INSTRUCTION BOOK

HUDSON SIX-40

1915

Fourth Editon

HUDSON MOTOR CAR CO.

DETROIT MICHAGAN

Instruction Book

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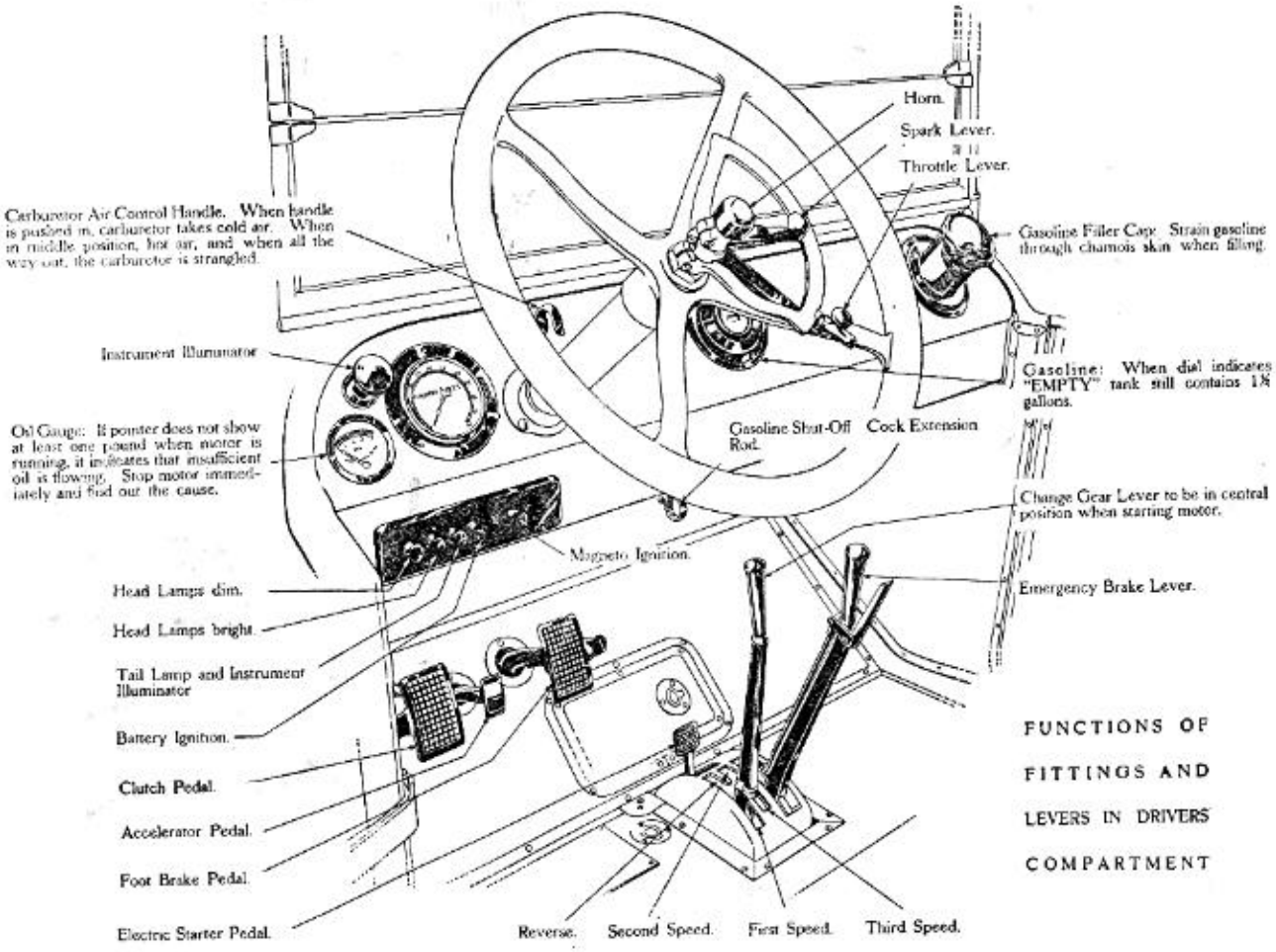
INDEX



FUNCTIONS OF FITTINGS AND LEVERS IN DRIVERS COMPARTMENT

Fig. 1

How To Start Motor

Follow Instructions by Paragraphs

See Fig. 1.

1. Pull out "M" button on Ignition Switch.

2. Place spark lever about halfway up quadrant, and throttle lever all the way down.

3. To stop the motor, both "M" and "B" buttons must be pushed in.

There are three positions of the carburetor air control operated by the small pull rod which terminates in a handle on the cowl apron. When this handle is pulled half way out, hot air is drawn from the exhaust manifold through the carburetor.

This position is most suitable for cold weather as warm air helps volatilize the fuel.When the handle is pushed all the way in, cold air is taken in through the carburetor, and when the handle is pulled out as far as it will go, the control is in the "strangled" position. In this instance, the air supplied to the carburetor is materially decreased and suction from the motor increases the quantity of gasoline drawn into the cylinders.

In general, this handle should be pushed in, in warm weather and pulled half way out in cold weather. In starting, especially in cold weather, it may be pulled clear out to assist in priming the cylinders, but the hand throttle must be opened about one-third when cranking. By pulling out the handle, thus applying the strangler before turning off the ignition, the cylinders will be supplied with a rich mixture of gas which will materially assist in starting at a future time. There are various other positions between these three indicated, which may be used for different weather conditions, the correct point being determined more or less by experimenting with the car in operation.

If the motor fails to start when the electric cranking device has been in operation for 30 seconds, with the strangler closed, and with the spark and throttle levers in the correct position, discontinue cranking until you have made sure of the cause of the failure to start. This will save your storage battery.

A reserve Ignition System, consisting of A SET OF DRY BATTERIES, is furnished, and this may be used in case the storage battery is disabled by accident or other cause. In this event, the dry cells are used for Ignition, tiut it is good practice to start on the dry cells occasionally because this procedure will test the dry batteries and assure you that they are in proper condition for an emergency.

NOTE—DO NOT KEEP THE MOTOR RACING WHEN CAR IS NOT IN MOTION OR NOT PULLING. THIS SHORTENS ITS LIFE MATERIALLY.

DO NOT ATTEMPT TO START MOTOR WITH CAR IN ANY GEAR. THROW CONTROL LEVER INTO NEUTRAL POSITION.

Notes On Oiling

Every week or so the car should be looked over thoroughly and oil applied through the various oil holes provided for the purpose; also such moving parts as rod ends, pins, devises, etc., should be well lubricated.

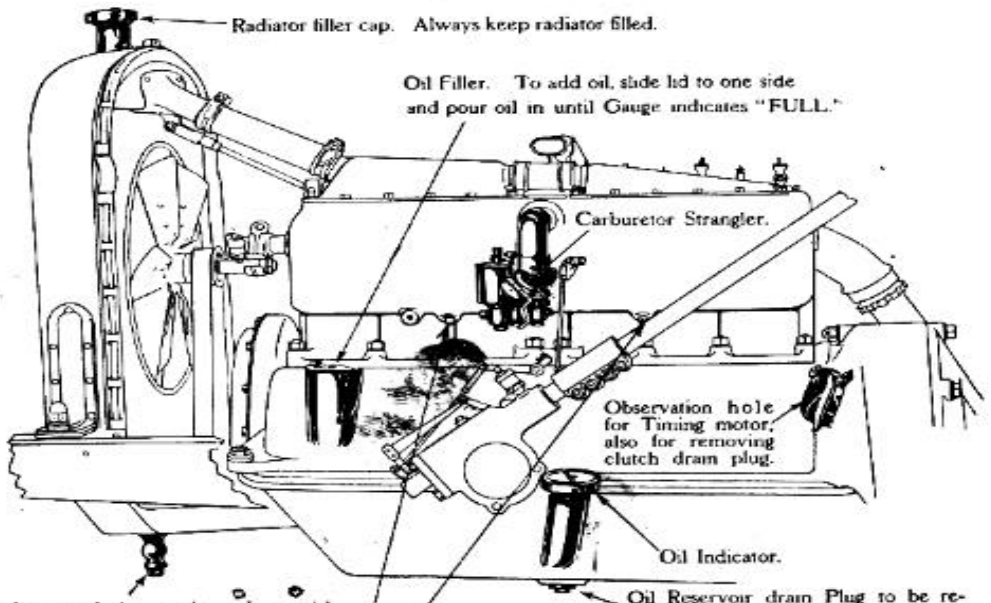
USE GOOD MOTOR OIL—Test all your lubricants with blue litmus paper to be sure no acids are present. It is difficult for us to recommend any particular grade of motor oil, as the same grade does not necessarily give the same results in different parts of the country, due partly to climatic conditions. We also find that some motor oils (sold under trade names), vary considerably in different parts of the country perhaps due to the fact that the origin of the crude oil from which they are made is not necessarily always the same.

Attempted economy by the purchase of inferior or cheap grades of lubricating oil always results in carbonized

Preparing the Car for Running

When preparing the car for running, the most important items to be looked after are: Oil, Water and Gasoline.

Fig. 2



Valve Tappet Adjustment

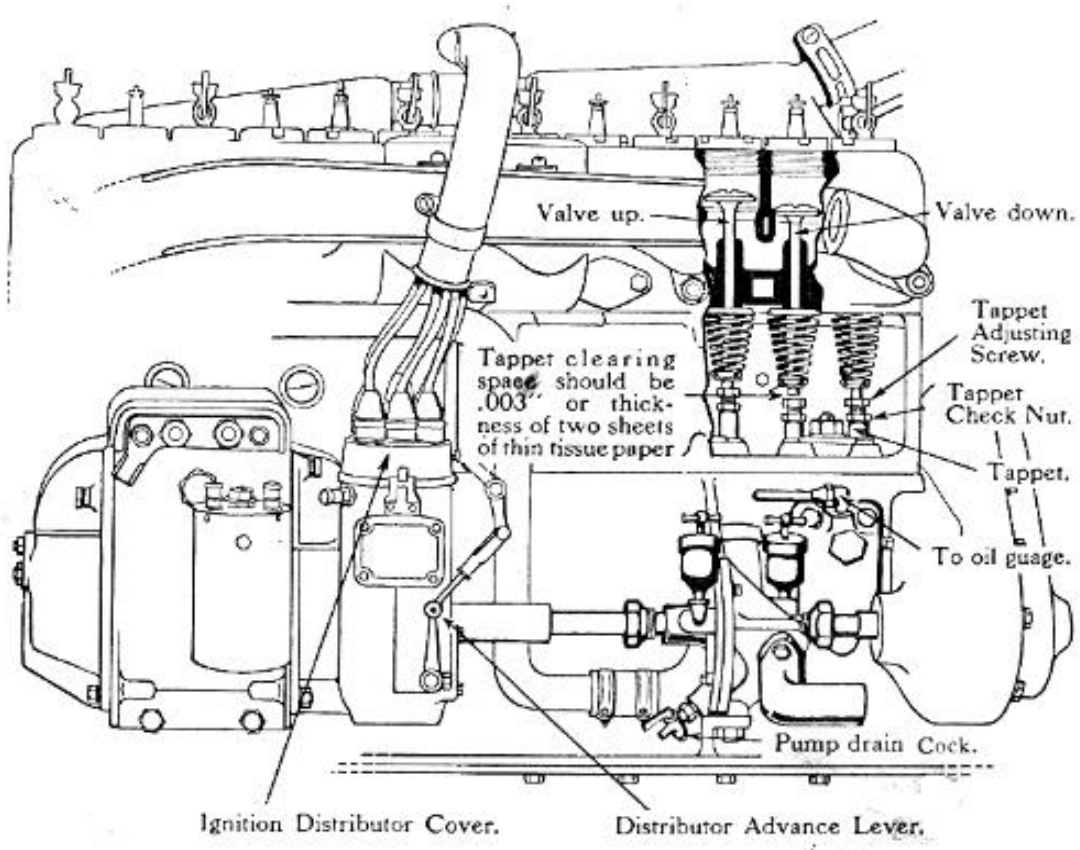


Fig. 3

oil always results in carbonized motors, burned-out bearings, overheating and loss of power, or other serious troubles. Like every other commodity, the payment of a fair price secures the best article.

In winter, a thinner grade of oil may be used than in summer. A tendency to overheat, which is indicated by a rapid evaporation of the water from the radiator, may often be eliminated by using a medium grade, rather than a thin grade, of motor oil of good quality.

Diagnosis of Common Trouble

IF MOTOR STOPS.

1. Out of gasoline.
2. Disconnected spark plug cables or other loose electrical connections.
3. Dirty contact points in the distributor or accumulation of oil or dirt on the underside of the distributor cover.
4. Out of motor oil, indicated usually by knocking in the motor, followed by an abrupt stop. If this occurs, do not attempt to use either the electric starter or hand crank until the motor has been allowed to cool off. Kerosene should be applied to the pet cocks while the motor is still warm. This usually is a serious matter, and the motor should have the attention of a good mechanic before attempting to put the car into service again.
5. Cannot crank motor. Frozen water pump. Seized motor bearings, due to lack of oil. Transmission engaged.

REASONS FOR MOTOR MISSING.

1. Short circuited spark plug. Points not adjusted to .025".
2. Partially short circuited or broken secondary terminals.
3. Poor contact between the various ends and clips of wiring.
4. Loss of compression in one or more cylinders. Valves may be stuck. Valves may need regrinding or reseating. Valve springs may be weak or broken.
5. Water in gasoline—the motor runs spasmodically. (This is the most difficult to separate from other causes, and should be one of the last things looked for.)
6. When motor misses, you may locate the missing cylinder by opening the priming cock on top of the cylinders, one at a time. After replacing with a new one the spark plug in the missing cylinder, or with one from another cylinder, you will have to determine whether missing is caused by defective plugs or wires leading to same. If the trouble is still continuing, turn over the motor slowly by hand in an endeavor to detect a defect in the compression in the different cylinders.
7. If missing is not due to any of the items mentioned above, there may be an air leak between the carburetor and intake manifold, or between the manifold and cylinder block.
8. If any wires in the entire electrical system have been tampered with at any time, refer to the wiring diagram in this Instruction Book. Page 40.

IF MOTOR LACKS POWER.

The motor will run but not pull on grades or under heavy loads.

1. Loss of compression due to leaky valves.
2. Too rich a mixture through some defect in carburetor, probably flooding due to grit under float valve.
3. Late Ignition. (See directions for timing of the distributor, page 42, retarded spark.)
4. Lack of water in radiator or oil in motor causing the motor to run hot.
5. Lack of gasoline. If lack of gasoline through stoppage of pipe, the motor will spit back through carburetor when throttle is opened.
6. Poor grade of gasoline, in cold weather, causing too weak a mixture.
7. Dragging brakes. See that the car can be rolled by hand easily or that it will coast down hill when clutch is released and not slow down. Feel the brake drum with your hand to determine over-heating.
8. Flat tires.
9. Stoppage of the jets in carburetor due to dirt or sediment.

ELECTRIC CRANKING FAILS.

1. Loose battery connections.
2. Depleted battery.
3. Motor brush contact on commutator faulty.

FAILURE OF MOTOR TO START.

1. Switch not turned on.
2. Gasoline not turned on, or out of gasoline.
3. Poor grade of gasoline in cold weather, or water in gasoline.
4. Weak ignition due to depleted dry cells when starting on the "B" button or to depleted storage battery when starting on the "M" button.
5. If the motor turns over very slowly your storage battery has become depleted, due to continuous cranking, prolonged burning of the lamps, with insufficient running of the motor or lack of care in filling with distilled water.
6. Contact points out of adjustment. See page 42.
7. Ignition unit shorted.
8. Water on coil or terminals.
9. Over rich mixture caused by continued use of strangler.

IF THERE IS GOOD CLEAN GASOLINE IN THE CARBURETOR AND A GOOD SPARK AT THE PLUGS, YOUR MOTOR WILL START IF PROPERLY HANDLED.

MOTOR KNOCKING.

1. Spark advanced too far. (See directions for timing Ignition, page 42.)
2. Too rich a mixture. Open the strangler, if in "Strangled" position, or run carburetor on cold air instead of "hot air."
3. Motor speed too low in pulling on hills or through bad roads, on direct drive-shift to a lower speed. Loose connecting rod bearings. (Light knock at high speed.)
4. Crank shaft bearing loose. Heavy pounding at low motor speeds and under heavy loads.
5. Too much play in valve push rods. (Light tapping sound.)
6. Tapping noise due to improper adjustment. (See instructions for adjusting page 5.)
7. Carbon in cylinders.
8. Automatic governor does not return to retard position easily.

REASONS FOR OVERHEATING.

1. Low supply of water.
2. Too rich a mixture of gasoline.
3. Carbonized cylinders.
4. Lack of motor oil.
5. Late ignition or retarded spark.
6. Broken or inoperative pump.
7. Radiator core stopped up with mud or other matter.
8. Loose or broken fan belt.
9. License tag is obstructing front of radiator.

How To Learn To Drive The Hudson Six-40

Start the Motor as Instructed on page 3.

Before shifting gear lever, advance the spark lever to the top of the quadrant, and the throttle lever about 1/2 inch from bottom of the quadrant. Press out the clutch pedal with the left foot and holding it in this position, move the gear shifting lever into the first speed position (inside back position). Gently let in the clutch, giving the motor sufficient advance of the hand control to prevent stopping of the motor as the clutch takes hold. Keep the car in this speed until you have learned the art of steering.

While it is more difficult to steer at this speed than at a faster speed, you should be cautious until you are thoroughly familiar with the operation which you have just gone through. Repeat this process a number of times so that you have

confidence in yourself before shifting. Before repeating the operation each time, throw out the clutch, push shift lever forward to the neutral or center position and bring the car to rest with the foot brake operated by the right foot.

With the car running in the first position and with the hand throttle almost closed, push out the clutch and shift lever to neutral position then through "H" plate into second speed position (outside forward).

This operation does not necessarily have to be done quickly provided the car and motor are running at the proper speeds. Never try to make this shift without first pushing out the clutch.

Just prior to shifting, the car may be accelerated by opening the throttle slightly. To shift to third position, accelerate the car slightly in second position and after pushing out the clutch, place the lever in third position (outside back).

To reverse the car, the shift lever is placed in the inside forward position.

NEVER ATTEMPT TO REVERSE THE CAR WHEN IT IS IN MOTION.

NEVER CHANGE SPEEDS WITHOUT HOLDING OUT THE CLUTCH AS THE GEARS IN THE TRANSMISSION WILL BE DAMAGED BY SUCH ACTION.

Always let the clutch in gently, after shifting gears, as there is nothing so hard on the car as violent action in this regard.

Do not continually slip the clutch to reduce the speed of the car; use gear shift lever instead and change speeds. Continual slipping of the clutch will burn the cork inserts and result in subsequent difficulty.

When preparing to stop, push out the clutch and apply the foot brake, gently allowing the car to coast to the point where you wish to stop rather than retarding its motion suddenly with the brakes.

Get in the habit of pushing out the shift lever while your car is coming to a stop, and after the car has stopped, apply the emergency brake so that the car will not roll or change its position after you have left it.

Use the brakes and clutch pedal as little as possible, controlling the car by means of the throttle. With the clutch engaged, closing of the throttle causes the motor to act as a brake which will relieve wear on the brakes and prolong the life of these parts.

Never switch off the ignition when coasting down a long hill, using the motor as a brake. By so doing the entire generator output will pass through the regulating resistance ("C" Fig. 3, page 39) and may cause it to burn out. If it is desirable to coast down a long hill with the motor as a brake—shut off the gasoline—IT IS MORE ECONOMICAL. The shut-off cock is placed conveniently at hand for this purpose.

In case of emergency, close the throttle and apply the foot brake at the same time.

DO NOT DRIVE FAST UNTIL THOROUGHLY FAMILIAR WITH THE CAR IN EVERY WAY.

When not using the car, see that both the "B" and "M" buttons are pushed in, in the "OFF" position.

Until you are familiar with the action of the clutch and brake pedal, it is often easier to learn to drive with the hand throttle, rather than the foot throttle or accelerator.

However, when you have mastered the points so far referred to, you will find it perfectly natural to operate the car with the accelerator pedal rather than with the hand throttle, and probably better ultimate results will be obtained.

WHEN IN DOUBT, DON'T DO ANYTHING. THINK THE MATTER OVER AND ANALYZE THE PROBLEM.

The Hudson Clutch

For the past four seasons' models, the Hudson Company has retained the same design of clutch, and it gives so little trouble that few have seen the inside of one.

The principle upon which it operates is the most simple one conceivable, based on the theory that there is a great deal of friction between cork and steel, but that the former element is extremely soft. In consequence the Hudson clutch is very smooth in action, but once engaged, it seldom slips.

The fact that the cork inserts become saturated with oil makes it difficult, compared with other types, to abuse the clutch. Except for an occasional cleaning out with gasoline, the only attention it requires is the maintaining of the lubricant, one-half kerosene and one-half engine oil, not more than a half pint of this mixture to be put in at a time.

In case of continued slippage, application of a small quantity of pure kerosene to the mixture already in the clutch will be of benefit, or adding a small quantity of motor oil will relieve the grabbing.

The Discs

The driving discs, which are secured in the flywheel by four specially heat treated studs, are stampings, carefully flattened and machined so as to slide freely on the studs. The driven discs are also stampings but are thicker and have numerous holes in them; into these holes the cork inserts are pressed.

The corks are first soaked in warm water to make them pliable, then they are forced into the holes by a special machine. A considerable amount of cork is left projecting on either side of the disc and this is shaped off to leave about l-32" after the corks have thoroughly dried out, then the corks are ground flat on a surface grinder.

In making a replacement of corks in a repair shop not properly equipped, the surfacing of the corks is usually accomplished by rubbing the disc on a piece of sand paper. The result is seldom satisfactory, as the corks are not flat and even, and do not give the full bearing surface which is necessary in order to have the friction to hold the power of the engine.

It is absolutely necessary that the corks be perfectly dry and show a full bearing surface. This latter point can only be ascertained by rubbing them flat on a surface that has been covered with Prussian blue or lamp black, using only a very thin coating. The greater the bearing surface obtained, the longer the corks will wear and the less the spring tension necessary.

The spring tension can be varied to suit the necessity by putting shims, about the size of a fifty-cent piece, at the back of the spring. This compresses it more, making it shorter when the clutch is engaged.

The cork insert discs drive the clutch drum on which they slide and this sliding, or separating motion is facilitated and equalized by small coil springs interposed between the driving discs.

Assembling the Clutch

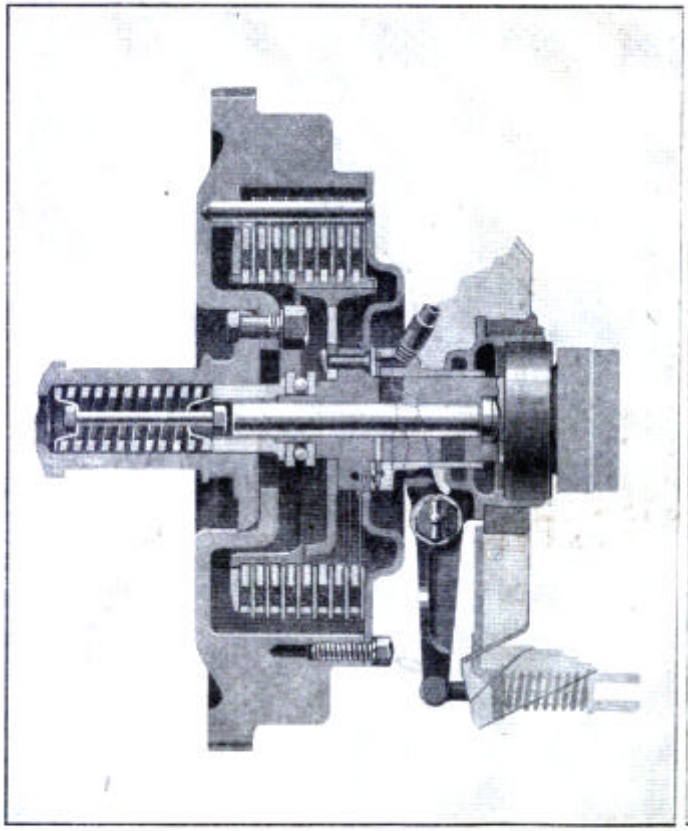
In assembling the clutch great care must be exercised or these little springs will slip out of place and, becoming jammed between the moving parts of the clutch will cause it to drag instead of releasing properly. Usually the noise made by the interference will indicate that something is wrong.

Another important feature is to see that the driven disc nearest the cover, at the back or transmission end of the clutch, does not slip out of the slots in the drum; this will cause a loud scraping sound when the clutch is released.

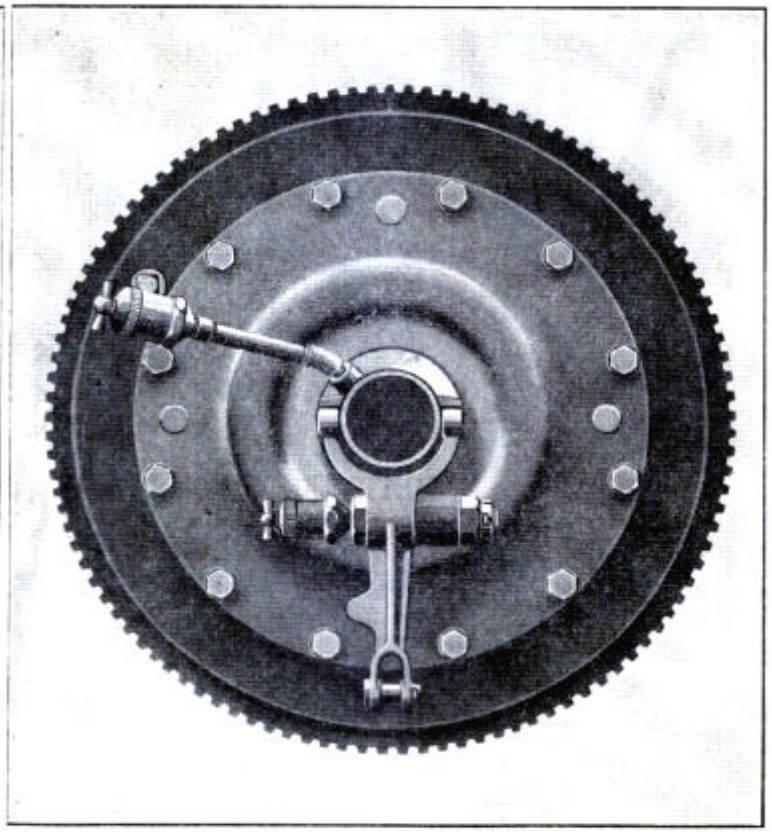
In assembling a clutch ready for inserting in the flywheel the following method is recommended:

1. Put the clutch drum on the bench and drop the discs on—a cork-insert disc first and then a plain disc. The discs should be selected so that they slide freely in the grooves of the drum and with the minimum amount of backlash.

2. After all the discs have been fitted in this manner, take the clutch cover and slip the studs



Sectional View of Clutch



Front View Showing Fork

through the holes in the driving discs, placing the separating springs one at a time.

3. This accomplished, and with the spring, the ball thrust bearing and the shims in place in the crankshaft, the clutch cover can be slipped into place.

4. By means of a lever looped into a wire on the motor foot and bearing against the driving jaws of the clutch, the whole clutch assembly can now be forced into place against the pressure of the spring very easily. When it has been entered sufficiently to allow of two cover bolts being started into place, the pressure of the lever may be released.

5. The cover should then be secured, care being taken to screw up the bolts evenly so that the tension on them will be the same all around. Unless this is carefully accomplished the cover will be strained and the lubricant will leak out.

Making Clutch Oil Tight

The gasket between the cover and the flywheel should be in good condition and shellacked onto the cover; it should be allowed to set for a while before using so that the shellac is "tacky" and will hold the gasket securely to the cover during the assembling operation. It is advisable to wind a little wicking around the heads of the bolts before screwing them down so as to prevent leakage.

The assembling and rendering oil-tight of the clutch is greatly facilitated by the driving studs being riveted into the cover. In this way there are no packed joints in the flywheel except the cover and the screws which secure it.

Also the cover and clutch can be assembled as a unit with no possibility of the discs slipping out of place by the simple expedient of clamping the jaws at the point where they project through the cover.

As a hint to the man who ever has to do this job on a 1915 model clutch, the bronze throw-out sleeve may be utilized as a clamp temporarily, by wrapping some paper or thin shim metal around the jaws and then pressing the sleeve over it. There should be just enough shimming to make the sleeve a tight fit, but not so much that the sleeve will be distorted or otherwise damaged in removing it.

Conditions Governing the Clutch

The thrust of throwing out the clutch is taken on a bronze washer which fits into a recess in the face of the sleeve. It is highly important that this washer be sufficiently lubricated at all times or it will burn out. Other reasons for the shortened life of these washers are as follows:

1. The spring which keeps the pedal from coming back farther than is necessary may be adjusted to too great a tension, thus putting a constant thrust on the washer.

2. The driver may have a habit of driving with his foot resting quite heavily on the pedal. This is unnecessary. See Bulletin No. 8, Volume 3.

3. The pedal may be improperly adjusted so that it is touching the toe-plate The result is the same except that in a case of this kind the clutch will probably slip so badly as to be noticeable.

4. The grease cup lubricating the pivot pin of the throw-out fork may be empty and the fork seized up so that it will not move freely.

5. There is a stop provided for the purpose of limiting the amount of throw given. Since the corks wear slightly with use and since too much throw is unnecessary, this adjustment should be inspected occasionally and always in the event of any repairs occasioning the dismantling of the transmission or pedals.

On the 1915 model this stop is on the left, on the cap that carries the gear-shift rods. The adjustment is simple to determine. Whenever you find that the transmission gears stop and the gears can be engaged without the pedal being thrown all the way out, the adjustment needs attention and should be screwed out to meet the sleeve lever until it stops its travel at the correct moment. Too much throw means more effort to release the clutch, and often makes the clutch noisy when disengaged.

The two most important instructions are: Don't slip your clutch more than is absolutely necessary, and then only when you KNOW it has sufficient lubricant to stand it. Don't drive with your foot resting heavily on the pedal, and if you must do so owing to congested traffic or natural nervousness, remember that the throw- out sleeve will need more frequent attention.

Front Axle

This is of the conventional "Elliott" type, of selected high carbon steel, dropforged and heat treated.The steering knuckles are also of nickel steel and turn on hardened steel bushings.The thrust bearings are steel, the upper one being held stationary by a tongue which fits into a groove in the king-bolt.

The adjustment for wear is accomplished by introducing shims between the top thrust washer and the axle fork.The king-bolt is provided with a passage which conveys the lubricant to the upper bearing and the thrust washers.There is a second grease cup which lubricates the lower bearing.Whenever it is obtainable we recommend Whitmore Anti-Friction No. 5 as the most desirable lubricant.This also applies to all other steering connections.

Timken bearings are used in the front wheels.The wheel hubs are of pressed steel construction and thus extremely sturdy.The bearing retainers are for the purpose of confining the lubricant and are not disturbed by the removal of the wheel

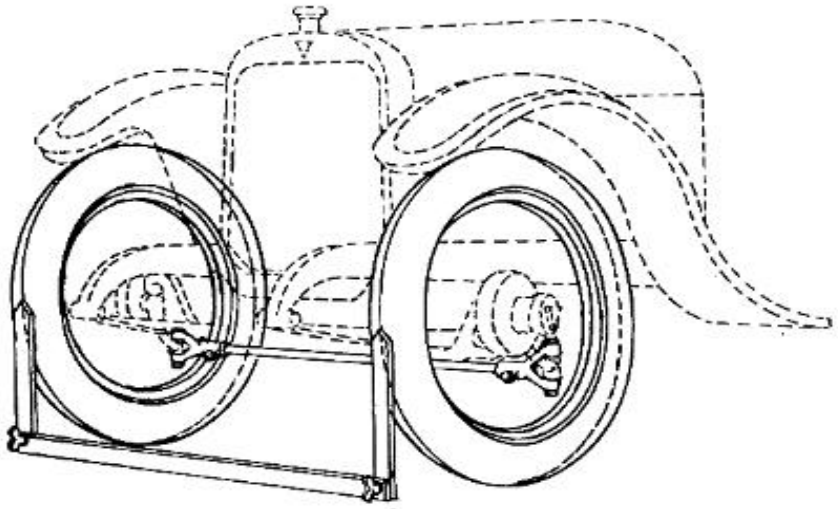
.

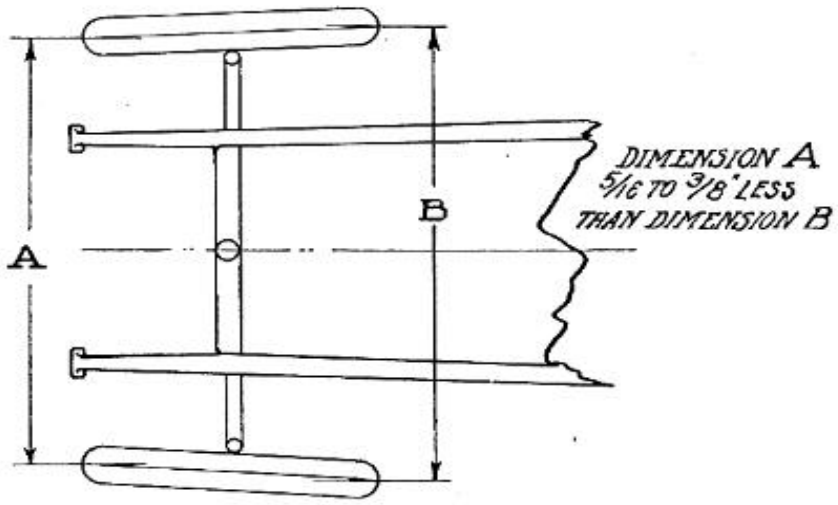
The wheel bearings should be adjusted by the nut so that a slight amount of play is noticeable when the wheel is shaken by grasping the tire. If the bearings are adjusted so that there is no play at all it will be impossible for any lubricant to penetrate between the rollers and cones, and on account of the excessive pressures that may result from such adjustment, the life of the bearings will be impaired.

Since it is to be expected that any bearing will wear sooner or later, we would caution all against overlooking this important point of inspection. Too much play is almost as bad as a tight bearing, but is more objectionable on account of the rattle it causes.

The alignment of the wheels is an important factor in the life of the front tires. The front of the tires should be about 5/16" closer together than the rear, measured at the same height from the ground. The easiest way to check this adjustment is as follows: Jack up the front of the car from the centre of the axle so that the distance rod is not interfered with. With both wheels free to revolve, a centre line can be marked on each tire by holding a soft lead pencil against it when spinning. The pencil must be held steady or the result will not be a straight line. Next measure with a tape or stick the distance between these lines at points opposite the hubs at the extreme front of the front tires.Next, measure the distance at the points opposite the hubs at the extreme rear of the front tires.This dimension should be from 5/16" to 3/8" greater than the measurement obtained at the front, allowing for any slight wobble of the wheel.

The handiest way to check this alignment is with the distance stick shown in the illustration





To adjust the distance rod it is necessary to remove one of the bolts when the clamp screw can be loosened and the clevis adjusted by turning on the threads of the distance rod. Any backlash is the axle knuckles and

devises should be taken up by straining the wheels outwards in front before setting the distance by the rod, and the job should always be checked after the wheels have been let down on the ground with the weight of the car on them.

The Hudson Rear Axle

The 1915 model axle is a semi-floating type, but with the difference that the live axle drive shafts are butted in the centre and the load on the wheel bearings is compensated.

In the illustration No. 1, page 53, it will be noted that the live axles are tapered, not only at the point where the wheels are secured, but also extending through the inner race of the bearings "B."

This construction offers several advantages. The wheels are held in place side-ways and the shafts cannot become loosened in the bearings and thus be cut away, as is the case with straight bore bearings. The thrust of each wheel bearing is in a direction outward from the centre of the axle.

Since the shafts butt in the centre it is obvious that the thrust load will be taken by the bearing opposite to the side upon which the thrust is applied. In turning a corner to the left, for instance, the right hand rear wheel will be carrying the weight of the rear end of the car entirely and the left wheel will have a tendency to leave the ground. The weight load will be all that is carried by the right wheel and the entire thrust load will be transferred to the wheel bearing on the left, which being
off the ground, carries absolutely no weight load.

Thus the live axles are actually "floating," a great deal more so than if the driveshafts were rigidly secured to wheels mounted on a fixed, immovable axle housing.

So much for the question of the degree of "float."

This type of axle is used extensively abroad because of its stability combined with light weight and high efficiency in transmission of power.

The two cars which made such a wonderful showing at Indianapolis this year—Delage and Peugot—were equipped with axles almost identical with the one herein described.

In this country the Packard, Pierce and White, all high-grade cars, are the most notable examples.

In taxicab service it is a recognized fact that the semi-floating type of axle is the most suitable for heavy duty.

The advantage of strength is obtained through the use of the most desirable materials in places where a full-floating design renders it impossible without an abnormal increase in weight.

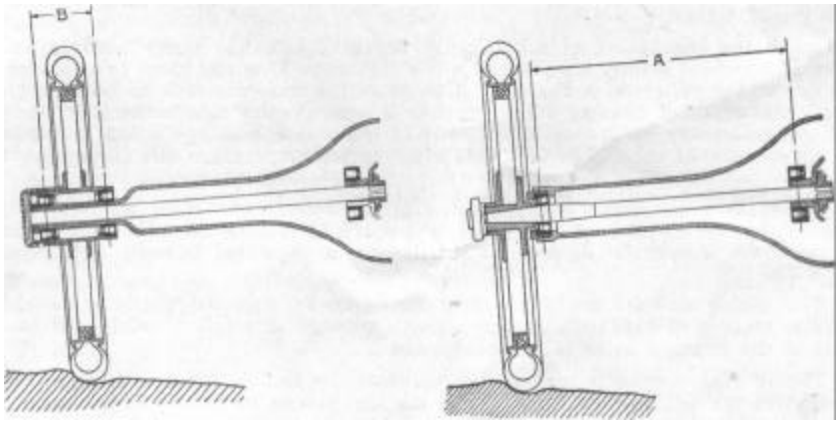
The following examples serve to illustrate this.

Since the destroying effect upon wheel bearings is due to thrust, or load occasioned by other conditions than the weight of the car and power transmitted through the live-axles, it is easy to comprehend that the difference between the bearings required to withstand the same amount of destructive effort will be proportionate to the difference between the distances "A" and "B" in the illustration No. 2.

The load upon the differential bearing in "A" is exactly one tenth of the load on the inner wheel bearing at "B." Of course the load on the outer wheel bearing "B" is also greater than the load on the wheel-bearing at "A," force applied the same in both cases.

The live-axle shaft is made of solid chrome-nickel steel, heat treated to resist the bending strain of such a load.

In the full-floating type "B" the leverage is ten times as great under any condition, but the bending stresses must be resisted by the axle housing, which is of necessity a pressing grade of carbon steel and



No. 2

not nearly as strong as the solid shaft at "A."

Furthermore, to facilitate the mounting of the wheel bearings the axle housing is invariably reduced at this point. The sectional area of the housing is usually half the area of the solid shaft. There is less tendency to bend the shaft (which is inexpensive to replace compared with the housing), and the safety factor is twice as great as that of the housing (which is very expensive to replace).

From the standpoint of the car owner this is an advantage.

It should also be remembered that the live axle on a semi-floating type may be bent to a considerable degree without any resulting damage other than the wheel wobbling. On the full-floating type the bending of the housing in the least degree results in the destruction of the alignment of the drive shaft. This latter condition cannot exist for any length of time without either crystallizing the shaft or destroying the wheel bearings.

It is claimed that it is a commercial impossibility to manufacture an axle of the full-floating type in which the alignment of the two wheels and differential will be perfect. For this reason we have said that a full-floating axle must have two universal joints on each drive shaft, one at each wheel end and one at each differential end. Such an axle is in use on a car of French manufacture but it is not by any means a commercial proposition.

Another advantage in the semi-floating construction is the elimination of backlash in the driving mechanism.

There are no slip joints at the connection of the drive shafts with the wheels as is essential in any axle claimed to be full-floating. Also the enormous reduction in the bending stresses at the differential end, where there is a joint, make wear at that point an easy matter to resist by the use of suitable materials.

A fewer number of parts is another result of this construction.

Weight, especially un-sprung weight, which is a constant load upon the tires, is reduced without sacrifice of sturdiness. The wheel bearings are unrestricted by hubs and may be proportioned to give a greater factor of safety without presenting a cumbrous appearance. The axle housing proper may be made lighter and shorter over-all. The differential bearings are much smaller and the carrier is also lighter. The live-axle shaft is heavier but not much so compared with the great increase in strength. This 1915 axle

is many pounds lighter yet much stronger in every way than the 1914 type.

From the standpoint of accessibility the 1915 axle has many advantages. To remove the wheel is only a matter of a few minutes. One nut must first be removed and the wheel puller does the rest. Compare this with the task of removing eight nuts, then a wheel bearing lock-nut then a washer and finally another nut. All this was necessary before an adjustment of the wheel bearings could be made and the appearance of the flange and nuts after such an operation left something to be desired.

The gasket too was usually spoiled in the operation. Now we have only to remove one nut to take off the wheel, one more to release the bearing adjustment, and we have a very much more accessible form of wheel bearing adjustment to deal with.

The spring saddles are solid with the brake supports so that all the braking effort is transmitted directly to the springs through a single casting, not through rivets in the housing as in 1914 construction.

The driving torque is transmitted through the rivets, but it is negligible compared with the brake effort, and the rivets are placed to better advantage on the longer expanse of support available.

Adjustment of Wheels

Through usage the wheel bearings or drive shaft bearings shown at "B" in illustration No. l, are subject to a certain amount of natural wear which in turn allows end play to develop in the drive shafts. As the wheels are rigidly fastened to drive shafts by being pulled up on a taper on the shafts, bearing wear will cause side play in the wheels, which can be taken up in the following manner after wheels have been removed. For this operation we provide a special puller included in the tool kit.

"A" in the illustration is the adjusting nut for the bearing "B," and "C" the locking bolt for adjusting nut "A." After removing locking bolt "C," tighten "A" turning toward right to tighten or toward left to loosen. A special wrench is furnished with tool equipment for this purpose.

Care should be taken in making this adjustment not to take up all play on one side, but it should be equalized. The lining-up of the brake drum and the axle housing on the opposite side to that on which the adjustment is being made will indicate whether the wheel is out too far on that side.

Take up the adjusting nut so that the drive shafts show no end play but are perfectly free and the bearings do not bind. Should it be impossible to lock the adjusting nuts "A" when the above results are obtained, back off rather than tighten so that notches will line up in the adjusting nuts. This adjustment does not affect the ring gear or drive gear in any way due to the fact that drive shafts float through.

Adjustment of Gears

Before attempting to make any adjustments, remove the Inspection Plug— left side of gear set and differential carrier. (See illustration No. l.) See that the back face of the teeth on both pinion and ring gear are flush. The pinion adjustment can be reached by first removing the pinion adjustment lock held in place by two bolts on top of carrier (shown in small cut in illustration). End play in pinion shaft should be taken up by turning front bearing adjustment toward left (when looking at the axle from front end). This is the inner nut. The outer nut which is for rear bearing adjustment should be held against movement during this operation.

Take up play between bearings until there is no end motion, but do not bind or cause shaft to turn hard. Line up slots in both adjusting nuts, then turn both toward right to bring pinion deeper into mesh with ring gear, or toward left to withdraw. The proper amount of back lash between teeth of ring gear and pinion is from .006" to .008".

The grease cup on the pinion housing is intended to lubricate the pinion bearings. This should be filled frequently with Whitmore Anti-Friction No. 5 Grease. It should always be examined when a pinion adjustment is made and an additional quantity of grease added at the adjustment opening.

If the pinion is flush with the ring gear and there is too much lash in same or too little, the ring gear may be adjusted either in or out to remedy this condition. The adjustments should be made as follows: Remove the differential cover plate on rear of axle housing. Take off differential bearing adjustment locks and back off slightly the bolts holding the bearing caps in place, so that the adjusting nut can be turned easily. Only loosen very little as the threads in these caps will become cross threaded if bolts are backed out too much.

To move gear toward right, back off right hand adjusting nut one or two notches at a time and take up on left hand nut the same number, or if gear wants to go to the left reverse the action. Take side play out of the bearings by these adjusting nuts. When the proper results have been obtained, tighten bearing caps and see that bearing adjusting nut locks are put in place.

Lubrication

Whitmore Compound No. 45 is used to fill rear axle housing, 6-1/2 pounds being the quantity. Filling the housing too full will cause the grease to eventually work out at rear wheels and front end of pinion shaft. When this occurs it will be necessary to lower the level, clean out the case, remove grease from shafts and renew the felt washers located at the above mentioned places. Unless this is done the grease will come out due to capillary attraction, even though the level is lowered.

Lubricant in rear axle should be looked after every 2000 miles. Clean out occasionally and refill with the same grease after it has been strained, then add new grease if necessary to get the desired amount. Grease cups are provided also (shown at "D" in illustration No. l) just inside of brake supports. These lubricate the rear wheel bearings. The grease cup on the pinion housing is intended to lubricate the pinion bearings. These should be filled frequently with Whitmore Anti-Friction No. 5 Grease.

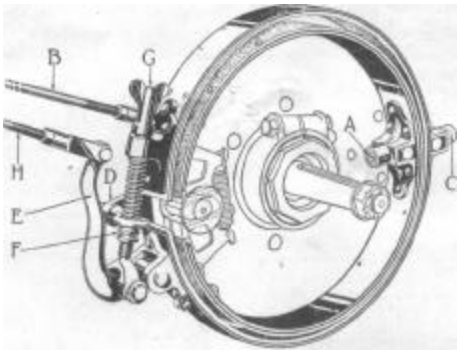


Fig. 4

Adjustment of Brakes

The internal or emergency brakes are of the expanding type, and work against the inside of the brake drum on rear wheels. When adjusting these brakes it is first necessary to see that screw "A" Fig. 4, is either turned up or loosened so as to have 1/64" clearance between brake drum and brake at this point. When this

is determined, disconnect the brake rod "B" from cam lever which is not shown on sketch, then with wheel in place, the hand lever released, and wheel jacked up from floor, move the cam lever forward until the brake starts to take hold. Release the lever slightly so that there is no drag and connect rod "B" making the necessary adjustment to clevis on this rod so that the above result will be obtained.

Make this adjustment to both rear wheels and care should be shown to get both brakes to take hold at the same time, this to be determined by applying brake hand lever a notch at a time. As these brakes are not supplied with equalizers, any variation can be adjusted by either taking up or letting out on the devises at end of rods "B."

The external or foot brakes are of the contracting type and work on the outer surface of the brake drums of the rear wheels. In adjusting these brakes disconnect brake rod "H" from lever "E" allowing lever "E" to fall back on bracket "D." Starting with screw "C" at rear anchor bracket, space the brake band from drum allowing 1/64" clearance. The same clearance should be maintained all around and can be obtained by either taking up or releasing on adjusting nuts "F" and "G."

For example, if brake band has no clearance at top and too much at bottom, make the following adjustments: screw down on nuts "F" until proper clearance is obtained at the bottom and then properly set these nuts. During this operation, the relative position of upper part of brake band with drum has been changed; if clearance is not enough, release nut "G" and if too great take up on "G." Get these results on both brakes, then connect lever "E" and rod "H." In doing so do not pull lever "E" away from bracket "D" but lengthen or shorten rod "H" in order to connect up the lever and rod.

The external brakes are provided with equalizers and will adjust themselves evenly provided the levers and arms do not get gummy or rusted from lack of lubrication.
If a brake squeaks, it is an indication that it is dirty and needs cleaning. The dirt clogs the pores in the surface of the lining and glazes it over. Gasoline, or better, kerosene will remove the dirt. The wheel should be removed and the linings cleaned with a stiff brush, like a tooth brush.

The Acton of the Zenith Carburetor

The Zenith carburetor differs from most conventional types on account of the absence of variable air valves or other moving parts. It is a "fixed" adjustment carburetor, but not necessarily a non-adjustable one. The object of this article is to explain the various adjustments and their uses.

Perhaps the most important and at the same time the easiest one to master is the WELL adjustment. This is shown at "A" in the illustration. When the motor is not running, the pocket around the well and also the well itself is filled with gasoline up to the level determined by the float and needle valve in the chamber "B."

The upper end of the well is connected through a by-pass with the opening opposite the throttle valve. It follows that the suction at this point is very strong when the throttle valve is nearly closed, as is the case when the motor is throttled down to its lowest, or "idling" speed. In starting the motor, therefore, the throttle valve should be left at its idling position, so that the gasoline contained in the well will be drawn up through the by-pass, giving an over-rich mixture for a moment, and thus "priming" the motor. As soon as this pocket is emptied, only just the amount of gasoline that can pass through the small hole in the well can be used, and this will be mixed with air drawn in through the openings at "C."

The sizes of the wells are determined by measuring the amount of water they will pass in a given time and are stamped accordingly; they seldom require changing, even in the most abnormal climates. The air adjustment is a useful and necessary adjustment, and must be altered to suit climatic conditions, summer and winter, if the smoothest results are desired.

The carburetor illustrated is known as the "horizontal" type. The adjusting valve is unscrewed to admit less air, and screwed up (downward into the chamber), to admit more air.

Too much or too little air will cause the motor to "roll," or run in spasmodic jerks when idling. This frequently makes it necessary to open the throttle wider than usual in order to keep the motor from stalling. The explanation of this phenomenon is well worth giving here.

When the mixture is too rich in gasoline, the latter piles up on the top of the flat throttle valve, and when sufficient gasoline has collected there it is agitated by the air passing the valve and vaporized, giving an excellent mixture for a moment only, and causing the motor to speed up. The increased speed immediately exhausts the gasoline supply, due to the increased suction, and the mixture becomes too lean with the result that the motor slows up, and will stop if the gasoline does not immediately collect on the valve and start the performance over again.

In the case of a lean adjustment the action is exactly the same but is caused, primarily, by the mixture being too weak to supply the motor at the speed for which the throttle valve is set, so it slows down until sufficient gasoline has accumulated on the valve, then it speeds for a moment, and then the mixture again becomes too weak.

It is not possible to get a six-cylinder motor to idle smoothly with the spark advanced. If there is a load on the motor, however, it will deliver power smoothly and evenly with an advanced spark. The reason for this is that the light weight of the reciprocating parts and flywheel, coupled with perfect balance, make such a motor extremely sensitive to ignition which takes place before the pistons have passed over their dead-centers.

In a four-cylinder motor, which must have a heavy flywheel to carry the reciprocating parts past their dead-centers, there is a constant load on the motor to cushion the effect of advanced spark. In fact the

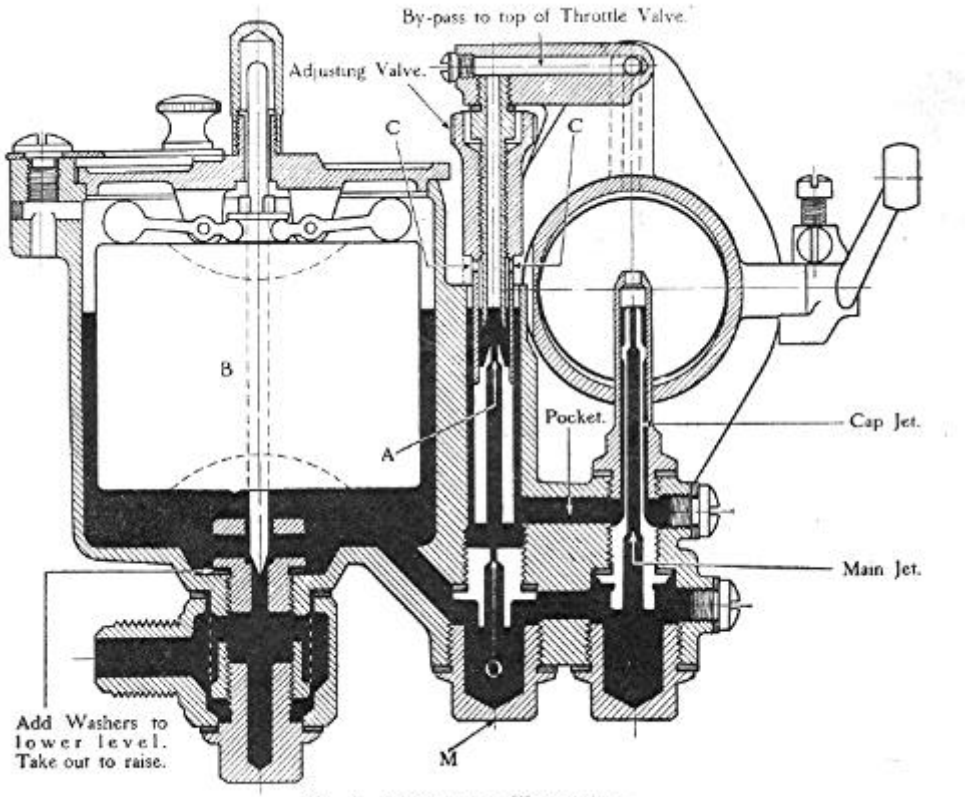


Fig. 5—Carburetor Illustration

advanced spark is necessary to get the power sufficient to keep the motor running and overcome the load of the flywheel, etc.

In adjusting the idling device, therefore, the spark should be retarded and the throttle set at the closed point. If the movement of the screw in either direction causes the motor to speed up and run more smoothly, the throttle set screw should be backed out slightly. This will cause the throttle to close up and the motor speed will be reduced. It will then be necessary to re-set the idling adjustment for this reduced speed, and so on until the motor speed is constant and sufficiently low to permit throttling down to four miles an hour on high gear with a retarded spark.

If the well is clogged or obstructed in any way it will be impossible to get the motor to idle properly and it will not throttle down on high speed. Remember, that the well alone affects the low speed. The jets do not emit any gasoline until the throttle is open and the suction at the hole opposite the throttle valve is reduced. If the level of the gasoline is too high the jets may "leak" or overflow. This will give too rich a mixture and will hinder the adjustment of the idling device. Such leakage may easily be detected, by placing the finger on top of the jets in question, and noting whether the motor can be made to idle by making the adjustment while so doing.
To inspect the well for an obstruction, remove the steel nut under the carburetor. The body of the carburetor can then be taken completely off, and the well unscrewed from the valve. In doing this, care should be taken not to lose the locking plunger and spring. The air inlets are protected by a screen, but this, too, may become clogged or dirty and should be inspected before attempting adjustment. Blocking of air inlet causes the suction on the well to be increased and too rich a mixture to be given.

It is important to note that, before attempting to adjust any kind of carburetor, the ignition should be definitely known to be 0. K. The gap of the spark plug points should be checked to see that they are not set to more than .025", about the thickness of a fairly well worn ten cent piece. If there is a tendency to miss-fire persistently on one particular cylinder, it is an indication that spark-plugs, valves, poor compression or something other than the carburetor is at fault. Listen at the exhaust pipe to determine if it is the same cylinder that is missing all the time. The miss will appear as regularly as a watch tick if it is NOT carburetor trouble. To determine when the motor is running regularly, when adjusting the carburetor, watch the fan. It is immediately apparent in the fan speed if the motor runs irregularly.

Zenith Carburetor Compensator and Main Jet

Next of importance is the compensator, which might be called the better half of the main jet.

It will be noticed that there is a pocket of gasoline in the passage, and also around the main jet, when the well is in action, supplying the motor for idling purposes. Immediately the throttle is opened, the suction on the top of the cap jet commences to draw gasoline from it and also from the main jet. Before these jets settle down to deliver their steady flow, however, the pocket of gasoline contained in the space between the jet and cap jet, and in the passage leading to the compensator must be exhausted. This sudden richening of the mixture when the throttle is opened gives the engine better acceleration than would otherwise be possible without using an over-rich setting at all times. The size of the compensator does not affect this condition, but the level of the gasoline does, since it decreases or increases the amount of gasoline in the pocket, according to whether it is too low or too high, respectively. The gasoline level should come exactly ?e" below the top of the cap jet.

After the pocket of gasoline referred to above is exhausted, the main jet and the compensator supply the gas necessary to run the motor at the higher speeds. It is easy to see that where we have two small openings instead of one large one there is a much greater range possible for varying the flow. To cut

down the amount of gas used, therefore, either one may be changed for a smaller size. The determination of the best one with which to commence operations can only be made after" they have both been removed and their sizes noted. The compensator is usually "5" larger than the main jet for ordinary climate and normal running, say up to 40 miles an hour. For hill climbing in normal altitudes, and where constant pulling power is needed without excessive speed on the level, "10" larger will be better. If more speed than 40 M. P. H. is required and that on good level roads, or where there is always a good run at the hills and they can be climbed as fast as the car will go, the main jet will need to be equal to or larger than the compensator, according to the speed of the motor.

Bear in mind that the two always work together, but the compensator is affected most by the lower speeds, up to 20 M. P. H., and the main jet is affected by the speeds above 20 M. P. H. and it becomes more noticeable as speeds above 40 M. P. H. are reached.

In reducing gas consumption, it is safe to assume that the size of the main jet can always be reduced first. If this step affects the acceleration too noticeably, increase the compensator "5." This may strike a happy medium. Remember that economy and speed, and especially "jam down the throttle" acceleration never go together. The most economical setting will give only normal acceleration unless the accelerator pedal is depressed gently, and the throttle must never be slammed open suddenly or the motor will starve, especially if it is at all cold. It does not require very much mixture to supply a motor running at 665 revolutions, 20 M. P. H., and the throttle needs to be open but very little to keep it running at this speed. To accelerate at low speeds, therefore, the throttle must be opened slowly, thus feeding only the amount necessary—and vaporizing it more perfectly by drawing it past the small opening around the throttle valve, or churning it. Rapid acceleration with a wide open throttle can only be obtained by excessive use of gasoline, no matter what make of carburetor be used, and it cannot be done economically.

Use Good Gasoline

Those owners who live in territories where extremely cold weather prevails in the winter, will be interested to know the advantages of using high grade gasoline. The common fuel sold as gasoline is extremely low test and seems to be deteriorating in quality each year. As a fuel it leaves a great deal to be desired, but for obvious reasons must be endured, either until a better grade is manufactured for universal consumption or a new fuel is evolved. At temperatures ranging from 20° F. to 5° below zero, the low test fuel will be proportionately difficult to ignite when cold, and at 5" below zero it will be practically impossible to ignite it.

It should be borne in mind that high test gasoline may cost two or three cents more per gallon, but the amount of gasoline used in warming up the motor will be much less, and therefore the general economy will be increased. It will not actually result in a saving in fuel cost, but it will mean much less annoyance and, at least, equal cost. With a low grade fuel, it is necessary to strangle the motor, and frequently to prime it before the fuel will ignite and the motor can be started. It is then necessary to run the motor with the strangler closed for two or three minutes in order to get it hot enough to get the benefit of the hot air pipe and aid in volatilizing the fuel and eliminating the necessity of the strangler. Even with the low grade fuel the carburetor will operate satisfactorily in the winter time if the motor be thoroughly warmed up before the car is driven. With the high grade gasoline, it may be necessary to use the strangler to start the motor, but it will be possible to get it into the hot air position immediately after starting.

It should be understood that when the strangler is closed the suction on the carburetor jets is terrific and the volume of gasoline drawn out and used to run the motor for three or four minutes under these conditions would ordinarily run the car a mile. This is why gasoline economy decreases in cold weather. The less the

The less the necessity for using the strangler, the greater the economy, hence the reason for keeping the motor warm whenever possible and using high grade fuel.

In order to be convinced, every Hudson owner should try a tank full of 70 test gasoline. He will soon be convinced that it is well worth the extra cost.

If the car is stored in a cold garage and difficulty is experienced in starting up in the mornings, it would be well to consider the installation of a cheap stove or heating device to keep the temperature in the immediate vicinity of the engine not lower than 30°. A small thermometer is a very handy article in any garage in winter, as it will usually explain reasons for its taking so long to start the motor. This must be taken into consideration before complaining, and especially must it be remembered that constant cranking is a severe drain on the storage battery. It is also interesting to note that the storage battery is affected by temperature and will not operate as efficiently at zero as it will at 60°, which is the ideal temperature for a battery. At 5° below zero the efficiency of the battery is considerably reduced. This is unavoidable with any style of storage battery.

We, therefore, urge every Hudson owner, who has a private garage, to install some heating system to facilitate starting and save gasoline and the storage battery. If a stove is not desirable, a 100-watt tungsten lamp placed under the hood and left burning every night will go a long way toward keeping up the temperature. A blanket thrown over the radiator will help to retain the heat generated in the lamp. A thermometer will prove very handy for comparison in case of trouble.

Dirt in the Carburetor

If the dirt is so minute that it passes through the screen at the base of the float chamber, where the gasoline feed pipe is connected it will most likely clog the idling well, or "jet." In proportion to the blockage, this will either partly or entirely prevent the engine from throttling down. If the speeds under 8-10 miles are impossible, and the engine stalls when the throttle is closed, this is the recognized symptom. Small flies or bugs will some times clog the air adjustment with the same result.

If the carburetor action is weak and does not seem to feed gasoline sufficiently fast, especially on the hills or when pulling hard, the condition of the screen under the float chamber should be verified. One nut, directly under the barrel of the gasoline connection, must he removed first, and then the union on the pipe connection. The filter can then be taken apart and cleaned.

Water in the gasoline line, or tank, is distinguishable by the same symptoms, only the spitting back of the engine is more pronounced, and the stalling more complete, it being possible to start the engine only after a long rest, or after flooding the carburetor.

If you are experiencing any of these symptoms in the slightest degree, don't waste electrical energy in spinning the engine. Clean out the carburetor, or go to the dealer from whom you purchased your car and tell your troubles to him.

Transmission

The transmission used on the Hudson Six-40 1915 is of the selective sliding gear type having three speeds forward and one reverse. The only care necessary is to see that it is properly lubricated at all times. A note on this will be found in Lubricating Chart, page 26.

Avoid clashing of the gears when shifting, as a continuance of this procedure will in the end lead to difficulty, such as chipping off the ends of the teeth which in turn get into the grease that is constantly passing between the teeth of the gears and through the bearings and thrust washers. If you find it difficult or almost impossible to shift the gears without clashing, and this after continued practice to avoid doing so, there is undoubtedly something wrong and you should take the matter up immediately with our nearest dealer.

Steering Gear

The steering gear used on the Hudson Six-40 1915 is of the worm gear type, the steering column being supported in the case, above and below, by two ball thrust bearings. The worm wheel support is equipped with an eccentric bushing, with which adjustment can be made when too much play occurs between worm wheel' and worm gear. The end play in the steering column, which is accompanied by very noticeable rattle when driving on rough roads, can be taken up by removing the necessary number of shims at the base of the steering gear case.

The lubricant for the steering gear should be a heavy grade of cylinder oil or a light grade of Whitmore Compound. Cup grease is not practicable as it does not flow, and therefore the lubrication of the vital points would not be taken care of properly. In cold weather it is very desirable to have a light grade of lubricant so that all parts will be properly oiled.

The drag link which connects the front axle steering arm and steering gear lever, is provided with ball and socket joints at either end. These can be readily adjusted to take care of any natural wear which takes place. These joints are protected by leather boots to keep out dirt and water. Grease cups provided at either end supply the necessary lubricant. Do not neglect these joints. Turn up the grease cups every day so that the grease is actually oozing out.

Care of Springs

After a new car has been driven a few hundred miles it will be .noticed that the spring clips have become loosened, due to the fact that the surfaces of the spring leaves fit closer together after wearing off the high spots. After this first wear has taken place the loosening of the clips will not be as frequent unless the car is subjected to very hard driving over rough roads, and if this is the case, frequent examination of these clips is advisable. Loose spring clips and lack of proper lubrication is the cause for the breakage of springs in the majority of cases.

Lubricate the spring leaves with a mixture of oil and graphite. This is accomplished by jacking up the front or rear of the car by means of the frame so that the weight is relieved from the springs and in this way spreading the leaves. Accessory houses now carry a tool for spreading the spring leaves and this is very convenient in applying the lubricant. If lubrication is neglected, water and dirt will, get between the leaves, thereby rusting the surfaces. This is not only detrimental to the riding qualities of the car, but also causes the leaves to break readily, due to, lack of proper action of the spring under these conditions.

Storing Your Car for the Winter

Cars that are put in storage or in a cold garage or warehouse for any extended period, must be given careful attention when they are put into commission again, otherwise the stagnated lubricant in the motor base, transmission and rear axle is apt to cause trouble. It must be understood that the oil film in the motor bearings and also in the transmission thrust bearing, is gradually decreased during the storage period, and after a time the oil is totally excluded. To start the motor up and run it at such a speed as is usually necessary to warm it up, may result in the burning out of the bearings.

To guard against these possibilities, drain off the motor oil and put in fresh oil considerably above the level. Warm this oil if possible before pouring it into the motor base. Pour hot kerosene and cylinder oil mixed half-and- half through the pet cocks, and turn the motor over a few times by hand. This is necessary in order to overcome the rust and gummy oil deposit which will have formed in the cylinders due to the moisture and condensation.

To guard against injury to the transmission thrust bearings, pour about a pint of hot engine oil into the transmission before starting it up. This will then become agitated and will work into the thrust bearings

before the heavier lubricant is thinned out.

In the case of the rear axle gears, etc., which revolve at a much lower speed, these precautions are not so necessary, but if the temperatures in which the cars have been stored run considerably below 10° F., the axle cover should be removed and the lubricant either heated or mixed with a quantity of lighter grade lubricant.

All grease cups, especially those on the steering gear, axle, pinion and) pump shafts, should be fully exhausted and refilled before any attempt is made to put the parts into motion.

Refer to the Lubricating Chart, page 26, when applying the lubricant so that all points indicated will be taken care of.

Cleaning the spark plug points, distributor points, rotor and commutators on, generator will assist in starting, as corrosion and dampness collects at these points if car has been idle for any length of time.

The Action of Lubricants at Low Temperatures

Rear axle lubricants are seldom affected by temperatures as low as 10° F. As the majority of cars are used to some extent during the very cold weather, it is essential that we should guard against freezing or solidifying the lubricant, at the lower temperatures. In Detroit we frequently have temperatures as low as 3° below zero, and in such an emergency the transmission and rear axle lubricant is almost sure to solidify. At temperatures of 5° below zero, Whitmore Compound No. 45 has the consistency of warm tar, but unlike common cylinder oil and grease it is: still an excellent lubricant and can soon be agitated into its normal condition. As a precautionary measure, we recommend increasing the quantity slightly, adding about one pound more than usual and thinning it out with compound of a lighter grade.

The transmission lubricant soon warms up on account of its proximity to the motor and the momentary stiffness experienced in shifting gears is hardly objectionable enough to warrant changing the lubricant. If very low temperatures, say 15° below zero are common, it will undoubtedly be necessary to use a very much lighter grade of oil, and we suggest that you consult us in this matter so that we may advise you according to the territories in which the cars are being used.

Under ordinary conditions, the No. 7 compound specified for transmission use will be sufficiently fluid to thin up the heavier grade used in the rear axle. In our Instruction Book we have specified draining off the transmission every two thou-, sand miles, and washing it out with kerosene. Unfortunately, we omitted to mention the fact that it was not necessary to use new Whitmore Compound to refill the transmission. This particular compound has economic value inasmuch as it does not deteriorate with use. In draining off the transmission lubricant it is only necessary to strain it to remove the foreign matter, chips, etc., in order to make the compound as good as new. It is a good plan to wash out the transmission with kerosene. In doing this a little compound will be lost, but it is quite safe to put the old compound back provided it has been carefully strained, adding enough new lubricant to bring it up to the correct level. In straining, it may be necessary to warm it, preferably on steam pipes, and care should be taken to see that it passes through at least three layers of cheesecloth. It must not be warmed on a stove or in any way that will cause excessive heat to the bottom of the receptacle, as by so doing gas will form and the bubbles being confined will increase in pressure before the gas escapes. This is liable to cause an explosion or at least an unexpected fire. There is absolutely no danger in warming the lubricant over steam pipes or by placing it in another bucket of boiling water.

Lubricating Chart

"Oil is the best insurance against trouble."

—Howard E. Coffin

Lubricating Chart

Merely screwing down the grease cups will not give the desired results; see that the grease is actually oozing out from such parts all the time.

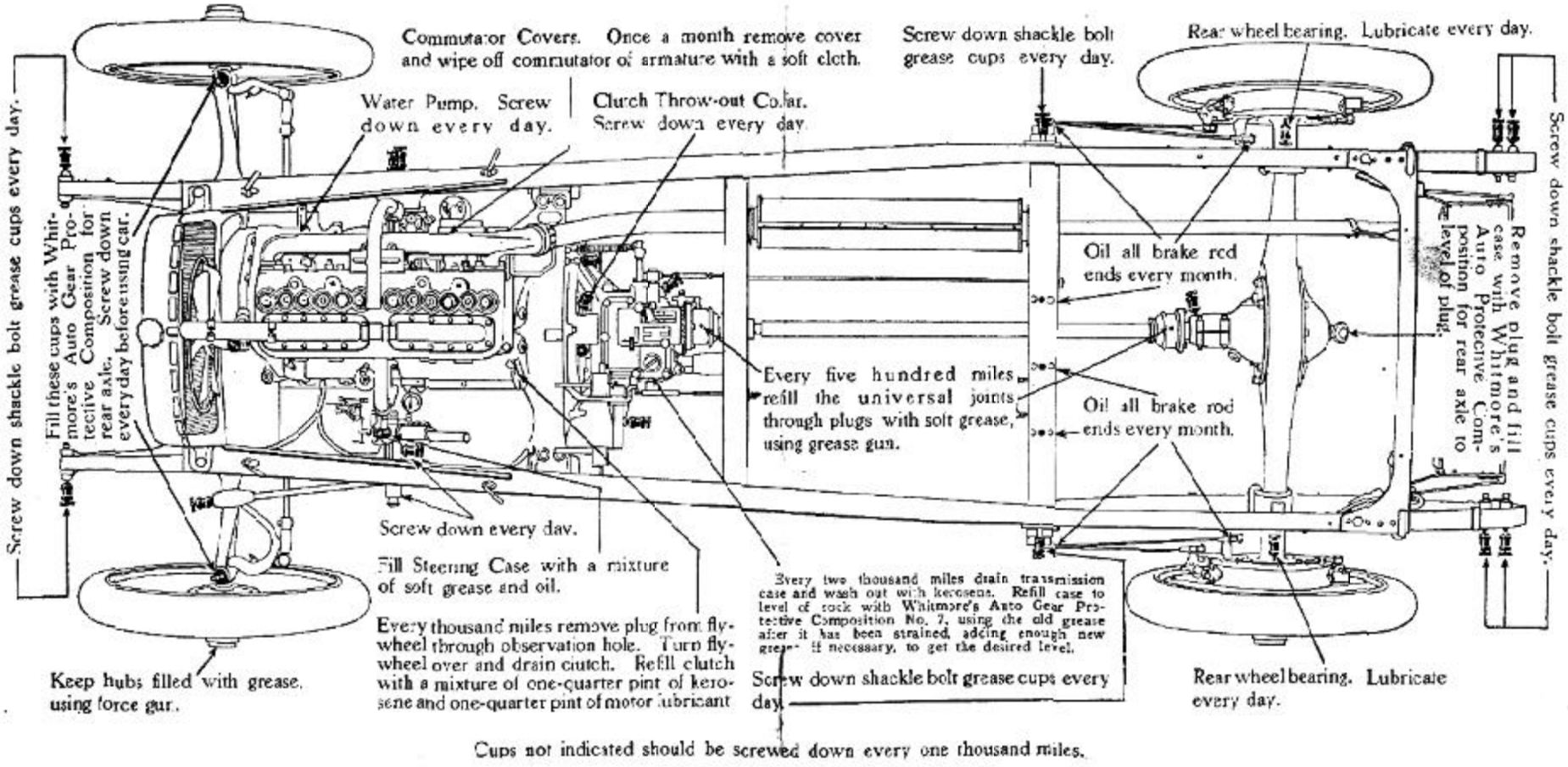


Fig. 9

NOTE:—Every two thousand miles, drain all oil from the motor by removing the plug at the bottom of the oil reservoir. Pour kerosene into the crank case through the filler on left side of motor, and turn the motor over with electric starter for a minute. Stop motor. Drain out kerosene and add fresh motor oil until the oil indicator on the left side of motor shows "FULL." This should require approximately 1½ gallons. Once a week when the car is laid up for the night, and while the motor is still hot, pour in each priming cock about three teaspoonfuls of kerosene, close them and let stand all night. In the morning start the motor in the usual manner.

Anti-Freezing Mixture

For 5 below zero:	
Alcohol	15%
Glycerine	15%
Water	70%
For 10 below zero:	
Alcohol	18%
Glycerine	18%
Water	64%
OR	
Alcohol	35%
Water	65%

Washing of the Car

When received a car is new, clean and neat—a thing of beauty.Why not keep it in this condition?

The car should be regularly and systematically cleaned and renovated.The varnish on a new car is always benefited by an occasional washing with clear, pure water.The car, even when not in active use, should be cleaned at stated intervals.

In summer, preferably the water should be cool.On a new car occasional washing with cold water serves to harden the varnish and increase its brilliancy. During the winter, if the washing is performed in a warm place, the use of cold water for an, occasional washing may be continued, but cold water applied in a cold place at a frigid season of the year is injurious to the varnish.

When the car is in daily use or following each period of road service, the varnish should be washed, top cleaned and the interior furnishings of the car renovated.

Things to remember: Never wash the car in bright sunlight. The sun dries the water up too rapidly, and causes streaks in the finish.Always use absolutely clean water and change it often to keep it clean.Never turn the hose on the body unless the stream is so broken up that it does no more than spray the body, but we advise the use of the pail and the sponge in preference to the hose.

Clean Top First

Before starting the washing of the car the top should receive attention. The Pantasote can be sponged off with clean tepid water, and when coated with road dust or mud, this water should contain enough Castile soap to provide sufficient' alkali to cleanse. Follow this cleaning by drying with a chamois skin.

Washing the Body

Begin washing the body by dipping the sponge well into the water, in order to pick up as much water as it will hold, then begin at the top of the panels and gently dash the water obliquely against the panels. Another way is to squeeze the water out of the sponge at the top of the panels to loosen the dirty accumulations, and. cause them to drop off. These instructions are for cars that afire washed immediately after road service.

When Washing Is Delayed

Provided the car has been put away for the night unwashed, and the mud and other road refuse allowed to dry on to the finish, it will harm the varnish to apply writer and attempt to remove these dry, crusty accumulations at once. All such surfaces should have plenty of fresh, clean water run down in an easy volume over the finish. Continue this practice until the dirt encrusted surface is thoroughly soaked up.Then let the work stand for 15 or 20 minutes for the water to so act on the

body of dirt and mud that under a fresh flow of water it will readily run away without injury to the finish.

In all cases the mud and dirt should be floated off by a natural flow of water rather than wiped off. This latter practice usually results in the finish being scratched and disfigured by the grit and dirt. It must be understood that a water-loaded sponge drawn or rubbed over a dirty or mud-bespattered panel develops a scouring effect. This diminishes the brilliancy of the varnish and reduces its capacity for protecting the undercoats.

The Second Washing

After concluding the first or preliminary washing of the surface a new sponge and a new pail should be taken in hand and the surface again washed with a fresh supply of clean water. A soft wash brush, oval in form, and chisel pointed, should be used to tool around the surface ornaments, mouldings and other attached body fixtures. Such places cannot be effectively reached with a sponge.

Use the same care and precautions in washing the chassis and under no circumstances employ the same tools for the body and the chassis and vice versa. In this way avoid transferring grease and oily stains from one part of the car to the other.

Drying the Body and Chassis

For drying off the water from the body of the car or chassis use a chamois skin free from lint and absolutely clean. Wring the chamois out after rinsing in clear water, or if dirty after washing out in a solution of soft water and Castile soap. Begin at the first part of the car washed, proceed to pass the chamois over the surface with just sufficient pressure to take up the water with the exception of a mist, which will quickly evaporate.

To attempt to wipe the car perfectly dry in all parts will result in injury to the luster of the finish. An erosive effect on the surface can be produced under the pressure of the chamois and this effect must be avoided at all times.

No car should be left unwashed for more than 24 hours.

Finish Cracked and Spotted by Mud

Mud in its various forms, in drying on a body of varnish, takes up the oil from the varnish, and in so doing destroys the luster. Road dirt or dust picked up or' highways largely given to horse travel is often saturated with ammonia, and all such accumulations are destructive to the finish. Such road refuse, if left to dry upon the finish, not only spots the varnish, but fractures the film and causes it to decay and crumble away.

Mud and dirt from the roads traversing lime districts are likewise destructive to both the luster and the fabric of varnish, the latter disintegrating under the effects of lime. Some varnishes, or, in fact, a great many of them, will spot under the effects of soapy or dirty water, the alkali and capillary mediums contained in these waters going at once at the luster of the varnish.

The car not systematically and regularly washed will have its finish often spotted from the effects of various gases and garage impurities. Many manufacturing cities are so poisoned with deleterious fumes that the finish on the irregularly and too infrequently washed car is spotted and deprived of its luster in a comparatively short time. Moreover, loss of luster is a direct result of improper and infrequent washing.

Care of Enamel on Hood and Fenders

Notwithstanding the extreme care and pains taken in enameling, and careful washing, the finish on these parts will show a tendency to dull from service. This is attributed to the fact that enamel has a peculiar

affinity to dirt. The hood and fenders are subjected to exposure, to dust and dirt, oil, grease and heat from the motor. These conditions in time cause to form a sort of filmy covering, which deadens the original gloss. The longer this condition is allowed to exist, the harder it will be to restore the luster. This is brought about by the simple expedient of taking off the greasy substance which is adhering to the surface of the enamel.

There are a number of preparations for removing the dirt and cleaning the enamel which can be secured from different accessory houses. Careful washing with Ivory Soap and water, afterwards removing the suds before they are allowed to dry, and polishing with a dry chamois, will restore the finish. FULLER'S EARTH and water can also be used to rub off the dirt if it is very obstinate, and will not harm the finish.

Cleaning of Nickel-Plated Parts

All nickel-plated parts may be cleaned with lamp black or with regular silver cleaner paste. Use only the softest flannel rag or chamois to rub with.

Do not clean lamp reflectors except when absolutely necessary and then use Putz Pomade, applied with a very soft clean chamois skin. These reflectors are silver plated and are very easily spoiled by frequent polishing.

Advice to the Driver

One of the first things that a new driver learns is the advantage to be derived from consideration and courtesy extended to others using the public highway.

Most drivers know that they are expected to turn to the right when approaching a vehicle, or to the left in overtaking and passing a slow-moving vehicle going in the same direction.

After they have come to realize the accuracy with which their car may be steered and the ease with which it may be called upon to pass and leave behind another vehicle, possibly approaching from the opposite direction, it seems natural for some drivers to display their nerve in not turning from the center of the road until they are almost upon the approaching vehicle. Often, however, the other fellow has as much courage and takes the same stand, and in the confusion which very' frequently follows, either one or both cars are damaged on account of collision.

In passing vehicles which are approaching, as large a margin of space as possible should be afforded, and in passing a slow-moving vehicle ahead, pass him as quickly as possible and without cutting in short ahead of him.

CITIES CONTROL TRAFFIC—The lack of consideration on the part of a few careless drivers has resulted in the adoption of very strict municipal regulations governing traffic.

Those who are familiar with city traffic regulations and apply them as well on country roads, will not be likely to encounter difficulties.

The burning of at least three lamps, including two head or side and one tail lamp, is enforced from sun-down to sun-up in practically every state. -

We have provided a dimming coil to be used in connection with head lamps so that side lamps are not necessary.

INTERSECTING ROADS—In approaching an intersection, either in the city or in the country, where a clear vision of the road approached cannot be had on account of buildings, fences, etc., obstructing the view, the car should be slowed down to a speed at which it can be readily stopped in case of the approach of another vehicle from either side.

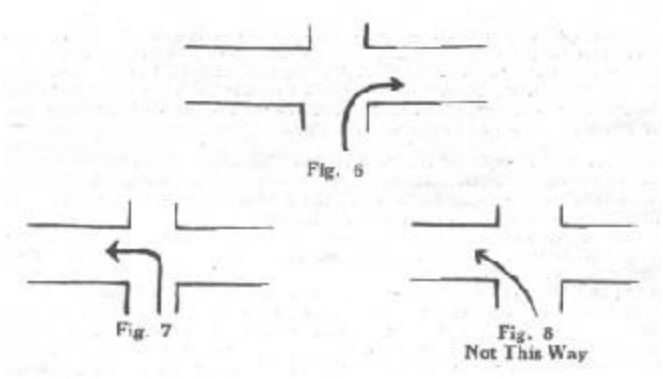


Fig. 6

Fig. 7

Fig. 8
Not This Way

TURNING INTO ANOTHER ROAD—In turning a vehicle into another road' to the right, the driver should keep his car as near the right-hand curb as practicable,, as shown on Fig. 6.

In turning into another road to the left he should turn around the center of the two as in Fig. 7. No vehicle should be slowed up or stopped without the driver thereof giving those behind him warning of his intentions to so do, by proper signals.

APPROACHING RAILROADS—In approaching a railroad crossing, especially if there is an incline or grade, the car should be dropped back into second speed and the approach made carefully, first to determine whether to make the crossing or not, and second, to be in position to accelerate the car suddenly with very little chance of stalling the motor.

Many accidents have happened because inexperienced drivers have become confused and stalled their motors. On noting the approach of the train, they have thrown on their power, or let in their clutch suddenly, with the result that the motor is stalled and it is then too late to move out of danger.

FRIGHTENING HORSES—Often drivers of horse-drawn vehicles become confused if their horses are frightened by the approach of an automobile, and in drawing up the horses sharply to one side the animals are liable to jump or rear with the result that the vehicle may be overturned and the automobile injured as well. In cases of this kind, it is better to stop the machine entirely and if necessary, even stop the motor.

CHANGING GEARS—More accidents result from unwillingness to change gears than from almost any other cause. Most American drivers use their first and second speeds only in starting their car. They allow the car to drift along and thus get into a tight place in traffic or too close to street cars and because of misjudging the speed of the approaching vehicle or their selfish desire to crowd out another car, collisions or other accidents frequently result.

It is a simple operation to change from third to second speed. It increases your power and affords the possibility of a great deal quicker acceleration as well.

The second speed is incorporated for a purpose. It is seldom that we are in such a hurry that we cannot spare a moment to afford absolute safety.

ACCIDENTS NOT DUE TO LOSING CONTROL OF THE CAR—Accidents. are not due to one's losing control of the car in many instances, but are more likely due to one's losing control of himself. One is not an expert driver until he intuitively performs the operations which control the car just as he walks or reaches out for an object.

WHEN THE CAR SKIDS—Although the driver feels helpless at first, a little experience will soon give him confidence.

Most skids can be corrected by the manipulation of the steering and brakes. An expert driver run keep his car straight under almost any conditions, but it is impossible to explain just how he does it. Usually the rear end skids first, and in the right hand direction, this being caused by the crown of the road. Under such conditions, the skidding action will be aggravated if the brakes are applied, and the car may be ditched or continue to skid until it hits the curb.

The correct action in an emergency of this kind is let up on the accelerator pedal to shut off the power; but not entirely so, or it will have the same effect as putting on the brake. If the car seems to right itself, the power may be applied gradually and it will be advisable to steer for the center of the road again. However, if the car continues to skid sideways, steer for the center of the road, applying the power gently. This will aggravate the skid for the moment, but will leave you with the front wheels in the center of the road and the car pointing at an angle. By, so doing, you can mount to the crown of the road again and the momentum of the car will take the rear wheels out of the ditch on the right hand side. It is customary to advise turning the front wheels in the direction that the car is skidding in order to correct the action but this can hardly be said to be true in all cases, as the amount of room on the skidding side is somewhat limited, and for this reason, the explanation given above will better apply to such a condition.

When turning a corner on asphalt pavements which are slippery, it frequently occurs that the front wheels skid. In a case of this kind, immediate action is necessary. It will usually be found that by applying the brakes suddenly for a moment so as to lock the wheels, the rear end of the car will skid in the direction in which the car is to be turned. This will help the action of the front wheels and the releasing of the brakes and the touch of the accelerator will bring the car around the corner without any over-travel of the front end. By applying the brakes in this way, it is possible to turn the front wheels in the direction opposite to that which the car is to be turned for a moment while the rear end is skidding. When the brakes are released, it is plain to see that the front wheels will have no tendency to skid further, as they will be pointing in the direction which the car is to be turned and the rear end will be in line with it, due to the skid.

Needless to say, this manipulation requires a little more expertness than the correction of an ordinary skid on a straight road.

IN CROSSING STREET CAR TRACKS AND CLIMBING OUT OF RUTS— Skidding can be prevented and accidents avoided, also the life of your tires lengthened if you will learn how to turn your car out of street car tracks and ruts. Make a sharp turn of your front wheel. Do not allow the wheel to climb along the edge of the rut and finally jump off suddenly, and do not attempt to climb out of these conditions at speed.

ROUNDING CORNERS AT SPEED—Driving a car around a sharp corner at twenty-five miles an hour does more damage to the tires than does fifteen or twenty- five miles of straight road work. This is an economical reason why one should drive around corners cautiously and slowly. The other reasons are obvious.

WATCH YOUR CAR CLOSELY—You will very soon become accustomed to all of the noises your car makes, and any sound, be it ever so slight, will be immediately perceptible.

DRIVING OVER ROUGH ROADS—The natural inclination of the driver is to throw out the clutch in coasting down hill or driving over rough roads. This should not be done. Keep the motor pulling your car over rough roads. Thus it keeps everything taut and lessens the shock and jar that the car gets through bumping. over ruts.

USE YOUR MOTOR AS A BRAKE—The motor is a natural brake whenever the throttle is closed. Prove this for yourself in the following way. At a speed of twenty miles an hour, release the accelerator and retard the spark, at a certain mark by the roadside—a telegraph pole, for example. Don't throw out the clutch, or the motor will have no braking effect. Now note how far you have traveled from the pole by the time your speedometer registers five miles. Then over the same road and at the same speed (20 M. P. H.), pass the pole again, but this time throw out the clutch. You will coast much further this

time before you drop down to five miles. Note the difference between this last mark and the first. This distance is proportional to the work done by the motor as a brake. By the same token, the wear on your brakes will be lessened in this proportion if you let the motor help. In short, never throw your clutch out until you have dropped down to the lowest speed at which the car will run, say two to four miles an hour.

And don't forget to fully retard the spark when coasting.

If the grade is long and steep, use the foot and emergency brakes alternately. This equalizes the wear on them.

A CAR'S SERVICE DEPENDS UPON THE DRIVER—Much of the satisfaction that an automobile gives depends upon the driver. If he neglects his automobile, if he does not lubricate it, or if he tinkers with it too much, he is bound to, receive unsatisfactory service.

No machine can be absolutely automatic. All things must wear in time. The best preventive of wear, and the most certain thing for increasing the life of an automobile, is proper lubrication.
Familiarize yourself thoroughly with all the lubricating points of your car. The chart in this book will show you where each one is located. Make the lubrication of your car as regular as the eating of your meals. If you do this, you won't have any complaint to make of your car becoming noisy or of bearings wearing out. If you don't do it, you will not get the satisfaction from your car that you had expected.

USE YOUR SPARK CONTROL LEVER—Few amateur drivers realize the advantages of the spark lever as a smooth driving aid.

But you will note that the expert, who makes such wonderful demonstrations, giving the car the feelings of a thing of life, nearly always has his hand on the spark lever. It is only when a level road stretches ahead of him that he seems to relinquish that little lever and you naturally assume that it is because he needs both hands on the wheel. It is because he uses his spark according to his speed that he obtains that smooth slow down in the traffic, without seeming to need a foot-brake at all; and that easy pick-up on high gear, with no signs of motor labor, that makes a six-cylinder car so attractive.

The Law of the Spark is simple. When you have mastered it you can demonstrate to yourself all the time.

You have noticed that your motor does not run smoothly, when idle, if the spark is advanced, but it invariably hits on all six like a clock if the spark is retarded. "There's a reason." The advanced timing of the ignition is a necessity when there's work to be done by the engine, as in propelling the car, but it becomes an evil if the engine is running light. Hence, the necessity of retarding it whenever there is no work to be done, as in coasting or idling.

The idling has been reduced to a minimum by the introduction of the self-starter. The coasting has been made more pleasant by the Six, which has the same continuous pull as a brake, as it has torque when functioning as a motor.

The pick-up is much enhanced if the spark is gradually advanced as the motor gains speed, bringing the lever up to about "half-way" at the first touch of the accelerator and then advancing about half an inch for every five miles per hour as the car gains speed. This, of course, applies to picking up from a low rate of speed; say, ten miles per hour, and in a less degree at greater speeds, since the car has greater momentum and the motor, therefore, less work to do.

COASTING MOUNTAIN ROADS—Whenever you approach a long and steep grade, it is best to put your gear speed lever into first speed and allow the car to drift down on the motor. This is better than using the brakes. It gives you absolute control of the car at all times.

KNOW YOUR CAR—Your satisfaction will be greatly increased if you will learn the details of your automobile. Learn to make the simple adjustments. They

are all described here. Do not depend upon some one else to do that which is so simply done, and which you can get such satisfaction in doing. There is nothing complicated nor complex about the HUDSON SIX 40. There are no inaccessible parts that should interfere with ready adjustments. Familiarize yourself with every detail of the car as explained in this book and you will have greater confidence in venturing over any road at any distance from a repair station.

THE COST OF SPEED—The law is just as immutable in that it collects as great a cost for speed in a motor car as it does of any machine or of man. If you run fast, if you work hard, you require more food to sustain you. If you drive your car at a fast speed all the time, it requires more fuel—more gasoline and more oil.

If you work fast and hard, you wear out more quickly, and so does an automobile.

Tires, for instance, last twice as long on a car that is driven at fifteen miles an hour as they do upon cars that are driven at thirty miles an hour.

Remember that the service your car gives you is as much dependent upon the manner in which you operate it as is your own health dependent upon the manner in which you care for it.

KEEP YOUR TIRES INFLATED—Do not use tires when they are soft. There should be a pressure of 75 pounds per square inch in the rear tires, and 70 pounds per square inch in the front tires. A tire pressure gauge is a good investment. It adds mileage to your tire service.

USE OF HEAD LIGHTS—Do not use the electric head lights turned' to the "bright" position when approaching or passing a car or other vehicle on a narrow road, unless you are traveling in the same direction. The light confuses them and may result in a serious accident.

The 1915 Six "40"
ELECTRIC SYSTEM

Fifty per cent of all electrical troubles, whether on your automobile or in your home, are due to faulty contacts and loose connections in the wiring. If it were possible to solder all connections permanently, there would be little work for the service man.

The vibration of a car will loosen the connections eventually, no matter how well the original installation is made. Our advice is, go to your dealer for an inspection periodically, or, better still, familiarize yourself with your car so that these little attentions will be given by the hand that is so largely responsible for its condition.

The Hudson Electric System

The 1915 system has been improved and simplified. It is the single wire, single unit system—the frame of the car being used to carry the return current.

The generator, storage battery, motor, lamps, horn and ignition apparatus each have a connection "grounded" to some part of the frame of the car or engine. The other connections are made with copper wires or cables. All of these connections are shown diagramatically in the simplified circuit diagram, Fig. 1.

To Start the Engine

Be sure the gear shift lever is in the neutral position. Place the spark lever. (the short one on the steering wheel) at the centre of the sector, and the throttle (the long one on the steering wheel) at the bottom of the sector. Have the right foot reaay to touch the accelerator pedal and open the throttle when the motor starts.

Pull out the "M" button on the Combination Switch, Fig. 1, as far as it will come because it has two contacts to make. Slowly push the starting pedal forward and, as soon as the engine fires, release the pedal quickly.

When either the "M" or "B" button on the Combination Switch is pulled out, it closes the circuit between the generator and the storage battery at the contact (X) on the diagram, Fig. l, and starts the armature of the generator, turning over slowly so that the gears can be meshed. The "M" button closes the magneto type ignition (at X-l). It should be used for all normal starting and running conditions.

The "B" button closes the dry cell ignition circuit (at X-2), which is to be used only in case of emergency.

In operating either of these two buttons, care should be taken to see that they are pulled out as far as they will come. If they are not pulled out as far as they will come, the ignition circuit will not be closed.

When either the "M" or "B" button is pulled out and the armature is revolving, a clicking sound will be heard. This is the operation of the generator clutch. This clicking sound will serve as a reminder that the ignition circuit is closed. When the engine is stopped or stalled, do not leave either the "M" or "B" button pulled out, as the battery will discharge through the generator.

When pushing out the starting pedal, if it should happen that the motor clutch, which is located back of the motor generator, should be in such a position that the ends of the teeth come against the ends of the teeth in the flywheel instead of the teeth of the one sliding into the teeth of the other, be careful not to try to force the starting pedal. Simply allow it to come back a little and try again. By this time the gears will have changed their relative position so as to allow the teeth to mesh properly.

Do not continue to crank the engine for more than thirty seconds, if it should fail to start. After the engine has started, do not hold the starting pedal in; this will burn out the lubricant in the motor clutch. If the motor clutch on the motor clutch shaft should become dry and stick, very serious damage to the armature and clutch may result, on account of the high rate of speed at which it operates.

Take Care in Starting Motor

It frequently happens that you are in a very crowded street where the noise of the traffic prevents your hearing whether your engine is running or not. As a result, the starting pedal is pressed down with the intention of starting the motor, only to realize an objectionable screeching sound and a sense of having done some damage to the starting gears.

It is not reasonable to suppose that an absolutely fool-proof piece of apparatus can be devised which will eliminate the possibility of this happening, and we there-fore take the opportunity of cautioning all owners against being too hasty in assuming that the motor has stopped. In the winter time when the

Note—Numbers and letters on this diagram correspond with those on figures 2, 3, and 4.

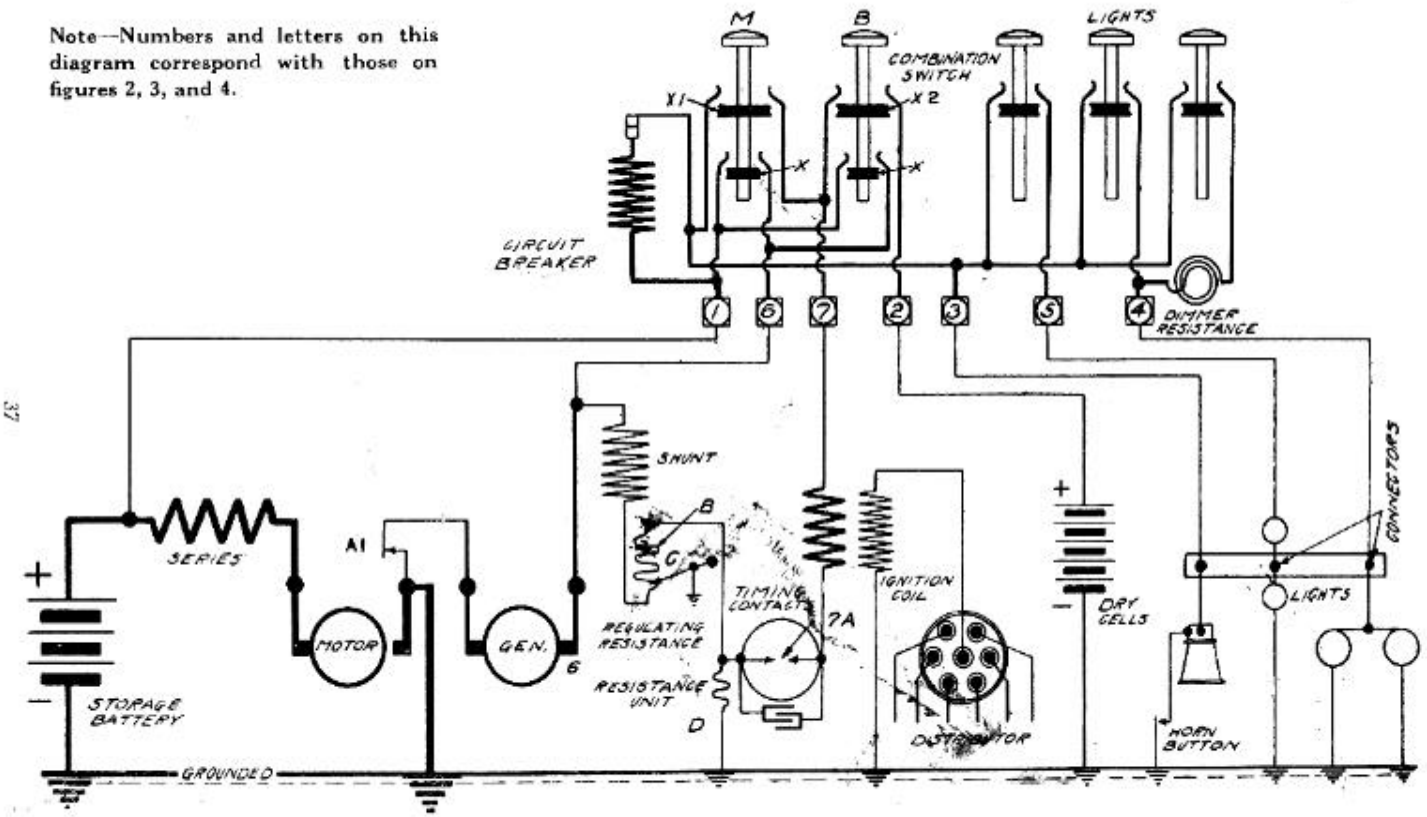


Fig. 1

curtains are all down and much exterr noise is excluded, the danger is increased.

To safeguard against this, get into the habit of either pressing down on the foot accelerator or advancing the hand throttle so as to determine if the motor is running. Do this in every case before the starting pedal is pressed down, if you are not certain that the motor is in operation.

The Complete Starting Operation

1. Close the ignition switch and circuit between the generator and the storage battery.
2. Starting gears brought into mesh.
3. Generator circuit is opened at contacts A-l, Fig. 2, by movement of brush.
4. Motor circuit is closed by dropping brush.
5. Motor starts and gears are released by letting up on the pedal.
6. Motor circuit is opened and generator circuit is closed again at contacts A-l.

The Motor Generator

The motor generator, operating as a motor, receives its energy from the storage battery and transmits it through the motor clutch to the flywheel for cranking over the engine.

The motor generator, operating as a generator, receives its energy from the engine through an extension of the pump shaft, and delivers electrical energy for the charging of the storage battery, and for operating the lights, horn and ignition.

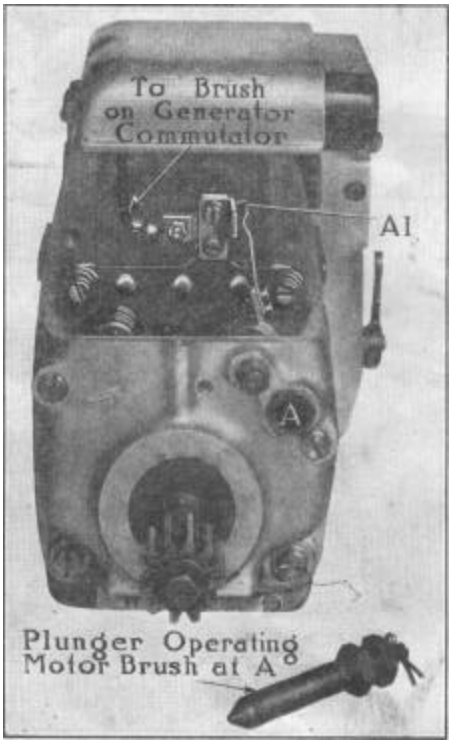


Fig. 2

The Motor Clutch

The motor clutch and gears, which operate between the flywheel and the armature pinion, are for the purpose of getting a suitable gear reduction between the armature and the flywheel, and permit the gear in mesh with the flywheel to overrun the armature when the engine starts, and prevent the armature from being driven at an excessively high speed during the short time the gears are in mesh after the engine is running on its own power.

The Generator Clutch

The generator over-running clutch is for the purpose of allowing the armature to revolve at a higher speed than that of the pump shaft during the cranking operation; at the same time it permits the armature to be driven by the pump shaft when the engine is running on its own power.

Regulation of Output

This is accomplished through a special resistance wire wound on a spool of noninflammable material and mounted in the distributor housing just back of the condenser as shown at "B" in Fig. 3. By inserting some of this resistance in the shunt field circuit at the higher speeds, the output is controlled automatically by the same mechanism that advances the spark. The circuit can be readily understood by referring to the circuit diagram, Fig. 1, and from this circuit diagram it can be seen that all of this resistance is in the shunt field circuit when the arm "C," Fig. 3, is at the top position; that is, at maximum speed. Also, the ignition resistance unit is. grounded through the output resistance and is cut out of the ignition circuit when the arm is at the top position. This increases the intensity of the spark at high, speeds.

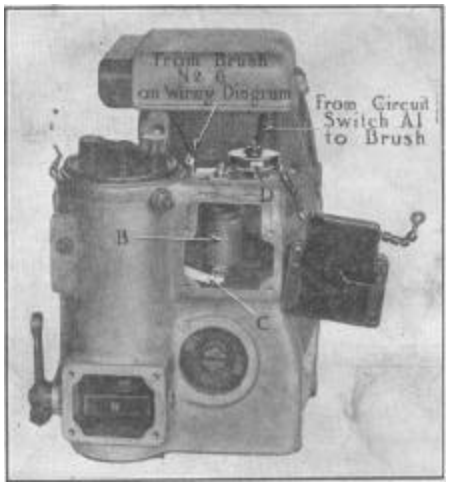


Fig. 3

The Combination Switch

The Combination Switch is located on the Cowl Board and makes the necessary connections for ignition and lights. The "M" button controls the 'magneto type ignition and the "B" button controls the dry battery ignition. In addition to this boh the “M” and “B” buttons control the circuit between the generator and the

both the "M" and "B" buttons control the circuit between the generator and the storage battery. When the engine is not running, or when it is running below 300 R.P.M. and the circuit between the generator and the storage battery is closed by either the "M" or "B" button on the combination switch, the direction or flow' of the current is from the battery to the generator and if the speed is very low, indeed, as when throttled down to three M.P.H. the generator will over-run and the clutch will be heard in operation, as before starting.

The amount of current that flows from the battery at these engine speeds is so small that it is negligible.

The button on the extreme left controls the headlights DIM.

The second button controls the headlights FULL.

The headlights are dimmed by cutting the resistance into the headlight circuit shown on Fig. l. This resistance checks the flow of current to the lamps, causing there to operate at a lower candle power.

If the headlights are operating DIM, it is unnecessary to depress the dim button in order to get them to operate at full candle power. Simply pull out the second button. This operation cuts out the resistance and if the button is again depressed, the lights will operate dim. The third button controls the tail light and dash illuminator. If, the dash illuminator goes out it is an indication that the tail-light is also out.

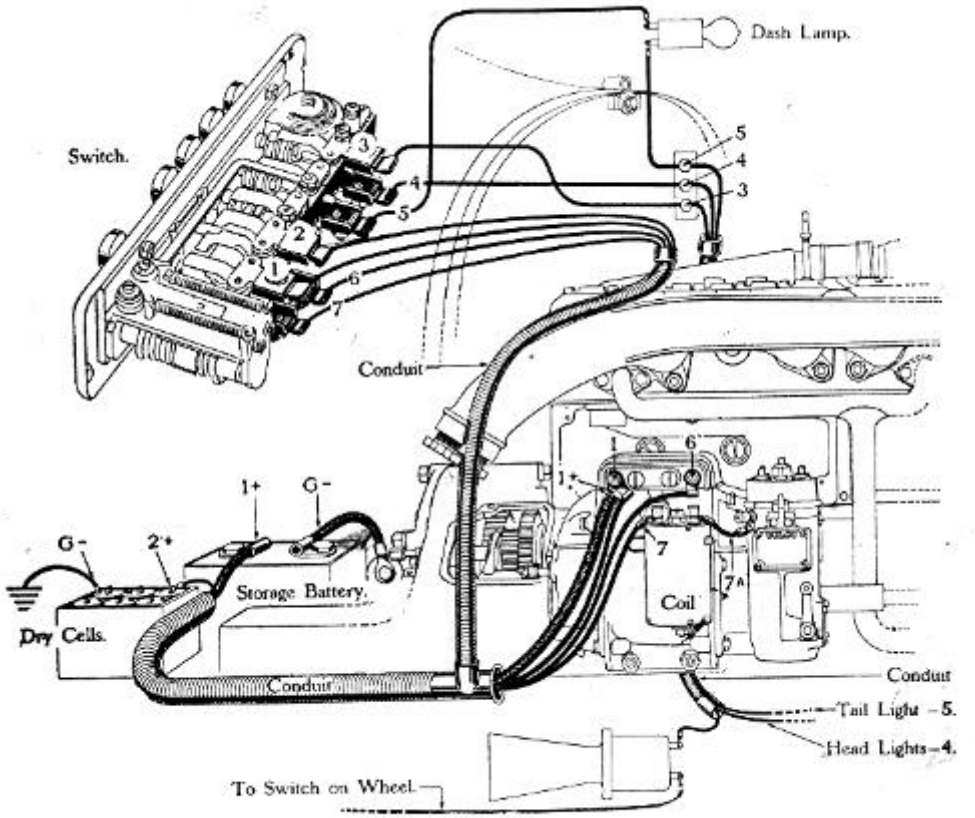


Fig. 4

Wiring Diagram, Six-40--1915, showing Switch, Battery, Dry Cells, Generator, Conduits, and all wires with the exception of the high tension wires running from the distributor head to the spark plugs.
Pity Cells.

The Circuit Breaker

The Circuit Breaker is mounted on the Combination Switch as shown at Fig. 1. This unit is a protective device, which takes the place of fuses., lt prevents the discharging of the battery or damage to the wiring and lamps, horn or ignition, in case any of the wires leading to these parts become grounded. As long as the lamps, horn and ignition are using the normal amount of current the circuit breaker is not affected. But in the event of any of the wires becoming grounded, an abnormally heavy current is conducted through the circuit breaker, thus producing magnetism which attracts the armature and opens the contacts. This cuts off the flow of current, which allows the contacts to close again and the operation is repeated, causing the circuit breaker t ass an intermittent current and give forth a tapping sound.

It requires amperes to start the circuit breaker vibrating, but once vibrating a current of from five to seven amperes will cause it to continue to operate.

In case the circuit breaker vibrates repeatedly, do not attempt to increase the tension of the springs, as the vibration is an indication of a ground in the system. By operating the various switches, locate the grounded line and eliminate it.

If the circuit breaker indicates a grounded wire, the cover of the junction box on the dash should be removed and the line which is grounded should be opened at the terminal on the junction block. If the circuit breaker stops vibrating when this is done, the ground must be in the line after it leaves the junction block. If it continues to vibrate, however, the ground is in the switch or ignition circuits.

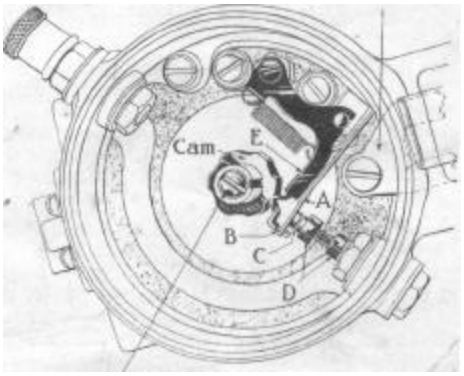
In case the circuit breaker continues to vibrate when all buttons on the combination switch are depressed, the trouble is almost sure to be in the horn or its connections.

The Distributor and Timer

The distributor and timer is carried on the front end of the motor generator and is driven through a set of spiral gears attached to the direct coupled end of the generator clutch as shown in Fig. 3.

The distributor consists of a cap or head of insulating material carrying one high tension contact in the center with similar contacts spaced equi-distant about the center, and a rotor, which mi. ins constant contact with the center.

Grounded to top of
regulating resistance



Screw for Cam adjustment

Fig. 5

The rotor carries a contact button, and serves to close the secondary circuit to the spark plug in the proper cylinder.

Beneath the distributor head and rotor is the timer which provided with a screw in the center of the shaft, the loosening of which, allows the cam to be turned in either direction to secure the proper timing

in either direction to secure the proper timing; turning in a clockwise direction to advance and counter-clockwise to retard.

See that the contact points, breaker arm and spring are in perfect condition. The contact spring "A" should have a good tension outward at the breaker arm "B." If this tension is not correct bend the arm "B" away from the contact spring "A." Bend "B" at the opposite end from that which runs on the cam. Weak tension at this spring "A" will allow the contact points to hang close together, thus causing arcing and burning, and resulting in poor contacts and ignition difficulties. When the points get in this condition they need attention and should be cleaned up so they have perfect contact. Often times a file is used to clean these points, with the result that the contact surfaces are not parallel as shown in small sketch (Wrong Way, and Right Way). Do not file the contact points unless they are badly pitted. Con- tacts can be cleaned with a piece of very fine sand paper.

Wrong Way Right Way

Before setting the ignition timing, it is essential that the contact points on the timer have a proper gap—C. (See Fig. 5.) If the gap is changed after timing the cam, the ignition timing will also be changed. The gap should be .010". When the cam is turned so that the arm is riding the highest point the contact is closed and the spring "A" should be .015" from the top of the slot "B."

A wrench is furnished with the car to fit nut "D," also a thickness gauge (.010") on this wrench for the contact points, and a thicker gauge (.032") for the spark plug points.

Care should also be taken that the lip on arm "B," which runs on the cam, should just clear the cam at the low points and not have too large a gap. This is governed by clip "E" which holds arm "B" away from the cam when the contacts are opened. Should the gap between the cam and lip on the low point on "B" be too great, or vice versa, clip "E" can be bent so as to adjust conditions.
The hand spark control is for the purpose of securing proper timing for various conditions, such as starting, difference in gasoline, variable weather conditions and for higher speed.

To Time the Ignition

Set the spark lever on the steering wheel at the top and see that the advance rod which connects the generator advance lever and sector gear at base of steering gear is not too long so as to bind the distributor advance ring in the generator. This rod should be adjusted so that the yoke end at the generator advance lever fits into this lever without any binding when the hand lever on steering gear is fully advanced. The distributor advance ring will wear rapidly if this adjustment is not properly taken care of.

Open the priming cocks on motor, turn slowly by hand, using starting crank for this purpose, until No. 1 cylinder begins to blow. This indicates that the piston is on its compression stroke. To determine this, hold your finger over the priming cock. No. 1. cylinder is due to fire in advance position when the mark "A" on the flywheel reaches the pointer attached to the crank case, which may be observed through the inspection hole on flywheel housing, left-side motor. Mark "A" is 5/8" before top center. Loosen cam and set to break at this point, when rotor button comes under No. 1 contact, on the distributor head.

The spark occurs the instant the timer contacts are open. In checking the+ timing, the cam should be held on tension in the opposite direction of rotation so that all back lash is taken up. The adjusting screw on the cam must always be set down tight after changing this adjustment.

After checking the timing, replace the rotor and follow with the distributor head, seeing that this is down) tight in position.

In taking apart the contact breaker assembly, care should be taken to keep intact the copper wire, which connects to spring anchor post. Loosening or breakage of the wire will cause current to travel through the spring, taking the temper out of it., and making breaker arm bind on the pivot.

The Breaker Arm is not grounded as in the 1914 system. It has two separate grounds; one through the Regulating Resistance and Arm to the ground and the other through the Ignition Resistance unit.

Ignition Resistance Unit

The ignition resistance unit is a coil of resistance wire, wound on a porcelain spool on the distributor housing. Under ordinary conditions it remains cool and, offers little resistance in the passage of current. However, if for any reason, the primary circuit of the magneto type ignition should remain closed for any considerable length of time, the current passing through the coil would heat the resistance wire, increasing its resistance to a point where very little current could pass, and insuring against a waste of current from the battery and damage to the ignition coil and timer contacts.

The Ignition Resistance unit has connected in parallel with it, the Regulating Resistance. When the arm "C," Fig. 3, is in the lower position, the resistance of this path greatly exceeds that through the resistance unit, and practically all the ignition current passes through the ignition resistance unit. But as the arm raises, as at high speeds, this resistance is decreased, and when the arm is at the top position the full voltage is applied to the ignition coil.

In the event of the ignition resistance unit being disconnected or burned out, it is impossible to get sufficient current through the regulating resistance, unless the arm "C," Fig. 3, is held near the top.

Regulating Resistance Units

Regulating resistances shown at "C," page 39, are individually suited to the generators in which they are installed. Those Units marked No. 817 have the greatest resistance and consequently give the smallest charge. Those marked No. 701 to 703 have less resistance and give a greater charging rate—No. 703 giving the greatest, and the others in proportion. Since the contact arm, operated by the centrifugal governor, is on the lower coil when running slowly, the resistance spools will not affect the output at these speeds. It is at speeds of over 20 miles an hour, when the arm has begun to travel over the coil that the amount of resistance in the circuit affects the output.

In testing the output, an Ammeter should be inserted between terminal 6 and wire 6 on the generator (Page 40, Fig. 4). On no account should the output exceed 20 amperes, regardless of the speed of the car. Between 15 and 20 miles an hour, the output should be 12 to 15 amperes, and will gradually ease as the car speed increases. Before testing the output of the generator the condition of the battery should be noted. A battery showing about 1.250 is best adapted for checking the generator.

In removing and replacing the resistance units great care should be exercised not to bend t contact arm so that it bears to hard on the spool, or so that it does not touch sufficiently hard to make contact. The former makes the arm stick when in the higher position, reducing the charging rate and the latter increases the resistance and causes arcing on the resistance net, eventually burning it out. The resistance units must be snapped into place between the spring retainers so that there is a good contact. When there is no contact the generator is not delivering any current.

Please note that by turning the spool upside down, so that the wide ferrule comes on the bottom, the charging rate, at high speeds, is not affected, but the point at which the resistance is cut into the circuit is changed so that the generator delivers more current at lower speeds.

The Ignition Coil

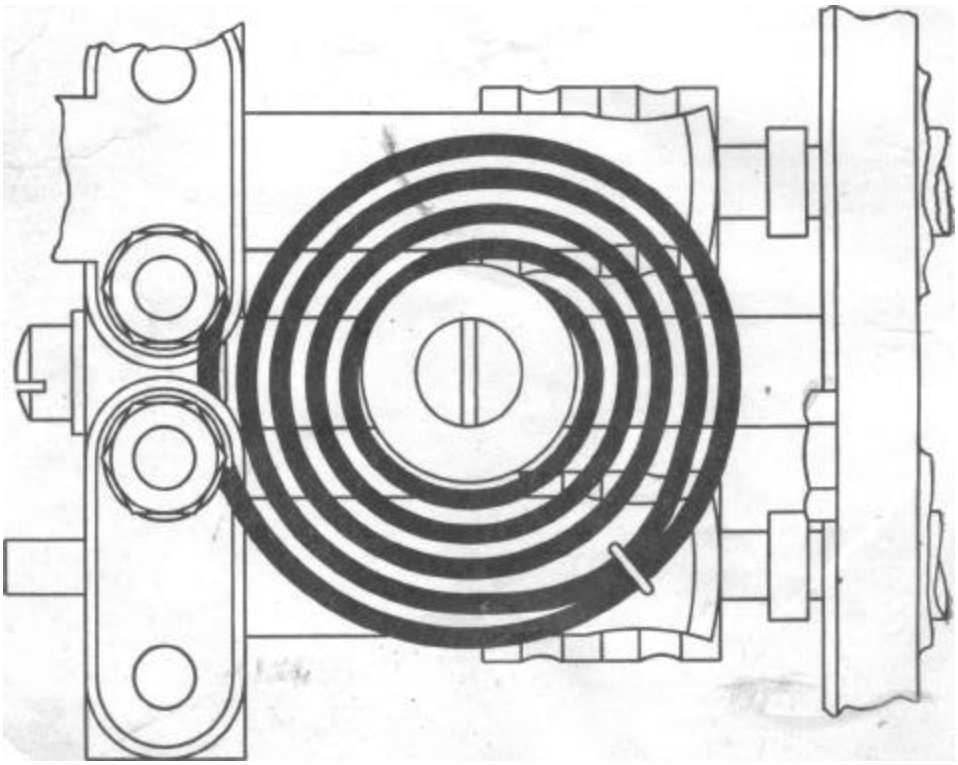
The Ignition Coil is mounted on side of the motor generator and serves to transform the low voltage current in the primary circuit to a current of high voltage in the secondary circuit.

The coil consists of a primary winding of coarse wire, wound around an iron core in comparatively few turns, and a secondary winding of many turns of fine wire; also, the necessary insulation and terminals for wiring connections. No attention is necessary except occasional inspections to insure that there are good connections between the wires and terminals, and the top of the coil between the connections is clean.

Varying the Dimming of Headlights

We frequently receive inquiries on the possibility of varying the intensity of the headlights when the dimmer is in circuit. As this is more or less a matter of personal taste, and so easily accomplished, we believe the following information and diagram will be of value:

It is necessary to remove the switch in order to bind up one or more coils as shown above. The switch is held in place by four bolts which pass through the housing at the back of the switch. When these bolts are loosened, the housing will fall down. Therefore, the No. 1 wire which connects with the generator, should be removed before dismantling the switch, otherwise a short circuit will result and the wires may be burnt out. (See Instruction Book, Page 40.) Tying two coils together will not make very much difference



Removing half' of the resistance will make a considerable increase in the light given, almost too much for town driving. We recommend experimenting by short circuiting the outer coil first, then making further adjustments to suit personal taste.

The following are the specifications and current consumption of the Hudson Six-40 1915 Lamps:

Name	Specification	Current Consumed
Head Lamps	7 Volt-15 C. P.	Both Lamps 5 Amp.
Dimmer	7 Volt-15 C. P.	Both Lamps 3 Amp.
Cowl and Tail Lamps	3-1/2 Volt— 2 C. P.	Both Lamps 1 Amp.

Lubrication

There are oil holes in each of the end frames which are exposed when? the covers are removed. These are for the purpose of conveying oil to the ball bearings on each end of the armature shaft. Four or five drops of good oil should be dropped into these once a week.

The ball bearing at the upper end of the distributor shaft is lubricated by removing the distributor head and rotor and applying the lubricant directly on then bearing.

The spiral gears for driving the distributor shaft are lubricated by filling the distributor housing through oil hole at the front end cover. Keep the lubricant up to the level of this hole. This can be observed by removing the oil hole plug. Use Whitmore Compound No. 13 at this point.

Information on Storage Batteries

Storage Battery

The 3-X-15-1 storage battery used with the Electric Cranking, Lighting and Ignition System is designed especially for it and is made by The Electric Storage Battery Co., of Philadelphia, Pa., whose products for the automobile trade are known as "Exide" batteries.

`The Storage Battery (Fig. 8) consists of three cells, each cell containing fifteen (15) plates—seven positive and eight negative. The battery when fully charged, will burn the head and tail lights approximately 12 hours.

When the battery is fully charged, the electrolyte or solution in the cells should have a specific gravity of from l.275 to l.300 as indicated by the hydrometer syringe (Fig. 8). The gravity will lower due to discharge, and when completely discharged will register from 1.150 to l.175—about 125 points less than when fully charged. If one cell regularly requires more water than the others, thus lowering the gravity, a leaky jar is indicated. Even a very slow leak will in time relieve the cell of all its electrolyte. A leaky jar should immediately be replaced with a new one.

The Electric Storage Battery Co. has distributors who do battery repair work in towns of any considerable size, and "Exide Battery Depots" in the following list of cities, where complete assembled batteries and repair parts are carried in stock, These depots are fully equipped to do any kind of battery repair work:

New York City-527-541 W. 23rd Street.
Philadelphia—Allegheny Avenue and 19th Street.
Boston-789 Tremont Street.
Chicago-333 West 35th Street.
Cleveland-5121 Perkins Avenue.
Atlanta-20 South Piedmont Avenue.
San Francisco-9-13 Minna Street.
Denver-1424 Wazee Street.
St. Louis-1415 Chestnut Street.
Kansas City-1329 Walnut Street.
Rochester, N. Y.-44 Cortland Street.

List of Sales Offlces

General Offices and Works—Allegheny Avenue and 19th Street, Philadelphia, Pa.
New York City-100 Broadway.
Boston-60 State Street.
Chicago—Marquette Building.
St. Louis—Fullerton Building.
Cleveland—Citizens' Building.
Atlanta—Candler Building.
Denver-1424 Wazee Street.
Detroit—Ford Building.
Portland, Oregon—Spalding Building.
Seattle—Coleman Building.
Los Angeles—Pacific Electric Building.
San Francisco-118 New Montgomery Street.
Rochester, N. Y.-44 Cortland Street.
Toronto—Canadian General Electric Co., Ltd.

Charging Circuit Diagram

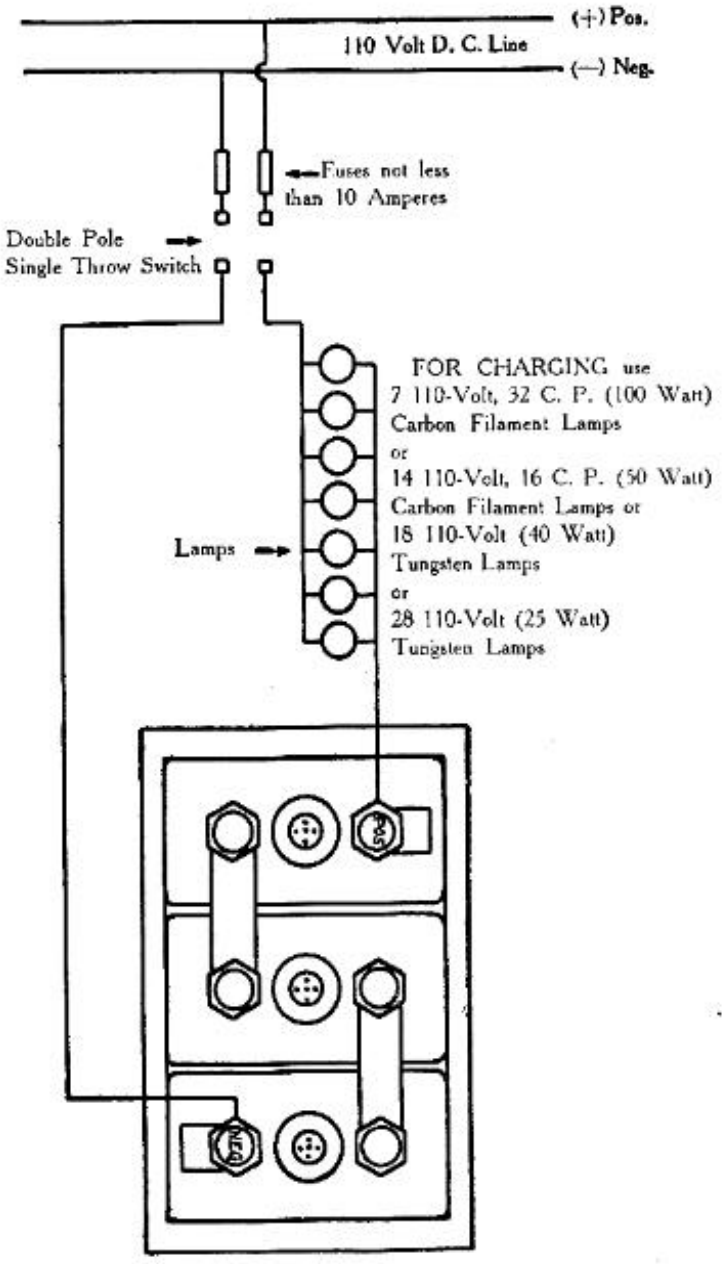


Fig. 6

Charging Storage Battery From An Outside Source

Battery Removed From The Car

It is necessary that the charging be done with DIRECT CURRENT. The simplest method when there is 110 or 120 volt direct current available, is to connect seven 110 volt, 32 candlepower, 100 watt carbon lamps in parallel with each other and in series with the battery to be charged; this combination giving approximately the proper charging rate-7 amperes. The positive terminal of the battery must be connected to the positive side of the charging circuit, and the negative terminal to the negative side. VERY SERIOUS INJURY TO THE BATTERY WILL RESULT IF CONNECTED IN THE REVERSE DIRECTION. The terminals of the battery are stamped "Pos." and "Neg."

To determine the polarity of the charging circuit, if a suitable voltmeter is not at hand, dip the ends of the two wires (Fig. 6) into a glass of water in which a teaspoonful of salt has been dissolved, care being taken to keep the wires at least an inch apart. When the current is turned on, fine bubbles of gas will be given off from the NEGATIVE wire.

The diagram (Fig. 6) illustrates just how the connection should be made. The charge should be continued until all the cells have been gassing or bubbling freely for five hours, and there is no further rise in the voltage of the battery or specific gravity of the electrolyte over the same period. A battery in good condition in a discharged state will require about ten hours of recharging. If it has stood in' a discharged condition for several weeks, it will require from twenty-five to fifty hours charging—all depending upon the condition of the battery and the length of, time it has stood discharged.

If only alternating current is available, a current rectifier must be used. Consult your city electrician regarding this matter.

Putting the Battery Into Service Again

Before putting the battery into service again, inspect and add distilled water, if necessary. If the battery has not been kept charged during the winter, it will be advisable to give it a fifty-hour charge at a four-ampere rate from an outside source before putting it into service again. Make sure that the terminals are free from corrosion and that good connections of the wires are made.

The corrosion, which is a greenish deposit, can be removed from the nuts by placing them in a solution of bicarbonate of soda (cooking soda) and water.

The corrosion can be removed from the posts by saturating a piece of cloth with the solution and wiping them off. Do not allow any of the solution to get into the cells of the battery.

After the parts are free from corrosion they should be washed in warm water, and a light coat of heavy grease or vaseline applied, but not between contacting points.

If the battery has been left on the car during the winter months, and received its periodic charges, it will not be necessary to give it any special attention other than to fill it to the proper height with distilled water. After the car has been driven for a number of hours, read the specific gravity of the electrolyte with the hydrometer syringe. It should register from l.275 to l.300 if the battery is fully charged.

Hydrometer Syringe

We recommend that every Hudson owner carry one of these useful instruments at all times—especially if it is impossible for him to obtain regular inspection of the battery through his dealer.

This instrument (Fig. 7) is for testing the specific gravity of the electrolyte of storage batteries. It is shipped unassembled, carefully packed in a substantial wooden box.

To assemble, hold the glass barrel, to which is attached the rubber bulb, in a horizontal position, and insert the hydrometer stem end first. Wet the soft rubber plug which is attached to the hard rubber pipette (nozzle) and FORCE RUBBER PLUG, grooved end first, into the end of the glass barrel as far as it will go, or until it strikes the shoulder in the barrel. It is important not to force the pipette too much in making this attachment, as the end of the pipette must not extend beyond the base of the grooves of the rubber plug—otherwise the flow of the electrolyte, will be retarded in emptying the hydrometer syringe.

Directions For Using

After removing the filling plug from the cover of the cell, compress the rubber bulb of the syringe and insert the pipette in the solution of the cell to be tested. Holding the instrument as nearly vertical as possible, gradually lessen the pressure on the bulb until the electrolyte rising in the barrel causes the hydrometer to float. In general, only enough electrolyte should be drawn to float the hydrometer free of the bottom by about one-half to three-quarters of an inch. The specific gravity reading is taken on the hydrometer at the surface of the electrolyte in the glass barrel.

If the electrolyte is below the top of the plates, or so low that enough cannot be drawn into the barrel to allow of a proper reading of the hydrometer, fill the cell to the proper level (see Fig. 8) by adding pure water; then do not take a reading until the water has been thoroughly mixed with the electrolyte. This can be accomplished by running the engine for several hours.

The specific gravity of the electrolyte is an indication of the amount of charge in the battery. In a fully charged battery the specific gravity should be from l.275 to 1.300. Gravity above l.200 indicates battery more than half charged. Gravity below l.200 and above l.150 indicates battery less than half charged.

(When in this condition, use lamps sparingly until, by charging, the gravity is restored to at least l.200. Gravity below l.150 indicates battery completely discharged. An exhausted battery should be given a full charge at once.)

Hydrometer syringes are not a part of the electric system, but can be purchased from the Hudson Motor Car Co., or from The Electric Storage Battery Co., Philadelphia, Pa.

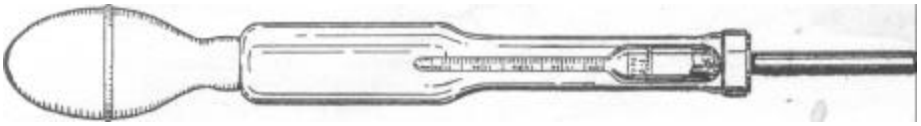


Fig. 7

The water for filling the batteries must be pure

Distilled Water,
Melted Artificial Ice, or
Fresh Rain Water.

Never keep the water in metal containers, such as a bucket or can. It is best to get a bottle of distilled water from your druggist, or an ice plant. A quart will last a long time. The whole point is to keep metal particles out of the batteries. Spring water, well or hydrant water from iron pipes generally contains iron and other materials in solution, which will ultimately cause trouble if used.

If electrolyte has been spilled from the cell, replace the loss with new electrolyte and follow with an overcharge by running the engine for several hours, or charge the battery from an outside source (Fig. 6).

The specific gravity of the electrolyte to be used for replacing the loss when spilled from the cells, or due to broken jars, should be the same as that of one of the .Adjacent cells. This can be determined by the use of the hydrometer syringes (Fig. 7).

When new electrolyte is required to replace loss from spilling or when removing sediment or replacing a broken jar, it can be made by mixing chemically pure sulphuric acid of l.840 specific gravity, and distilled water, in proportion of two (2) parts of acid to five (5) of water, by volume.

THE ACID MUST ALWAYS BE POURED SLOWLY INTO THE WATER, AND NOT THE WATER INTO THE ACID. A glass, earthenware or other acid- proof vessel, thoroughly clean, should be used for mixing, and the electrolyte allowed to cool before using. If a lower specific gravity than 1.300 is desired, more water should be added to the acid.

The proper specific gravity of the electrolyte, when the battery is fully charged is l.300, as indicated by the hydrometer syringe, but a variation of from l.275 to l.300 is allowable. NEVER ADD ACID OR ELECTROLYTE TO THE CELLS EXCEPT TO REPLACE LOSS BY SPILLING, A BROKEN JAR OR WHEN REMOVING SEDIMENT.

Removal of Complete Cell

To remove a cell from an "Exide" 3-X-15-l battery for inspection, or repair, disconnect the cell by removing the top nuts and connectors (Fig. 8). Slack off several turns on the tie bolt nuts in the sides of the case, and the cell may then be lifted out.

On replacing cell, be sure that the polarity (POS. and NEG.) is as before. Tighten up nuts in sides of case and replace cell connectors, first coating studs and nuts with vaseline or grease. Make sure that lead covered nuts are drawn up tight.

The nuts in the sides of the case, in connection with bolts extending through the case, draw the case sides together and hold the cells firmly.

Sediment

The sediment which gradually accumulates in the bottom of the jars, should be removed before it reaches the bottom of the plates, as it is very harmful to the battery. Necessity for its removal is indicated by lack of capacity, excessive evaporation of the electrolyte, and excessive heating when charging. When a battery requires removal of sediment, better results follow if the work is done at a place where they are thoroughly familiar with storage battery practice. If a battery is in need of cleaning or repairs, it is best to communicate with the Hudson Motor Car Co. or The Electric Storage Battery Co., who will advise you where to ship the battery.

DO NOT SEND BATTERIES WITHOUT RECEIVING INSTRUCTIONS.

Care of Battery When Car is in Storage or Laid Up for the Winter

When a car is idle or in storage for any considerable period, the battery should not be left on the car without proper attention.

If the car is to be out of service as long as one month, but less than two, be careful to add water to the cells just before the last time the car is used and endeavor then to run the car so that the battery will be as nearly fully charged as possible. The specific gravity of the electrolyte must read between l.275 and l.300. Disconnect the wires of the battery, as even a slight leak in the wiring will cause the battery to discharge.

When the car is to be out of service for two months or longer the battery should be taken out and treated as follows: Remove the filling plugs and add pure water until the level reaches the bottom of the filling tube. Replace the filling plugs, turning them as far as they will go to insure their being firmly seated.

NEVER CHARGE A BATTERY WITH THE FILLING PLUGS OUT, AS THE AUTOMATIC VENTS ARE CLOSED AND FLOODING WILL RESULT.

Charge battery as instructed on Page 48.

When fully charged place the battery where it will be dry, cool and free from dust, but where it is accessible so that it will receive the proper attention. Rest the battery on wooden blocks so as to keep the bottom clear.

Once every two months give the battery a freshening charge. Always remove the filling plugs and add pure water, before starting charge. Keep this charging up until the cells gas freely and evenly. Test the cells between charging periods so as to determine if they are all uniform.

The gravity is an indication of the state of charge of the battery. A battery discharged below a specific gravity of l.150 will not crank over the engine, nor will it burn the lights to full candlepower when the engine is not in operation.

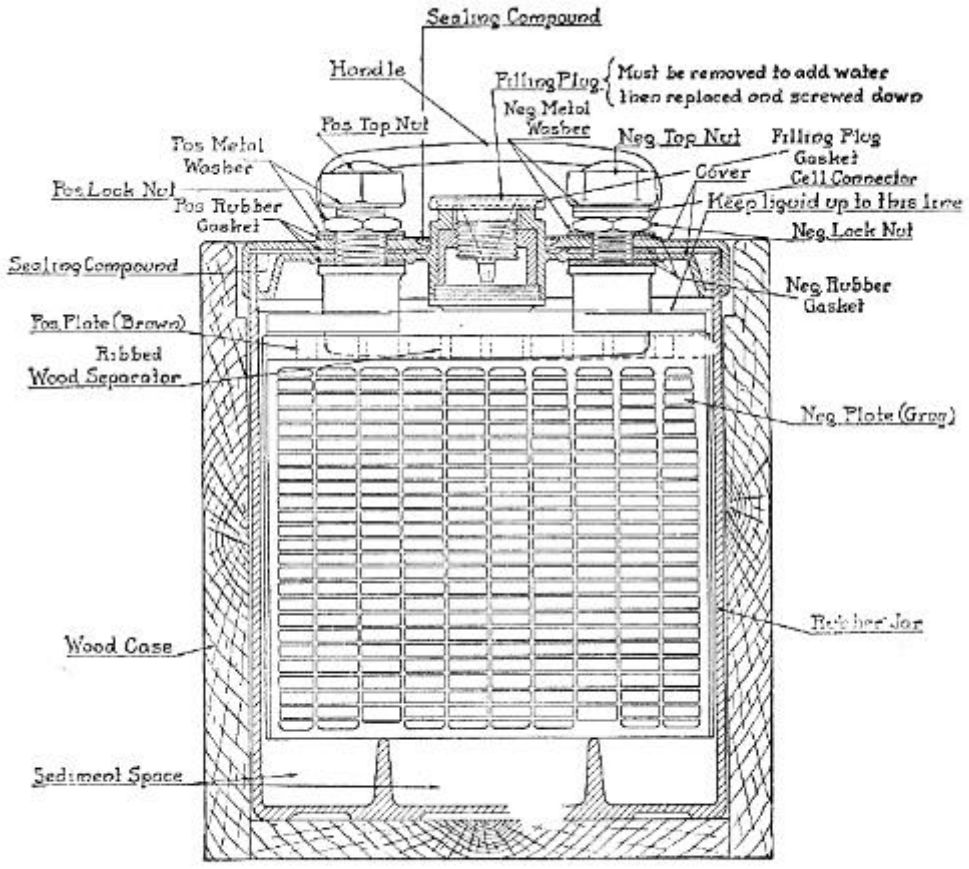


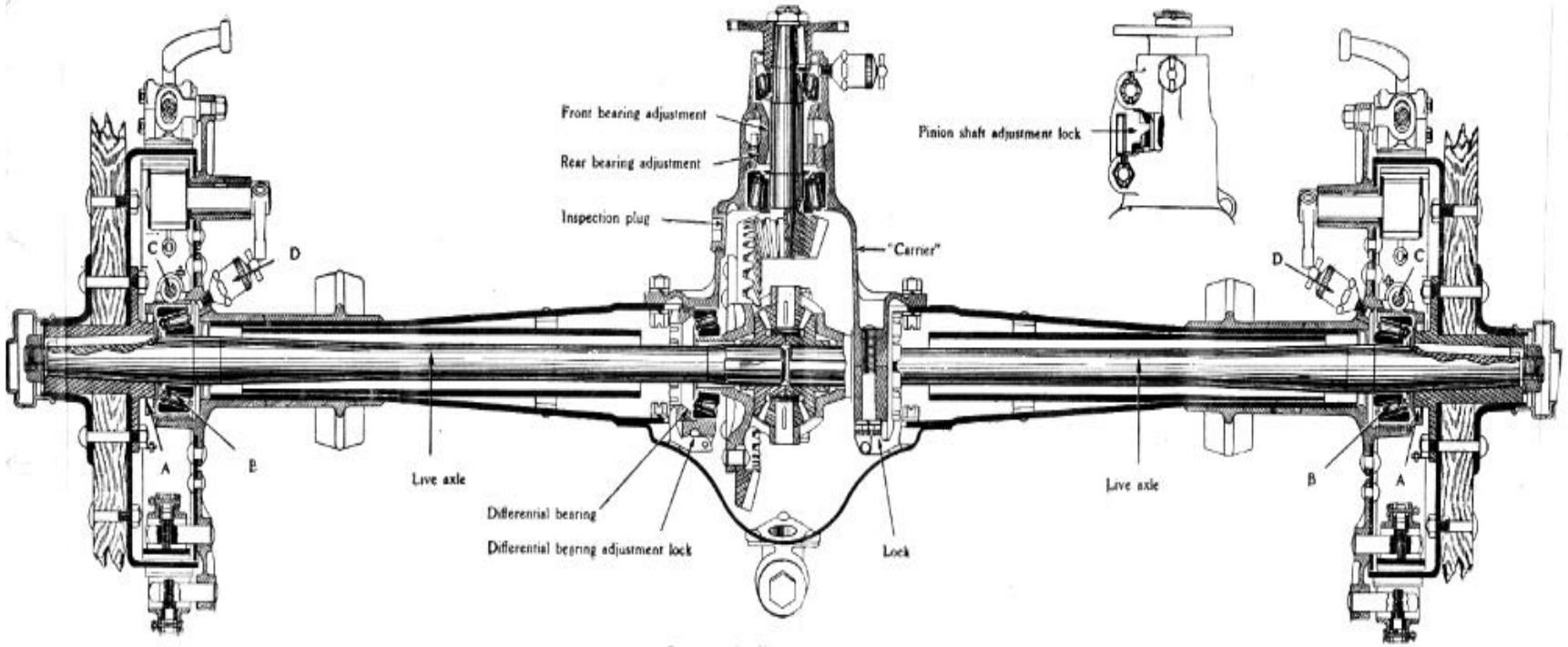
Fig. 8

Adding Water

The electrolyte must always cover the plates. Replace evaporation by adding pure, fresh water. NEVER ADD ACID.

If below the bottom of the filling tubes (see Fig. 8, "keep liquid up to this line"), add pure, fresh water, bringing the liquid up to the proper height—level with the bottom of the filling tube. Ordinarily it will require only 2 or 3 tablespoonfuls of water. In hot weather it may require more. Once every two weeks in cool weather and once every week in warm weather, unscrew the filling plugs and observe the height of the electrolyte. KEEP IT UP TO THIS POINT. THE FILLING PLUGS MUST BE REPLACED AND SCREWED UP TIGHTLY AFTER FILLING.

IF A PLUG IS LEFT OUT, OR LOOSE, THE SOLUTION MAY FLOOD OUT OF THE CELL, ESPECIALLY WHEN THE BATTERY IS BEING CHARGED. IF A PLUG IS LOST OR BROKEN, OBTAIN A NEW ONE AT ONCE.



Rear Axle Illustration No. 1