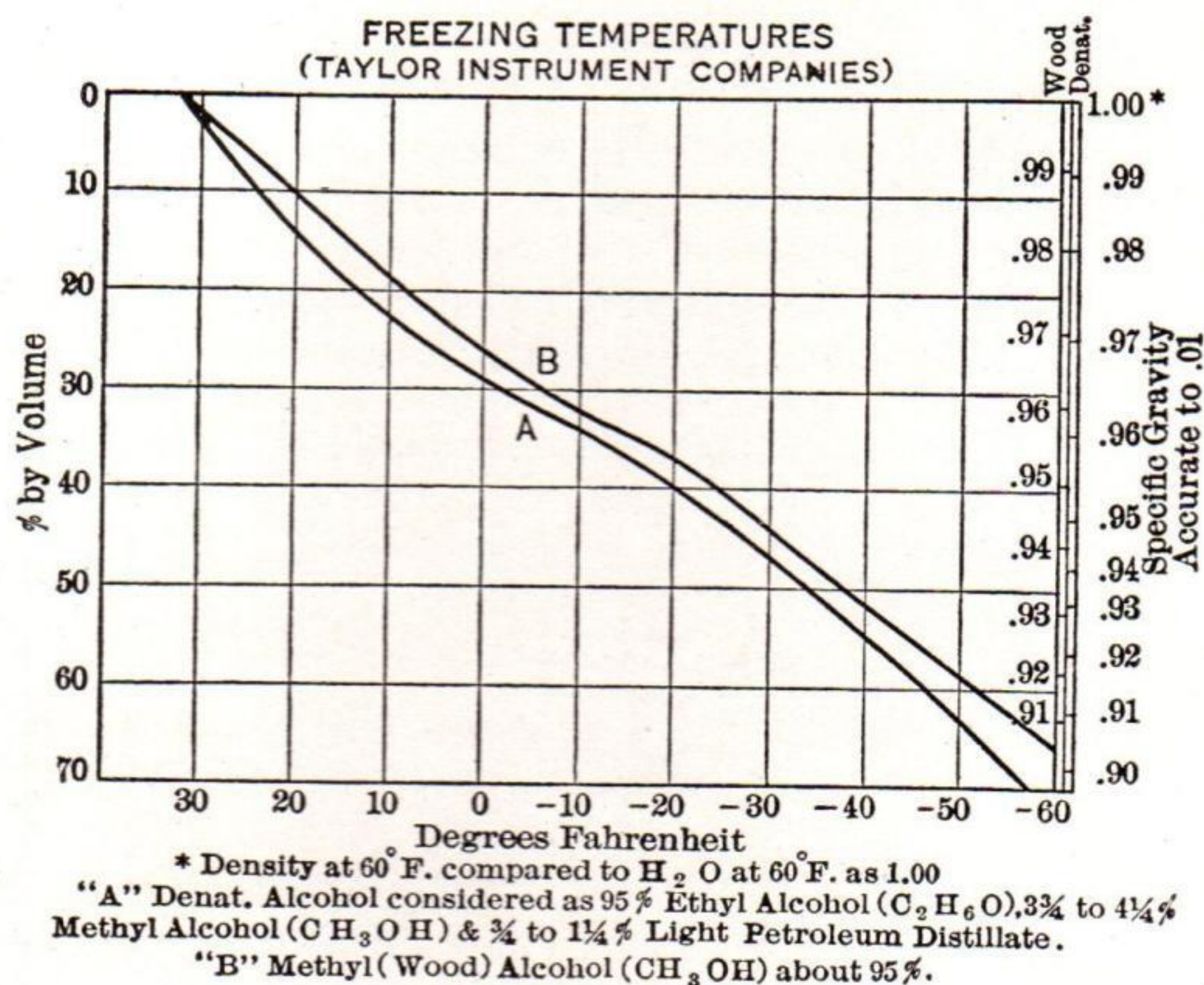


Fig. 6. Curve Showing the Percentage of Alcohol Necessary to Prevent Freezing

Tires

Small holes in tires will rapidly cause trouble in winter on account of mud and ice accumulating, freezing and thawing. Special care should be taken to see that these cuts and holes are stopped up as directed in Chapter IV.

Non-skid casings are used a great deal, and under severe conditions tire chains may be used on the rear wheels. But in general the cord tires will be found remarkably effective in preventing skidding. Care should be taken not to have a larger tire on one side than on the other side, especially in the rear, nor to have a chain on one side and not on the other.

Preserving the Finish

The finish of the car should have special attention in cold weather, or it will lose its luster. Sudden changes in temperature should be avoided; therefore, in entering or leaving a heated garage, have the door open for a time so as to bring the temperature down or up gradually, rather than suddenly. Snow and icy mud must be cleaned from the car at the first possible opportunity to prevent serious

damage to the finish, and exposed metallic parts kept as dry as possible to prevent rust.

Brakes and Steering

Brakes and steering will merit special attention at this season. These parts are harder to lubricate and subject to more severe usage at the same time that they are naturally handicapped in efficiency by the cold. You have noted with satisfaction when starting a railroad trip how the car brakes and journals were carefully inspected and adjusted. Similar parts on a motor car are used more frequently than on the railroad, and certainly merit as careful attention. Check over your brakes frequently and see that they work properly; see that the wheels are in correct adjustment, and that the steering connections are not loose and are properly lubricated.

If the Car Is Stored

Drain the water from the circulating system and run the engine for just a moment to dry out the system thoroughly. Water jacket at the intake manifold must have special draining. **Draining**

The storage battery must always have special attention if not used for any length of time, for it will gradually discharge, and when in a partially or fully discharged condition it will sulphate or freeze and thus become entirely useless or require an expensive overhauling before it can be used again. We recommend that the battery be taken to a warm place and recharged every month. Add distilled water to the battery whenever necessary to keep the fluid level above the plates. Test the battery with a hydrometer syringe and do not permit the gravity to run below 1.150 under any circumstances. It should stand at 1.280 when fully charged. Note: A liberal quantity of vaseline should be applied to the battery terminals and lead connections to prevent deterioration. **Storage Battery**

PART II

Introductory

Generally speaking, the various units of the Marmon 34 may be divided according to their functions into five main groups, each of which forms the subject of a chapter, as follows:

CHAPTER VI. *Production of Power*—The gasoline engine, with all its auxiliaries, such as radiator, gasoline tank, muffler, etc., except electrical equipment.

CHAPTER VII. *Electrical Systems*—All starting, lighting and ignition units and connections.

CHAPTER VIII. *Transmission of Power*—Clutch, transmission, torque tube, rear axle, etc., including brakes.

CHAPTER IX. *Running Gear*—Steering, front axle, wheels, springs, frame, etc.

CHAPTER X. *Passenger Accommodation*—Body, windshield, top, upholstering, etc.

CHAPTER XI. *In Case of Trouble.*

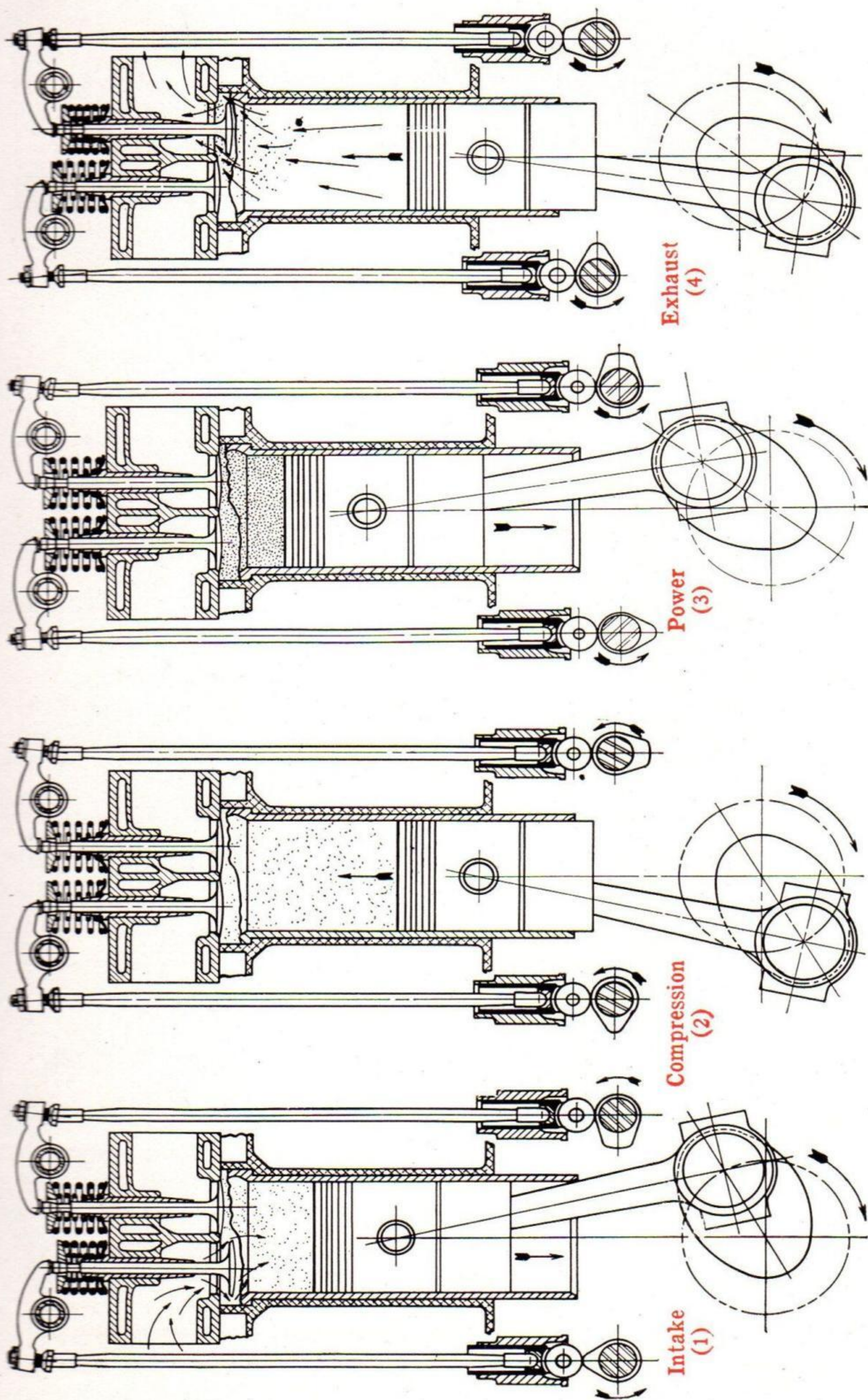


Fig. 7. The Four-Stroke Cycle. The Mechanism is Rearranged for Convenience in Illustrating

CHAPTER VI

Production of Power

IN the Marmon 34 we have the internal combustion engine in a high stage of development. The principle of "harnessing" the explosive force of a mixture of gasoline vapor and air is quite commonly known, but may well be here reviewed.

Principles of Engine Operation

To understand the *principle of the four-stroke cycle engine*, consider the action of cranking in a single cylinder. Each time the starting crank is turned half around, the connecting rod forces the piston to slide alternately from top to bottom, and from bottom to top of its stroke. It takes two complete turns of the crank or four strokes of the pistons to complete a cycle. Starting with the piston at the top of its stroke, we have the following train of events:

The Four Strokes

1. *Suction Stroke.* Intake valve open; exhaust valve closed. Piston moves down, drawing in above it a mixture of gasoline vapor and air through the carburetor.

2. *Compression Stroke.* Intake and exhaust valves closed. Piston moves up, compressing the mixture. At this point an electric spark between the terminals of each spark plug explodes the mixture.

3. *Working Stroke.* Intake and exhaust valves closed. The great pressure caused by the explosion of the gas forces the piston downward.

4. *Exhaust Stroke.* Intake valve closed; exhaust valve open. The piston moves up, expelling the burnt gas and clearing the cylinder for the new charge.

It is seen that during only one of the four strokes is actual work performed, the other three being used to prepare for this working stroke.

The same cycle takes place in order in each cylinder, giving six working strokes for each two revolutions of the crankshaft—an extremely steady power output with smooth running results.

Various Power Plant Systems

Just as the whole car may be divided into its principal units according to their functions, so the power plant may be subdivided into the mechanical system, the valve system, the gasoline system, the lubrication system, the cooling system, the exhaust system and the ignition system. Except the ignition system, which is included in the following chapter, the various systems are discussed in order below.

The Mechanical System

The parts which are directly employed in transmitting the force of the explosions to the clutch for delivery to the rear wheels, we have called the Mechanical System. This refers to the main motor block with its cylinder barrels, the pistons, connecting rods, crank shaft and bearings. In the Marmon 34 the six cylinders are three and three-fourths inches bore, and pistons have a stroke of five and one-eighth inches.

In removing the engine from the frame it is necessary either to remove the flywheel or lift the front body section. The former is recommended.

Removing
the Engine

The disassembling of the engine is so simple, a detailed explanation is not necessary. In case the crankshaft is to be removed from the car, the engine should be removed and turned upside down. After removing the two oil pan sections without disconnecting them, the connecting rods should be disconnected before removing the crankshaft.

Disassem-
bling the
Engine

Be careful to keep bearing shims in same as original order and don't reverse caps.

If it is necessary to remove the cylinder barrels, first remove the packing gland and then the packing that will be found around the lower ends of the barrels. Then remove the header and the barrels may be lifted out.

Removing
Cylinder
Barrels

In replacing the cylinder barrels bear in mind that while these barrels should not fit loosely enough to be inserted and pulled out with the hands, they should not be what is usually termed a force fit. A light tapping with a small wood block should be sufficient to drive them in place. Another point on which extreme care should be used is the fitting of the packing glands around the bottom of the sleeves. If the nuts which fasten these glands are not drawn down evenly they will have a tendency to place the barrels in a strained position and draw them out of round. After the sleeves and glands have been replaced the cylinder block should be tested for water leaks by using a water pressure of from 20 to 25 pounds. This will verify the work which has just been finished and allow a chance for correction if leaks develop. This testing should be done with warm water. Boiling water is even better if available. This test should also be made before the header is put on, and another test made after the header is installed.

In case a leak is found, it may be corrected by drawing the packing gland down a little tighter, proceeding carefully in this respect, as previously advised.

In reassembling, great care must be taken to see that the bearings are tight, but not too tight, that the numbers

Cautions

on the connecting rods, halfway between the crankshaft and the piston, all face the flywheel, that the numbers on the rods and caps correspond and that the bearing bolt nuts have cotter pins. When the cylinder header is replaced, *new gaskets must be used* and must be shellacked on one side. Important precautions when fastening the header are: First, to see that the header goes down squarely without displacing the gasket, being held by the guides at the ends. Second, when fastening the header in place, always tighten the bolts at the center first, working towards the ends alternately on each side. Then the nuts should be given an extra turn in the same progression so they are thoroughly tightened, but care must be taken not to tighten these nuts too tight. Average hard pressure at the end of a six-inch wrench is enough. Extension wrenches should not be used for this purpose. It is, however, important to go over these nuts once more after the engine has been run in a hundred miles or so in order to take up the slight set in the gasket, bolts and nuts.

Pistons

Removing Pistons

If it is desired to remove pistons without disassembling the motor, remove the oil pan, disconnect the connecting rod, remove firing head, and lift out the *cylinder barrel* as described above, with the piston and rod in it. After the first five hundred cars of the 1918 series had been built a change was made on the connecting rod bearings. The corners of the bearings were turned off just enough to permit the piston and connecting rod to be removed through the top of the cylinder barrel. This is sometimes very convenient when it is necessary to remove the piston but not the sleeve.

The pistons are long special aluminum composition castings, carefully machined. They have three special oil-tight rings above the pin and a wiping ring below. The piston pin is held endwise by spring rings in grooves beyond the end of the pin. If pistons are removed, care must be taken to see that they are replaced in the same cylinder and with the same side to the front of the engine, as originally.

Piston Pins

To remove the piston pin, first extract the locking rings, then plunge the piston in boiling water. This will release the grip of the piston on the pin and permit it to slide out.

Connecting Rod Bearings

Taking Up Bearings

The connecting rods are light steel forgings bearing on the piston pin through a bronze bushing above, and in a split babbitt faced bronze backed bushing on the crankshaft below. Between the halves, brass shims of varying thick-

ness are used. Wear will be extremely small (assuming proper lubrication) and may be "taken up" in slight amounts by removing the thin shims. This delicate work is to be undertaken only by a skilled mechanic. The connecting rods are numbered on a small boss the same as the pistons, and the side of the rod carrying this boss should be toward the rear of the motor.

The crankshaft is a heavy steel forging carefully balanced. There are four main bearings, which are carried by the cylinder block castings. The bushings, held securely in place by means of dowels, are constructed and adjusted similarly to the connecting rod bearings. The third bearing from the front alone takes the end thrust in both directions by means of flanges on either side.

Crankshaft

The Valve System

The camshaft has integral cams, and is held in four large bearings. The camshaft gear, which takes the drive, is fastened to a flange back of the front bearing and is a helical-cut, heat-treated, cast-iron gear. It has, of course, twice the number of teeth of the crankshaft gears, causing the cams to operate the valves as desired every second revolution.

Camshaft

Figure 8 shows how the cam (A) on this shaft as it revolves strikes the roller (B), which is thereby lifted together with the tappet (C), which in turn lifts the push rod (D). This actuates the rocker arm (E), which depresses the valve stem (F), opening the valve. As soon as the motion of the cam permits it, the valve springs (G and H) close the valve. Intake and exhaust valves all operate in the same manner, but the action takes place at different times in accordance with the requirements of the four-stroke cycle.

Action of
Valves

Numbering the cylinders from front to rear, the cycle takes place in the order, 1-5-3-6-2-4. This firing order gives correct as well as properly distributed crankshaft stresses.

Firing
Order

Removing Valves

In order to remove valves, first remove the motor cover plate, then the firing head. The rocker arm shaft is also thereby removed. The work can then be conveniently proceeded with on the bench. Holding the valve in the closed position, push down on the valve spring retainer and "cock" over to one side, permitting the stem to come up through the eccentric hole in the retainer. This releases the valve retainer and springs.

To change a valve spring it is not necessary to remove the header. Simply remove the push rod and hold the valve stem up by inserting a bent tool through the spark plug hole.

Grinding Valves

Grinding valves may be necessary occasionally to keep them perfectly seated and prevent loss of compression. Valves should be ground whenever carbon is removed. The exhaust valves will require the most attention, as they handle the foul gases. If grinding is thought necessary, remove valve and examine valve seat in the firing head.

**Do Not
Grind Unless
Necessary**

**Detailed
Instruction**

Do not grind unless the valve seat surface is pitted. A cleaning with gasoline is often sufficient. If grinding is necessary, mix oil and fine carborundum or oil and powdered glass, place just enough to cover seat lightly on the valve seat, replacing the valve. Grind with screw driver inserted in the slot of the valve, turning it in a semi-circle from left to right and right to left, pressing it lightly so as not to push out the grinding material from between the valve and seat. Lift the valve off the seat for an instant, turn it half-way around and repeat the operation until the seat is bright and smooth. If grinding has been done properly, a light silvery line will show all around the valve; if not, repeat the operation. This is a somewhat delicate operation and careful handling is required. Valves may easily be ruined with coarse emery, rough usage and grinding in a steady rotary motion without occasionally lifting the valve from the seat.

Cleaning

When finished, clean valve and seat carefully with gasoline, squirting plenty of gasoline into the opening through which the valve stem passes. Use care to remove thoroughly all particles of emery or grit. After thoroughly cleaning valve, place a few drops of oil on the valve stem, place the spring and washer in position, slip the valve stem into position and replace the valve springs and retainer. After mounting header, adjustments can be made to provide the proper opening and closing.

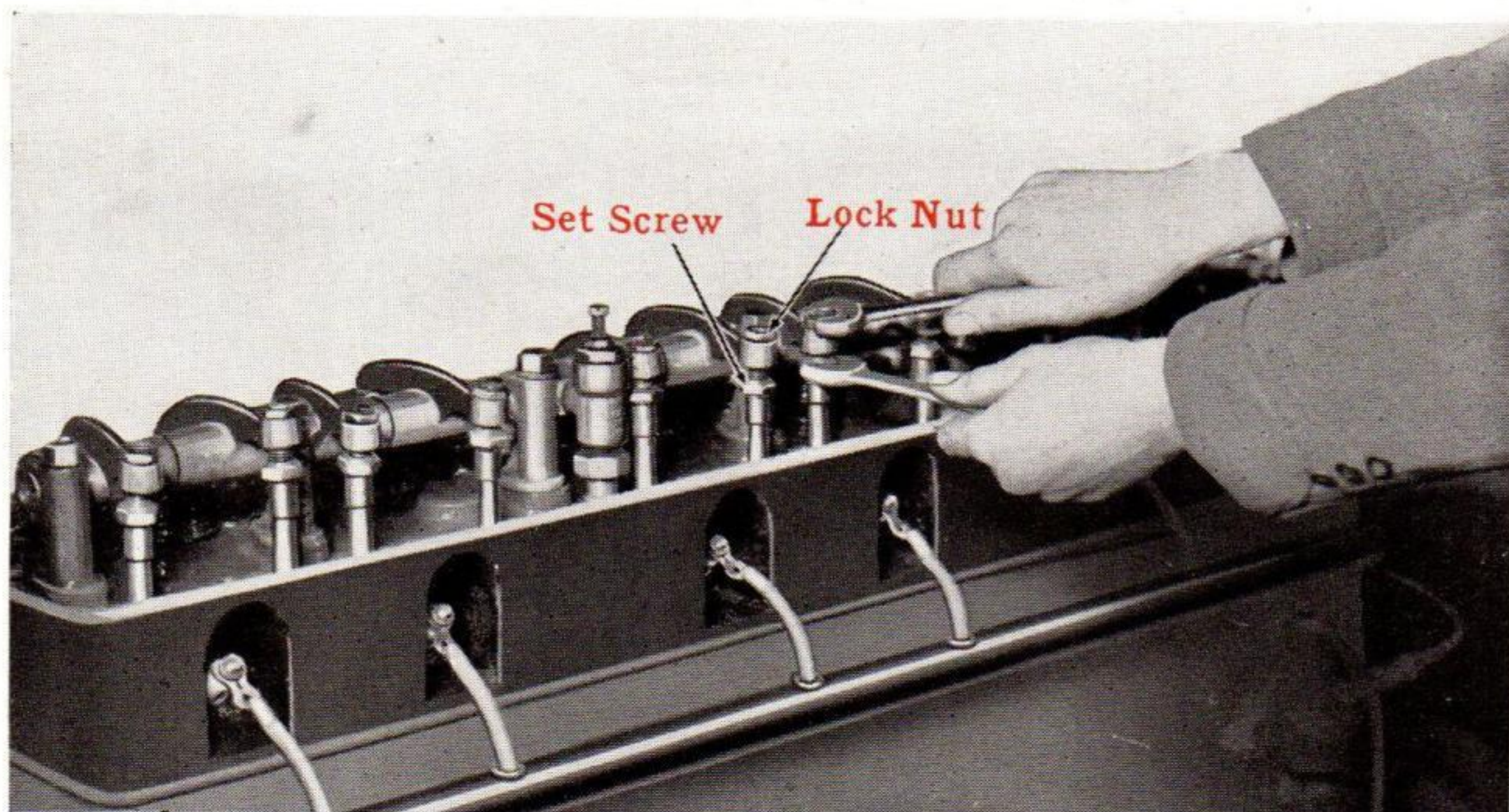


Fig. 9. Adjusting Valves

Adjusting Valves

Adjusting valves consists in obtaining the proper clearance between valve stem and rocker arm. For this purpose the point of contact on the rocker arm is a set screw (J), which is held in place by the taper lock nut (K). Do not adjust too close. Too little clearance will cause loss of compression when the stem heats and expands, and too much will cause noise. However, a little noise is preferable to possible engine trouble. The proper amount is .003 inch to .004 inch, or between one and two thicknesses of this paper. In making this adjustment always have the engine hot. By making it when the engine is cold you are inviting trouble, for the subsequent expansion when the engine warms up will warp the push rods. By using two wrenches the adjustment may be made while the engine is running, but it can also be done while the engine is at rest, as follows:

Clearance

Motor
Hot

First, make sure that the valve is not in a position when it is riding the cam, then loosen the lock nut (K) and, inserting a piece of newspaper between the valve stem and the rocker arm, turn set nut up until it just grips the paper and tighten the lock nut. Test the clearance by noting that the paper is free as the engine is revolved, except when valve is being lifted.

Valve Timing

The time of opening and closing of valves with reference to the engine speed, of course, has an important bearing on the performance of the engine. If the valves open too early it will cause back-firing, while if they open too late a sluggish engine and overheating will result. Since the position of the camshaft is always the same with reference to the pistons (because the camshaft is always in mesh with the crankshaft gear), and since the cams are all integral parts of the shaft, the valve timing can not change. If the front motor gears are ever removed, they may be put back in the proper position by seeing that the marks on the edges of the teeth "dovetail" together.

Timing
Not Usually
Necessary

As an additional check, use may be made of the flywheel markings, as follows:

Remove the top cover and twirl between the fingers the long aluminum rod (for the No. 1 intake valve—the second rod from the front) while someone slowly turns the starting crank. Stop the engine at the exact point when the push rod is no longer free to turn, and note the markings on the flywheel. If the engine is properly timed, the line marked "IN-OP" near "TC 1+6" will be directly under the pointer. The exhaust valve is tested in the same way, except that the mark "EX-CL" is used to show the point at which the exhaust valve closes. The point at which the in-

Using
Flywheel
Markings

take closes and that at which the exhaust opens are not shown, as, if the other markings for the same valve are correct, these are sure to be. The marks "TC 1+6," "TC 2+5" and "TC 3+4" designate the top centers of the several cylinders and the timing of each starting from the proper top center is similar to that for No. 1, described above. The marks "IN-OP" and "EX-CL" each refer to the cylinders whose "TC" is nearest.

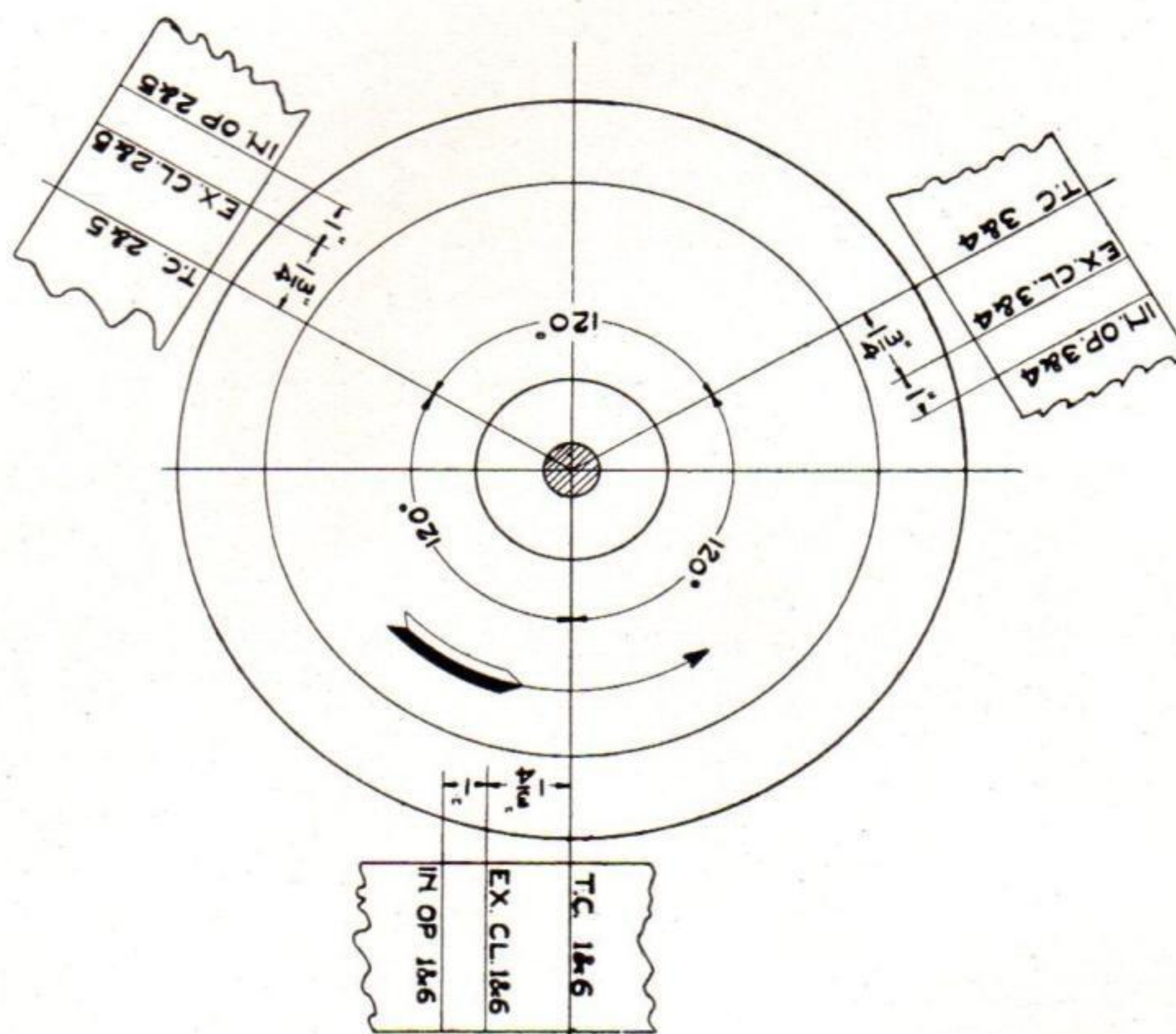


Fig. 10. Valve Timing Markings on Flywheel

The Gasoline System

The cowl gasoline tank provides for a positive and continuous flow of gasoline to the carburetor by gravity. A convenient stop cock permits shutting off the supply when desired. There is a plug in the gas line just below the tank and just in front of the cowl for convenience in draining the tank, and there is a screen in the line which should be cleaned occasionally. In filling the gasoline tank use a funnel, preferably fitted with chamois, to retain water and dirt. The presence of gasoline in the carburetor may be readily checked on account of the glass float chamber in the carburetor.

The Carburetor

In performing its delicate task of vaporizing the gasoline, mixing it with air before admission to the cylinders, the carburetor must, of course, be adjusted carefully to give good results. At the factory the carburetor is carefully set for the best operation, and should not ordinarily be

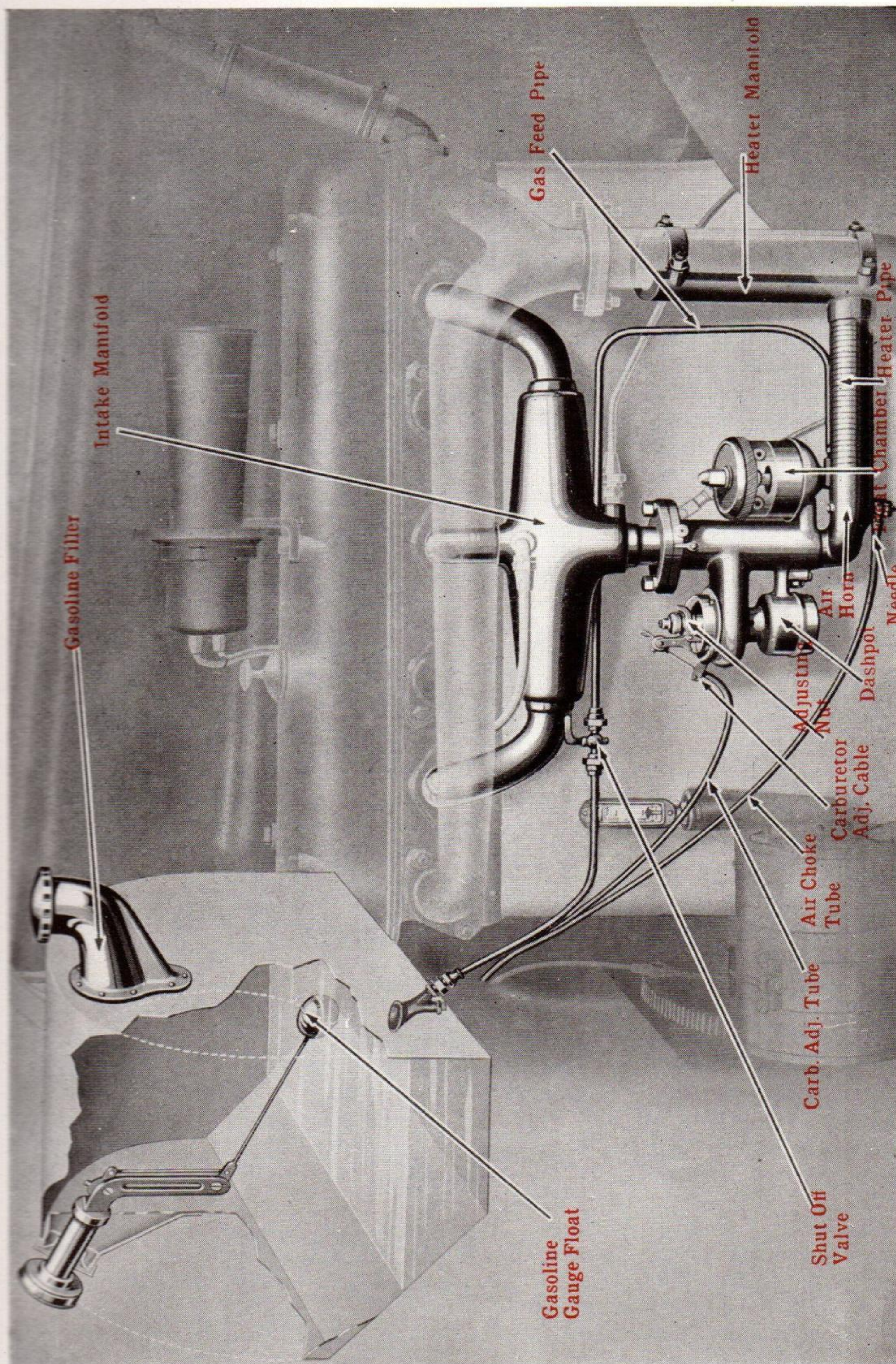


Fig. 11. Gasoline System

changed in any way. If you suspect something is wrong, look to the spark plugs, ignition system, see that the gasoline has no water and make certain the trouble is nowhere else before touching the carburetor.

Warm air is drawn into the carburetor through the tube extending to the exhaust pipe. This is especially necessary for good operation in winter.

Descriptive

The carburetor is a Stromberg Type H, having a fixed size air opening, or Venturi tube, with an adjustable gasoline nozzle for low speed, and a high speed jet whose opening increases as the auxiliary air valve opens, so that the air and gasoline openings expand in proportion to the demand of the motor. A dash pot at the lower end of the air valve stem prevents valve flutter, also a quick lowering of the intake manifold vacuum, with resulting condensation of

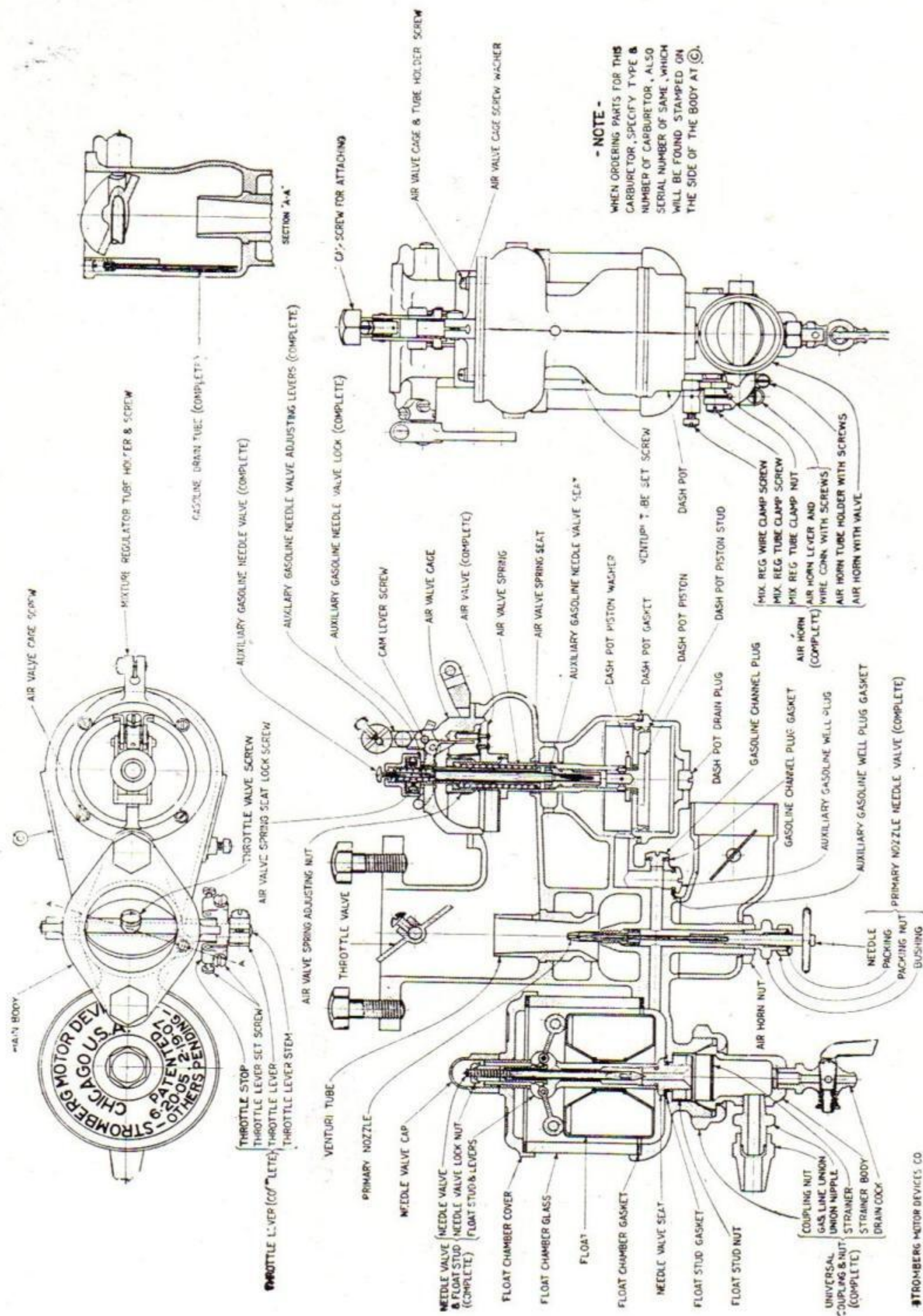


Fig. 12. Carburetor Details

the mixture, when the throttle is opened quickly from a nearly closed position.

The low speed adjustment is controlled by a needle valve seating in the primary nozzle opening, which opening is about two sizes larger than usually necessary, thus giving a limit on this adjustment. While the engine is idling the air valve should always be entirely closed.

Low Speed
Adjustment

The high speed adjustment is controlled by regulating the position of the auxiliary gasoline needle valve in relation to its seat, which is carried in the air valve stem. The end of the needle carries a small cap and projects above the nut (see illustration). During the first small opening of the air valve, this needle, being seated, travels downward with the valve. When the needle cap strikes the nut the needle stops moving, and any further opening of the air valve lowers the needle seat, thus bringing in the auxiliary or secondary gasoline supply. After passing the needle seat the gasoline rises up along the needle and is delivered into the air stream at the edge of the air valve. The high speed running adjustment is obtained by varying the position of the nut downward (clockwise) giving less gasoline, and upward more.

High Speed
Adjustment

The dash control operates, first, to tighten the air valve spring, and then raises the auxiliary gasoline needle. For starting in cold weather the hot-air horn valve should also be closed for a moment, but this should be opened as soon as the engine starts. At low engine speed during cold weather, proper combustion demands a richer, heavier gasoline mixture, obtained by pulling out the carburetor control knob until the engine fires evenly.

Dash
Control

See "Detecting Faults."

The Lubricating System

Nothing is as vitally important to the life of the engine as proper attention to the oiling system. Every point which moves with reference to another point which it touches must have lubrication. All the internal moving parts of the Marmon engine are oiled by the justly famous Marmon Force Feed Oiling System.

About Lubricants

Some engines use oil only once. The Marmon uses it over and over, giving greatly increased economy. It is clear that only the best oil should be used in this way, for a cheap grade of oil will disintegrate, deposit sediment and cause trouble. Careful attention to quality, and regular draining and flushing of the system will bring a sure reward in long bearing life and efficiency, saving expensive repair bills.

Quality
of Oil

Selection
of Oil

There are so many brands of oil for sale, backed by plausible salesmen's arguments, that the motorist is at a loss to make a selection. The fact is, properties like color, absence or presence of free carbon or acid, flash point, cold test, fire test, viscosity, etc., while having their bearing upon the merit of the oils, are of little significance to the owner in aiding in his selection. Therefore, we recommend that the owner select an oil of established merit and watch it carefully for sediment, as recommended below, until its suitability is established.

Recom-
mended
Oils

The body should be medium heavy for warm weather and medium for cold. We have learned from experience that the following oils are good oils for the Marmon 34, and recommended that one or the other be used exclusively:

Monogram Heavy, manufactured by the New York Lubricating Co., New York.

Oilzum Heavy, manufactured by White & Bagley, Worcester, Mass.

"Veedol," Medium, Platt & Washburn, New York City.

Care of Oiling System

Oil
Capacity

The oil reservoir holds three and one-half gallons of oil. The system is filled through the hole on top of the engine cover, after removing the cap. The amount is accurately registered by the dial on the float gauge just back of the carburetor on the right side of the engine. On account of the time required for oil to reach its level, the float will take a few seconds after filling to respond.

Draining
Oil

The engine oil should be drained after the car has covered its first three or four hundred miles, and thereafter periodically. Place a bucket under the drain plug in the bottom of the oil pan and unscrew the plug, using a wrench and the small square furnished with the tool equipment.

Flushing
Oiling
System

If the oil has disintegrated, forming sediment and a watery substance, the system should be flushed before re-filling with fresh oil. To do this, simply disconnect the intake pipe of the pump at the outlet of the regulator and immerse the end leading to the oil pump in fresh oil and run the engine long enough to force out all of the old oil.

Cleaning
the Oil
Screen

The oil screen is readily removable for cleaning when desired, but its construction is such that sediment rejected will naturally settle in the oil pan and be removed when the oil is drained. To remove the oil screen, disconnect the feed pipe lines from the crank case and remove the bolts which hold the oil screen in the crank case. Be sure no lint is left on the screen.

When replacing, be sure the gasket to the oil pan is tight—it should be shellacked on one side and graphited on the other—and be especially careful that the coupling of the oil pipe is air-tight.

Before starting the engine, remove the small pipe plug near the oil pump at the rear of the camshaft and prime the pump with oil.

A complete overhauling of the circulation system will rarely be necessary, but when desired an effective method of cleansing is to remove the oil base. The connecting rod bearings and crankshaft oil ways may then be cleaned from below without disassembling the engine. Disconnect the rod bearings, remove the nuts from the stud through the large hole in the crank pin, remove the stud and cap. Clean out this large hole and also the hole to the surface of the bearing. Cleaning may be extended farther to include outer oil pipes, which may be blown out with air without disconnecting. When reassembling, be sure these pipes are air-tight. Do not fail to prime the oil pump, as described above, after overhauling.

Overhauling
the Oiling
System

How the Oiling System Operates

Oil is carried in the oil pan below the sweep of the cranks. At the outlet of this pan the oil passes through a screen and into a pipe leading to a pump. The pump is located on the rear end of the camshaft, outside of the cylinder block. Leading from the pump is a short pipe which unites with another pipe, one end of which is connected with the main feed pipe running the length of the engine and the other to the vacuum control valve. This valve contains a plunger or check valve. A pipe also connects the upper end of the vacuum valve with the intake manifold. When the engine is running at a low speed or idling, the position of the check valve or plunger is not affected, and the oil is permitted to flow through the vacuum valve and back into the engine through a hole in the cylinder block, registering with the hole in the vacuum valve. As soon as the engine is accelerated a vacuum is formed in the vacuum valve by the suction from the intake manifold. A spring in the vacuum valve above the spring regulates the action of the check valve, so that it will not rise up and down, except when a vacuum is created by accelerating the engine. When the vacuum causes the plunger to rise, the opening into the cylinder block is shut off, and the oil, which is under pressure from the pump, is forced into the main feed pipe, which distributes the oil to the pipes leading to the several crank shaft bearings.

Holes in the hollow crankshaft register with grooves in the crankshaft bearing: thus, oil is forced into the crank-

shaft and on to the connecting rod bearings and through these to pipes leading to the piston ends of the rods, lubricating the piston pins and piston; then it falls back to the oil pan.

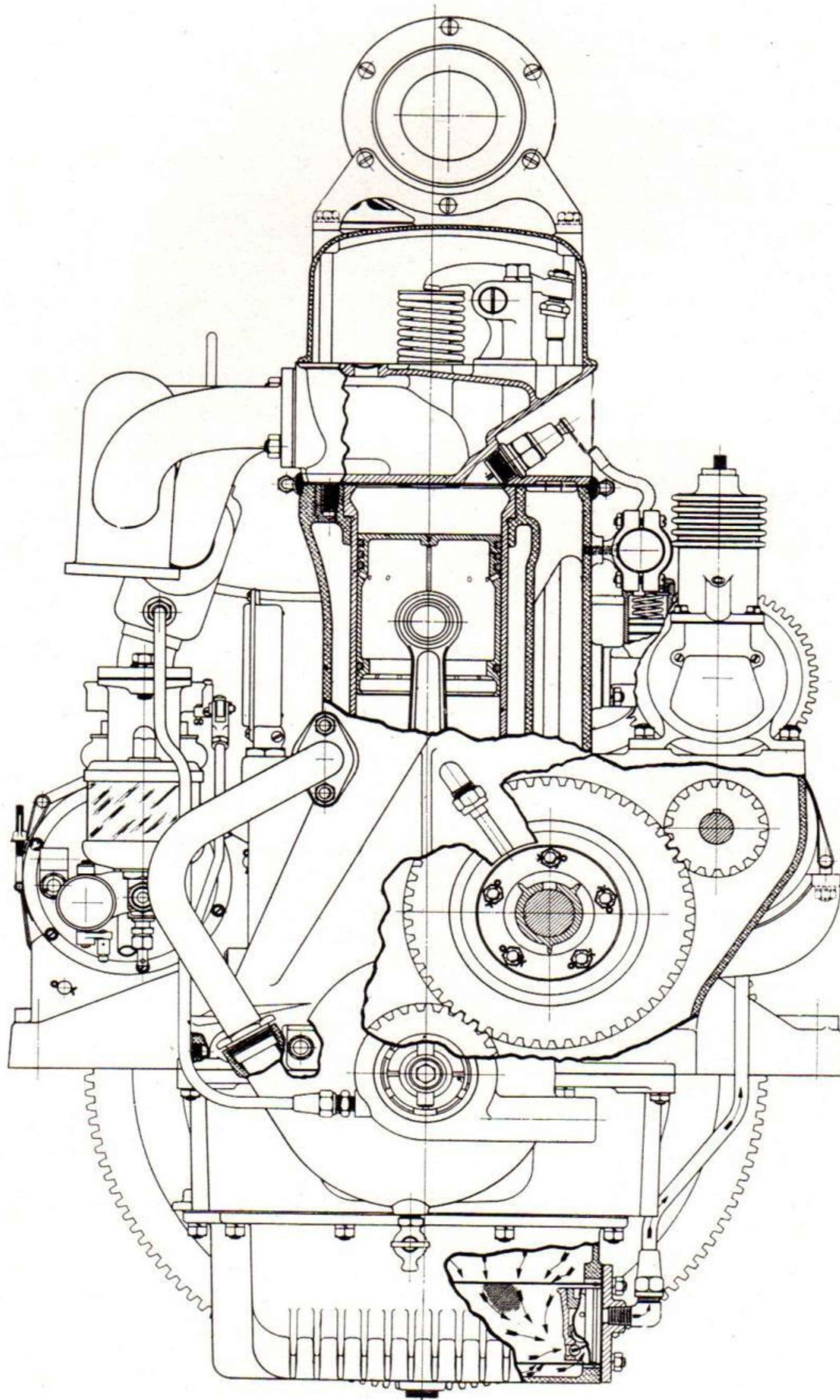


Fig. 14. Engine, Front End Section

The oil which is conducted to the top of the engine circulates through the hollow rocker shaft, lubricating all the bearings on this shaft. From this shaft it passes out the overflow and drops down around the valve push rods to a

trough in the crank case where a constant head provides for perfect lubrication of the cam bearings, cams and valve tappets, and from these is splashed to the cylinder barrels and pistons, then falls back into the oil pan.

Adjusting Oil Pressure

The oil pressure is carefully adjusted at the factory and should require very little or no attention, except in extreme cases, but should a change become necessary it will be well to bear the following points in mind. When the engine is idling there should be no pressure shown on the gauge and the size of the stream from the overflow should not be larger than a small wheat straw. At thirty miles per hour or when a heavy load is placed against the engine the gauge should show from ten to fifteen pounds pressure, and the size of the stream from the overflow should be limited only by the size of the overflow pipe.

To make this adjustment it is only necessary to turn the screw, in the valve at the overflow on the top of the engine, to the right to increase the pressure, or to the left to decrease it, but do not attempt any change of this kind until the engine has attained its maximum efficiency heat.

The Cooling System

The manner in which the cooling system operates is clearly shown in the accompanying illustration.

The radiator should be filled frequently, even though there has been little loss of water. The system must be full at all times.

An excellent check on the condition of the cooling system is the motometer mounted on the radiator cap. This device is simply a thermometer registering the temperature of the water.

Motometer

From a theoretical standpoint, the efficiency of the motor increases as the temperature of the combustion chamber increases, but there are, of course, practical considerations, such as passenger comfort, damage to metals, etc., which limit the desirable temperature and necessitate a cooling system. Thus it will be seen that its function is largely negative, and that if it does its work too well it defeats its own purpose. If your engine reaches a high temperature take warning, for this is a danger signal and an investigation should be made at once to determine the cause. The subject of overheating is discussed in Chapter XI. Some things which can be done in the interest of efficiency to prevent over-cooling in winter, are discussed in Chapter V.

Overcooling
and Over-
heating

Thermostat

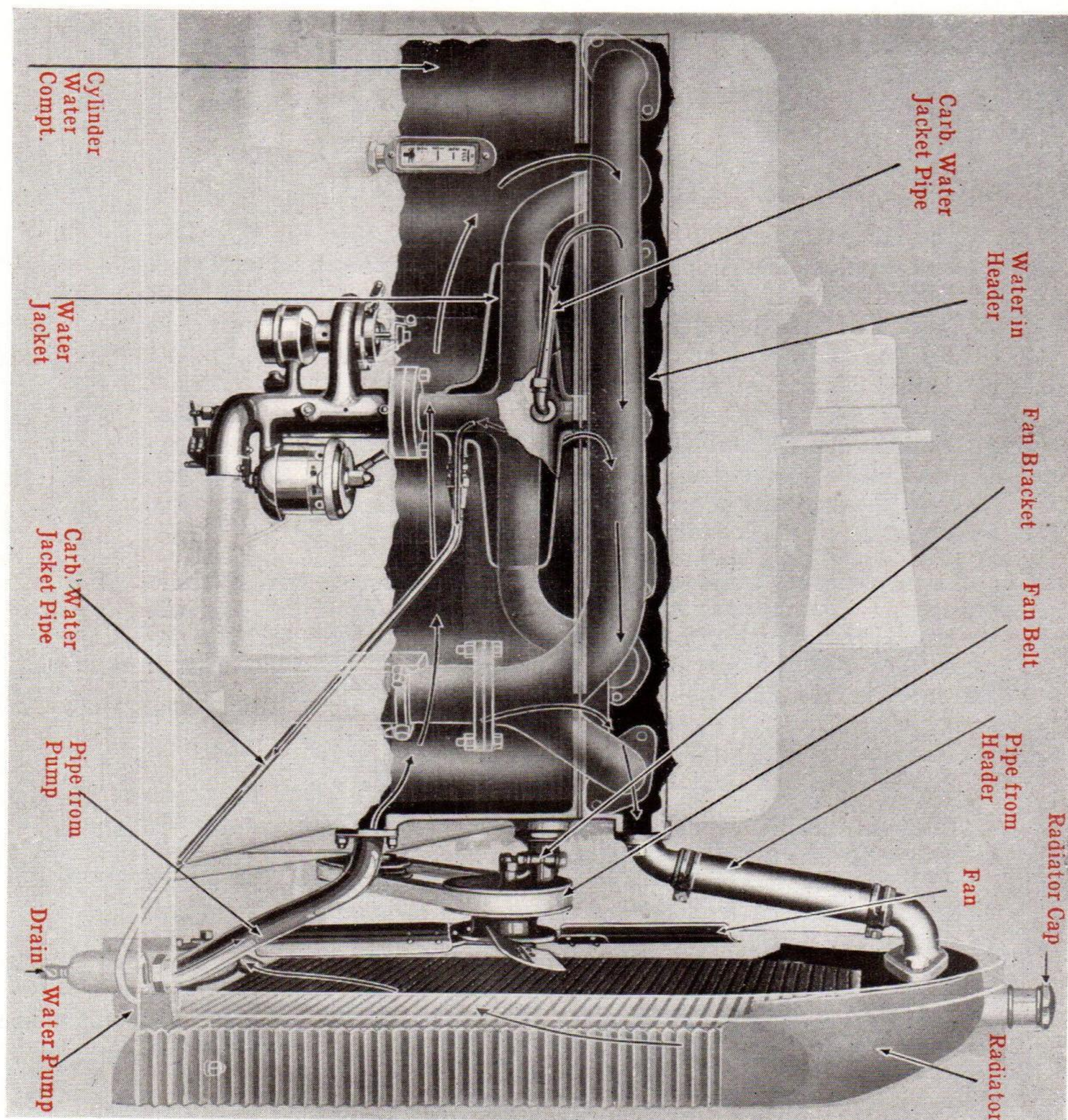


Fig. 15. Water Circulation System

Disassembling

The radiator core is readily removable from the shell, by simply unscrewing the ring nut at the filler and the support bolts at the sides.

To repack or inspect water pump, remove radiator and front under pan. Remove front end stud, permitting the hand crank cross pin to be driven out. Disconnect water pipe at cylinder connection and unbolt the two water-pump

Water
Pump

support studs, thus permitting the whole pump assembly to slip off forward.

To clean the radiator, add one pint of glycerin and enough boiling water to fill the system, and then run the engine. Drain out and flush with clean water. The radiator may be flushed frequently. The lower radiator connection may be detached and a stream from a hose run through. Reversing the direction of the flow increases the efficiency of cleaning.

To Clean
Radiator

The fan is an important factor in cooling. The belt should always be kept tight enough to prevent slipping (too tight a belt will wear the fan bearings) by adjustment of its eccentric bracket on the cylinder. The fan hub has ball bearing drive, reducing friction and wear.

Fan

Auxiliary Shaft Drive

A train of only three helical cut gears takes care of the cam shaft and auxiliary shaft drive. These gears are mounted behind the front bearings so the gears are perfectly supported. The cam-shaft gear is heat-treated cast iron.

Front
Motor
Gears

The auxiliary drive gear is mounted on annular bearings. To inspect these parts, loosen generator and magneto clamps and slide these units back. Remove the tire pump drive gear and loosen the six cap screws and the stud holding the bearings and plates. This will permit the gear and shaft, together with the front bearing and fan pulley, to be removed forward.

Exhaust System

The exhaust manifold is of steel tubing and it has four ports fastened to the firing header. The pipe is led to the front of the engine and thence down and back to the muffler amidship of the car. Carrying the exhaust to the front permits the rapid cooling of the exhaust gases and subsequent reduction of the back pressure, and also prevents the heat of the engine annoying passengers in the front seat in hot weather.

After the exhaust manifold has been heated to redness on account of the extreme hard, hot work, it may, on removal from the firing header, be found to have warped somewhat. This condition is allowed for by making the stud holes larger. As this part is made of welded tubing any necessary repairs may readily be made with the oxy-acetylene welding process.

The muffler is simply a long "nest" of pan-shaped stampings having different size and shape openings in the base,

Muffler

through which the gases must pass, and in so doing the explosive force is prevented from causing noise when coming into direct contact with the outer air.

Cut-out

The muffler cut-out is a valve ahead of the muffler opening, which permits the gases to exhaust into the air without going through the muffler. The old-time theory that the muffler cut-out is essential for maximum power has been exploded, for tests have definitely established the fact that the loss of power on account of mufflers is not appreciable. For this reason, together with the fact that there is considerable agitation on the part of the pedestrian public and the authorities, we have not connected the cut-out with the driver's seat, but have merely installed it on the exhaust pipe to facilitate engine adjustments.

CHAPTER VII

Electrical Systems

THE BIJUR starting and lighting equipment on the Marmon Model 34, 1918, cars is designed for six volts and consists of two separate units, a generator and a starting motor. Electrical
System
Units

The starting motor is in operation only during the period of starting and remains idle at all other times. The generator is in operation at all times when the engine is running and supplies current for all lights, and charges the storage battery when the engine is running at speeds equivalent to car speeds of twelve or more miles per hour. Current for lights is supplied by the battery when the engine is running at low speeds equivalent to car speeds of less than twelve miles per hour, or when the engine is idle.

The complete electrical equipment on each car consists of:

Bijur Generator.

Bijur Starting Motor.

Bijur Starting Switch.

6-volt, 120-ampere-hour Prest-O-Lite Battery.

A Model 354 Weston Ammeter Scale 30-0-30.

Briggs and Stratton Combined Lighting and Ignition Switch.

6 Gang Fuse Blocks.

Magneto.

2 Main Head Lamps.

2 Auxiliary Head Lamps.

Instrument Lamp.

Tonneau Lamp.

Tail Lamp.

Inspection Lamp.

Horn.

After the engine reaches a speed equivalent to a car speed of twelve or more miles per hour, the generator reaches its normal voltage, or electrical pressure, and will maintain a constant voltage at all higher speeds. Operation
of System

The current output from the generator at any time will depend upon the state of charge of the storage battery, as well as the number of lamps in use.

If a car has been left standing for some time with the lamps burning, the storage battery will become more or less discharged and its voltage lowered. Under these conditions the generator voltage or pressure will be considerably higher than the lowered voltage of the storage battery, permitting a relatively large charging current to flow into the battery. This current, indicated by an ammeter on the dash, may be as high as twenty to twenty-five amperes and the battery will rapidly acquire a charge. With any lights in use, the total current of generator will not be indicated, for reason that the ammeter is connected in circuit so as to register the current given out by the generator less the current consumed by the lights connected in circuit.

As the battery becomes charged its voltage increases, reducing the difference in pressure between the generator and battery and decreasing the charging current to the battery. With a fully charged battery, and with no lights in operation, the current from the generator may decrease to five or six amperes.

Generator and Regulator The generator is mounted on a special bracket at the front left-hand side of the crank case, and is held in place by means of a strap. The generator shaft projects at both ends of the machine, the front end being connected to the accessory drive shaft by means of a coupling. The rear end of the shaft connects, through another coupling, to the magneto.

Mounted on the generator is an aluminum box, held in place by a single knurled screw, containing the automatic switch for opening and closing the circuit between battery and generator, also the automatic voltage regulator.

Projecting from one end of this box, and fitting into a receptacle on this box, is a disconnecting and reversing plug.

The one wire connecting the generator to the battery circuit is soldered into this plug. The circuit between the generator and battery is completed by means of a small screw in the disconnect plug, which, when locked in place, grounds one side of the generator circuit to the frame.

Due to the reversible characteristics of generator, no attention need be paid to the polarity of the battery, should the battery be removed for any purpose.

If wrong connections are made, the generator will instantly reverse itself and charge the storage battery in the proper direction. This is a valuable feature, as it requires no electrical skill to make replacement of the battery, or in connecting the generator in circuit.

The regulator box, in which the cut-out switch and automatic voltage regulating device are enclosed, is sealed to

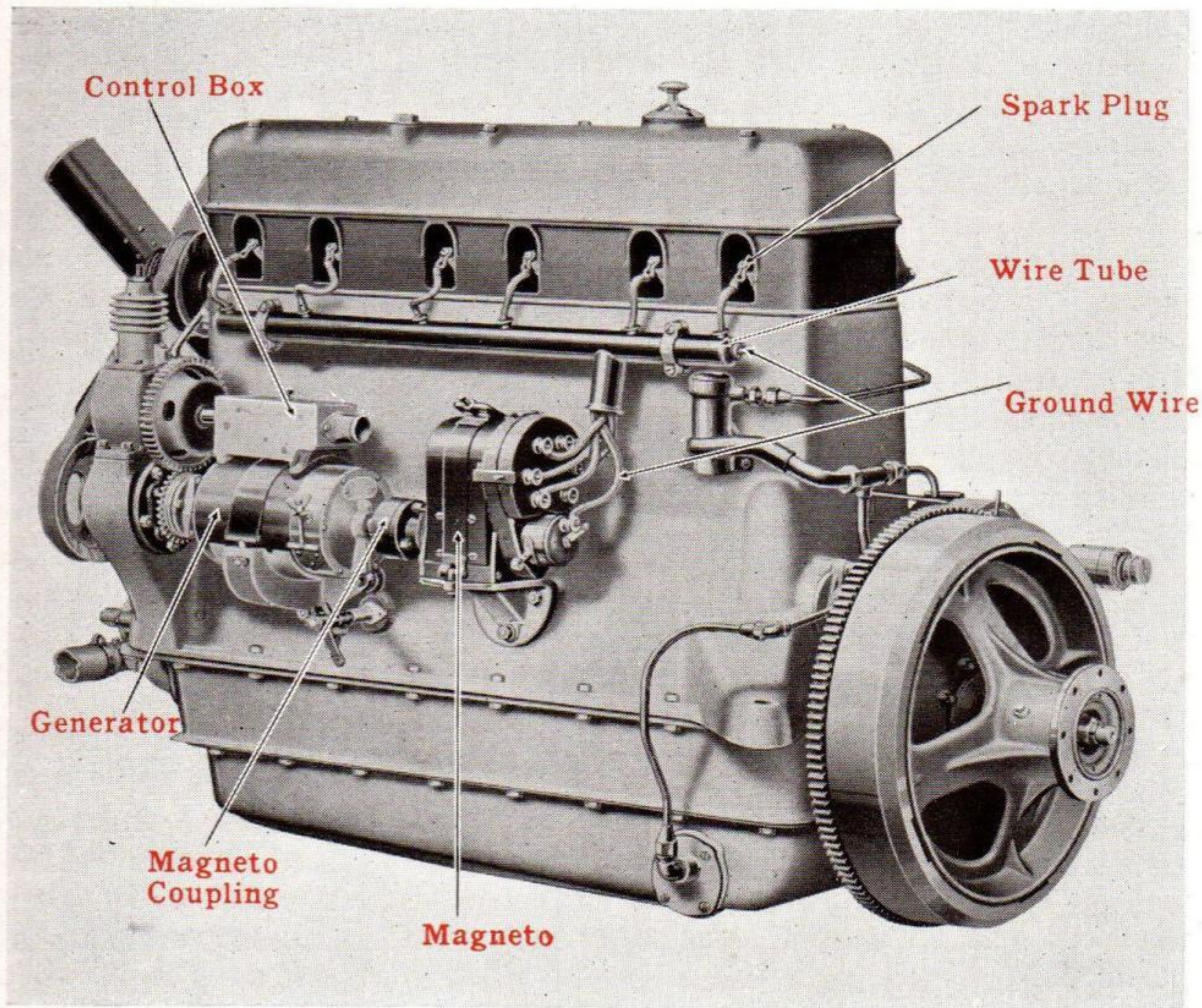


Fig. 16. Electrical Units on Engine

prevent anyone from tampering with its adjustment. Adjustment of this instrument is correct when shipped from factory, and *the Bijur Motor Lighting Company is not responsible for the proper functioning of the automatic switch and regulator if the seals of this box are broken.*

In case the regulator box is to be removed, do not insert a screw-driver or any other object between the generator and regulator box to pry the latter off.

Loosen the knurled screw on top of the regulator box and lift the box by grasping it with both hands, keeping it horizontal while pulling it up, so as not to damage the connecting pins.

Should it be necessary to remove the battery from the car, the lights may be supplied direct from the generator without making any additional electrical connections.

If the regulator box is removed from the generator, the lights may be supplied directly from the battery without having to make additional electrical connections.

The starting motor is mounted at the rear right-hand side of the engine, being held in place by a bracket and holding strap. The dowel pin in the yoke of the starting

Starting
Motor

motor prevents it from turning in the bracket after it is secured in place by the holding strap.

The starting motor is provided with an armature having a threaded shaft on which a special Bijur automatic screw shifting device travels in and out of mesh with the teeth cut on the flywheel and automatically cranks the engine.

Depressing the button of the starting switch, projecting through the center of the toe board, connects the starting motor directly to the battery. The instant that the starting switch button is depressed, the armature of the starting motor begins revolving, and by virtue of its design, the shifting mechanism is automatically screwed into mesh with the teeth on the flywheel and the engine is cranked.

The instant that the engine begins firing, the rotative effort of the flywheel is transmitted to the pinion of the automatic shift, and the over-riding speed of the automatic shift, with respect to the starting motor's armature shaft, causes the pinion to disengage with the teeth on the flywheel.

Wiring The wiring diagram, Figure 32, page 91, shows the layout of cables as they are placed on the car frame. The generator, and all lights, are on the single wire grounded system, the frame of the car acting as a common return conductor.

The circuit between the storage battery, starting switch and starting motor is made up with heavy cable, and use is not made of the car frame as a return conductor between the battery and the starting motor. The positive cable from the battery to the starting motor is grounded by means of a jumper wire marked (Ground No. 4) completing the circuit between the battery, lights and the generator.

The generator has only one cable leading to it. To complete the circuit between the generator, battery and lamps, the disconnect plug at Figure "BB" is grounded to the frame when locked in place by means of a small fillister head brass machine screw. This screw is connected to one of the flat brass contractors in the disconnect plug, which makes contact with one of the pins in the disconnect, thereby completing the circuit.

Fuses for the different lighting circuits are carried in the fuse block mounted on the dash. In making any replacement, substitute only standard fuses.

Mounting of instruments, generator, starting motor, fuse block, and all details shown on the wiring diagram, approximate, as closely as possible, their relative positions on the car (viewpoint taken from driver's seat).

All cables shown represent the wires making permanent connections. All car wiring is protected with rubber covering or is enclosed in loom.

The meter on the dash shows the current supplied to the battery by the generator, or the amount of discharge from the battery to the light when the engine is idle or running at speeds below twelve miles per hour, or when starter is being used. The meter should always indicate current going into the battery which is the total current generated less the current consumed by the lights. If no lamps are in use the meter will indicate total current generated by the generator.

Ammeter

The meter should indicate the "Discharge" from the battery with lights in use when the engine is idle or running at low speeds, corresponding to car speeds of less than twelve miles per hour. When no lights are in use under the same conditions, the meter's needle should rest on "Zero."

Should the ammeter show a "Discharge" when the engine is idle, or when the car is standing still, and with no lights in operation, it is indicative that the main switch in the regulator box has not opened the circuit between the generator and the battery, or that an accidental ground has developed in the cable "B" leading from the ammeter to the generator on the cable "C-B," connected to the lighting and ignition switch, or either the lighting and ignition switch is out of commission.

Lighting and Ignition Switch

The combined lighting and ignition switch mounted on the dash controls the various lighting circuits and the ignition circuit. The wiring diagram shows back connections for this switch.

Each car is equipped with the following lamps:

- 2 Head Lamps, 30 C. P., 6-8 volts, single contact.
- 2 Dim Head Lamps, 8 C. P., 6-8 volts, single contact.
- 1 Tail Lamp, 4 C. P., 6-8 volts, single contact.
- 1 Cowl Lamp, 4 C. P., 6-8 volts, single contact.
- 1 Inspection Lamp, 4 C. P., 6-8 volts, single contact.
- 1 Tonneau Lamp, 4 C. P., 6-8 volts, single contact.

Lamps, Lamp Bulbs, and Bulb Replacements

In making replacement of lamp bulbs, standard bulbs should be used. Substitution of larger candle power lamps will naturally require more current, and will necessarily impose a very heavy duty upon the battery or generator.

First, see that all the necessary adjustments to the engine have been made; then depress the starting foot pedal as far as it will go and hold it firmly in place until the engine begins firing. THE INSTANT THE ENGINE BEGINS FIRING THE FOOT PEDAL SHOULD BE RELEASED.

To Start the Motor

If the engine does not start firing promptly after spinning it with the electric motor, do not continue to spin it, but see that the proper adjustments for starting have been made, that there is plenty of gasoline in the carburetor, and that the ignition is in good working order.

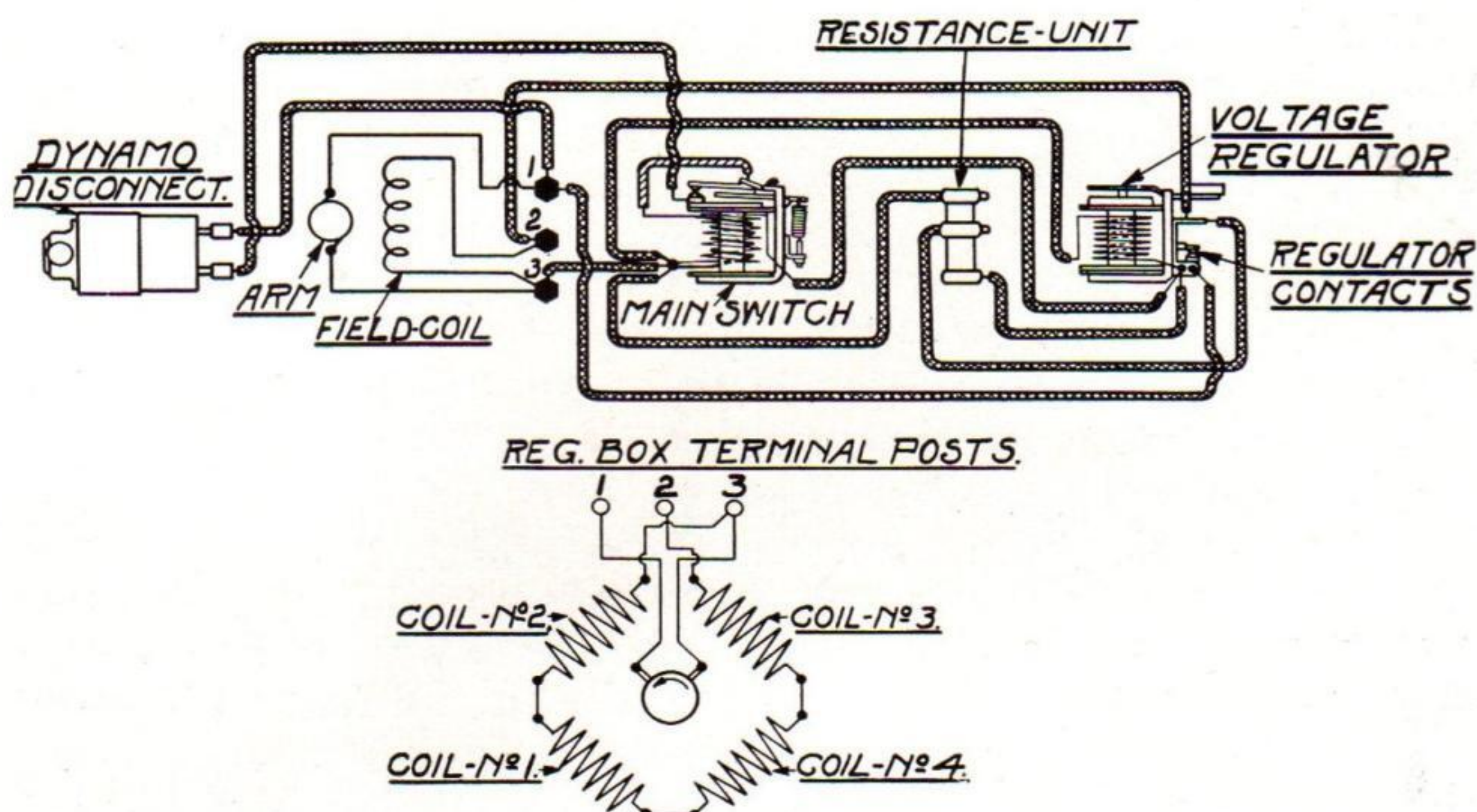


Fig. 17. Schematic Wiring

Continued spinning of the engine by the electric motor will not damage the electrical equipment, but is a useless drain on the storage battery and should be avoided.

NEVER DEPRESS THE STARTING PEDAL WHEN THE GEAR SHIFT IS OUT OF NEUTRAL.

THE STARTING SWITCH SHOULD NOT BE RAPIDLY OPENED AND CLOSED. THE SWITCH SHOULD ONLY BE CLOSED WHEN IT IS CERTAIN THAT THE FLYWHEEL HAS COME TO A COMPLETE REST.

BEFORE THE ENGINE COMES TO A COMPLETE REST, THE FLYWHEEL IS ROCKING BACK AND FORTH. SHOULD THE STARTING MOTOR MECHANISM ENGAGE THE TEETH OF THE FLYWHEEL DURING THIS PERIOD, AN EXCESSIVE STRAIN WILL BE IMPOSED ON THE STARTING MECHANISM BY THE ENGAGEMENT WITH THE FLYWHEEL TEETH, RESULTING IN SERIOUS DAMAGE.

Care and Maintenance

The one line wire from the generator is soldered into a brass plug, which fits into the receptacle of the aluminum box mounted on top of the generator. This plug, provided with a handle in which the line wire terminates, is the disconnecting plug. This plug should never be left in the receptacle with the handle in a vertical position, but should be pushed inwardly and turned in either direction until it springs forward and locks itself into place.

Regularly every two weeks, or after 500 miles of travel, the regulator disconnecting plug should be reversed by pushing inwardly as far as it will go to unlock, then turn past its vertical position until it springs forward and locks

on the opposite side of the disconnect. By reversing the disconnect plug, the direction of the current through the regulator contacts is reversed, thereby equalizing the wear on same and prolonging their life.

Regularly every two weeks, or every five hundred miles, two or three drops of thin oil should be put into each of the oilers of the generator and starting motor. Do not flood the bearings with oil.

Inspect the brushes about every one thousand miles' travel to see that they are bearing correctly on the commutator, and that they are free to move up and down in their respective holders. Thin strips of No. 00 sandpaper should be used to seat the brushes of the generator if they are not bearing properly on the commutator. Any foreign matter, dirt or dust that may have collected on the brushes can be removed by washing the brushes thoroughly in gasoline. Do not use cloth or emery paper. With the engine running at a moderate speed, No. 00 sandpaper cut into thin strips, inserted under the brush, with the rough side against the commutator, will remove any foreign material that has collected on the surface of commutator. After cleaning, be sure to blow out of the machine all the sand particles loosed from the sandpaper.

Ignition

The Bosch "Independent" magneto and key switch are employed. With this system, only a single wire runs from the magneto to the switch, and no additional ignition accessory is required. This wire carries no current, except when cutting out the spark, but is simply arranged so that it may be "grounded," either with the lighting switch handle on the dash or with the key of the switch by turning same in clockwise direction. If it is ever necessary to crank by hand, the engine must be "turned over" with the spark lever advanced about half way.

Magneto

The magneto should be so timed that with a fully retarded spark the interrupter platinum points will just begin to separate when the line marked "top center" on the flywheel has still one inch to go before passing under the flywheel pointer. (See Valve Timing.) On the magneto coupling, there is an adjustment by which the magneto timing may be advanced or retarded, in its fixed relation to the engine piston, as desired. The factory setting, however, will be found to be the best for all-around use, and should be left as it is.

**Magneto
Timing**

Numbering the magneto distributor terminals from left

**Firing
Order**

to right, the spark plugs from front to rear, the connections from magneto to plugs are as follows:

Terminals Nos. 1, 2, 3, 4, 5, 6,
to plugs Nos. 1, 5, 3, 6, 2, 4.

The engine cylinders are threaded for the seven-eighths-inch S. A. E. standard spark plugs.

**Spark
Plugs**

The spark plug firing points should have just the right clearance or gap, must be clean and dry to prevent short circuiting and consequent misfiring. Plugs should be removed occasionally, cleaned, adjusted and replaced. For cleaning, a tooth brush and alcohol are recommended.

The gap should be adjusted to about .032 inch. This is just about the thickness of an ordinary pin, or of eight sheets of this paper.

In replacing a plug, make sure that a gasket is used and the plug screwed down tight.

The careful motorist usually carries an extra spark plug or two ready for use if needed.

In case of ignition difficulty, make sure that the terminals are securely connected, that the interrupter lever moves freely and that the platinum surfaces make clean and flat contact. (See "Detecting Faults.")

Storage Battery

Description

The storage battery consists of a group of three independent cells incased in a stout wooden box. Each cell is contained in a hard rubber jar, and consists of an assembly of grid-plates immersed in a solution of sulphuric acid known as electrolyte. The plates are alternately positive and negative, each plate being separated from its neighbor by a thin wooden separator. All positive plates are joined together at one corner and connected to the positive terminal of the cells. Similarly, the negative plates are connected at the opposite corners. When an electric current is passed through a cell, it causes a certain chemical action to take place between the positive and the negative plates, resulting in a condition of the storage battery known as "charging." In this condition, the battery thus charged is striving to get back to its original condition, or discharge itself, and it is this reaction which produces and gives off electric current. This also explains why a battery will always discharge itself in time if not used. On many cars this important member is robbed of its possible life of usefulness. It is permitted to sicken and die, simply through failure to receive the nourishment essential to its life. A few necessary precautions are outlined on page 53.

First. Battery fluid covering the plates is as necessary to your battery as oil to your motor. "Boiling" and evaporating constantly lower the fluid level, which must regularly be brought up to the top of the plates. Never add any fluid except *pure distilled water*. Get this from a druggist, or use melted artificial ice, and carry it in a *bottle* (use no metal retainers). City, spring or well waters contain injurious chemicals. Each week unscrew the vent plugs and add enough distilled water to bring fluid to the bottom of the inside cover.

**Keep
Fluid
at Proper
Level**

Second. The second essential is that the battery be not allowed to become completely discharged, and, above all, not allowed to stand in a discharged or partially discharged condition. If at any time your lights become dim, and starter sluggish, it is a sure sign of battery weakness. Give the battery an extra charge by opening throttle one inch and letting motor run at medium speed, while the car stands with lights out for three or four hours, and you will doubtless note an improvement.

**Keep
Battery
Charged**

Third. The cause of a battery running down in service may be due to the condition of the battery or the electric generator, but it is more likely to be caused by using up more electric current than the generator can supply. This is almost sure to be the case if the car is used only for short runs, or mostly at night, or left standing for long periods with lights on.

**Do Not
Waste
Current**

An hydrometer syringe should be used regularly. With this you can draw up a quantity of the battery fluid and measure its specific gravity, which indicates the state of charge, the fluid in a fully charged battery standing at 1.285; 1.250 is about one-half charged, while a gravity of 1.150 indicates a completely run-down condition. Of course, this assumes that the original quantity of sulphuric acid is still present, and that the fluid is at the proper level. If the solution has leaked or spilled, being replaced by water only, the hydrometer syringe can not give a true condition of the state of affairs. Chemically pure sulphuric acid, poured into distilled water until the hydrometer indicates a gravity of 1.300 when cold, should replace spillage.

**Use of
Hydrometer**

If test shows battery below 1.250, run the engine as described above until charge rises to 1.285. If gravity does not rise, see that battery connections are all clean and tight and generator is charging. This can be tested with the ammeter.

If, by inspecting and testing the battery, you notice that there is any leakage, other than what may come out of the vent plugs at the top, examine the battery carefully for broken jars, which will have to be replaced. Should you

Leakage

find that one cell shows 0.025 difference in gravity from the others, especially if this difference is continued and increasing, the fact should be brought to the attention of the battery makers or representatives.

Service If the car is not in service for a week or more, remember your battery will require attention, as any battery gradually discharges on standing. Leave the battery with someone who can have it charged periodically. The battery makers have service stations all over the country, whose names and addresses we or they can supply.

See that storage battery is not loose in its retainer.

**Special
Battery
Pointers** If battery is removed, handle it very carefully to avoid breaking jars.

Do not drag a battery across a floor with one handle.

Avoid over-filling, as acid may spill out and cause damage.

Neutralize escaped acid with caustic soda or ammonia.

Keep dirt, dust, and especially all metallic matter, away from a battery.

Do not use an open flame about a battery.

CHAPTER VIII

Transmission of Power

IN THE successful motor car, great care must be taken that the power generated in the engine is applied to the rear wheels in exactly the most advantageous manner. The clutch furnishes a special means to prevent a sudden application of power, which would cause jerky starts. The change-speed gear or "transmission" permits increased effective force to be applied to the rear wheels for starting and for hard pulls (first and second speeds), and also provides for reversing the car. The propeller shaft carries the power to the rear axle. The rear axle bevel gears switch the direction of the power from lengthwise to crosswise and also effect the required reduction in speed. The differential permits one wheel to be driven faster than the other, and the drive axles finally carry the power to the wheels. On the Marmon 34 the units back of the clutch and their respective housings are assembled together in a single large unit known as the "rear system." Their functions and construction are detailed in the following discussion.

Theory of Clutch

Differential

The Rear System

From the transmission back, the rear system is assembled as an independent unit, which may be removed from the car as a whole for repairs if necessary. To do this, disconnect the brake rods and shock absorbers, then, supporting the weight of the frame by a board extending under the frame, the end held on a chain pull, disconnect the large spring shackle. Then remove the circle of bolts ahead of the transmission and the four bolts holding the ball joint housing to the frame. Remove speedometer shaft plate. Then the rear system may be slid out from under the car. The transmission, torque tube, wheels and hubs and rear axle housing may then be readily removed and disassembled as desired.

Removing

The Clutch

The Marmon 34 cone clutch is simply an aluminum wheel having a conical rim engageable with the corresponding surface within the flywheel. Depressing the clutch pedal moves this cone back and disconnects the motor, while a spring action holds the clutch in contact when the clutch is let in. Smooth application of power is assured by the five steel discs set within the flywheel, which give a slipping contact with gradually increasing force until the whole surface of the cone comes into full contact as the clutch is entirely engaged. No adjustment for easy engagement is necessary. The metal and asbestos fabric with which the cone is lined usually requires replacement after 10,000 to 20,000 miles running, the life being largely dependent upon the class of service.

Disassembling

To disassemble the clutch, remove the circles of bolts at the universal joint and at clutch flanges, and take out the drive shaft, thus released. Then remove cotter and back off main clutch nut. The spring retainer can then be pulled off its key after inserting $\frac{3}{8}$ -inch cap screws in its threaded

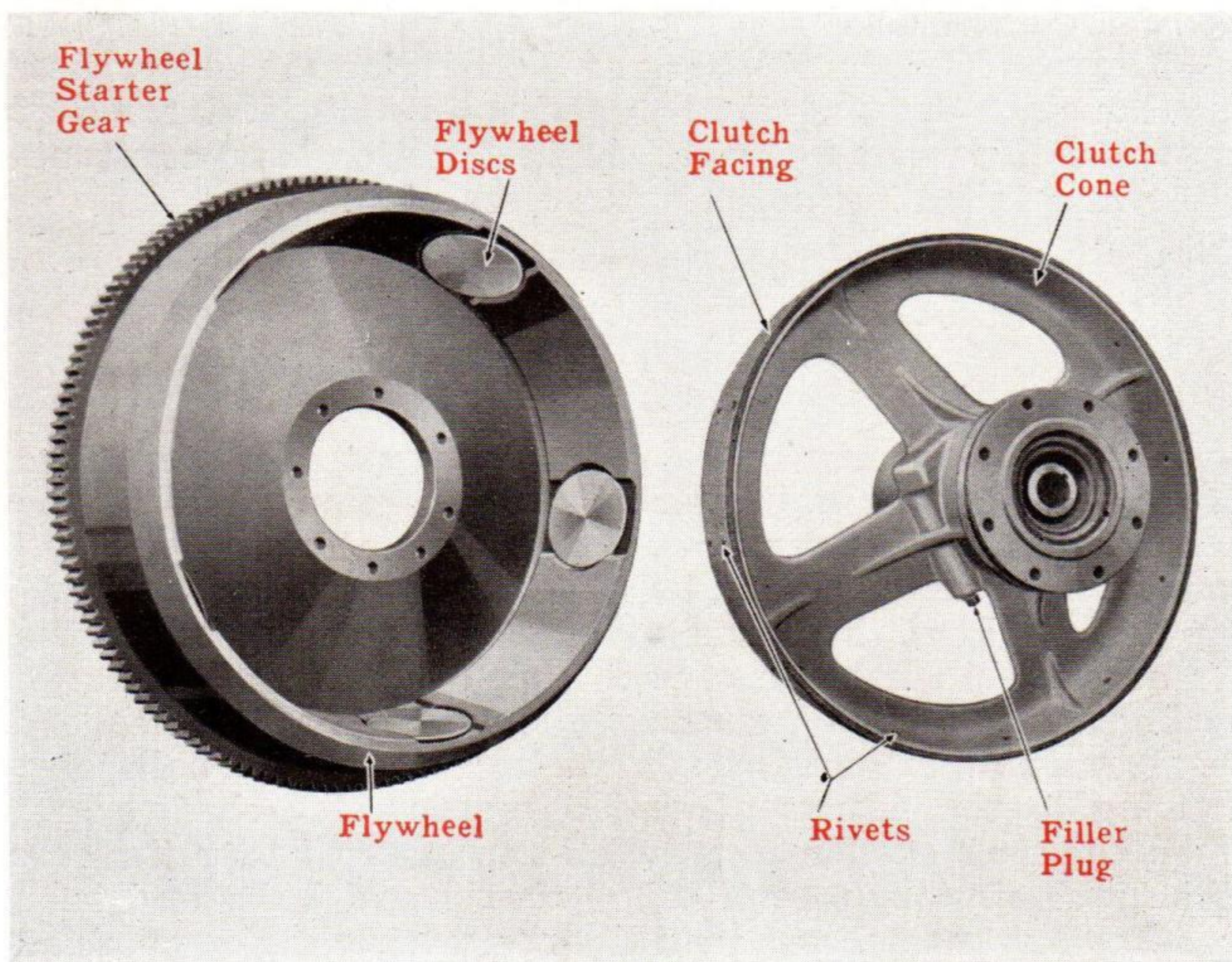


Fig. 18. Flywheel and Clutch

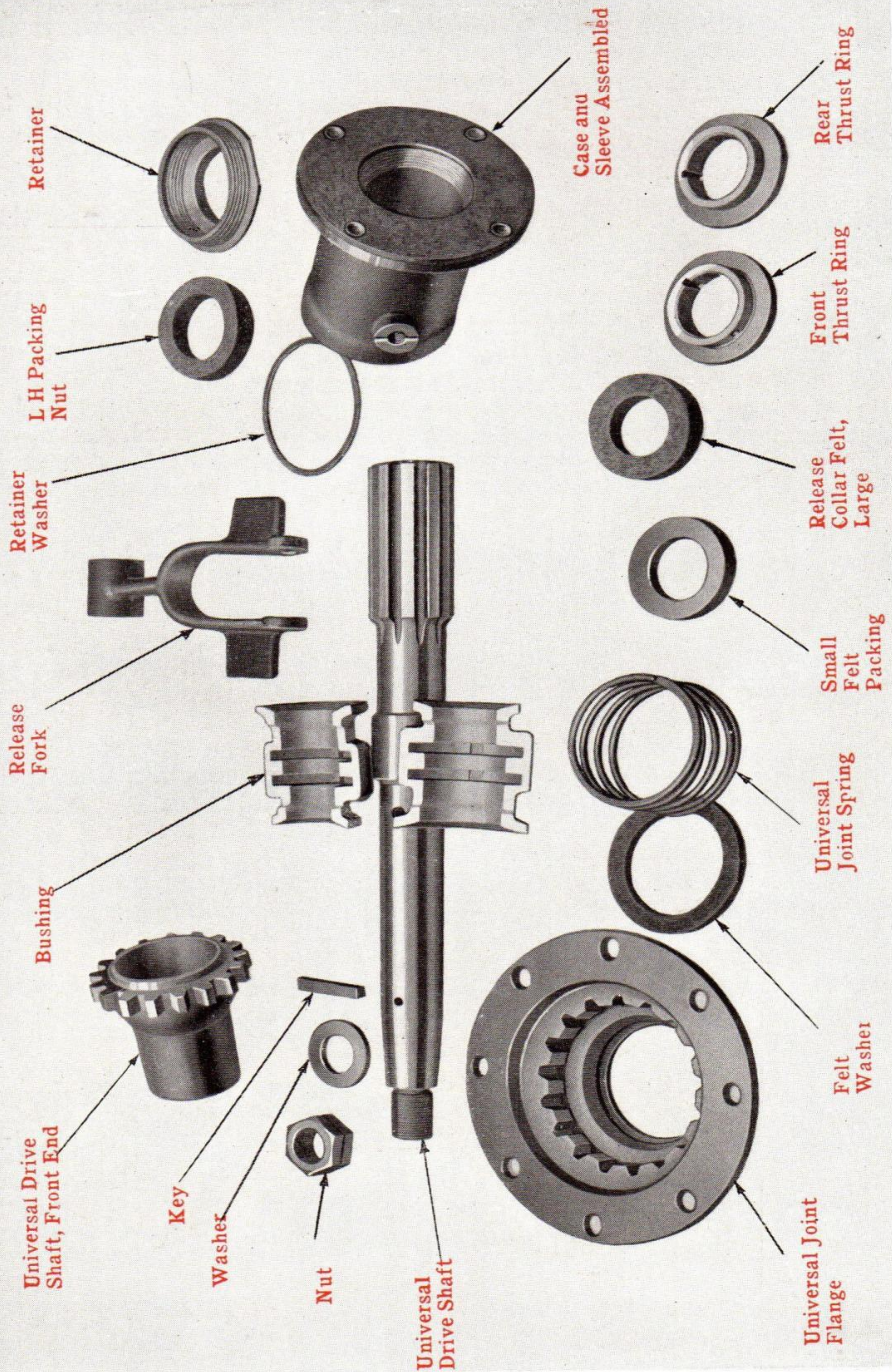


Fig. 19. Clutch Release Mechanism

holes. Then the cone will slide off the pilot shaft. In replacing, care must be taken in fitting the spring retainer on its key.

Relining the Clutch

The standard facing for these clutches is superior to leather, and to get the best service renewals should be made with the same material. To install, clean off all remains of the old facing, lubricate the cone with graphite, and slip the new facing in place. It may be necessary to force it gently, but do not hammer the edge. Soaking the facing in water will aid the facing to slide on easily. Then put rivets firmly in place, making sure the heads are below the surface. This is best done by placing the rivet head against a punch or small steel bar held vertically in a vise, and riveting with the round head of a machinist's hammer.

Replacing

See that the felt washer and hub bushing at the front of the cone are in good condition, then fill hub with oil and replace, making sure to get all parts back just as they came out.

Clutch Release

The shaft back of the clutch has two flanges about which is fitted a split collar, giving a marine type of bearing, which should be filled with oil. The backward thrust to release the clutch is applied to this collar by a yoke linked to the clutch pedal shaft. The bushings of these shafts and links are self-lubricating. The clutch pedal stop is against the floor-board. Inspection should be made, from time to time, of the shifting collar to be sure that, from lack of lubrication, this part does not revolve with the shaft when the clutch is released.

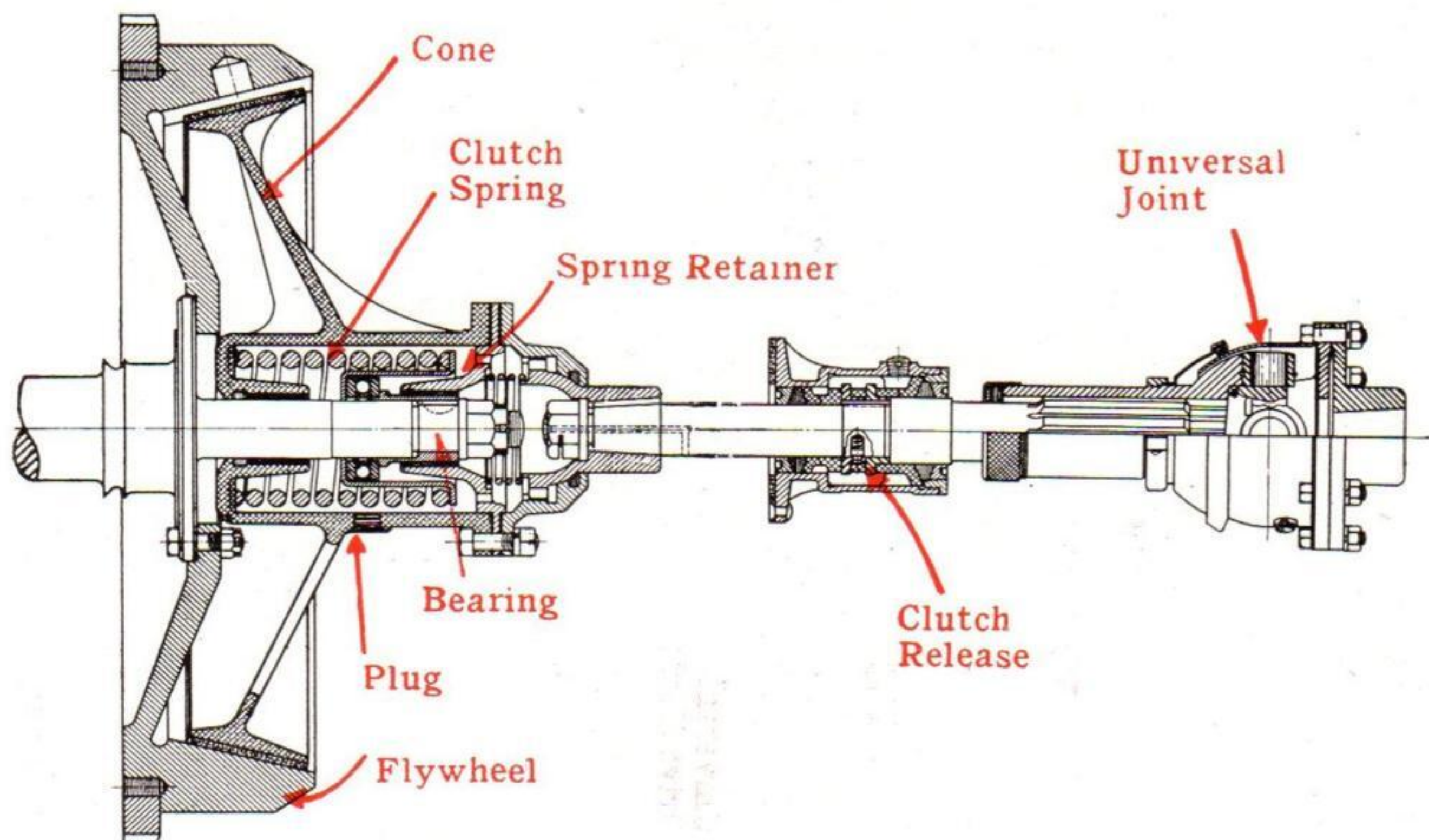


Fig. 20. Clutch and Universal

Universal Joint

The slip joint between clutch and transmission is of simple construction, requiring little attention, except proper lubrication. It should be kept about two-thirds full of good soft grease, free from grit or acid. After about one thousand miles of running, the outer casing may require a single adjustment to take up the initial wear in the flax packing. Loosen the "binding screw" and turn the "casing adjustment nut" until the outer casing is as tight as may be rotated readily with both hands (without tools). Then be sure to tighten the binding screw. Too loose an adjustment will allow escape of lubricant, and too tight will cause heating.

When a car is repainted, care should be taken to keep paint away from the ball near the flax packing. If joint is disassembled, be sure not to reassemble the oil hole opposite one of the lugs, or it can not receive lubricant.

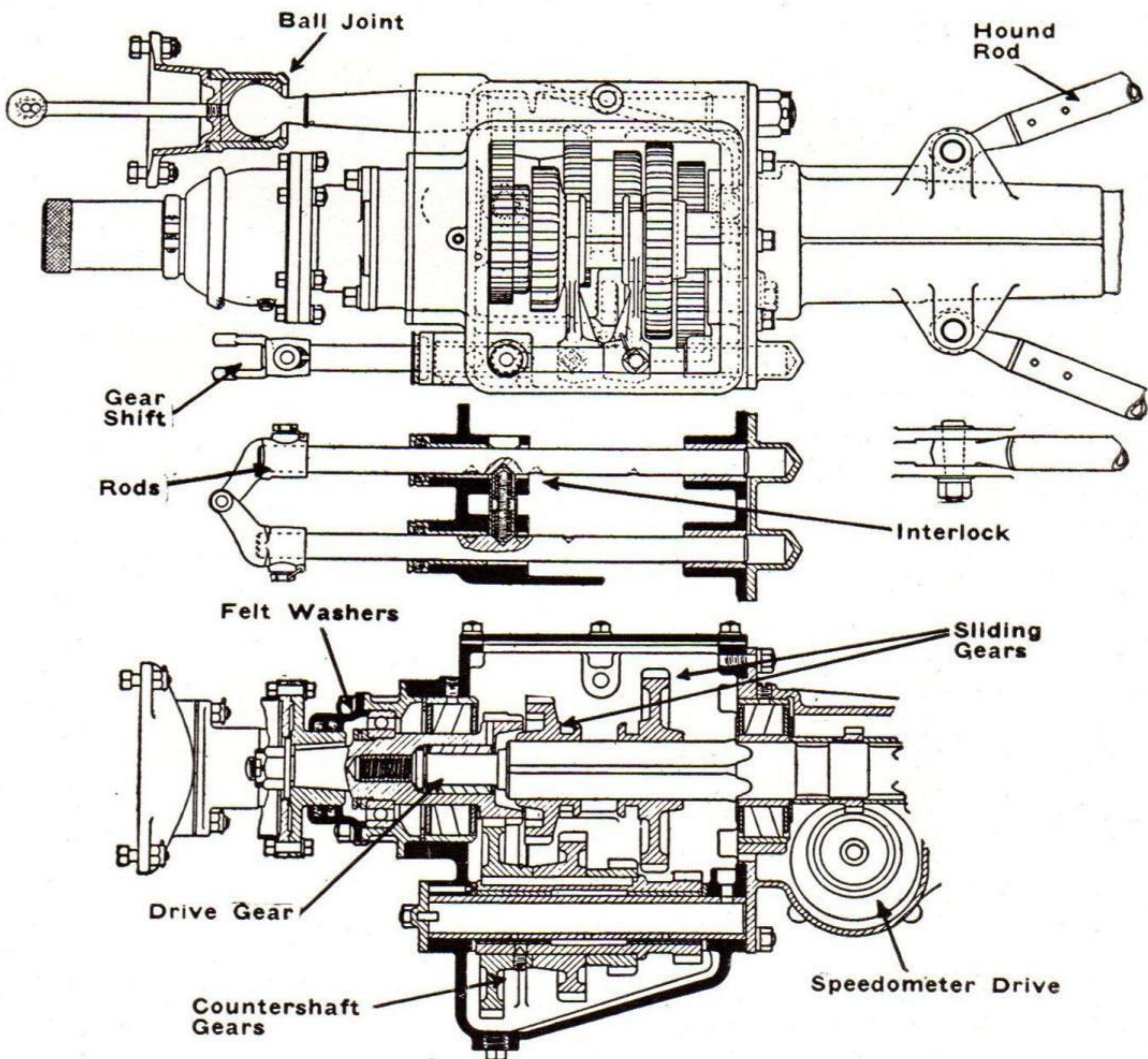


Fig. 21. Views of Transmission Assembly

Change Speed Gear or “Transmission”

The gasoline engine differs from the steam or electric power producers in that it can not continue to give a strong pull at the very lowest engine speeds. Hence, under conditions where low car speeds are necessary, there must be some means of increasing the relative speed of the engine. This is accomplished by a set of gears operating on much the same principle as the gears in a watch. The reverse gear is conveniently incorporated in the same train of gears.

**Main
Drive
Gear**

**Sliding
Gear**

**Gear
Positions**

The main drive gear is flanged to a shaft, which turns with the motor when the clutch is engaged. This gear is always in mesh with a larger gear on the counter shaft below. The counter shaft extends rearward and carries three other gears of varying size. Above the counter shaft is a squared shaft continuing the direction of the main drive gear shaft, but free to move independent of it. This squared shaft carries two gears with squared holes, which must turn with the shaft, but which may slide forward and back upon it. The large sliding gear is for low and reverse speeds and the smaller gear for intermediate and high. “Neutral” is shifting lever position when both these gears are riding free in the space between their respective engaged positions. When the operator throws the lever into low speed position a finger forces the larger gear to slide into mesh with a small gear on the countershaft. The square drive shaft then revolves much more slowly than the motor, giving greater power and correspondingly less speed to the rear wheels. Intermediate speed causes the other gear to mesh with a larger counter shaft gear, giving more speed. For high speed, this gear slides forward, engaging a clutch on the main drive gear direct, thus making the drive shafts virtually into one continuous shaft. For reverse, the large sliding gear is made to engage a small idler gear, which meshes with the counter shaft instead of directly on the counter shaft gear, thus changing its direction.

**Principle of
Transmission**

It will be seen that the whole drive system from motor to wheels, from a control standpoint, is in three independent sections, with the two joints between them at the clutch and gear case, respectively. The center section must be free to move with the rear whenever the rear connection is changed, as in shifting gears. Hence the necessity of throwing out the clutch whenever the gears are changed. Letting in the clutch with the lever “in gear” connects the remaining link and permits the motor power to be applied to the rear wheels. A thorough understanding of this point will make every characteristic control operation perfectly clear.

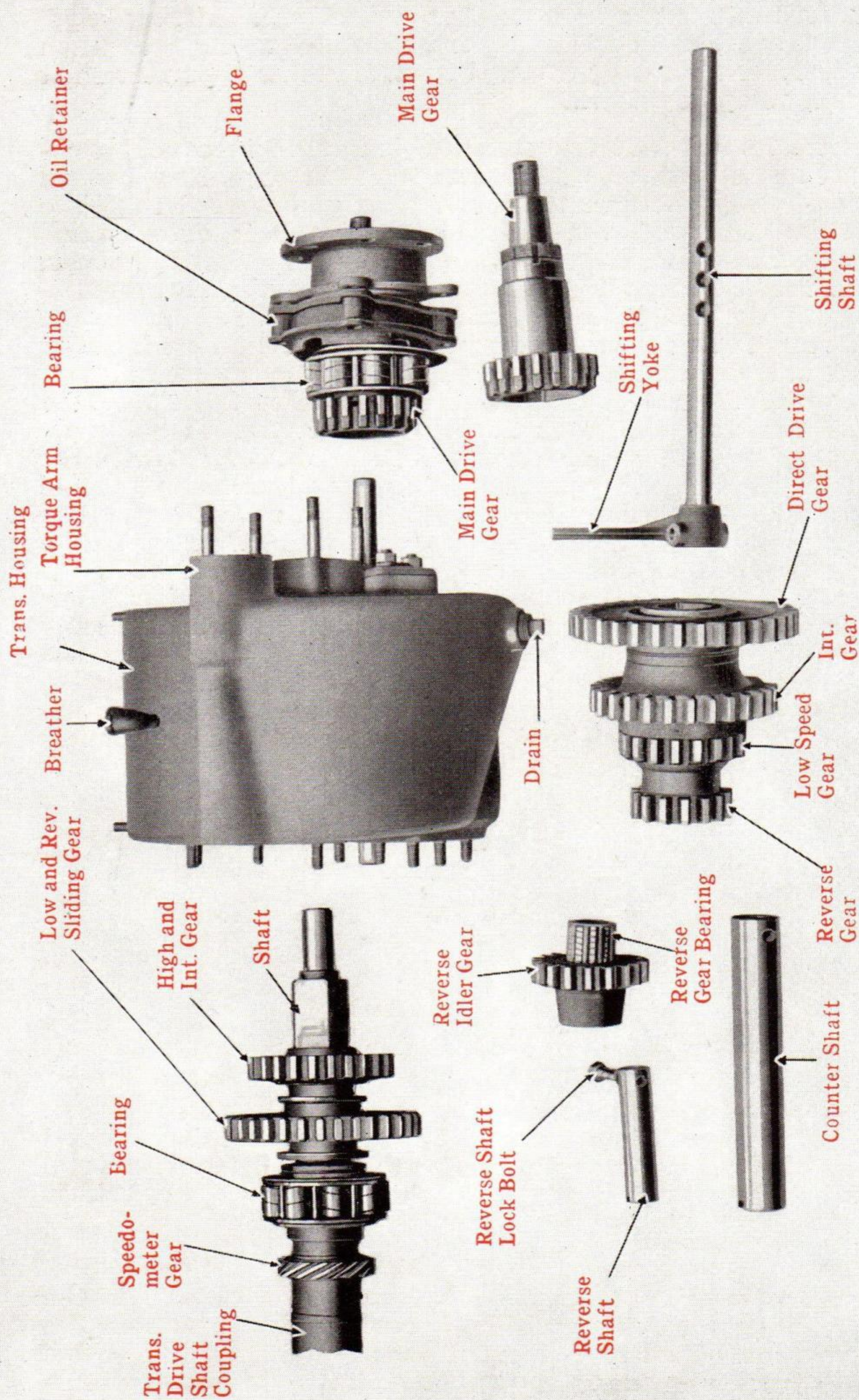


Fig. 22. Transmission Disassembled

For instance, it will explain why it is necessary to wait for the center section to slow down slightly in shifting "up," and why speeding up the motor with clutch re-engaged when gear lever is coming through neutral makes a perfect shift when "stepping down."

Description of Trans- mission	The Marmon 34 transmission is housed in a very compact and sturdy case filled with oil. Oil should be drained occasionally through the lower plug and refilled until the oil level is about even with the counter shaft, or one-third full. The gears may be examined by removing the cover, but for a thorough inspection or repair, the rear system should be swung from under the car, as described previously.
Removing	The main drive gear assembly is freed by removing the four cap screws, and can be readily further disassembled if necessary. The countershaft construction is unusual in that it revolves on a stationary tubular axle, the gear assembly having two long bronze bushings in contact with the
Countershaft	axle. These bushings are lubricated by oil, which enters the interior of the axle tube through a hole near its end and thence out small holes onto the bushings. To remove the counter shaft axle tube, simply take off end plate and slide out, thus freeing the gear assembly. When replacing, make sure that the small spacers at the ends of the gear assembly are in place, that the axle tube goes in with the small holes DOWN, and that the Woodruff key is in place in the end plate. The counter shaft reverse gear serves as a hub for the other gears, which are held in place with a feather key and a set screw in the countershaft drive gear.

If gear shifting rods are removed, care must be taken to prevent injury to the operator when the plunger spring and plunger fly out as the upper rod is withdrawn.

On account of the use of oil, to prevent leakage, all gaskets and felt washers must be tightly in place.

Drive Line

The drive line consists of the transmission shaft and the propeller shaft, which are welded together in order to make a strong and permanent coupling. The propeller shaft, which is tubular in section, and as a result of this light, yet possessing great strength, carries the bevel drive pinion and its bearings. The manner in which these are mounted is clearly shown in the accompanying illustration.

In order to remove the drive line from the torque tube, first remove the bevel pinion end nut and then pull off the bevel pinion and the plain ball bearing. Next take off the bevel pinion thrust bearing nut, lock nut and washer, which allows the remainder of the assembly to be removed forward. On replacing the parts, care should be taken that the thrust bearing center race is a tight fit on the extension of

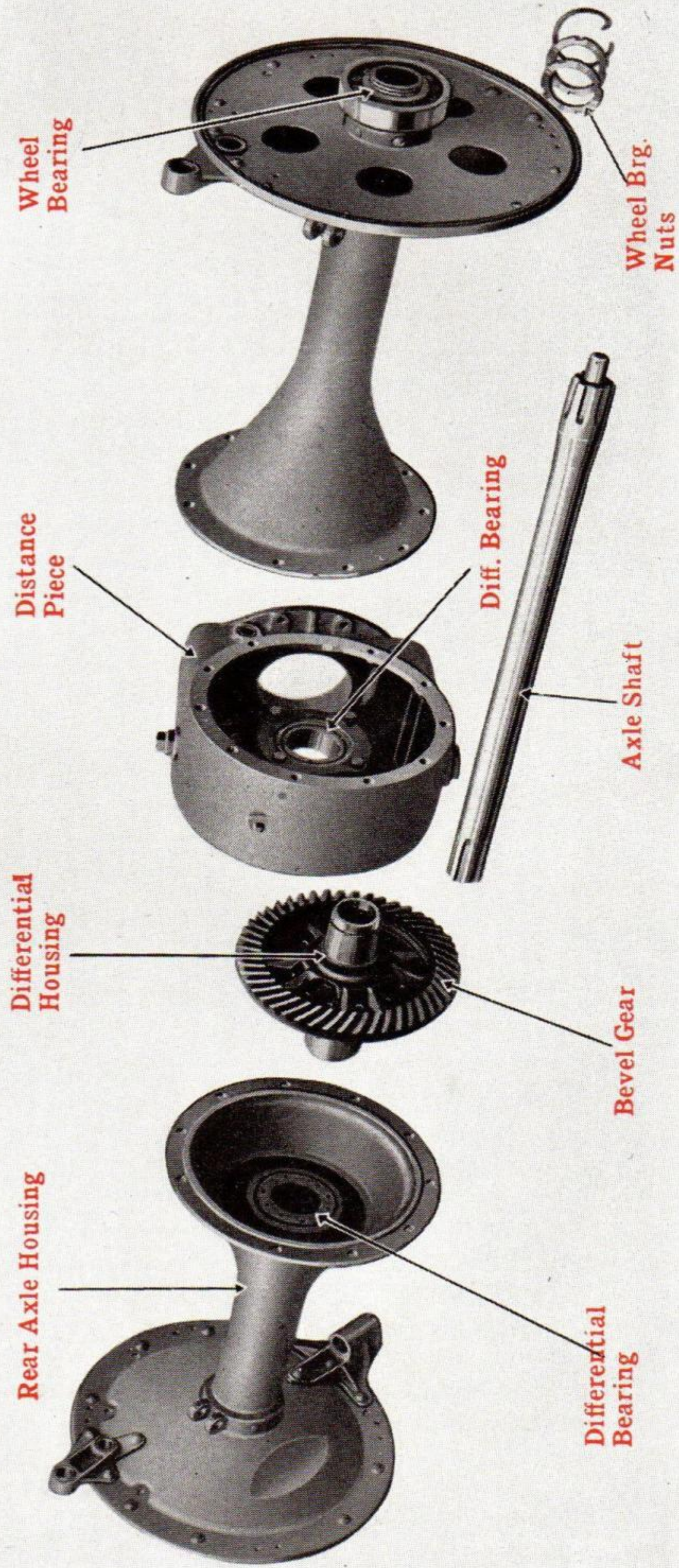
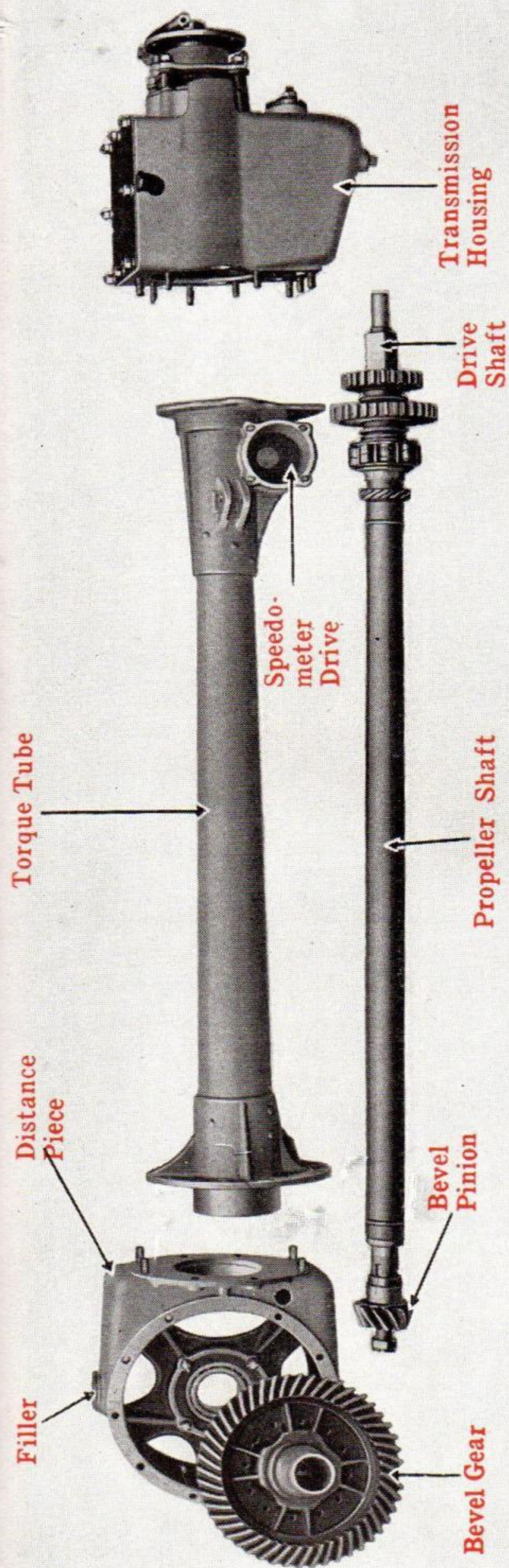


Fig. 23. Rear System Parts

the thrust bearing nut and also that the nut is securely tightened against this center race.

Bevel Drive Gears

By means of the bevel drive pinion and gear the rotary power from the engine is switched at right angles so as to be delivered to the rear wheels and at the same time a necessary reduction in the speed is effected. To insure silence, the bevel gear teeth are cut diagonally (or spiral-cut), and no adjustment is provided. The bevel pinion is fastened to the propeller shaft, as described above, and the bevel gear is a ring gear bolted to the differential case.

Differential Gear

Description Instead of delivering the power from the bevel drive gear direct to the axles, the differential gear is mounted at the center of the axle housing. The purpose of this gear is to permit one wheel to turn faster than the other, as it must whenever going around corners. The large main bevel drive gear is bolted to the differential case, which carries four pins extending toward the center, on which are mounted the four differential pinions. To right and left are the two differential gears, each meshing with all four pinions and having splined hollow center into which the right and left axle shafts fit. Normally, this whole mechanism turns as a unit, so that each wheel travels at exactly the same speed as the bevel gear, but when rounding a corner the differential action takes place. If you should jack up both rear wheels and keep the bevel gear from turning, and turn the left wheel forward, the right wheel would turn backward. This is because the left differential gear on the end of the axle shaft revolves the four differential pinions, the teeth on the opposite side naturally traveling in the opposite direction, thus turning the right differential gear BACKWARD. This is the identical action which takes place when one wheel is turning faster than the other while the car is in motion, except that at the same time there is a forward motion of the whole mechanism in addition. The principle is something like the action of a whipple-tree on a wagon.

Principle of Differential

The main differential support is at the center of the housing, consisting of a double row ball bearing. In addition, there is a plain roller bearing at the left.

Rear Wheel Hubs

The outer end of the axle shaft is fastened to the wheel hub with a spline and nut, the wheel hub riding on an annular ball bearing mounted on the rear axle housing and also carrying the brake drum.

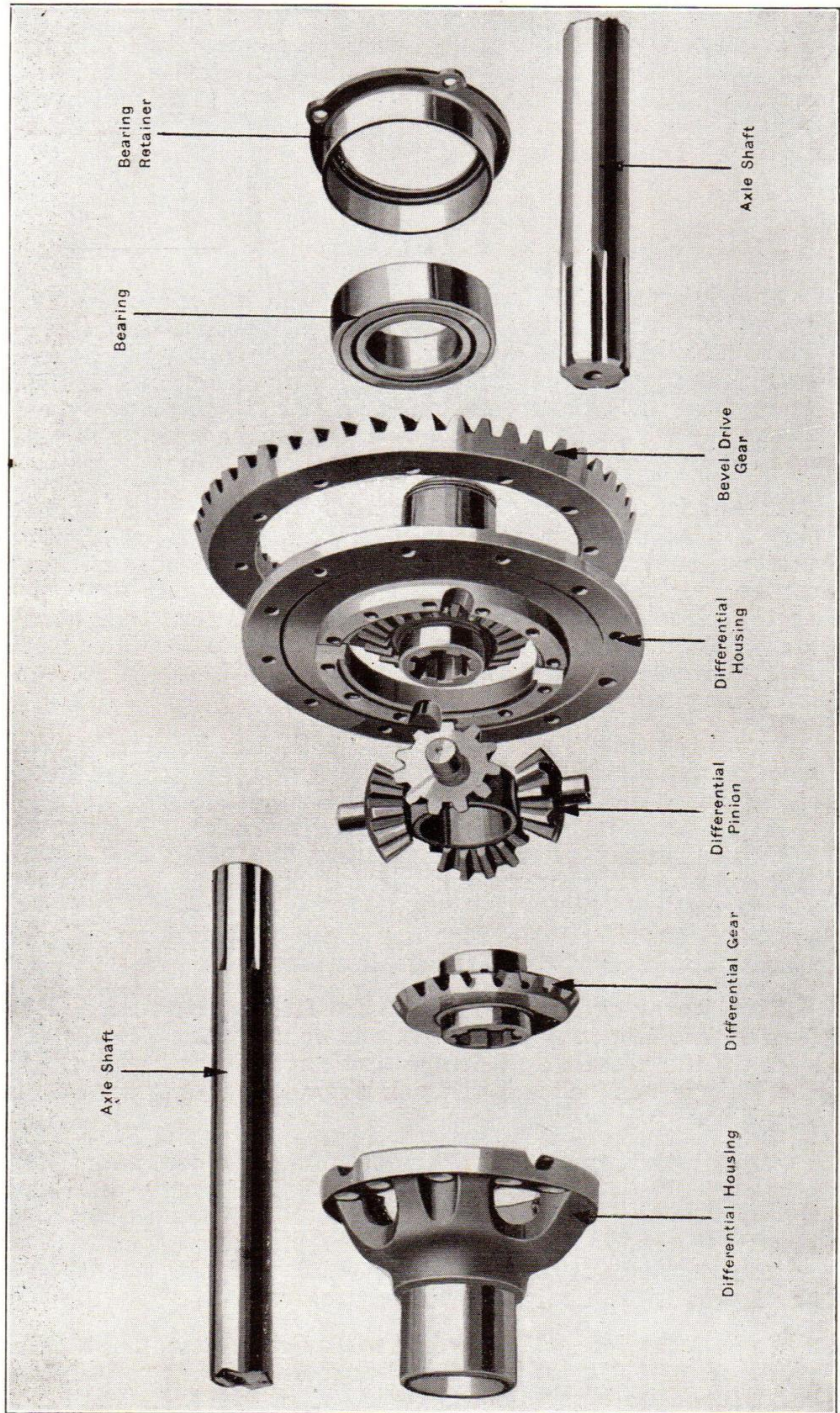


Fig. 24. Differential Parts

To disassemble, first remove the demountable wheel, then the circle of bolts, releasing the permanent wheel hub, and permitting the axle shaft to be withdrawn. The ball bearing can then be removed by taking off the double wheel bearing nut. The brake drum is freed at the same time.

Brakes

The Marmon 34 has two powerful brakes operating against 17-inch brake drums rigidly attached to each rear wheel hub. The heat resisting friction fabric linings have a perfect surface to engage the accurately machined drums. These brakes are easy of adjustment, but are properly set at the factory and should require little adjustment for several thousand miles.

The absence of equalizers makes for simplicity of operation and adjustment. The right foot pedal controlling the external contracting brake bands and the hand brake lever controlling the internal expanding brake bands are connected directly with levers mounted on the rear axle housing. There are two adjustable levers on the brake control shafts, where a positive equalizing adjustment, described later, may easily be made.

Adjustment of Brakes

The adjustment of the brakes, both for holding power and for equalizing, is very simple. After the car has traveled several thousand miles, the brake linings will wear so that it becomes desirable to adjust the brakes in order to get that perfect action so necessary to safety and satisfactory service. But failure of the brakes to hold as securely as desirable—note this fact carefully—may be due to other causes. Until after this is investigated, no adjustments should be made in the brakes themselves.

Dirt, ice or grease may cover the friction surfaces. Before proceeding to adjust the bands or replacing the linings take off the wheels and drums and examine the fabric. If the linings need cleaning, wash them off with gasoline or kerosene.

Testing Brakes

Jack up the rear axle, with the brakes in a complete "off" position. Note the clearance of both the internal and external bands around the drum, which should be uniform and about $1/64$ inch. On the external band, this will extend to within only about three or four inches of the end of the band, where the clearance will be greater.

To test the internal brake band for clearance, use a thin piece of meal, inserting this between the drum and the band from the inner side of the brake support.

For a more elaborate and sure test, both for holding

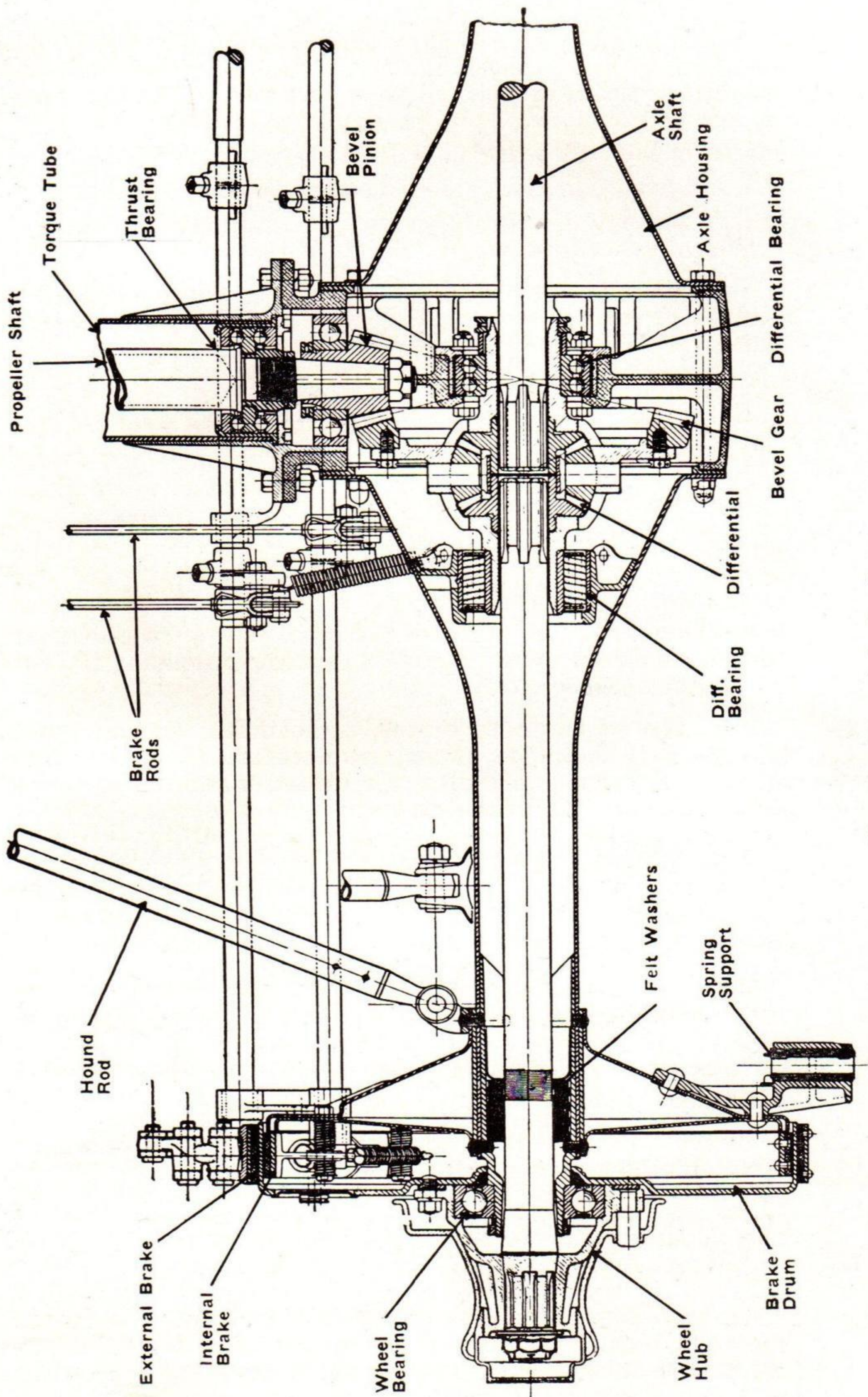


Fig. 25. Rear Axle Section

power and what is equally important, the equal action of the right and left brake bands, proceed as follows:

Block the front wheels securely to prevent the car moving forward or back.

Jack up the rear wheels until entirely clear from floor.

Put all brakes on both sides in complete "off" position.

Start the engine, run it slowly, and transmit the power to the rear wheels, as when driving in low gear.

Engage brakes carefully and lightly and note the action of the wheels, which will show clearly any inequality between the right and left adjustment.

External Brakes

Ordinary Adjustment

The following directions apply to adjustment for wear: To draw the external brake band closer to the drum, turn the nut "F" (Fig. 26) to the right, or clockwise, being sure it is always turned to a place where the groove "G," in its under face, fully engages with the rib on the top of the fitting, thus automatically locking the adjustment.

In order to obtain a uniformly small but sure clearance around the drum, bend the release spring brackets "H" out or in as may be necessary.

Adjustment After Replacement

After the replacement of the brake lining or some part that has been damaged, it may be necessary to make more elaborate adjustments than are required when merely compensating for wear of the lining.

In addition to the preceding directions, a lengthening of the rod adjustment and readjustment of the equalizing levers will be described later.

Internal Brakes

It is necessary in making internal brake adjustments to remove the wheel but not the brake drum. Then remove the inspection hole cover, thus exposing the cam and cam adjustment plates.

For wear of the brake band lining that can be taken up by this method, proceed as follows:

Ordinary Adjustment

Jack up the rear axle. Put all brakes on both sides of the axle in a complete "off" position. Now, if the adjustment is merely to take up for wear of the brake band lining in service, it is only necessary (1) to remove the wheel, (2) remove the inspection hole cover in the drum, (3) loosen screws "C" "C" (Fig. 26), give cam plate "D" "D" one-half turn outward (i. e., to the left or counter clockwise) and tighten screws "C" "C."

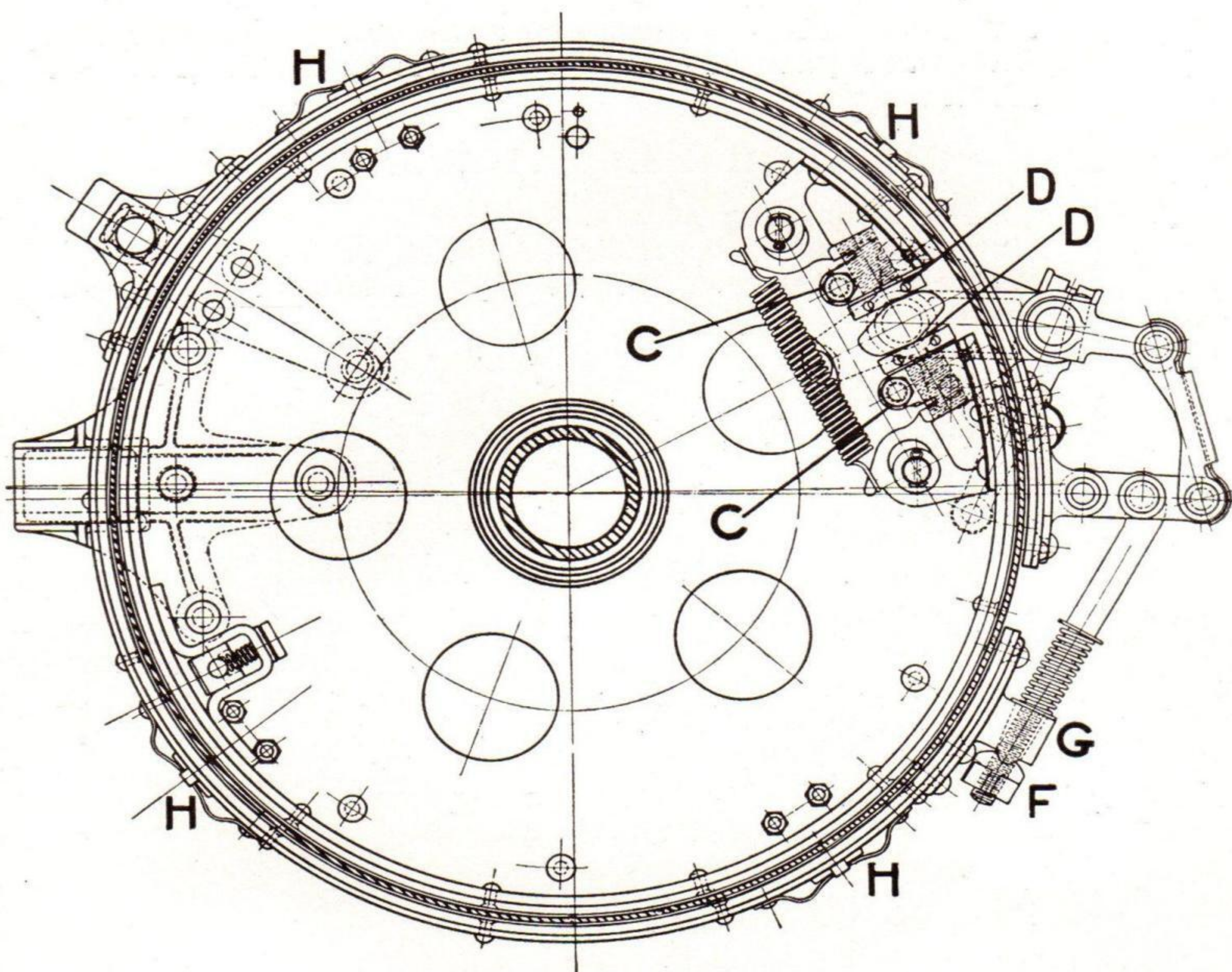


Fig. 26. Brake Assembly

Try the brake in "off" position for bare yet sure clearance, so it will not drag. Try it in "on" position for holding power. If greater clearance is required, partially reverse the adjustments detailed in the preceding paragraph. If still more holding power is desired, and there is some clearance yet to spare in "off" position, repeat the adjustments to a partial extent.

After a replacement of some damaged part it will be necessary, as in the adjustment of the external brakes, to resort to more elaborate adjustments.

Adjustment
After
Replacement

With both wheels off the ground and all brakes on both sides of the car in a complete "off" position, adjust both upper and lower halves of the brake band by loosening the screws "C" "C" (Fig. 26) and turning the plates "D" "D" in or out as required until all parts of the brake band lining clear the drum by about $1/64$ of an inch. Then tighten the screws "C" "C."

To determine whether the brake band lining bears against the drum all around, set the brakes, not too tight, and feel

for any openings between the drum and the brake lining with a thin piece of metal. Do this from the inner side of the drum.

Equalizing Adjustment

After completing the above adjustments, it will be necessary to proceed as described in testing the brakes, in order to determine the relative holding power of the right and left brakes.

Any adjustment necessary to equalize the action may be made by loosening the locking bolts in double levers on the control shafts, after which pull forward on the lever joined to the shaft leading to the brake which does not hold. Then lock the bolt.

Adjusting the Rods

With the driver's foot pedal and hand operating lever in "off" position, adjust the length of the brake rod by turning the wing nut found at the front lever so as to give even clearance all around each brake drum.

CHAPTER IX

Running Gear

THE FRAME and the parts attached to it, except engine, rear system and body, can be conveniently grouped as the "running gear." This includes frame, springs, shock absorbers, wheels, axles and steering gear. Units
Included

The Marmon 34 frame performs several important functions besides simply supporting the weight of the car. It includes in the single unit the side shields, running boards, fender support, motor cradle, steering gear support and tire carrier, besides forming the side sill of the body and the rear seat support.

The wide flange of the side rail, which forms the running board, is hot riveted to the upright. Being of heat treated steel, with a heavy flange, it will be very little distorted, even by a severe collision, and then can readily be straightened. There are no running board or fender supports to be tightened.

Body Springs

All springs are of special alloy steel and a patented construction, having rebound leaves fitted to the reverse side of the main leaf, thus greatly reducing the strain on the whole spring. The front springs are otherwise of the conventional longitudinal semi-elliptic type. The rear springs are dual elliptic, transversely mounted, with their centers fastened with a large single bolt. The right ends are rigidly fastened to the frame and axle, respectively, while the left ends are shackled. The upper spring, being shorter than the lower, prevents periodic vibration.

All spring clips, bolts and shackles should be tightened from time to time. Should one side at the rear be lower than the other, the car may be trued by moving the spring bolt toward the high side. Spring
Clips

On account of the special intercommunicating graphite retainers inside the spring leaves, it will rarely be necessary to graphite the leaves, but when the car is overhauled, the leaves may be separated and graphite inserted.

Deflection of the front springs does not affect the steering, because the arc which centers at the rear of the reach rod is neutralized by the arc which centers at the front of the front spring. This feature of design also eliminates wear on the mechanism.

Shock Absorbers

The Hartford shock absorber, used on the Marmon 34, operates with somewhat the same motion as one's legs in assuming and returning from a squatting position, the "hip" connection being attached to the frame of the car and the "foot" connection to the axle. The effective work of the shock absorber is done at the "knee," where are located a series of discs alternately connected to the upper and lower arms, which are held against each other by a five-pronged spring, held in place by a nut.

The shock absorbers are readily adjustable by varying the tension of this spring. To increase the tension, the nut (which is just above the pointer) should be turned with a wrench to the right (or clockwise); to decrease the tension, the nut should be turned to the left (or counter-clockwise). As the pointer moves with the nut, the increase or decrease, as the case may be, is shown on the dial.

Adjustment of Shock Absorbers

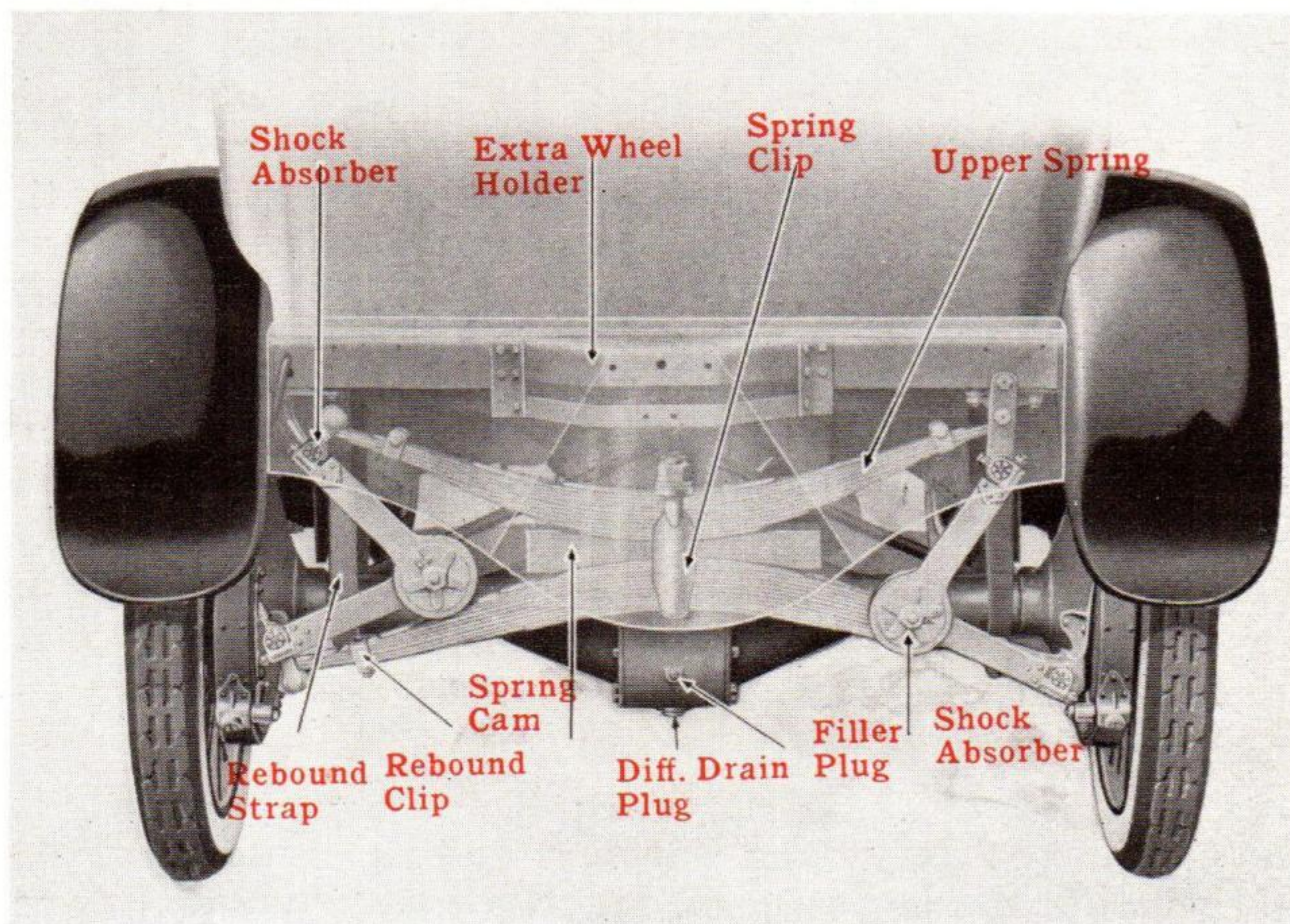


Fig. 27. Spring Suspension

It is, as a rule, desirable to have a greater tension on the two rear shock absorbers than on the two front absorbers, because the rear springs of the car are generally more powerful and active than those on the front. It is most important that the tension of both rear absorbers be identical. This holds true for the two front absorbers as well.

When the shock absorbers have been adjusted they will require no further attention for many thousand miles of actual road work, the five-prong spring compression washer taking up any little wear automatically. In the course of time, when the wear on the friction discs becomes a little greater than the tension of the compensating spring washers, about a quarter of a turn of each of the adjusting nuts will recompense the compensating washers and restore the shock absorbers to their normal efficiency. Thus one, or perhaps two, adjustments, each requiring but a few minutes to make, will serve the average season.

The shock absorber tension may be released entirely for riding over roads such as cobble stones, but may be taken up to their original setting when touring through the country or over roads having deep ruts or ridges.

Wheels

The manner in which wire wheels are mounted and removed is discussed in full in Chapter IV. The use of a little graphite is recommended put on the various contact points from time to time to facilitate removal and avoid rusting.

The principle upon which the wheel clamp nut is used to hold the wheel in place is as follows:

This clamp nut is essentially a ring, threaded internally, to engage the threads on the fixed hub, and, on the outside, tapering to clamp and hold the wheel hub shell in correct rigid position. These nuts are threaded for a loose running fit, by virtue of which looseness there is a slight difference in the diameters, and a consequent greater difference in circumferential length of the threads. Thus, should the nut not be drawn up tight, through either neglect or intention, the wheel supporting the weight of the car would bear upon the nut and hence upon the threaded hub in theoretical line contact. As the wheel and hub turn when the car rolls forward, the nut also turns, but only as it is carried forward

Wheel
Nut

by the line of contact. The threads, wedging together under the pressure of the load, after the manner of a cone clutch, prevent slippage between the threads, and, therefore, force the nut to lag behind the angular travel of the hub parts and, consequently, to screw itself on to the threads when they are properly positioned on the car—that is to say, on the right-hand side of the car the hubs are provided with left-hand threads, while on the left-hand side of the car the hubs have right-hand threads.

Automatic Locking

On the other hand, when the nuts are once in place, there can be no creeping action, as there is no difference in diameter or peripheral length, and they therefore clamp together in the conical end of the hub. Experience and repeated trial have demonstrated that if a nut is inadvertently left loose, the rolling of the car for only a short distance will suffice to tighten it. On the other hand, when the nut is brought home, and this differential creeping action ceases, no amount of backing up would suffice to loosen it.

As an additional precaution, a latch lock is used, which permits the clamp nut to tighten but not to loosen, except when the latch is released by fitting the large box wrench in place. It is, of course, important to have the pins, holes, taper contacts and threads clean, smooth, well lubricated and unpainted whenever they are fit together.

The wheel nut wrench (see page 13) has a slot in one face which should be placed over the latch *only after tightening the nut* in order to make sure that the latch engages in the lock. When using the wrench to screw the nut either on or off, the latch should come against one of the unslotted faces of the wrench.

Wheel Hubs

Rear wheel hub construction is explained in Chapter IX, and front wheel hubs below.

Front Axle

The front axle is a steel forging of I beam section, having a large vertical eye at each end. Into this the swivel axle is fitted.

The swivel axle, or spindle, is shaped like an inverted “L,” and when assembled the lower projection turns in a solid, circular bronze bushing which has been reamed to fit. A nut and cotter pin hold the spindle tightly in the bushing,

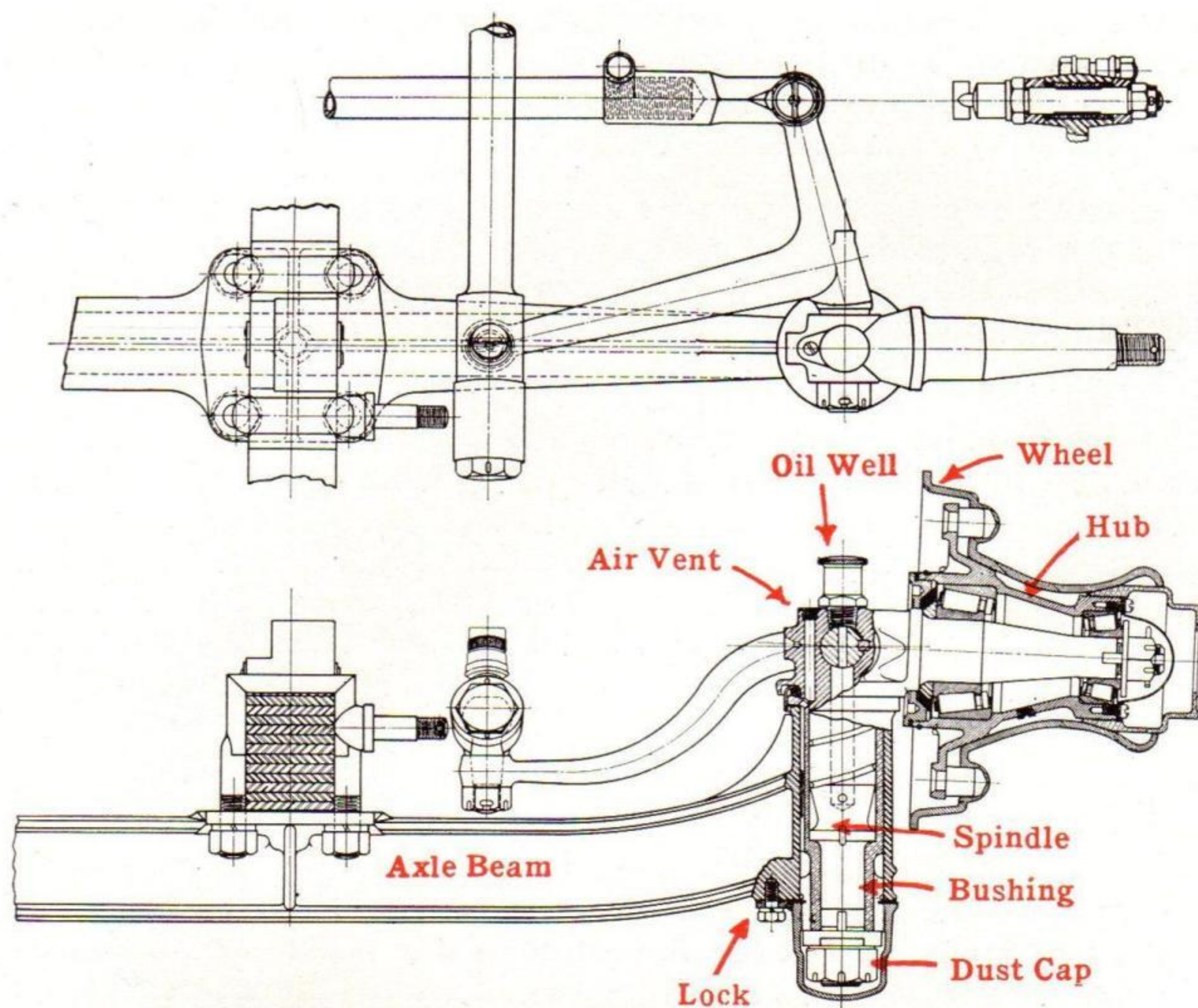


Fig. 29. Front Axle Hub and Spindle

while a large cup shape nut on the bottom of the bushing bolts the assembly in the axle beam, at the same time forming an oil reservoir. The crack between the spindle and the bushing is closed at the top by a dust cap which is threaded to the bushing, and also by a projecting shoulder on the spindle. Ample lubrication has been provided by means of an oil cup on the top of the spindle, which connects with an enclosed reservoir. This cup should be filled approximately every one thousand miles. This design is stronger than the ordinary type of forged axle as well as being far more effective in producing easy riding and longer wear. An air vent is provided from which the plug must be removed when filling oil reservoir.

Front Wheel Hub

The hub upon which the front wheel rides is supported by two taper roller bearings, at either end of the horizontal arm of the L-shaped swivel. A felt packing on the inner side, and a steel cap on the outer provides a grease-tight housing for these bearings. They should be cleaned and lubricated when the car is overhauled.

To remove the wheel hub, first remove the wheel, then

Removal

remove lock ring and loosen the felt washer retainer on the inner side. Then, by removing small screws, take off the bearing nut cap. The main bearing cotter, nut and tongued washer may then be removed, permitting the hub to slide off.

Before replacing, see that bearings are thoroughly clean and packed with fresh, good grease. In getting the bearing adjustments, be sure the felt washer retainer is loose; then tighten when through with the adjustment.

Turn the nut until it binds, revolving the hub to take up the back lash. Then relieve one-fourth turn to give the bearing proper clearance. At this point it would be well to mount the wheel and note that it turns free, and that there is the least perceptible amount of shake when alternately pushing and pulling on the tires at the top and bottom of the wheel. Then do not fail to see that the main nut cotter pin and grease cap are in place, and the felt washer retainer screwed in place and held with its lock ring.

Reach Rod

An arm on the left front wheel swivel carries a ball to which is fastened the front socket of the steering reach rod. The rear reach rod socket is fastened to the crank of the steering gear. Sockets are adjustable and should be kept free, but not too loose.

Thus the reach rod simply transmits to this front wheel swivel the forward and rearward motion of the steering arm when the steering wheel is turned. Similarly the steering cross rod, connecting the two front wheel swivels, carries this motion from the left to the right wheel. These four ball and socket joints are the only places on the car which carry grease cups, and these are easily reached and should be turned up regularly. The steering mechanism is, of course, a vital part of the car, and common sense dictates that it have frequent inspection and the recommended attention.

The Steering Column

The steering column contains five concentric tubes, with respective connections for the four controls at the wheel. Through the center runs the horn wire, surrounded in order by tubes for the throttle, spark, friction ring (stationary), steering wheel and outer shell. On the lower end of the steering shaft is a worm, provided with thrust bearings, which turns the worm gear operating the steering crank shaft. If end play develops in steering shaft, it may be adjusted.

The steering gear may readily be removed from the frame and disassembled for cleaning and lubricating, but

if no change in its operation is detected, refilling of the oil chamber every 1,000 to 3,000 miles is the only necessary attention.

The steering gear adjustment is properly made at the factory, but when enough wear has taken place to necessitate taking up some of the lost motion, this may be done by removing one or two of the shims under the plate at the bottom of the steering gear. To do this disconnect the spark and throttle control arms at the bottom of the gear and slide them off. Then remove the nut which is around the column and which fits into the bottom plate. Next, remove the four capscrews holding this plate and it may be taken off without difficulty.

CHAPTER X

Passenger Accommodation

Cowl
Section

THE TOURING car body is made in three independent sections, each bolted directly to the frame. Any unit may be removed from the car without disturbing the others, by simply loosening these bolts.

The front (cowl) section contains the gasoline tank and dash equipment, and carries also the windshield with front top support. The gasoline tank is firmly held in place with padded wooden strips, but may be readily removed if desired.

Access to the instruments may be had by slipping out the agasote board below the gasoline tank. The front board (under the hood) may also be removed if desired.

Windshield
Supports

The windshield support extends to the base of the body section, rigidly fastened to the wooden frame. The ring

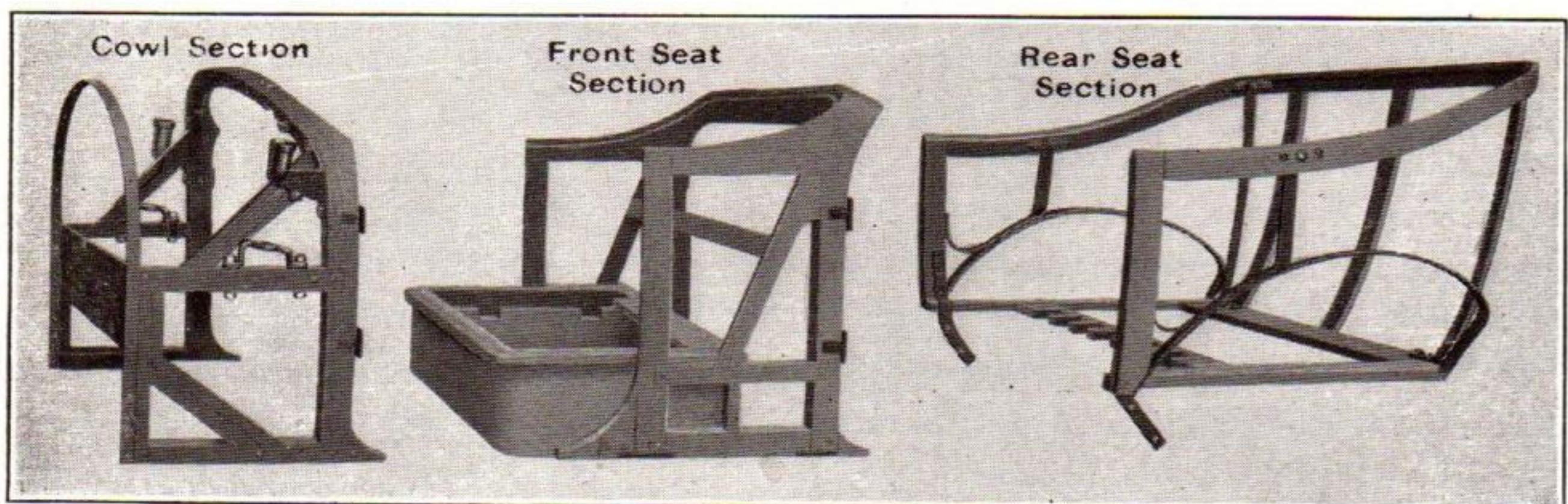


Fig. 31. Body Sections

nut at the top may be tightened if play develops, and the standards may also be tightened after removing the front compartment upholstery.

The body bolts to the frame may also require taking up after a few thousand miles' running.

The central body section includes the front seats. It will require no attention except, perhaps, occasional tightening of frame bolts.

Front
Seat
Section

The upholstered seat back may be removed if desired, as follows: Remove the screws from the several screw eyes at the base of the seat back, and lift the upholstery

straight up, off the screw hooks which hold it in place at the top.

The rear (tonneau) section, besides accommodating the rear seat, supports the top. The rear cushion rests directly on the pick-up of the frame, and the steel cross member at that point forms the heel board of the rear seat.

Tonneau
Section

The windshield positions are maintained by small screws which fit into teeth in the trunnions. Therefore no tools need be used in tightening these thumb screws. Thus the maintenance of the position of the shield is not dependent upon the force used in turning these screws. Care should be taken to move both sides of the shield simultaneously.

Windshield

Top

The top is of pantasote, heavy grade, and will last well if care is taken to avoid injury through chafing when the top is lowered back. It requires no dressing, but may be brightened up occasionally with a little gasoline. To lower and raise the top proceed as follows:

1. Take top rest irons from tool equipment and screw into the rear corner of the body in place of the nicked plug.
2. Loosen the side curtain cover in the visor of the top, and turn the windshield clamp lever to a vertical position.
3. By striking up on the visor, free the windshield support. Loosen the flaps over the front.
4. Pull down on the joint of the front bow, and draw the front section of the top back, fitting the eye and pin of adjacent bows together.
5. Let the whole top back into the rests, being careful to tuck in the folds in such a way as not to be chafed or stretched.
6. Clamp the top rest in place and fit the top boot.

Lowering
and
Raising
the Top

Side curtains for the seven-passenger cars will be found in the visor board and in the envelope at the rear of the top, so divided as to be easily arranged for installation. The curtains for the four-passenger cars will be found in the envelope in the rear of the top. The installation and removal of these curtains is but a simple matter and one making it requires little or no special instruction other than the key to how to operate the "Lift the Dot" fastener used.

This fastener is an ingenious device which is operated in exactly the manner indicated by its name. It contains a lock which fastens to the stud on which the fastener sets when holding the curtains in place. To unlock the fastener

it is only necessary to lift up the fastener, using care to see that the "lift" is applied at the point on the fastener indicated by a dot. Applying pressure at this point releases the lock, but a pull applied at any other place only tightens the grip of the fastener, or puts an undue strain against it.

CHAPTER XI

Unusual Conditions

WHEN the driver has become accustomed to the characteristics of his car, any irregularities of operation will become evident immediately they develop. The senses of sight, hearing, feeling and even smelling come into play in detecting faults. While we can not hope to anticipate all possible causes of trouble, perhaps some general suggestions for emergencies may be of value.

First, get all the evidence. By trying the various controls, speeds, operating conditions, etc., localize the source of the trouble as far as possible. For instance, a knocking noise which disappears when the clutch is depressed indicates that the noise is not in the engine proper.

Second, examine all the mechanism which seems to be affected as far as possible without disassembling.

Third, refer to the description of that mechanism in this book.

Fourth, after you know the conditions, the solution will usually suggest itself. But do not act hastily. Never make the common mistake of getting yourself into a big trouble trying to get out of a little one. Do not try something "hit or miss," and never try changing an adjustment without making sure to get it back just where it was if unsuccessful.

Fifth, enlist the assistance of a competent mechanic whenever possible.

We give the following detailed instructions to be followed by the operator only in case of an emergency on the road. You will gain in the long run by not attempting repairs yourself, except in emergencies. In case of trouble get in touch with a competent mechanic, a Marmon dealer if available, and write us.

Troubles and Remedies

The meter will not indicate a "Charge" when gas motor is running at speeds corresponding to car speeds of less than ten to twelve miles per hour. Failure of the meter to indicate at higher speeds, however, shows that there are loose or open connections between the generator and the battery. The connections at the motor and storage battery should be made clean and tight.

The Gen-
erator

(a) If the motor does not indicate when the gas motor is running at speeds corresponding to car speeds of twelve or more miles per hour, the trouble should be localized as follows:

Remove the disconnecting plug from the generator, and with a single contact head lamp bulb, make contact between one of the brass segments showing on the face of the plug and the central contact of the bulb. At the same time make contact between the metal stem of the bulb and the frame or other metal parts of the car. If the circuit between the generator and battery is not broken, the lamp bulb will light and the meter will show a "Discharge" by indicating to the left of the central zero. If the bulb lights and the meter does not indicate, the fault is with the meter.

Failure of the bulb to light shows that there are loose or open connections between the generator and the battery. The wiring should be carefully inspected and the defects remedied.

(b) If the trouble should be traced to the generator, first see that the disconnecting plug is in one or the other of its operating positions; second, see that its contact faces are clean and bright and that the spring plungers in the socket are making good contact with the contact faces at the disconnect plug; third, that the three contact pins, which go into the three holes on the top of the generator, are making good contact in their respective receptacles; and lastly, after loosening the window strap, which covers the brush windows, press the brushes down on the commutator, and with the engine running, see that they are making good contact and do not bind in their respective brush boxes. Do not put oil or any other lubricant on the brushes or the commutator.

(c) As this generator supplies a large amount of current to a low or discharged battery, and a small amount of current to a fully charged battery, a heavy charging current maintained day after day denotes that there is a steady leakage of current due to defects in the wiring, short-circuited battery cells, lights left on all night, or a defect in the combined lighting and ignition switch. It may also indicate that the level of the electrolyte is low in the battery. As before stated, distilled water should be added so that the plates are always submerged.

The Starting Motor

(d) If the starting motor fails to start when the starting pedal is depressed, the trouble may be due to loose or open connections at the battery, the starting switch, the motor, or a fully discharged battery. All connections should be clean, tight, and should make good electrical contact. Remove the terminals of the battery and see that these terminals and the taper holes into which they fit are not

corroded. All dirt and corrosion should be removed and the cable terminals greased with vaseline. After the terminals have been replaced they should be covered with friction tape.

(e) The starter will not operate if the car has been left idle for a long time, permitting the battery to become discharged. A discharged battery can be indicated by low gravity or lights burning dim.

(g) If brushes are not bearing on the commutator. Remove the brush window cover on the starting motor and see that the brushes are pressing on the commutator and that they do not bind in their respective boxes. Do not put oil or any other lubricant on the commutator or brushes.

(h) Motor inoperative. If the motor is inoperative, it should be removed and returned to the Bijur Factory or the nearest Bijur Service Station for attention. Before removing the motor, the cable connected to the positive terminal of the battery should be disconnected in order to prevent grounding of this negative cable should it accidentally touch the frame, or any metal parts of the car.

If the car is to be operated with the motor removed, this cable should be again connected to the battery and cable marked (Ground No. 4) should be bolted to the frame of the car. The exposed terminal connector of the negative cable of the starting motor should be taped up to prevent the short-circuiting of battery.

After making above connection, generator equipment may be operated independently of the starting equipment.

Failure of individual lights to burn may be due to burnt out bulbs, bulbs not making good contact in their sockets, open circuits in the wiring, or a blown fuse in the lighting circuit. **Lamps Fail to Burn**

Burnt out bulbs should be replaced. If the bulbs are not burned out, see that they make good contact in their sockets,

Examine the connections at the combined lighting and ignition switch and fuse block and Ground Connection No. 4 to see that all are clean and tight and making good electrical contact. If the lights do not burn because the fuses are blown examine the circuits for grounds or short-circuits. If possible, do not replace the blown fuse with a new one until the cause of the trouble has been located and remedied.

If it is necessary to use the car before the trouble can be located, the circuit having the trouble should be left open by leaving out the fuse. Never replace a blown fuse with anything but another similar fuse.

In making extensive repairs to the wiring, the positive battery cable should be disconnected from the battery. (This positive cable is the one leading from the battery direct to the positive terminal of the starting motor.)

General Should any trouble arise with the lighting switch, ignition system, storage battery or electric horn, the question should be taken up with the manufacturers of these parts, or with the Service Department of the Nordyke & Marmon Company.

The warranty on the generator, starting switch, starting motor and meter ceases if any repairs are made or attempted by unauthorized parties. The warranty on the regulator box ceases if any of the seals are broken. Should any trouble arise with Bijur apparatus, do not make attempt to repair, but get into immediate touch with the Bijur Motor Lighting Co., of Hoboken, New Jersey, or the nearest Bijur Service Station.

**If Starter
Turns Engine
But Engine
Will Not Fire**

(a) Do not continue to "churn," but check over motor conditions. See that—

Ignition switch is not on at "O" position or the key turned.

Throttle lever is open about 1½ inches.

Air choke and carburetor adjustment buttons are out (in cool or cold weather).

There is gasoline in the carburetor.

Gasoline line cock is open.

(b) With a very cold motor it may take some time to get an ignitable mixture into the cylinders, but if the air choke valve almost entirely closes the carburetor intake, a strong suction will draw gasoline into cylinders effectively. In extremely cold weather a prompt start will follow wrapping a hot water-soaked cloth about the intake manifold.

(c) In moderate weather continued churning with the air choke closed will cause cylinders to flood. To clear motor, open wide the air choke and throttle levers. If still unable to get an explosion, do not continue to apply starter, but look for the trouble.

(d) See that carburetor is getting its supply of pure gasoline.

Lift the float needle and note whether the carburetor floods.

Drain the carburetor float chamber and note whether it refills.

If you can not get gasoline to flow, water may be frozen or line may be choked with sediment. Clean the screen in the carburetor float base.

If gasoline supply seems all right, turn to ignition.

(e) See whether you get a spark at spark plugs when cranking by placing a screw-driver or other metal from metallic connection on top of plug to metal on motor. If not—

Disconnect magneto ground switch wire. If it then fires, this wire is grounded somewhere, causing the trouble.

If not—

Remove and inspect distributor.

See that breaker is working.

(f) If you get a good spark, examine the spark plugs. They should have a gap of .032 inch (eight thicknesses of this paper).

See that they are free from soot.

See that porcelain is not cracked.

(a) Before attempting any readjustment of the carburetor, it should first be made certain that the trouble is due to the carburetor, or is of such a nature that it can be remedied by carburetor adjustment.

**If Motor
Does Not
Fire Regu-
larly**

(b) Make sure that there are no air leaks in manifold system; that the ignition system is in good order (if the cylinders "cut out" or miss singly and without apparent connection the trouble is probably due to ignition, but if the trouble seems common to all the cylinders, it may lie in the carburetor system); that spark plugs are clean, and have proper gap; that valves are not holding open, and that all cylinders have full compression; that there is a continuous supply of gasoline to float chamber, without water in the line; that gasoline is of good quality.

(c) As long as there is gasoline at the normal level on the float chamber, failure of the carburetor to function can only be due to—

Water in carburetor—drain carburetor and race engine to clear out any water in float chamber bowl.

Dirt clogging up jets, or interfering with action of air valve, so that it does not come back to seat promptly on idle. These troubles are very rare, and require that the carburetor should be taken to a Marmon dealer or a Stromberg service station for inspection and cleaning.

(d) If gasoline does not reach float chamber, inspect and clean screen, inside large hexagonal nut coupling below float chamber.

(e) If float chamber floods, this is probably due to particles of dirt on float needle seat; drain cock below carburetor; remove hexagonal nut above float chamber and flush carburetor by raising and lowering needle with fingers; rotate needle several turns on seat and seat it by tapping

gently with wood screw-driver handle. If float does not rise readily as gasoline flows in after carburetor has been drained, it may be punctured and partially filled with gasoline, in which case a new one must be obtained.

(f) If you can operate the car it is better to wait and have a competent mechanic go over it at the first opportunity.

(g) If a Marmon dealer is not available, write us, answering the following questions:

Does the motor miss at all speeds alike? Give details.

Have you found that the missing is in any certain cylinder or cylinders? State which.

Is trouble the same at all times, or irregular?

Have you examined valves and noted their action?

(a) See that you have plenty of water.

**If Motor
Overheats**

(b) See that you have plenty of oil and that it is circulating.

(c) See that all water connections are free and water is circulating properly.

(d) See that fan is turning. Fan belt may be slipping.

(e) Test magneto timing. Full retarded spark should take place one inch before dead center. See that spark lever connection is operative.

(f) See that carburetor adjustment is correct.

**If Motor
Fires Prop-
erly But Car
Has Little
Power**

(a) Emergency brake lever may be set.

(b) Brakes may be dragging. See if they are hot.

(c) Lubrication may be exhausted.

(d) Note whether motor is overheating.

**Irregularities
in Oiling
System**

Form the habit of noticing the dash pressure gauge frequently. Failure to register or sudden excessive pressure are danger signals. Make sure you have sufficient oil. To determine whether the gauge is damaged, disconnect the oil gauge pipe and note whether oil flows freely. If so, the difficulty is with the gauge, which may be attended to later. Sudden high gauge pressure, except when starting in cold weather, is a sign of a stoppage in the line, and the system should be cleaned. Be sure dirty oil has not obstructed the screen.

How to Order Parts

PLACE ORDERS THROUGH MARMON DEALERS

To avoid unnecessary delay and useless correspondence parts for repairs should, where possible, be ordered from the dealer from whom the car was purchased or from nearest Marmon dealer, who is generally in a position to know what is desired and how to order it. Our branches and dealers carry stocks of parts.

With the large number of cars in use it is impractical for us to deal direct with all Marmon owners. Where conditions are such as, in our judgment, to warrant it, we will fill orders for parts at prices listed in our Parts Price List, providing remittance accompanies the order.

Send New York or Chicago draft or money order. Do not use local checks. All prices are f. o. b. factory. Indianapolis, Ind. If no remittance is enclosed, we will refuse order or send C. O. D. at our discretion. If necessary to order direct, note carefully the points below.

Ordering by Mail or Telephone

GIVE THE CAR NUMBER. This number will be found upon the name plate on the dash, under the instrument board. It is also stamped on the upper flange of the right frame channel under the front floor board. This number must always be given with any order.

GIVE NUMBERS AND NAME OF PARTS. If part can not be identified, describe the part and its location in the car, enclosing sketch or returning part for sample if necessary. It is always best to give the part numbers whenever possible.

RIGHT AND LEFT. Always consider the right side of the car at the right when sitting in car facing forward.

PAINTING. Some parts are kept in stock painted standard, but most parts requiring painting will have to be painted to order, taking several days' time. If you want parts painted always so state, giving colors and striping. (We reserve the right to ship parts unpainted if not ordered painted.)

GIVE SHIPPING INSTRUCTIONS. State whether we shall ship by Mail, Parcel Post, Express or Freight. Write your name and address carefully and plainly. (If we are not advised we shall use our judgment at purchaser's risk.)

Ordering by Telegram or Cable

Observe all the points above for ordering by mail. The following classes of service are now in use by the Western Union Telegraph Co., and corresponding service for straight messages and night letters applies to the Postal Telegraph Co.:

TELEGRAMS (called "Black"): Full rate, quick service. Ten words is the same rate as 50-word night letter. Less than 18 words is cheaper and quicker than a 50-word day letter.

NIGHT TELEGRAMS (called "Red"): Accepted up to 2:00 a. m. at reduced rates to be sent during the night and delivered not earlier than morning of the next ensuing business day.

NIGHT LETTERS: Accepted up to 2:00 a. m. for delivery on the morning of the next ensuing business day. The standard rate for a 10-word telegram is charged for the transmission of 50 words or less, and one-fifth of such rate is charged for each additional ten words or less. Must be written in plain English.

DAY LETTER, WESTERN UNION ONLY (called "Blue"). A deferred day service. One and one-half times the standard night letter rate for the transmission of 50 words or less, and one-fifth of the initial rate for each additional 10 words or less. Subordinate to the priority of transmission and delivery of regular telegrams. Must be written in plain English.

ALWAYS MAIL CONFIRMATIONS OF TELEGRAMS AS SOON AS SENT.

Returning Parts

If parts are returned for any purpose, follow carefully these points:
Put **Your** name and address prominently on outside of package as well as ours.

PACK CAREFULLY TO PREVENT DAMAGE EN ROUTE

Always prepay transportation charges. Parts will not be accepted otherwise.

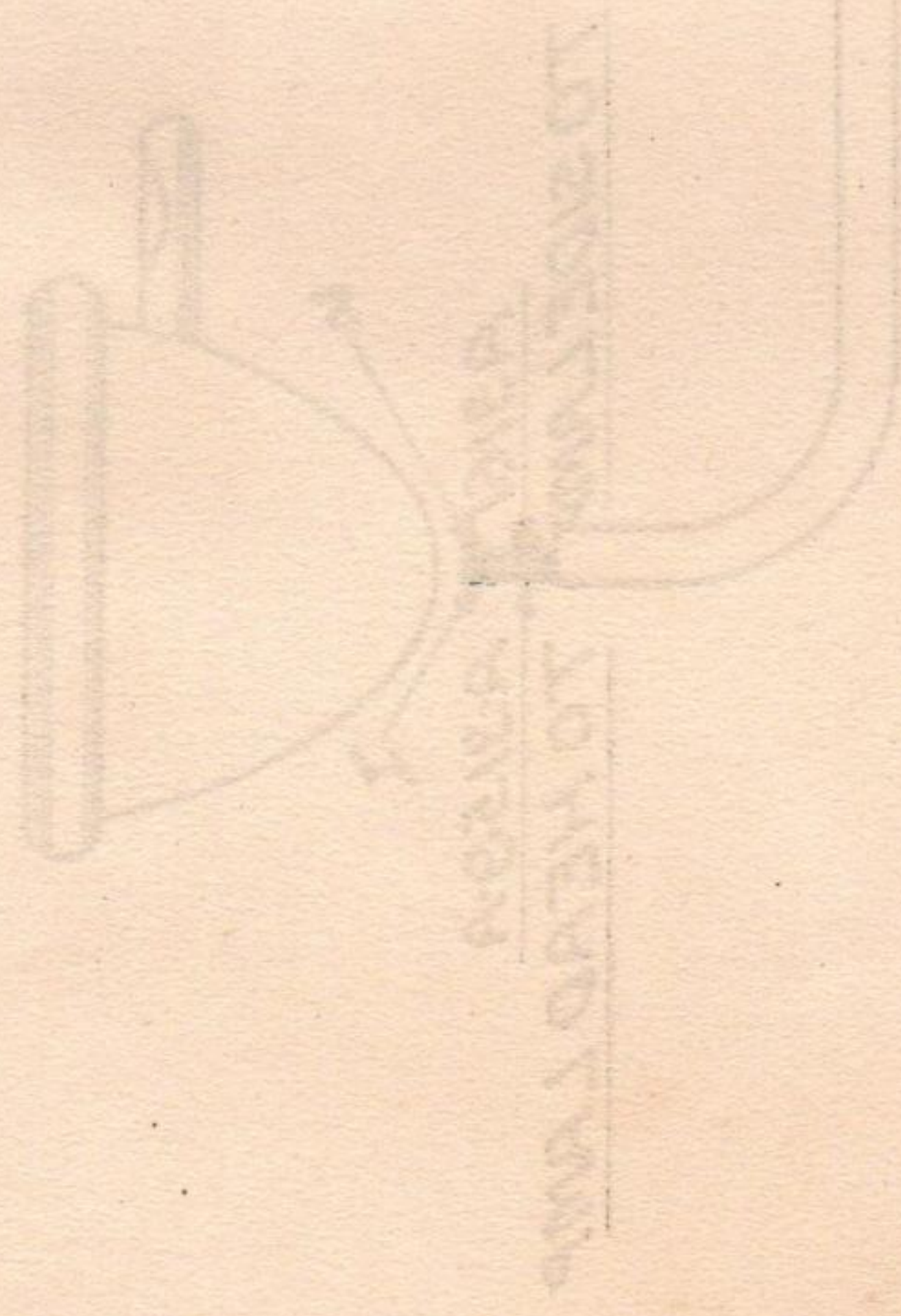
Tag each article carefully with information below, using regular form of tag furnished by the factory and see that it is properly filled out in detail.

Then **WRITE US** stating why part is returned, giving circumstances in detail, also all of the above information. You can not give too much detailed information as to why you are returning parts. Also state how parts are shipped and enclose transportation company's receipt.

NOTE CAREFULLY

Goods correctly shipped on bona fide orders can not be exchanged or credited for, unless special circumstances warrant. Therefore, if it is desired to return any goods for credit or exchange, write for permission to do so before making shipment.

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SMITHSONIAN INSTITUTION
WASHINGTON, D.C.

