Instruction Book

THE Detroit ELECTRIC

1916 Pleasure Cars

THE ANDERSON ELECTRIC CAR COMPANY
Detroit, Michigan, U. S. A.

The Operation and Care of

DETROIT ELECTRIC

Models 56, 57, 58, 59, 60, 61

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The Anderson Electric Car Company

Detroit, Michigan, U. S. A.

DETROIT ELECTRIC INSTRUCTION BOOK

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DETROIT ELECTRIC INSTRUCTION BOOK

PART ONE—OPERATION

1. FUNCTIONS OF CONTROL LEVER.

See Plate 1.

The upper and shorter lever at the side of car is the control lever.

This lever is shown in the horizontal or neutral driving position. Moving the lever forward from this position operates the controller which makes the various electrical connections necessary to run the car at different speeds. Pulling this lever backward from a running position first cuts off the power and at the extreme backward position, applies the electric brake. There are five speed positions of the control lever in addition to the "neutral" and braking positions indicated by the speed dial at the top of the control mast.

When not in use the control lever folds upward to a vertical position and a Yale lock is provided to lock it in this position so that the car cannot be operated.

The push button operating warning signal is located in the end of the control lever where it is convenient for the driver.

2. STEERING LEVER.

See Plate 1.

The lower and longer lever is the steering lever.

This lever is shown in the horizontal or operating position. Moving the lever forward from this position steers the car to the left. Pulling this lever backward steers the car to the right.

When not in use this lever also folds upward to a vertical position, or by releasing the steering lever catch, it can be folded downward, out of the way.

3. FOOT BRAKES.

See Plate 1.

Of the two foot pedals the larger one operates the service brake on the rear wheels while the smaller pedal operates the cutout switch in the main power circuit, and also the brake ratchet to lock the brakes.

4. TO OPERATE CAR.

See Plate 1.

Assume the driver's seat, unlock the control lever, and while holding back the reverse stop, bring the control and steering levers to the horizontal position.

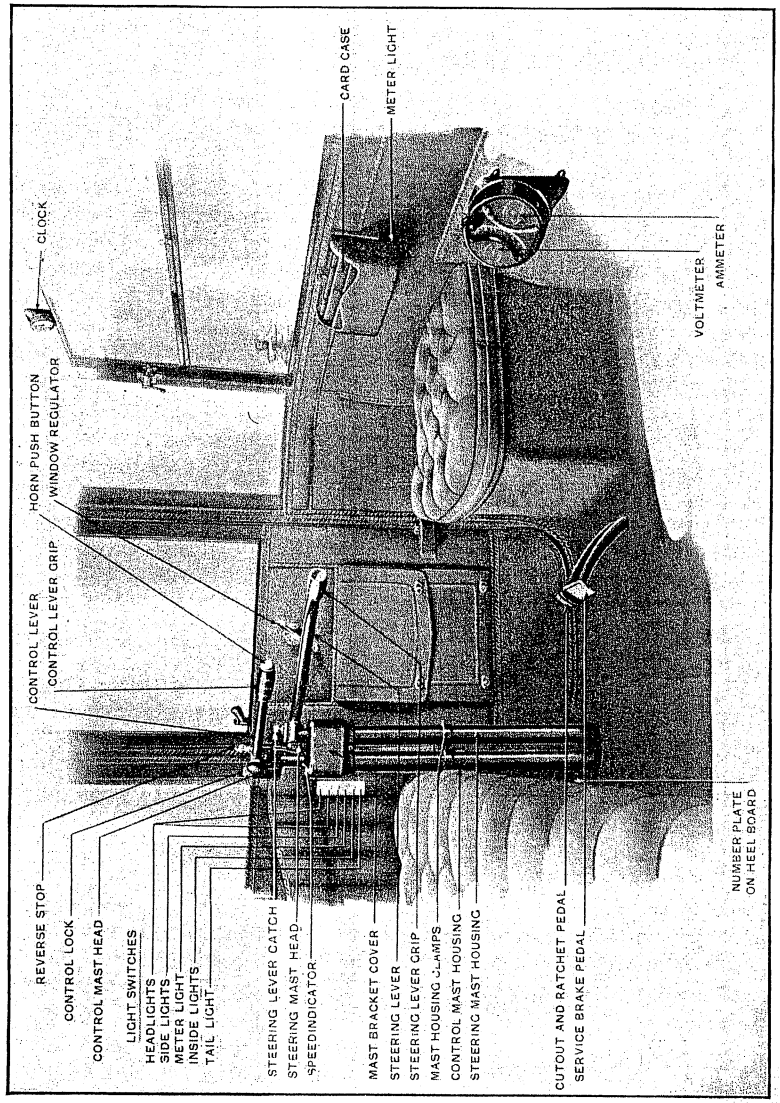


PLATE 1—Interior Rear Drive Brougham (Model 57)

If you have not run a "Detroit Electric" before, first try the operation of the control lever with the car at a standstill and the brakes in locked position. This can be done by first pressing the cutout and ratchet pedal until the ratchet clicks and the pedals are held down. In this position the brakes are set and the power is cut off at the cutout switch so that the car will not move when the control lever is operated. (If the previous driver has done his duty the pedals will already have been set as described, as this is the proper way to leave them when leaving the car.)

Move the control lever forward and backward through the different speed positions, until you have become familiar with its operation. Note that you can feel a notch corresponding to each speed indicated on the speed dial. The notches indicate the correct positions where the controller makes full electrical contact.

Learn to move the control lever with a sudden impulse from notch to notch, without hesitancy, pausing only at each point where the speed notch can be plainly felt. This will prevent burning of the controller contacts and thus save maintenance expense.

If the speed notches cannot be felt plainly the controller probably is in need of lubrication or the control system is in need of adjustment. The necessary attention should be given without delay. (See "Controller," pages 15 and 22.)

When you have become thoroughly familiar with the operation of the control lever, including the operation of Reversing as described below, release the foot brakes by applying slight pressure to the small pedal while holding the control lever in the extreme backward (braking) position. The car will now run when the control lever is moved into the speed positions.

Use first speed for brief intervals of running only, such as in starting and slow running in traffic. Any of the other four speeds can be used continuously for as long intervals as desired. The highest speed (5th) is the most efficient and satisfactory for hill climbing or heavy running such as in sand or new snow. The 3rd and 4th speeds are most efficient for ordinary level running.

The beginner should not attempt to drive faster than 2nd or 3rd speed utnil a fair degree of confidence is acquired.

5. TO STOP.

See Plate 1.

For the ordinary slowing down in traffic the electric hand brake will be found very serviceable and handy. To apply this brake, simply pull the control lever back toward the body as far as it will go. This makes an electrical connection at the controller

which energizes the magnets of the electric brake, thus drawing the metal disc at the head of the motor against the asbestos friction lining of the brake.

The strength of the electric hand brake is governed solely by the strength of the electric current flowing through its windings and is not dependent on the strength with which the control lever is pulled back. Do not pull on the control lever any harder than is necessary to bring it back to a stop. If the hand brake is not strong enough, or if it is too strong, have it adjusted without delay. (See Electric Hand Brake, page 27.)

For controlling the speed of the car on hills use the foot brakes, using the hand brake in addition if desired.

To stop quickly in an emergency press the cutout pedal which carries the other pedal with it. This single operation will cut off the power, apply wheel brakes and set the ratchet. The ratchet keeps wheel brakes applied until released by a slight pressure on the cutout pedal while the control lever is held in the extreme backward (braking) position.

If for any reason the controller becomes inoperative while the car is running, the power may be cut off and car stopped in this same way, by pressing the cutout pedal. This is one of the important safety devices of the Detroit Electric.

Never apply the foot brakes with the control lever in a speed position except when absolutely necessary in emergencies. When it is necessary, for any reason, to apply the foot brakes before bringing the control lever to the "neutral" position, be sure to press the cutout pedal so that the power will be cut off at the cutout switch.

Before vacating the car press the cutout pedal to set the brakes. Next make sure the control lever is in "neutral" position (marked "N" on the speed dial), raise it to the vertical position and lock it in this position, taking the key with you. The reverse stop (See Plate 1) must be held back in order to raise the control lever to the vertical position.

It is impossible to remove the key from the control lock except when the control lever is in the vertical position and the key has been turned to lock the control.

We cannot impress upon you too strongly the importance of forming the habit of setting the foot brakes and raising and locking the control lever in neutral position every time you leave the car. This will make operation or theft of the car impossible and will prevent meddling. Accidental releasing of the brakes by

anyone moving about the car will also be prevented, which is an important point especially when the car is left on a hill.

Doors may be locked from either inside or outside if desired. To lock doors from inside turn black knobs provided for that purpose. If desired to lock doors from outside use Yale locks provided in door handle.

These Yale door locks are operated by the same key as is used for the controller.

6.TO REVERSE.

See Plate 1.

With the control lever in "neutral," raise it until its further upward movement is arrested by the reverse stop. Then advance it into the speed positions in the same manner as when driving forward. This will run the car backward, the five speeds being the same as in running forward.

To stop from reverse speed pull the control lever back to "neutral" and apply the brakes. At the neutral point the control lever will automatically drop into position for driving forward.

7. TO SHIFT FROM ONE DRIVING POSITION TO THE OTHER IN THE DUPLEX DRIVE MODEL 60.

See Plate 2.

In the duplex drive model there are two separate sets of control, steering and braking devices each of which is just the same and operates the same as in the single drive models.

On entering the car note which set of pedals is depressed flat against the toe board and which set is up in operative position. If the front set of pedals is up (as in Plate 2) the car is ready to be driven from the front seat.

If it is desired to shift from the front driving position and drive from the rear seat, proceed as follows:

First—Ratchet the front brake pedals and lock the front control lever in the neutral, vertical position.

Second—Pull upward and inward on the knob of the brake shifting lever to release it; then move shifting lever backward as far as it will go. Holding it in this position, depress front pedals flat against the toe board and before removing the foot from the pedals bring the shifting lever forward again to its original position. This brings the rear pedals up to the operative position and locks the front pedals down.

Third—Leave the front seat, fold the front steering lever down and turn the front driver's seat to face backward by first pressing

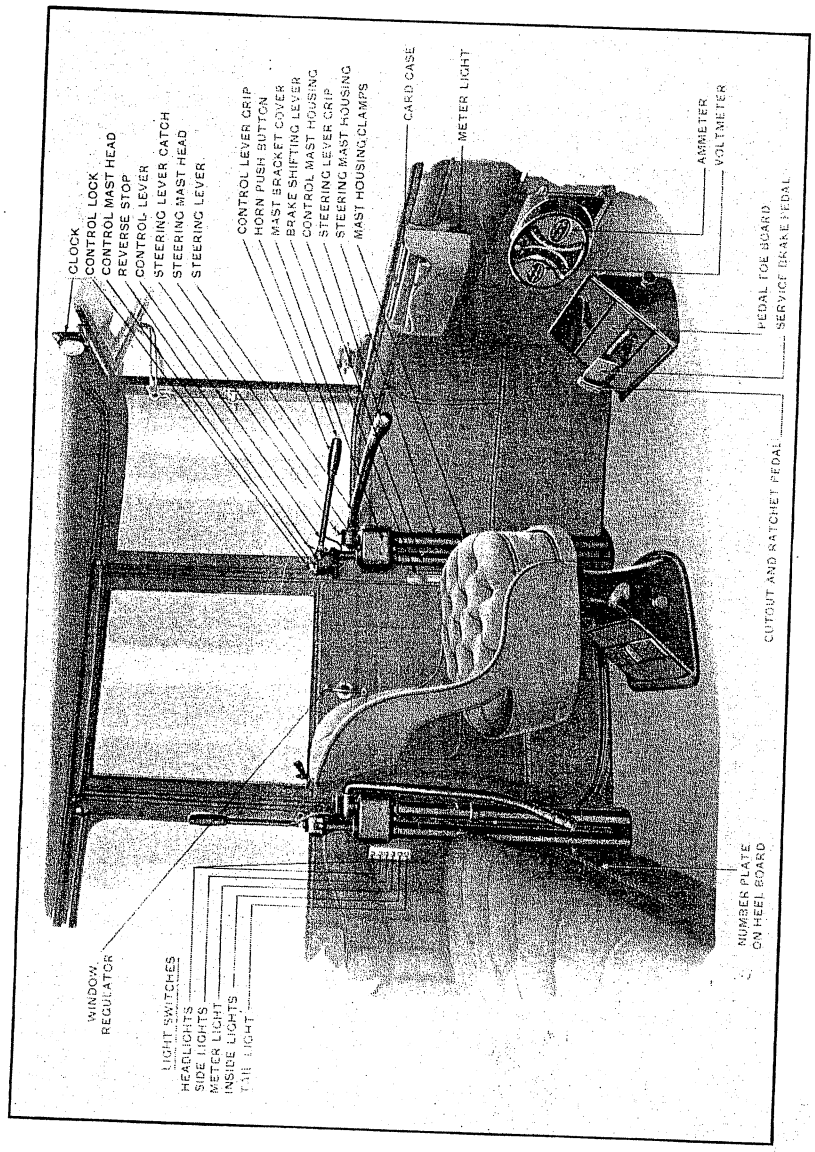


PLATE 2—Interior of Duplex Drive Brougham (Model 60)

upward on the catch underneath the bottom of the seat. To fold the steering lever down first lift it slightly and pull back on the steering lever catch.

Fourth—Raise the rear steering lever to the horizontal position and assume the rear driver's seat.

Fifth—Unlock the control lever and bring to the horizontal position, release the foot brakes by a slight pressure as previously explained, and the car is ready to be driven.

To shift from the rear to the front driving position proceed exactly as above, except, of course, that you will operate the brake shifting lever while sitting in the rear driver's seat.

When shifting from one position to the other always depress the pedals, as you would when vacating the car. The brakes then remain set during the shifting operation.

Always make sure that the steering lever which is not in use is folded down rather than up. It is not safe to leave it in the upward position while the car is being driven as the swaying of the car may cause it to drop to the horizontal position.

With the exception of the shifting features the operation of the duplex drive model is the same as that of the single drive models.

8. METERS.

See Plates 1 and 2.

The combination volt-ammeter supplied with cars having lead battery equipment indicates the voltage, or pressure, and amperage, or flow of the battery current.

When running on first, second and third speeds the battery is connected as two separate batteries working "in parallel," that is, independently of each other. On these speeds the voltage shown by the volt-meter will be approximately one-half what it reads on fourth and fifth speeds where the battery is connected as a single unit "in series."

On any speed the voltage will become lower as the battery discharges. The following table shows the approximate voltage limits on different speeds when the car is running freely on a level street having a clean, hard pavement.

Car running on	Battery Fully Charged	Battery Fully Discharged
2nd speed	42 volts	36 volts
3rd speed	42 volts	36 volts
4th speed	84 volts	72 volts
5th speed	84 volts	71 volts

These figures apply only to cars equipped with the standard 42 cells of lead battery and not to cars from which cells have been removed or to which cells have been added.

Form the habit of observing the voltage occasionaly as you come to level stretches of pavement and try to keep from discharging the battery below the above mentioned low limits of voltage. It is preferable to recharge before the fully discharged point is reached.

If you should happen to discharge the battery to a point approximating the low limits as shown in scale, make sure that the battery is put on charge without delay before it is used again. (See part 4, Battery Instructions.)

The amperage or flow of current varies considerably for different speeds and for different road and weather conditions. After a brief period of use the driver will learn the normal ampere draft of his car under local conditions.

Should the current draft exceed normal figures appreciably it is probably an indication that the car is not running freely and needs adjustment, lubrication or replacement of worn parts. The use of gas car tires or underinflation of tires will also cause an increased current draft.

The volt-ammeter also servies to indicate the voltage and amperage during charge and no other meters are required with the charging set.

Cars having Edison battery equipment are fitted with a Sangamo ampere-hour meter in place of the volt-ammeter. This instrument records in ampere-hours the amount of charge put in or taken from the battery.

The capacity of the A-6 Edison battery is 225 ampere-hours, and when the hand of the ampere-hour meter reaches this point it is time to recharge.

On charge the hand of the ampere-hour meter travels in a reverse direction and when it reaches zero the battery is fully charged.

9. LIGHTS.

See Plates 1, 2, also diagram 47100.

The location of the switches for the different lights is shown in Plates 1 and 2. In model 56 the inside lights are of course omitted.

Note that two switches (Nos. 1 and 2) are used for the headlights. Pull out both of these to burn headlights at full brilliancy, while to dim them push in switch No. 1 and leave switch No. 2 out.

When the car has just come off charge and is standing, the lights burn with extreme brilliancy which is likely to shorten their

life. In such a case it is best not to switch them on until just before you are ready to run the car.

It is not advisable to switch on lights while the battery is charging, as the high charging voltage is liable to destroy the bulbs.

The lights are connected to one-half the battery only. In order that they may be changed from one-half the battery to the other half from time to time, to prevent any unbalancing of the battery, a lighting throw-over switch is provided in the controller compartment under the floor. (See diagram No. 47100 in back of book.) Change this switch over at least once a month. This is particularly important where the lights are burned a great deal.

10. A FEW THINGS A CAREFUL OPERATOR WILL NOT DO.

1. A careful operator will not remove the charging plug until the switch on the charging set has been opened. He will make sure the charging plug is removed before starting the car.
2. He will not release the foot brakes until he is ready to start the car.
3. He will not, under any circumstances, get out of his car without first setting his brakes, raising control lever to upright position, locking it in place and removing the key.
4. He will not, under any circumstances, reverse his car when running forward without first coming to a complete stop.
5. He will not attempt to reverse without first seeing that the control lever is in neutral position.
6. He will not attempt to run the car forward after reversing without first bringing the car to a complete stop.
7. He will not attempt to raise control lever to the upright position when it has been in reverse without first making sure that it is in the neutral position.
8. He will not drive up to a stopping place at the rate of 20 miles an hour and then suddenly apply the brakes. He will shut off the current at a reasonable distance from the stopping place and coast, applying the brakes softly and easily at the proper time. He has in mind eliminating a waste of current, unnecessary wear on brake shoes and general strain throughout the car.
9. He will not use current on a down grade where the grade is sufficient to keep the car under fair headway.
10. He will not coast down a grade and wait until the car nearly stops before applying the power. He will strive to maintain, as nearly as possible, a uniform speed.

11. He will not try to obtain 20 miles an hour suddenly from a standing start. He has in mind preventing strain on the gears and parts generally. He will, in starting, take the speeds one at a time, pausing a short time in each to allow the car to accelerate gradually.

12. He will not turn corners at a high rate of speed as he knows this strains the car, wears out the tires and is dangerous.

13. He will not attempt to turn the front wheels with the steering lever when the car is standing. He will take hold of the wheel itself to do this.

11. A FEW THINGS A CAREFUL OPERATOR WILL DO.

1. A careful operator will keep his tires well inflated at all times.

2. He will keep his car well and properly lubricated.

3. He will study and strive to follow the manufacturers' instructions.

4. He will make as few starts and stops as possible.

5. He will study his car, and ask advice from the manufacturers' representative on points that are not clear.

6. He will have his car thoroughly overhauled and inspected at least once each year, as he knows that in so doing the car will give better results and longer life.

7. He will have his car refinished every six or eight months. Paint will not last forever. He will not expect the paint on his car to last as long if his car stands in front of his home from early morning to late at night as it does on his neighbor's car, which is run under shelter, out of sun and bad weather, when not in use.

PART TWO—LUBRICATION AND CARE

12. GENERAL.

See Plate 3.

An automobile is a machine and, like all machinery, it must be regularly and properly lubricated to give efficient service and to protect parts from damage. We cannot too strongly impress this fact upon you.

The lubrication chart, Plate 3, makes clear the proper lubrication of the parts in the single drive models. The duplex drive model is just the same except that the brake pedals, control masts and steering masts are duplicated.

In addition to the lubrication called for in the chart there are a few rod connections and other moving parts which require a few

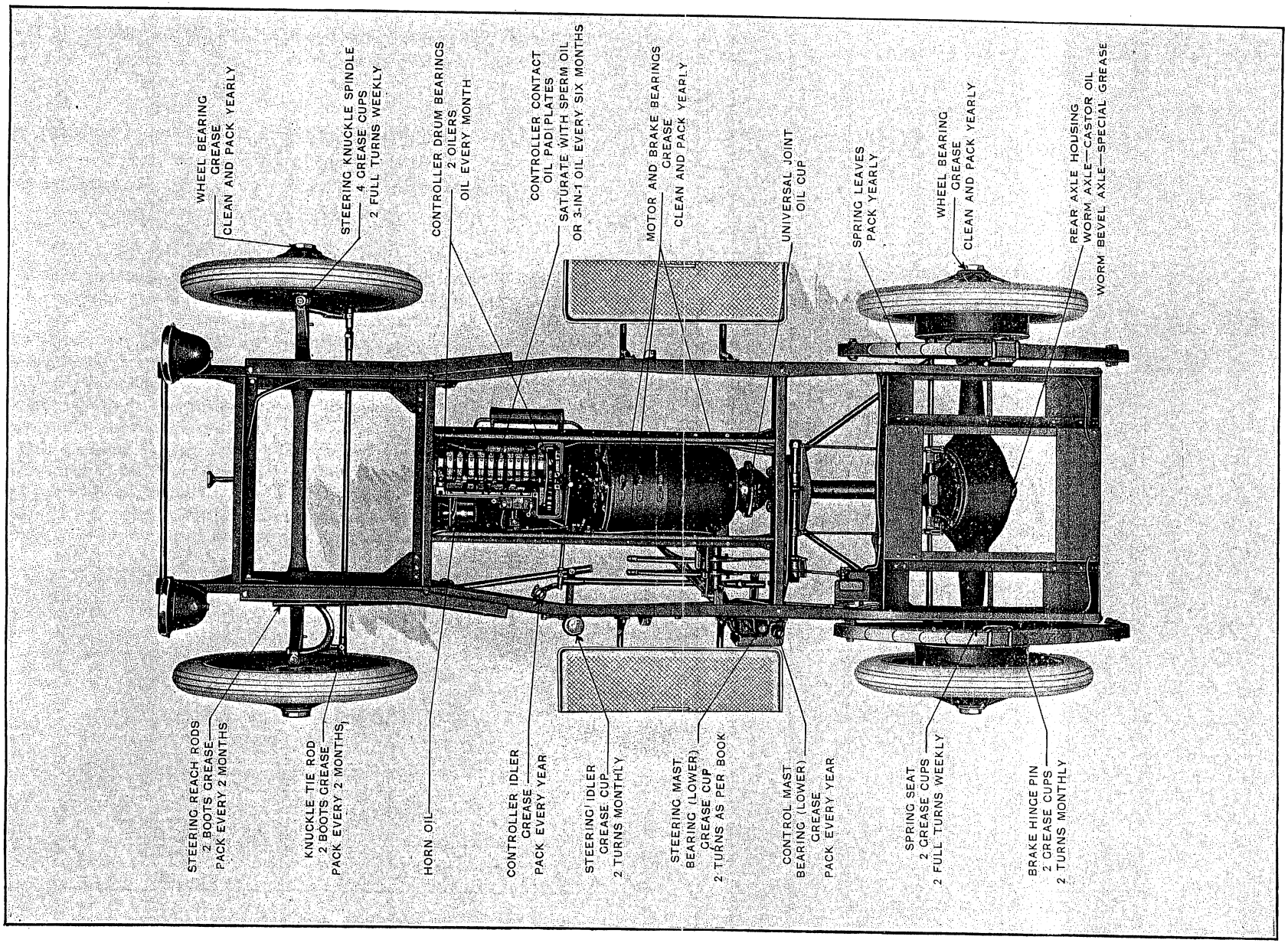


PLATE 3—Lubrication Chart

drops of oil occasionally. Also the instructions below should be given careful attention. Refill grease cups as often as they become empty.

About once a year the car should be given a thorough overhauling, including cleaning, repacking and adjusting of bearings and other moving parts and renewal of worn parts. For instructions regarding the taking down of the different parts see Part Three, Adjustments and Repairs.

13. KINDS OF LUBRICANT.

Where grease is mentioned in the lubrication chart (Plate 3), any good light grease, free from acid, can be used. It is, however, preferable to use a grease the character of which is changed as little as possible by changes of temperature. Some greases become extremely hard and lose their lubricating properties in very cold weather. These should be avoided. Do not use graphite grease except to repack the spring leaves. Where oil is specified use a high grade light engine oil.

Use nothing but the special kinds of lubricant called for on the controller contact plates and in the rear axle. We recommend that lubricating grease for worm bevel axle and universal joint be obtained from the Anderson Electric Car Company. This special grease may be obtained in 5 and 10 pound cans.

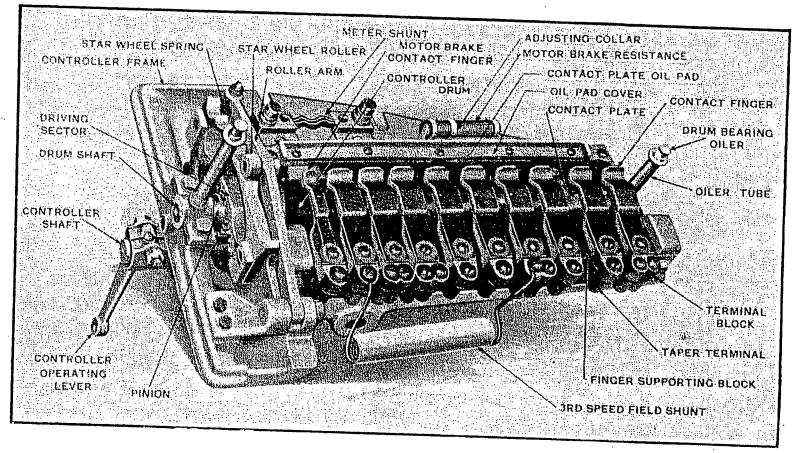


PLATE 4—Controller With Cover Removed

14. CONTROLLER.

See Plate 4.

The controller contact plates should be wiped clean once a month. The oil pad provided for lubrication of the contact plates is saturated with oil which should last three months. Renew the supply by pouring on the pad as much good sperm oil or "Three-in-One" oil as will be readily absorbed.

Give the star wheel roller and the hinge of the roller arm a few drops of oil every month.

Put a little grease on the controller pinion and sector every month.

Examine the controller fingers every month to see that they are making full and proper contact with the contact plates.

15. MOTOR.

The motor runs on two annular ball bearings, one at each end, and there is also a thrust bearing in electric brake at head of motor. Clean and repack these once a year. For instructions on how to do this and how to take care of commutator see page 31.

16. UNIVERSAL JOINT.

The universal joint housing just back of the motor is fitted with felt washers front and rear and is packed with one pound of thin grease for the lubrication of the universal joint.

An oil tube leading from the floor of the car is also provided so that should the universal joint require additional lubrication, oil can be applied.

During the yearly overhaul, clean out the housing and repack with grease while the torque tube is away from the motor.

17. REAR AXLE. WORM TYPE.

See Plate 5.

Once a month the rear axle should be inspected for height of oil, and, if necessary, oil should be added to bring the level just to the overflow opening. If, in making this monthly inspection, an axle is found which requires a considerable amount of oil to bring the level to the proper point, the axle should be carefully inspected and tested for leaks.

A leak at the drain plug can be corrected by coating the threads of the plug with shellac and screwing it in tightly. A leak at any other point requires the use of a new "Vellumoid" gasket, which should be ordered from the Anderson Electric Car Co.. In installing a new gasket the metal surfaces must be thoroughly cleaned and dried. A thin, even coating of shellac should then be applied to both metal surfaces and the parts should immediately be screwed down on the gasket before the shellac dries.

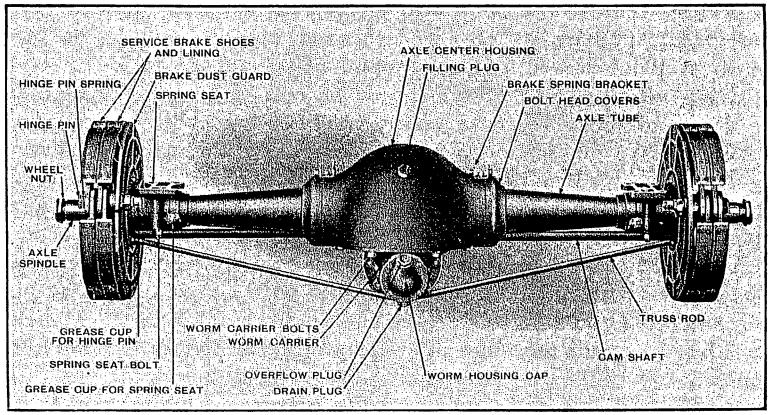


PLATE 5—Rear Axle. Worm Type

After three months' use of a new axle, and thereafter once in six months, axle should be cleaned and the oil completely renewed in the following manner:

Remove the filling plug, overflow plug and drain plug and drain the old oil out. Replace the drain plug and pour in about one quart of gasoline, jack up the rear wheels and run the axle with the motor in second speed for not longer than two minutes, or turn both wheels over in the same direction by hand. Drain and work out the gasoline thoroughly, then insert the drain plug tightly, using shellac on the threads. Now add one quart of castor oil or enough to fill to the height of the overflow opening with the car standing level. Insert the overflow plug and the filling plug tightly and the axle is ready for use.

Be extremely careful never to allow any dirt or foreign matter of any kind to get in the axle housing. A small amount of abrasive material will sometimes cause the worm gear to commence cutting with disastrous results.

It is highly important to use the very best grade of pure vegetable castor oil in worm axles. This oil can be obtained from any wholesale drug house or from The Anderson Electric Car Company. We cannot be held responsible if any other kind of oil is used.

18. REAR AXLE. WORM BEVEL TYPE.

See Plate 6.

As sent from the factory the axle contains five pounds of special grease, which is sufficient to run for at least six months. Every

six months remove the outer rear cover and take out upper inspection plug. If gears, as observed through inspection hole, do not appear well lubricated add one pound of special grease.

Every year the two covers should be removed from the rear of the axle and the old grease washed out, taking care to clean the bearings in the pinion housing. This can all be done without moving any of the gear adjustments in any way. The axle should then be refilled with five pounds of new grease and the back covers replaced.

A permanent oil-tight joint is made on the front of the axle housing by means of a Vellumoid gasket with a coat of shellac on each side. Should this joint leak, one or more coats of thick shellac painted around the edge of the casting will invariably cure the trouble.

An oil-tight joint at the rear of the housing is maintained by a $\frac{1}{16}$" thick cork gasket, shellaced to the face of the cover only, leaving the cover free to be removed for inspection purposes. Should the gasket become torn or broken a new one should be ordered from The Anderson Electric Car Co.

19. WHEELS.

Remove the wheel bearings, clean in gasoline and repack with grease during the yearly overhaul.

20. SPRINGS.

The eyes of the springs are lined with self-lubricating bushings. Should the spring links squeak, drop a very little oil in the grooves in the face of the links which will carry the oil between the squeaking surfaces.

Repack between the spring leaves with natural graphite grease during the yearly overhaul.

21. STEERING AND CONTROL RODS.

The ball and socket joints of the steering and control rods are packed with grease and covered with leather boots. Remove the boots, clean out the old grease and repack with fresh grease every two months.

22. BRAKE RODS.

Give each clevis end on the ends of all brake rods a few drops of oil once a week.

23. HORN.

Clean and lubricate the horn once a month in the following manner:

Take out the screw which holds the back shell to the horn and remove this shell.

Take a dry cloth and wipe the commutator clean.

After the commutator is thoroughly clean, apply a little vaseline or non-fluid oil with a clean cloth. In cold weather use thin oil. Apply to the commutator only the slightest film of lubricant. An excess obstructs the flow of current.

One a month a few drops of light machine oil should be dropped into the two oil wells inside the back shell.

Every three or four months a little non-fluid oil or vaseline should be applied to the toothed wheel next to the diaphragm.

24. CARE OF PNEUMATIC TIRES.

Do not ride a pneumatic tire flat. Running deflated is apt to injure the tire so that repair is impossible.

Keep the air pressure to 75 pounds for the 4½" tire. A higher inflation is not detrimental, but causes less comfort in riding. A lower inflation sacrifices efficiency and is detrimental.

If your tire is cut, bruised or injured so that repairs are necessary, have the work done at once.

Do not allow the car to stand in oil or grease, as this is detrimental to rubber.

When out of use for considerable periods, keep the weight of the car off the tires and store in a dark, cool room.

25. CARE OF CUSHION TIRES.

Do not drive in street car tracks. The sharp edges of the rails cut and grind off the sides of the tires, causing more wear and considerable more injury to the tires than would be acquired by driving on the worst of roads.

Do not allow the car to stand in oil or grease, as this is detrimental to rubber.

Have your tires inspected from time to time by the local Motz representative. He will be glad to advise you and tell you how to obtain the maximum mileage and service.

When out of use for considerable periods, keep the weight of the car off the tires and store in dark, cool room.

26. CARE OF BODY.

The finish of a body is the result of many weeks of extremely careful work in the paint shop and its lustre depends on its elasticity. Even the finest dust will scratch the surface of the varnish and paint if wiped off with a cloth. The only proper way to remove dust and mud is by washing.

Great care should be taken not to use too great a force of water, but flow plenty of water over the parts from an open hose.

On the body proper no soap or preparation of any kind should be used, except by a washer of experience. It is advisable to have two sets of sponges and chamois, keeping one set for the body and upper surface of the fenders, the other for the running gear and under parts. Flow water liberally over the body until the dirt is loosened, then sop off with a sponge, afterwards drying the body with a chamois.

On the running gear and under parts of the fenders a high grade carriage soap may be used.

When the original baked enamel finish of fenders becomes dull the lustre may be restored as follows:

Prepare a solution consisting of one part ammonia water, three parts water and a small quantity of linseed oil. Rub this over the fender surface with a woolen cloth, and rub dry with a clean cloth of wool or any soft material.

Do not use this preparation on the body or on a fender that has been varnished, as it will injure the varnish.

PART THREE—ADJUSTMENTS AND REPAIRS

27. SAFETY FIRST.

Never get under a car or work on the controller, reverse switch, cutout switch, charging receptacle, or wiring without first disconnecting one main battery cable from the front battery and one from the rear battery. By so doing you will avoid any possibility of the car starting and all danger of short-circuiting the battery.

Referring to diagram No. 47102 in the back of the book, the front battery main cables are those numbered 2 and 4; the rear battery main cables are those numbered 1 and 3.

28. ELECTRIC WIRING.

See Plate 7, Diagrams No. 47100 and No. 47102, in back of the book.

These diagrams are the same for all lead battery equipped models, except Model 60, which has two reverse switches in parallel in the power circuit and two horn push buttons in parallel in the lighting circuit. Wiring diagrams for Edison battery equipped cars can be furnished upon application.

Each car shipped from the factory has correct wiring diagrams for its particular equipment pasted on the bottom of the removable seat board underneath the rear cushion.

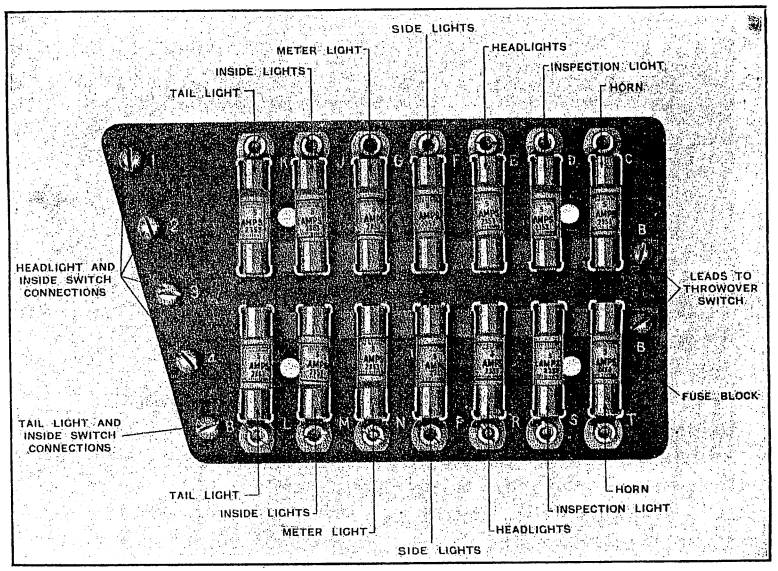


PLATE 7—Fuse Board

Underneath the removable floor board the lighting throw-over switch is located. (See wiring diagram 47102.) The position of this switch determines from which half of the battery the current for the lights is drawn. If switch is up, the rear battery is supplying current to the lights; if down, the front battery is supplying current to the lights. This switch is provided with large capacity fuses which act as protection for the wire leading to the entire group of lighting circuits.

Underneath the left side of the rear seat the fuse board (see Plate 7) is located.

In case one or more of the lights do not light or the horn does not blow (other lights being O. K.) the trouble is due to the burning out of either a fuse or a light bulb. The location of the fuses corresponding to the different lamps can be determined by referring to Plate 7. For example, if the trouble is with the side lights, the fuses to be looked at are F and P.

The fuse board connections B. B. 1, 2, 3, 4 and 8 are for use only in case the body is to be removed from the chassis. By disconnecting these and the tail light connection at L the body can be removed without unsoldering or cutting a wire.

29. CONTROLLER.

See Plate 4 and power circuit diagram 47102.

The controller is located in the controller compartment below the removable floor board just forward of the center of the car.

The controller is protected from dust and dirt by a metal cover held on by two spring clamps which fasten underneath the oilers at the top.

To remove the cover simply push back these two clamps and lift it off.

The controller is fitted with a spring-operated roller, which drops into notches in a sector, to indicate the proper speed point where full electrical contact is made. If the driver properly manipulates controller handle, this sector device will prevent arching at controller which causes roughening of both the contact fingers and contact plates.

In case contact fingers or plates become rough, smooth up the contact finger and plate without delay. To do this, first be sure to disconnect the main battery cables, front and rear (see "Safety First," page 20). Then loosen the screw which holds the contact finger to the terminal block and remove the finger. Smooth this up with a piece of sandpaper or a fine file, being careful to leave a smooth, even surface which will bear its full width on the contact plate. Smooth up the contact plate in the same way, if necessary. If the parts are badly damaged it will be necessary to replace them.

In inspecting or adjusting the controller, make sure that all fingers make good contact. If a finger is making good contact it will rise about $\frac{1}{16}$" when it engages with the contact plate and will bear with its full width so that a thin piece of paper cannot be inserted beneath either side, at the point of contact. If any finger does not meet these requirements adjust it by bending. Care must be taken not to bend a finger down too far, however, as it might, if bent too far, catch on the edgs of the contact plate instead of riding over it. Also there is a possibility of short circuiting if a finger is bent crudely and too much.

In case the car will not run on any speed with the battery properly connected and the cutout switch closed, the trouble may be due to one or more of the controller fingers not making contact as above.

In case the car will run on 1st, 2nd and 3rd speeds, but not on 4th or 5th, the trouble may be due to poor contact of fingers No. 2 or No. 3.

In case the speed notches are not distinct at the control lever, make sure that all the ball and socket joints, the controller idler and lower control mast bearing, the controller bearings and shaft are properly lubricated, and that the contact plate oil-pad is lubricating the plates properly. Also make sure that the roller arm spring is not broken nor out of adjustment.

30. REVERSE SWITCH.

See Plates 8, 9 and 10.

At the bottom of each control mast there is a reverse switch which is accessible through the outer shield, as shown in Plate 8.

To open the reverse switch box, remove the small machine screws and nuts which hold the outer shield; then take out the four screws which hold the cover to the switch box and pull off the cover.

With the control lever in the vertical position the contacts should be in the position shown in Plate 8, with the contact brushes and blades out of contact by about $\frac{1}{8}$".

With the control lever in driving position each blade should make a good firm contact with its proper brush.

The reverse lock stop plate at the rear of the reverse switch box has a tongue which engages with the reverse lock collar, which collar is keyed, pinned to and rotates with the reverse switch shaft. This is so designed that the reverse switch shaft can only be raised from the forward to the reverse position, or to the vertical position, when the controller is at the neutral point.

The contact blades and brushes can be replaced without removing the reverse switch box from the car.

To remove the reverse switch shaft, proceed as follows:

First—Remove lever from lower end of shaft without disconnecting rods from lever.

Second—Remove cover from upper mast bracket, inside of car.

Third—Loosen mast housing clamp and drop upper section of housing.

Fourth—Make a careful measurement of the distance from the floor to the control mast male clutch. This dimension is for use in reassembling and will save much time.

Fifth—Pull out cotter pin and back up lock nut above clutch about one inch.

Sixth—Force up control mast male clutch until disengaged.

Seventh—Unscrew mast by turning the lower portion.

Eighth—Remove control mast housing.

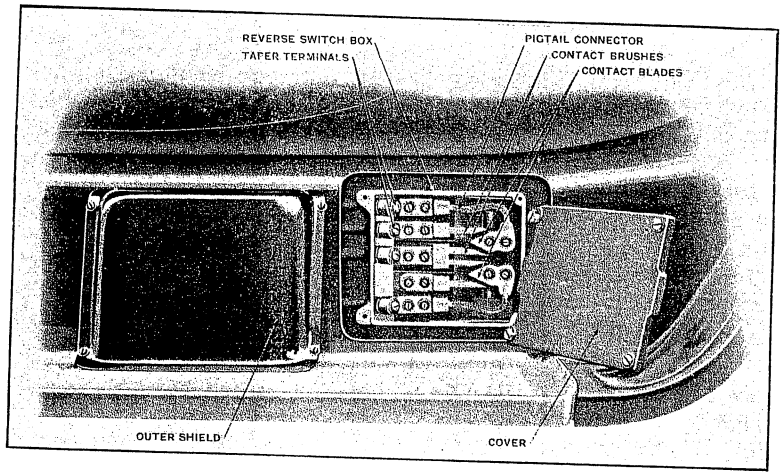


PLATE 8—Reverse Switch

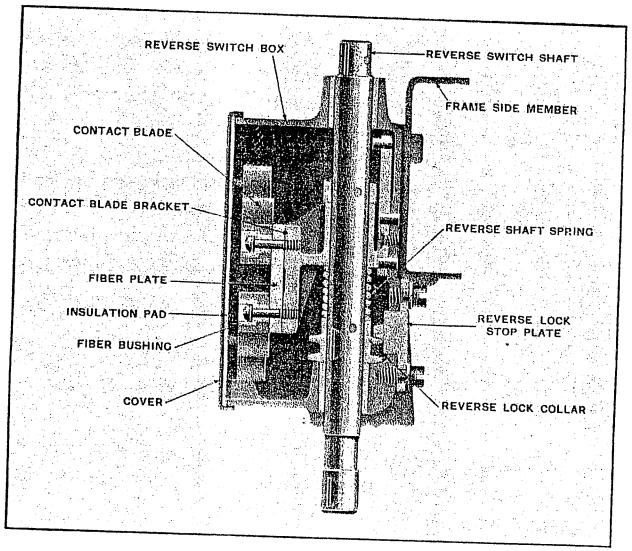


PLATE 9—Sectional View of Reverse Switch

Ninth—Remove contact blades from their bracket in the reverse switch box.

Tenth—Drive out pin in collar above contact blade bracket.

Eleventh—Drive out pin in reverse lock collar.

Twelfth—Slide reverse lock collar up shaft so that its key can be extracted.

The whole mast and shaft below the clutch can then be drawn up through the floor.

31. CONTROL MAST.

See Plate 10.

Two small universal joints are provided in the control mast to take care of the movement of the body due to road vibrations.

Should it be necessary to remove the lower joint take out the lower portion of the control mast (see page 23) and remove the joint by taking out screws at each end.

To remove the upper universal joint only, disconnect the control mast at the clutch as described on page 23, remove the control mast housing and take out the two screws through the universal joint.

When replacing a universal joint, adjust the screws tight enough to eliminate all lost motion and yet not so tight as to make control operation stiff. When the screws are adjusted, pein some of the bronze into the slot in head of screw with a prick punch.

The lower half of lower joints should be a close fit on the shaft, but must not be driven on or subjected to blows under any circumstances.

If the control mast rattles in the upper bracket take off the cover for the upper mast bracket and adjust the nut for control mast jaw. After adjusting, lock this nut securely with the small set screw.

To remove the control lock, take out small screw at the back of jaw and with the blade of a knife raise the lock.

To remove the lock plunger, drive out the small pin which holds the plunger cap and remove the plunger cap. This will allow the plunger to be easily extracted.

To remove the horn cable from the control lever, insert a knife blade between the metal part of the push button and the grip. Pull out the push button, remove the tape from the wires at the back of the button and disconnect the wires. Before replacing the push button, make sure the wires are carefully retaped so they cannot short circuit.

To mount a new grip on the control or steering lever, dip the grip in hot water for a minute or two, then quckly push it into place. Upon cooling, it will shrink tight. Do not use boiling water as it will change the hard rubber to a brown color.

To replace reverse stop spring, proceed as follows:

With the control lever in the neutral position, raise the control lever until the mast has been raised to its highest point; insert screwdriver or other flat metal piece under the left hand cam of

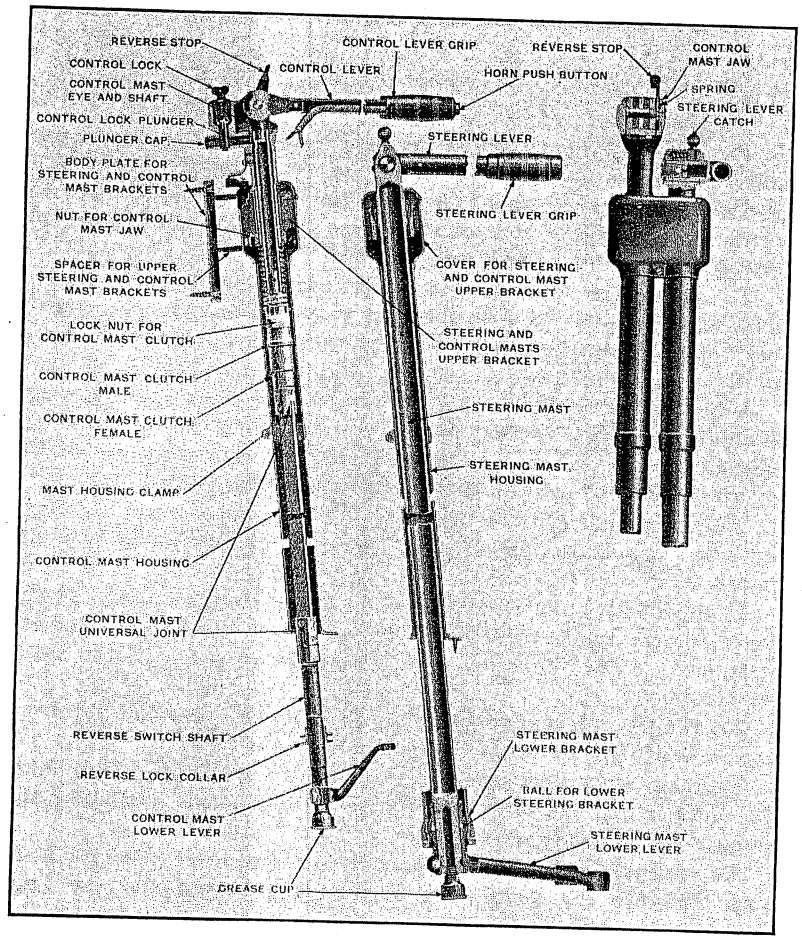


PLATE 10—Control and Steering Masts

control lever. Take out small nickel plated screw in the front side of control mast jaw and lift out the reverse stop. Lower the new spring in from the top and with a pair of pliers catch end of spring at side of right hand cam and press it into slot. Let the control mast down to its normal position. With the small end of a file or a knife hold other end of spring and replace the reverse stop and the nickel plated screw.

32. STEERING GEAR.

See Plate 10.

As the steering gear wears it may develop rattles in the ball joint connections of the different rods. To overcome this, remove cotter pins from the rod ends and screw up the plug with a heavy screwdriver, using a wrench on the screwdriver, if necessary, until all lost motion is eliminated. Then replace cotter pin and repack the ball joint with new grease.

The bearing at the lower end of the steering mast will also require an occasional adjustment. Make this adjustment by tightening the threaded collar just below the ball for lower steering bracket. (See Plate 10.) This collar is locked by means of a split clamp and cap screw which will have to be loosened before the collar can be adjusted. Tighten the collar with the spanner wrench supplied in the tool kit until there is no more rattle. Do not adjust too tightly or car will steer hard.

33. ELECTRIC HAND BRAKE.

See Plate No. 11 and Diagram 47102.

The stationary part of this brake, mounted on the head of the motor, consists of an electromagnet carrying a friction disc. The movable part, on the armature shaft, consists of a hub carrying a circular plate of thin spring steel, called the spring plate, which, in turn, carries a flat steel brake plate.

When the control lever is pulled to the brake position current is passed through the electromagnet winding and the brake plate is drawn magnetically into contact with the friction disc. The amount of current passing through the winding is controlled by an adjustable resistance located in the control compartment. When the control lever is moved out of the brake position the electric brake circuit is opened and the spring plate draws the brake plate free of the friction disc.

The stop studs which project through the spring plate are provided to prevent the brake being pulled into contact with the magnet when friction material has worn down.

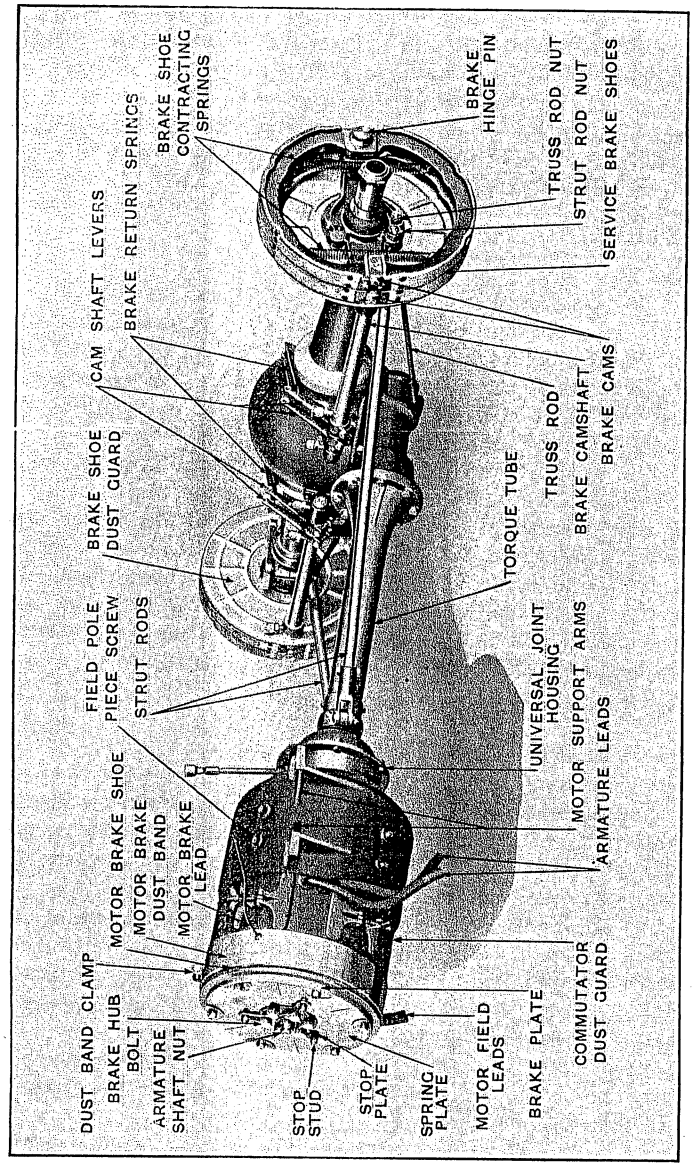


PLATE 11—Driving Unit Showing Brakes on Motor and Wheels

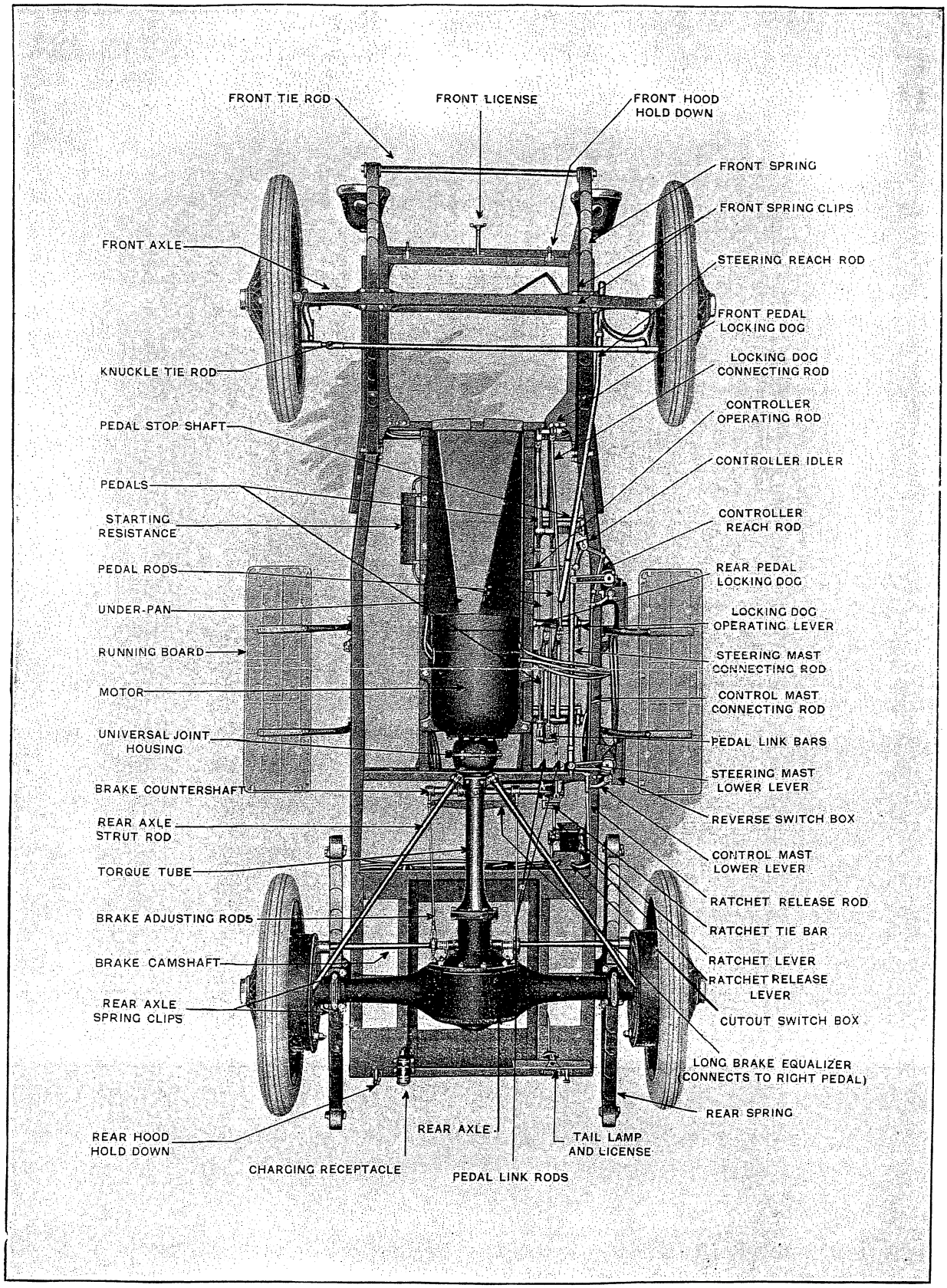


PLATE 12—Bottom View of Chassis (Model 60)

These studs are adjusted at the factory and should never be altered. When the brake has worn so that the brake is too strong, even with all the adjustable resistance in circuit, the brake can be further weakened in the following manner:

Unscrew the dust band clamp screw and slide the dust band forward. At the bottom of the magnet and behind the friction ring is an angle clamp; loosen the screw which fastens the clamp to the magnet and remove the horizontal screw which fastens the clamp to the friction ring. The friction ring, which is on a screw thread, can then be adjusted outward until there is little more than $\frac{1}{16}$" gap all around between the friction disc and the rotating plate; replace the horizontal screw in the clamp at the back of friction ring and tighten up the vertical bolt. The dust cover can then be replaced, and the brake resistance adjusted to suit the new position of the friction ring.

When the friction ring has become too thin for use, a new friction ring should be obtained from us and installed in the following manner:

Take out the six brake hub bolts and remove the spring plate and brake plate together. Unscrew dust band clamp screw and remove dust band.

Take out the horizontal screw which fastens the back of friction ring to the angle clamp and screw the friction ring off the magnet. Screw new friction ring onto magnet, setting it so that the friction face is slightly less than $\frac{1}{16}$" in front of the steel of the magnet face and lock the ring with the angle clamp as previously explained.

Replace the spring plate and dust cover, care being taken that the bushings around the brake leads are in their proper places in the dust cover.

The ordinary adjusting of the electric brake, to make it stronger or weaker, is done by means of the adjustable resistance mounted on the controller base. This resistance is fitted with a movable clamp and is connected to wires 11 and 12 in power circuit wiring diagrams. To make the brake stronger, move the sliding clamp toward the end to which the wire is attached. To weaken the brake, move the clamp away from this end.

The brake will tend to become stronger with wear, and the clamp must be moved occasionally to compensate for this. This is important, in order to prevent undue strain on the axle and excessive wear of the tires.

Back of the brake hub is a thrust bearing which takes the thrust occasioned by the application of the brake. To repack this bearing

with grease, remove the spring plate and the magnet previously described and then the armature shaft nut. In the hub are tapped two ⅜", 24-thread holes to facilitate the removal of the hub. The bearing is just back of the hub in a cup which is screwed and locked into the front end of the motor.

This electric hand brake instruction covers worm bevel gear cars. It is the same for worm gear cars, except that in the worm gear cars the friction ring is adjusted outward by shims instead of being mounted upon a large screw thread.

34. FOOT BRAKES.

See Plate 11.

On the worm axle there are two independent wheel brake systems, one connected to the left foot pedal and one connected to the right foot pedal.

On the worm bevel type axle there is one brake system which is connected to the right foot pedal.

These brakes should be adjusted for wear only by the brake adjusting rods (see Plate 12), between the brake equalizers and the camshaft levers on the rear axle. To make the adjustment, have the pedals released and loosen the lock nuts next to the yoke ends which connect to the camshaft levers on the axle. The other end of the brake adjusting rod at the equalizer is provided with a square end for turning the rod with pliers or a wrench. If the pedals are too slack, screw the rod further into the yoke end. Always adjust the two corresponding rods about the same amount.

The brakes should be adjusted so that the brake shoes are as close to the drum as possible without, however, actually touching the drum. Be sure to leave enough clearance between brake shoes and drum so brakes will not drag and consume current when released.

A convenient and good way to test for dragging brakes is to jack up both rear wheels and run the motor on 2nd speed. If the axle oil is cold, let the motor run for at least two minutes to warm the oil, then read the ampere draft on the meter in the car. This reading should not be more than one or two amperes higher than a similar reading taken before commencing to adjust, and should be less than 15 amperes.

If such a test indicates that the brake shoes are dragging, the brake adjusting rods should be unscrewed until the current draft falls to the proper point. The lock nuts next to the yoke ends should then be tightened securely.

Should it be found on the worm bevel type axle that one-half only of a shoe is working, the other half of the shoe can be brought into action by loosening the loose face clamp bolt, and inserting one or more shims between the back of the loose face and its bracket on the brake shoe and again tighten the clamp screw.

When the lining on the brake shoes has worn, then it should be removed by cutting the rivets which hold it, and a new piece of lining substituted, using the old rivet holes so that the shoe is not weakened by drilling a large number of holes.

Cut the brake lining to length and rivet the two ends to the shoe first, so that when the lining is drawn down into the depressions it is tight on the shoe all around.

35. CUT-OUT SWITCH.

The position of the cut-out switch box on the chassis is shown on Plate 12. The switch can be inspected by removing the rear seat cushion and taking off the top cover of the box.

Should it be necessary to work on the contacts, disconnect the two cables, and by taking out two screws underneath, the bottom of the box to which the contacts are attached can be removed.

Before replacing the contacts after they have been removed for any purpose, see that the hole in the contact arm inside the box is filled with clean grease.

These cut-out switch instruction refer to worm bevel cars. The contacts on the worm driven cars are removed through the opening in the top of the box.

36. MOTOR.

The motor commutator in normal use quickly assumes a glossy, bluish tint. The motor should be thoroughly inspected during the yearly overhaul and, if the commutator is found to be black, it should be cleaned with No. 00 sandpaper. This is best done by jacking up one rear wheel and turning it while the sandpaper is held lightly against the commutator.

If the commutator is found to be rough or badly grooved by the brushes, the armature should be taken out and a light cut taken over the commutator in a lathe, to smooth it up and true it.

Never use emery paper or extremely coarse sandpaper on the commutator.

To remove the armature, first take off the two dust covers at front end of motor by taking out the clamp screws and slide the covers forward toward the controller.

Next take off the motor brake hub and thrust bearing, as described under Electric Hand Brake, pages 29 and 30.

Next block up the car securely and take away rear axle, as described on page 33.

Next unscrew the nut which fastens universal joint to armature shaft and remove the propeller shaft.

With a piece of string tie up the brushes to the ribs of the frame around the commutator so that all brushes are clear of the commutator. The armature, with its rear bearing pedestal, can then be drawn out of the rear of the motor, taking great care not to drag the armature across the pole pieces of the motor or damage the insulation in any way.

After turning down the commutator it is advisable to shape the brushes to a good bearing by wrapping a piece of No. 00 sandpaper around the commutator, with its sand side toward the brushes, and working the sandpaper gently back and forth, with the brushes bearing upon it, until the brushes are a good fit to the curvature of the commutator.

To remove and repack the front motor bearing with grease, take off the entire motor brake, as described on page 29. Take out the spring ring which locks the motor brake thrust bearing cup and unscrew the cup. This allows the armature bearing to be easily withdrawn. When replacing the thrust bearing for the motor brake, see that it is clean and well packed with grease.

To remove and repack the rear motor bearing with grease, take off rear axle and propeller shaft, as described on page 33. Draw the oil thrower off armature shaft and unscrew the bearing lock nut. The bearing can then be easily withdrawn.

37. FRONT AXLE.

See Plate 13.

The front wheels should have from ¼" to ⅜" gather. This means that the front wheels, when in proper adjustment, should measure ¼" to ⅜" less from rim to rim at the front than at the back, measuring at the height of the wheel center in each case. If a knuckle arm or the knuckle tie rod has become bent in any way the gather will be changed, thus causing hard steering, increased current draft and excessive wear of the front tire.

If there is not sufficient adjustment on the knuckle tie rod to bring the wheels back to the proper gather, the bent part should be replaced or straightened, without heating. This adjustment is important and should be checked from time to time.

The front axle is designed to be mounted with the knuckle pins tilting backward from 1 to 1½ degrees. If the angle of the knuckle pins is more than 1½ degrees or less than 1 degree, steering

trouble will result. This angle can be adjusted by the use of wedge-shaped shims (which we can supply) between the spring and the spring pad.

38. REAR AXLE.

A slight noise in coasting sometimes develops without there being any real trouble in the gears and should give no cause for worry. Such a coasting noise may pass away in time.

Be sure to correctly locate a noise before doing anything to the axle. We have known of cases where what was supposed to be noise in the axle was located in the speedometer gears or in the motor.

To remove the rear axle from the car, first disconnect the brake rods from the cam shaft levers on the rear axle; second, take out the cap screws which fasten the universal joint housing to the motor; third, remove the lower halves of the rear axle spring seats by unscrewing the two ½" nuts from each spring seat. (It is a good plan to tie the lower half of each spring seat to the spring from which it was taken.)

Fourth, jack up the frame of the car securely in this position; fifth, pull the axle from under the car, taking care not to spill out the oil or grease.

WORM TYPE.

See Plates 5, 11 and 14.

To remove the worm carrier, take axle from under the car, turn the axle over so that the worm carrier is uppermost; take the hub caps and the bolt covers off the wheels and remove the driving shafts; take off both wheels; remove the truss rod nuts and take out the truss rod; unfasten the strut rods from the universal joint housing and take off the torque tube. The worm carrier can then be unbolted and lifted out of the axle.

No adjustments or replacements of gears or bearings in the worm axle should be attempted outside of the factory. The adjusting is a very delicate matter, but when made right at the start requires no further attention until the gears and bearings are worn out.

With proper attention given to cleaning and lubrication (see page 17) the gears and bearings should not require replacement for a long period. When the time does come for renewal, the complete worm carrier should be sent to us to have the necessary new parts mounted.

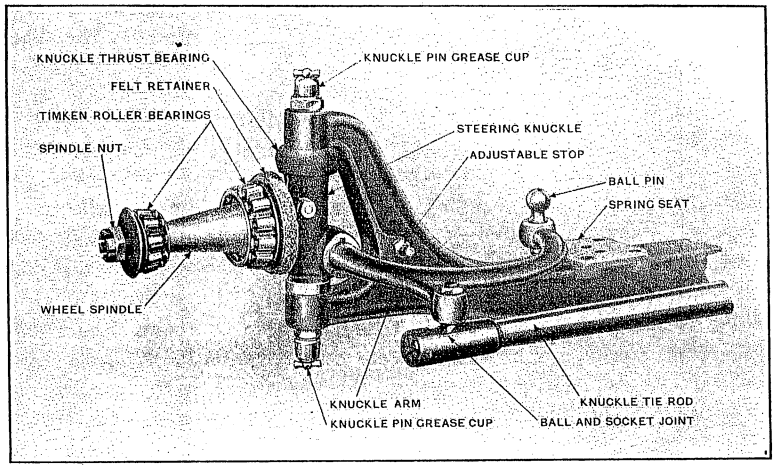


PLATE 13—Front Axle with Steering Connections

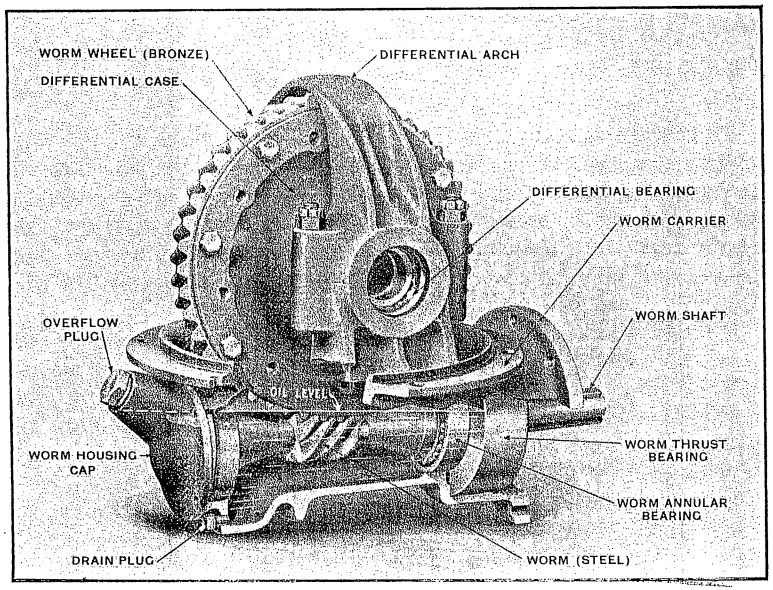


PLATE 14—Worm Gear Unit

If an unusual noise develops on the drive, the bronze gear should be carefully examined through the openings by means of a small searchlight. Should the gear be cut badly, it will have to be replaced. If the gear is only slightly scored, or if there are slight cavities where particles of bronze have flaked off, a thorough flushing with gasoline and renewal of oil should relieve the trouble.

In shipping a worm unit, be sure to pack it securely in a box by itself. Always state the mileage and give full particulars in regard to a unit shipped to us for any reason.

WORM BEVEL TYPE.

See Plates 6, 15 and 16.

Unlike the worm axle, the driving gears can be removed without taking the axle from under the car.

If the car is equipped with wood wheels, the driving shafts can be removed by taking off the hub caps and bolt covers and removing the nuts which bolt the driving flange to the wheels.

If the car is equipped with wire wheels it will be necessary to jack up each side of the axle and remove the hub caps and wheels; recesses are provided in the driving flange for the insertion of a chisel to drive off this flange. The flange is specially strengthened at the recesses to stand the hammering, and no places other than the recesses should be used for this purpose. After the driving shafts have been taken out remove the two covers at the rear of the center of axle housing, taking care not to damage the cork gasket; take off the lock plate which locates the differential adjusting nut. If the same gear is to be put back into the axle, mark the particular notch of the adjusting nut into which the lock plate is fastened. Then remove the cotter pins and nuts which hold on the main bearing caps and remove the caps. The gear wheel, complete with differential assembly, can then be easily taken out through the opening in the rear of the axle.

When removing the pinion, first loosen the pinion clamping bolt; next take out the two screws which hold on the pinion lock plate and remove the plate, taking care not to destroy the cork gasket.

If the same pinion is going to be put back into the axle again, mark the hole in the pinion sleeve into which the lock plate was fastened and measure the distance from the small end of the pinion to the joint face of the differential pedestal (this dimension should be approximately 4") so that the gears can be returned to their original setting.

Next insert the ends of a special wrench into the notches at the rear end of the pinion sleeve and unscrew out of the mounting. The pinion, completely mounted in its sleeve, can then be taken out of the opening in the rear of the axle.

When replacing the large ring gear on the differential after it has been removed for any purpose, take care that no one bolt is screwed down tight before the others, but travel round tightening each nut a half turn at a time until all the nuts are tightened. Unless this is carefully done the gear may be distorted slightly and it will be impossible to obtain an absolutely quiet axle.

The pinion may be assembled into its sleeve on the bench, taking care that the thrust bearing nut is tightened properly and securely fastened; the sleeve can then be screwed into the axle until the rear end of the pinion is (4″) ahead of the joint face of the differential pedestal.

The bearing mounted in the adjusting sleeve at the right hand side of the differential must also be very carefully tightened so that there is no lost motion in either direction and the nuts locked by the spring rings. The bearing on the left hand side of the

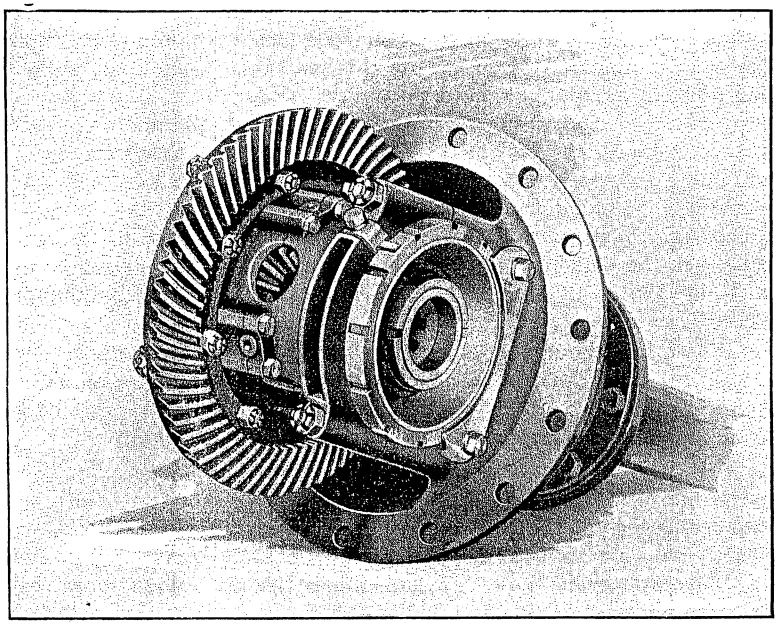


PLATE 15—Worm Bevel Unit

differential should be pushed on and the nut tightened and securely fastened by the spring locking ring. The whole differential can then be put into position and the bearing caps put on to the studs and the nuts put on loosely. (Never attempt to alter the adjustment of the gear without first loosening the nuts of the bearing caps two full turns and lightly tapping the caps sideways to ensure that the bearings are free to slide.) The ring gear should be adjusted so that from .004″ to .006″ backlash can be felt between the teeth of the gear and pinion and then the bearing caps tightened.

If the pinion has been properly located to the above dimensions the gears, when run, will probably be found to be reasonably quiet and absolute silence can be obtained by adjusting the pinion one or two notches forward or one or two notches backward; but if quiet running cannot be obtained within this range of four notches, the ring gear is probably distorted and should be dismounted from the differential, given a partial revolution and again carefully mounted.

Should it, however, be found necessary to adjust the ring gear out of mesh even but a few thousandths of an inch, the bearing caps must be loosened, as previously described, and the adjusting nut turned until the gear has moved outward about $\frac{1}{16}$″, then screw up the adjusting nut to bring the gear into the required position. It is impossible to satisfactorily adjust the gear outward unless done in this manner.

After the pinion has been properly adjusted, the locking cap on the top front of the housing should be screwed on its cork gasket to ensure an oil tight joint, and the clamping bolt tightened and secured.

Never try gears for silent running unless the pinion clamping bolt and the differential bearing caps are all tightened.

After any pair of gears have been run together for any length of time their respective adjustments should never be altered for any reason whatever; and, if taken apart for cleaning or other reasons, the locking notches of both gear and pinion should be marked before moving, so that they may be replaced in exactly the same relation.

39. WHEELS.

See Plate 16.

Wood Wheels. To remove the rear wheels and bearings: Remove the locking wire from hub cap and unscrew the hub cap; remove the hub bolt cover which is held in place by the hub cap;

remove the nuts which hold the drive flange to the wheel and pull out the drive flange and axle shaft; remove locking wire from the wheel nut; remove tongued washer and pull wheel partly off and then push it on again, leaving the outer bearing sticking out so that it can be easily and safely removed; the wheel will then slide off easily, leaving the inner bearing on the axle.

Wood front wheels and bearings are removed in the same way, except that there is no driving shaft to be taken out.

WIRE WHEELS.

To remove a wire wheel from its hub, press the brass locking spring on the hub cap and unscrew the hub cap in the opposite direction, indicated by the arrow on the cap. A special wrench is supplied for these caps. The entire wheel can then be lifted off its hub. The hubs and hub caps have right and left hand threads and each hub is marked for the side of the car to which it belongs, and each hub cap is marked with an arrow to show the direction it must be turned to screw it on. To remove the rear wire wheel hubs, first remove the wheels, as described above. Then take off the six nuts which hold the wheel hub to the bearing retainer and brake drum, and drive off the hub and axle shaft by inserting a chisel in one of the grooves provided for that purpose. These

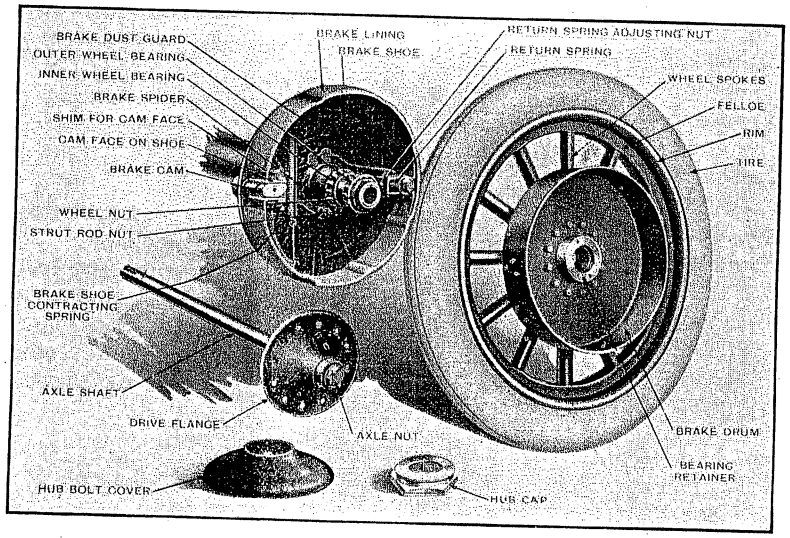


PLATE 16—Rear Axle Parts Wheel Removed

grooves are in the strongest parts of the flange and no other places should be used for this purpose.

Next remove the lock wire and take off axle nut. (The axle nut on the left hand side is a left hand thread.) Then pull the bearing retainer partly off and push it on again; this will enable the tongue washer and outer bearing to be easily removed and the retainer will then easily slide off, leaving the inner bearing on the axle.

To remove the front wire wheel hubs, jack up the axle and take off the wheels as previously explained. The hub is held on by a nut locked by a cotter pin the same as a wood wheel and it can be removed in the same manner as a wood wheel.

Before replacing hubs always take care that the bearings are filled with clean grease. For proper adjustment of bearings see section on Timken Roller Bearings.

40. TIMKEN ROLLER BEARINGS.

Every time a wheel hub is removed the cup of the bearing is removed with it and consequently the bearings must be properly readjusted when the wheel is replaced.

The best method is to adjust the bearing tight, then revolve the wheel a few times by hand. This will overcome any tendency to backlash. Then back off the adjusting nut very slightly so that by grasping two opposite spokes a barely perceptible amount of shake can be felt. If the bearings have been adjusted properly the wheel should spin easily and coast freely.

41. SPRINGS.

See Plate 12.

All spring clip nuts must be tightened at regular intervals. On a new car this should be done after the first month of service and thereafter about every three months. This is very important for protection of the springs.

All spring shackle bolts should also be examined occasionally and tightened as required, taking care not to tighten so much as to bind the spring and prevent good spring action. A loose shackle bolt may cause a very bad rattle on rough roads.

In removing a spring, put a clamp or wire around the spring leaves near the center, before loosening the spring clips, to hold the leaves together.

To remove a rear spring, block up the frame sufficiently to take all load off the spring. Remove the upper shackle bolts both front and rear. The spring clips of the upper half of the spring can be removed and the upper half slid out without interfering with the fender. The lower half can be removed by taking off the

two nuts which clamp the spring seat to the axle. The upper half of the spring seat will come off with the lower half of the spring.

42. BODY BOLTS.

The body is held to the frame by six bolts, three on each side. As a rule a new car requires two or three months of service before these bolts find a firm seat in the wood. In order to avoid annoying squeaks these bolts should be tightened every month for the first three months and once every six months thereafter.

43. HOODS.

See Plates 17 and 18.

Beneath each hood hinge is a piece of soft rubber sheet so mounted as to prevent any rain or wash water getting through the hinge into the batteries. Should this rubber become torn or detached it must be replaced.

The lower front edge of the front hood is fitted with rubber bumpers to prevent rattling. These rubber bumpers will have to be renewed occasionally.

44. FENDERS.

The fenders are mounted on the chassis in such a way that they can be removed without disturbing the body.

All the nuts which fasten the fenders are provided with lock washers. When replacing any of these nuts care should be taken that the lock washer is securely in place. Annoying noises will thus be prevented.

45. LAMPS.

If a lamp will not light examine both the fuses (see Electric Wiring, page 21) and the light bulbs.

All light bulbs have the Ediswan base. To remove a bulb from its socket push it in and give it a slight turn counter clock wise. This will free the bulb and it will spring loose.

The head and side lamps are supported by a specially designed ball and socket bracket.

To adjust the position of a head or side lamp loosen the cup-shaped nut, change the lamp to its proper position and retighten the nut.

To open the head lamp draw out one of the ball pins at the side of the glass.

To open a side lamp take out the small screw at the bottom of the hinged section.

The glass of the inside lamp is held by a spring fit and can be removed by pulling at the center of the lower rim.

To open the tail lamp remove the spring lock wire which holds the ruby glass.

46. HORN.

In case of trouble with the "Klaxet" horn take up the matter direct with the nearest Klaxon agency.

For lubrication and care of horn see pages 18 and 19.

For complete information see Klaxet Instruction Book, in tool box of car.

47. CHARGING PLUG AND RECEPTACLE.

When connecting the plug to the charging source, be sure to connect the positive wire to the terminal of the plug marked + and the negative wire to the terminal of the plug marked —. Should the receptacle have been disconnected for any purpose connect the positive battery wire to receptacle terminal marked + and negative battery wire to the receptable terminal marked —.

After the wires have been connected to the receptacle the recesses into which the wires are fastened must be filled up with insulating compound to prevent short circuiting by water.

48. VOLTAMMETER.

In case of trouble with the voltammeter take up the matter direct with the manufacturer, the Weston Electrical Instrument Company, Newark, N. J., thus saving considerable time.

In sending a voltammeter for repairs always send the ammeter shunt with it. Follow the wires down from the meter and disconnect them at the shunt on controller. NEVER CUT ANY METER WIRES.

The car may be run while the meter is being repaired by bolting together the two lugs which have been disconnected from the ammeter shunt and taping them well with insulating tape so there will be no danger of short circuit if they touch other parts.

If, when the ammeter is reconnected it reads in the wrong direction, simply exchange the position of the two small ammeter wires leading to the ammeter shunt.

49. AMPERE-HOUR METER.

In case of trouble with an ampere-hour meter, take up the matter direct with the manufacturer, the Sangamo Electric Company, Springfield, Illinois.

50. ODOMETER.

In case of trouble with the odometer the hub cap containing the instrument must be taken off and returned complete to the

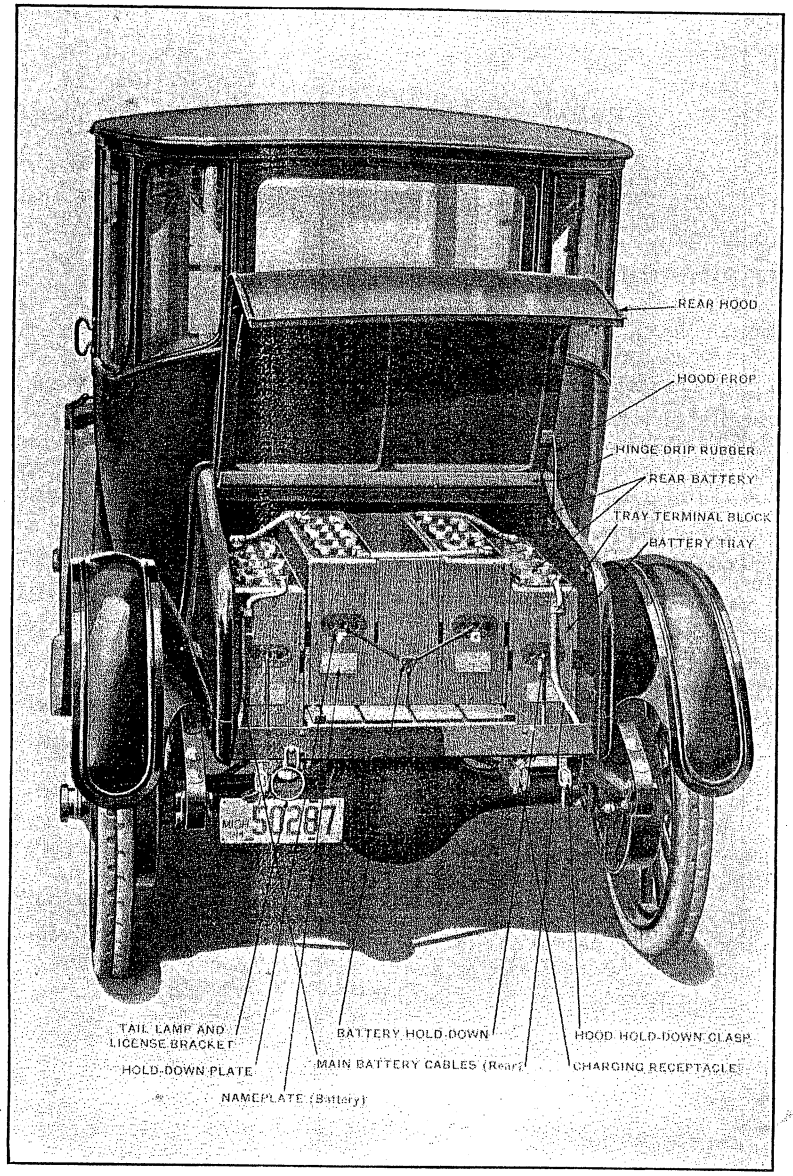


PLATE 17—Rear View of Car With Hood Up

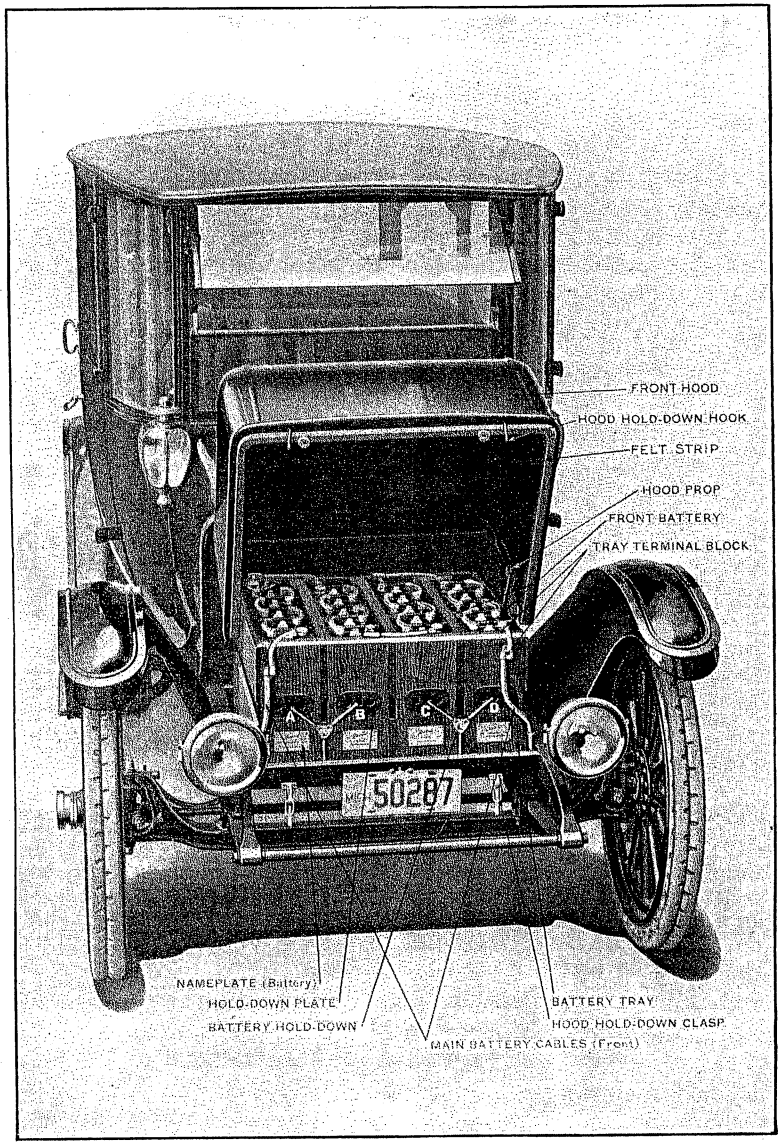


PLATE 18—Front View of Car With Hood Up

nearest branch of Anderson Electric Car Co. The instrument must never be tampered with for any reason whatever.

51. CLOCK.

The clock used is manufactured by the Waltham Watch Co., Waltham, Mass. Any trouble with the clock should be taken up direct with the manufacturer.

This is an eight-day clock. To change the setting pull out on the lower half of the ball on the winding stem.

To take clock out of case insert key in the lock at side of case and give it one turn, then give the clock one quarter turn and it can be taken out easily.

52. TO REMOVE BODY.

Disconnect the voltammeter from the shunt and car wiring, as described on page 41, or if an ampere-hour meter is used, disconnect the three wires from the back of the ampere-hour meter and loosen up the front carpet so these wires can be pulled down as the body is lifted.

Disconnect wires from the fuse board (Plate 5) under the rear seat as follows: Remove screws 1, 2, 3, 4, 8, B, and B; also disconnect the wires L, T, and C. It will be seen that there are two fibre cleats which hold the wires together. These also must be removed.

Disconnect the control mast as described on page 23 and remove center section of the mast.

Remove the lever from the bottom of the steering mast; drop the steering mast bearing and pull the steering mast up into the body, plugging the opening in the floor so the mast cannot drop down again.

Remove the plate around the pedals and loosen up the floor boards so pedals can pass through. In the model 60 disconnect also the shifting lever connecting rod which connects the lever under the front driver's seat with the locking dog operating lever.

Remove the six bolts which hold the body to the side rails of the frame and the body is ready to be lifted off.

53. TO REPLACE BROKEN GLASS.

In case of broken window glass in the front quarter or the sides proceed as follows: Remove the aluminum moulding on the outside of the glass and take out the old glass carefully without breaking the rubber channel into which the glass is set. Coat the edges of the new glass with varnish and then replace this rubber channel on the new glass, then set the new glass into the body and replace the aluminum moulding, fastening it so that it presses the rubber chan-

nel against the glass. Touch up all bare and marred places with black color varnish.

To replace broken door glass proceed as follows: Remove the lower window moulding and the rubber weather strip underneath it; unfasten the lower curtain fasteners and raise the door pad; turn the window regulator until the retainer channel, which holds the door glass, is just below the top of the opening; unscrew the three screws which hold the rectangular panel plate to the retainer channel; raise the glass and channel until the channel is above the door opening and slip two pieces of wood underneath the channel; remove old glass and rubber gasket from the channel.

Place rubber gasket on the edge of the glass and then press the glass and gasket into the channel, using a cabinetmaker's clamp to make a tight fit. Lower the glass to place and screw the channel plate to the channel. Replace the window moulding and rubber weatherstrip.

Should more detailed instructions be desired a special blue print and instructions can be obtained from the factory upon request.

54. TO REMOVE A BATTERY.

Disconnect all battery cables and the jumpers which connect the traps to one another. Unscrew the wing nuts on the battery hold-down irons underneath the frame and remove battery hold-downs. There is one such hold-down at the front end of the front battery and two at the rear end of the front battery, one at each end of each outside rear tray and two at front end of the center rear trays, and one at the rear end of the center tray. After these are removed the batteries can easily be lifted out by means of the special lifting handles found in the tool kit.

In putting the batteries back make sure to place and connect all trays in the exact position shown in the power circuit wiring diagram. (See diagram 47102.)

PART FOUR—BATTERY INSTRUCTIONS

55. GENERAL.

See Plates 17, 18, and 19.

CARE OF BATTERY.

Lead battery terminals should be kept clean and covered with a thin coating of vaseline to protect them from corrosion by the acid. The tops of the battery cells should be kept free from dust and dirt at all times.

Always raise the hoods for ventilation while battery is being charged.

Edison batteries must be given particular attention in regard to keeping clean and dry. Send for Edison battery instruction book if your car is equipped with an Edison battery.

The standard battery equipments of 1916 models is 42 cells of 15 thin plate lead battery and 54 cells of type A-6 Edison battery.

The following instructions apply to the standard lead battery equipment only. If your car is equipped with Edison battery don't fail to send for the Edison Battery Company's instruction book and instruction card.

The following instructions are intended particularly for the owner who keeps and charges his car at home:

Plates 17 and 18 show the standard lead battery installed in a car. See instructions for removing battery from car, page 45.

56. UNPACKING AND INSPECTION FOR BROKEN JARS.

Take off the top and one side of the box, in order to slide out the battery trays, as a short drop may break a jar or the acid may be spilled. Clean off the tops of the jars and trays. Examine all connections. They should be clean and bright. Take out the vent plugs and see that the acid covers the plates. If the level of the acid is low, add distilled water only to bring the solution just above the plate tops. Do not fill to the normal height of ½" above the plate tops as the solution level will rise considerably during the first charge after standing.

If the level of the acid is much lower n some cells than others examine them carefully for leaks; the jars may have been broken in transit. In case a leaking jar is found, cut the connectors and pull out the whole cell. If plates are still wet place the element in another jar and cover immediately with electrolyte of the same specific gravity as the other cells. If they have become partially dry fill with 1.220 electrolyte. If the plates have dried in the least the cell should be charged at 8 amperes until the voltage and specific gravity of the acid have reached their maximum and have stopped rising for at least four hours. The specific gravity should then be adjusted to 1.285 and the cell replaced in the battery. If no jars are available use a clean crock, glass jar or other acid-proof receptacle until a jar is obtained, covering at once with electrolyte as directed above. If no electrolyte is available, cover the elements with distilled water. A soon as possible, replace the element in a good jar and charge as above.

The battery is shipped fully charged, but before using it is important to give a freshening charge at 8 amperes until the voltage and specific gravity are at a maximum, otherwise full mileage may not be obtained on the first few discharges.

57. FREQUENCY OF CHARGING.

The best results are obtained by keeping the battery fairly well charged all the time. "Get enough current into the battery and get in with a minimum of gassing." The rate of charge is immaterial as long as the gassing and temperature are watched as outlined below.

When a battery is charged the water of the solution is decomposed by the electric current into gases. These gases unite with the active material of the plates during the early part of the charge, but as the charge proceeds a point is reached known as the gassing point, where more gas is formed than the active material of the plates can take care of and bubbles rise to the surface of the cell. The temperature of the cell also commences to rise at this point. At first the bubbles rise slowly, just as a kettle of water being boiled commences to simmer, but if the rate of charge is high they will soon commence to rise quite violently, the same as the kettle boils violently and the temperature will rapidly reach the danger point (105 degrees F.). The greatest wear on the positive plate takes place during this gassing period, therefore the longest life of the battery can be obtained by keeping this to a minimum. On the other hand, the greatest harm occurs to the negative plate when it is allowed to stand over two-thirds discharged. A complete discharge once in a while does the battery no harm, provided the battery is not allowed to stand after it is two-thirds discharged and it is always better to follow this with a full charge.

From the above it will be seen that the best results are obtained by keeping the battery fairly well charged all the time.

58. CHARGING APPARATUS.

Where it is desired to charge one's own car the market affords the following apparatus:

Where 110 volt Direct Current is available a rheostat should be used. These are obtainable in any capacity desired with prices varying in proportion to their capacity.

Where 220 volt Alternating Current is available a mercury arc rectifier or a motor generator set should be used. Mercury arc rectifiers are obtainable in 30, 40, 50 ampere sizes with prices varying in proportion to the size.

Rotary generator sets, which can be used on both 220 or 110 volt Alternating Current are available in sizes of any capacity desired with prices varying in proportion to the size.

59. CHARGING.

Always make sure the control lever is locked in neutral position and see that both hoods are raised for ventilation before commencing to charge.

Turn out vehicle lights while charging to prevent burning out the bulbs.

The following is the usual method of charging which has been governed more or less by the capacity and prices of the charging apparatus available:

The charge can be started at any rate up to 35 amperes, which is practically the capacity of the standard charging apparatus, provided care is taken to see that the finishing rate when the specific gravity and voltage are up does not exceed 10 amperes. The great secret of obtaining long life from a battery is to finish each charge at such a low rate that strong gassing and overheating are prevented. 10 amperes is the maximum permissible finishing rate; 6 to 8 amperes is better.

Charging at a rate higher than 10 amperes after cells have commenced to gas freely must not be permitted.

The following table shows the approximate battery voltage, during charge, at which strong gassing will commence and at which the current rate must be reduced to between 6 and 10 amperes. The table also shows the approximate final voltage at the end of an overcharge to the point of maximum specific gravity:

	Volts Per Cell	Voltages of 42 Cells
Voltage gassing point.....	2.35	99
Voltage at finish of overcharge.....	2.55	107

Charging voltage readings vary with temperature and age of the battery; the higher the temperature and the older the battery, the lower the voltage will be. Take voltage readings only when the battery is charging or discharging. Readings taken when the car is standing idle are of no value.

The density or specific gravity of the acid changes during charge and discharge and specific gravity readings taken by means of a hydrometer syringe (see Plate 19) give the most reliable indication of the state of charge. The specific gravity will read about 1.140 to 1.170 after a total discharge. It will rise during charge and at the end of a full overcharge should read 1.270 to 1.300.

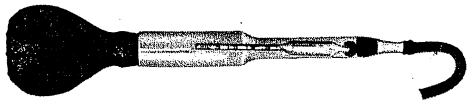


PLATE 19—Hydrometer Syringe

The hydrometer syringe is a convenient and inexpensive little instrument which it will pay you to obtain and use if you are charging your car at home. This instrument is used universally in the best electric garages.

Hydrometer readings are not dependable unless any added water is thoroughly mixed with the acid by subsequent charging. Hydrometer readings are not comparative unless the acid levels are one-half inch over the plates in all cases.

Hydrometer readings depend on temperature to some extent. For every 10 degrees F. rise in temperature the specific gravity readings will drop three points (.003) and vice versa. At ordinary temperatures this variation is negligible.

If at any time the battery temperature tends to rise above 105 degrees F. reduce the charging rate or stop the charge altogether until battery cools.

60. UNATTENDED CHARGING.

For overnight charging, without attendance, start at such a current rate that, as the rate falls due to rise of battery voltage, it will reach a minimum of 6 to 10 amperes when the charge is complete. The proper starting rate varies, depending on the type of charging apparatus used, and will have to be determined by trial. With mercury arc rectifier sets or direct current line the proper starting rate will ordinarily be from 18 to 20 amperes. With some types of small rotary chargers, however, the proper starting rate will be as high as 35 amperes.

In starting on overnight charge, unattended, the charging apparatus should be set at a point which previous experience has shown will make the finishing rate not over 6 to 10 amperes.

61. HURRYING THE CHARGE.

If it is desired to charge in a short time use the maximum capacity of the charging apparatus until the gassing point is reached. (See table, page 48.) The charging rate must then be reduced in successive steps down to the normal finishing rate, keeping in mind that the gassing point voltage must not be exceeded at a current rate higher than 10 amperes.

62. PERIODICAL OVERCHARGE.

Once a month follow the regular charge with an overcharge at the finishing rate until the specific gravity in every cell has stopped rising. During the overcharge take the specific gravity of each cell once every hour. When four successive readings of every cell are alike, showing that the specific gravity has risen to its maximum point, the overcharge may be stopped.

The maximum specific gravity should be between 1.270 and 1.300, with the acid level not more than one-half inch over the plate tops. If higher than 1.300 reduce it by withdrawing some acid and replacing with distilled water. If lower than 1.270, do not add acid, but proceed as directed below under Addition of Acid.

To properly carry out the above instructions will mean that the overcharge must be continued at least four hours after the end of the regular charge. In case the battery has become sulphated, due to insufficient charging, it may be necessary to continue the overcharge for ten to fifteen hours or longer.

63. ADDITION OF ACID.

Never add acid to the battery under ordinary operating conditions. The capacity and life of batteries are too often reduced by the unnecessary addition of acid. Under normal conditions the battery will need no addition of acid during its whole life. The acid in a battery cannot evaporate, only the water evaporates. Therefore, if no acid has leaked or splashed out, and the specific gravity is low, the acid must be in the plates in the form of sulphate, and the specific gravity must be restored to the proper point by an overcharge at the finishing rate.

If the specific gravity in a few cells is lower than the average, it is due to some abnormal condition in these cells, such as a leaky jar, sloppage, impurities in the acid or a short circuit. THE FIRST THING TO DO IS TO REMOVE THE ABNORMAL CONDITION. This done, the cells must be given an overcharge at the finishing rate until the specific gravity has reached a maximum and has entirely stopped rising for eight or ten hours. If, at the end of such an overcharge, the specific gravity is below 1.270, some 1.300 acid may be added. DO NOT ADD ACID AT ANY OTHER TIME, AND NEVER USE STRONG ACID OR VITRIOL.

64. ADDITION OF WATER.

During the charge, water is evaporated, causing a decrease in the amount of electrolyte and an increase in the specific

gravity. As the electrolyte should cover the plates by one-half inch, it is necessary to replace this loss with distilled water; never by the addition of acid. It is advisable to replace this evaporation before charging, so that the added water will mix thoroughly with the acid before hydrometer readings are taken.. The frequency with which the battery must be filled or "flushed" depends on the temperature and the amount of water evaporated in gassing. This acid must never be allowed to fall below the tops of the separators.

65. IDLE BATTERIES.

If a battery is to be idle for a long period, the following procedure should be followed:

Give battery a regular overcharge before the period of idleness.

After this charge flush cells right up to the covers, to allow for evaporation and absorption of the acid by the plates.

Give battery a freshening charge at the finishing rate once every month.

Give battery a discharge followed by a regular overcharge before putting into regular service again.

After putting back into service the capacity may not reach its maximum again until after several charges and discharges.

66. CAUTION.

Keep all metals and other impurities out of the battery. Impurities in the electrolyte, even in minute quantities, are very detrimental to the life and capacity of the battery.

Do not use iron buckets for water or acid.

Keep the battery clean—jars, covers, straps, terminals and connectors. It will prevent trouble from leakage and short circuits.

Keep the tray terminals greased with vaseline or oil to protect them from acid.

Keep naked flames away from the battery when charging.

Investigate and repair troubles at once.

67. VEHICLE BATTERY TERMS.

Positive Plate.

Distinguished by dark-brown color.

Negative Plate.

Distinguished by gray color.

Straps.

Moulded lead to which the plates are burned to form groups.

Positive Group.

A number of positive plates held together by a strap.

Negative Group.

A number of negative plates held together by a strap.

Wood Separator.

A thin, flat, specially treated piece of wood, slightly larger than the plates, and grooved on one side. The smooth side is placed against the negative plate.

Rubber Separator.

A thin, perforated sheet of hard rubber, which is placed between the positive plate and the grooved side of the wood separator.

Separator Hold-Down.

A rectangular block of wood, placed between the strap and the tops of the separators to prevent the separators from floating and exposing the bottom of the plates.

Element.

A positive and negative group, assembled with separators and hold-downs.

Jar.

Made of hard rubber and having ribs in the bottom to support the element.

Electrolyte.

A mixture of distilled water and pure sulphuric acid.

Complete Cell.

A jar containing element and electrolyte, and with cover and vent.

Connectors.

Moulded lead strips for connecting together the cells.

Tray.

Hard wood box or crate with handles, and tray terminals, into which a number of complete cells are placed.

Connecting Terminal.

Metal castings for connecting one tray of cells to another.

Battery.

The total number of complete cells, which, assembled in trays and properly connected, are necessary for propelling a vehicle.

Polarity.

A cross (+) or P indicates Positive; a dash (—) or N indicates Negative.

Gassing.

The bubbling which takes place toward the end of charge due to gases rising through the electrolyte.

PART FIVE—TROUBLE FINDING

68. GENERAL.

Do not change adjustments or disarrange parts until you are sure they are at fault. Study the symptoms and if the fault cannot be located consult the nearest Detroit Electric dealer or write the factory.

The following is intended simply as a key to aid in locating causes or trouble. For further information see Parts Three and Four.

69. CAR WILL NOT RUN AT ALL; VOLTMETER NEEDLE DROPS TO ZERO.

(a) The trouble is in the battery or battery wiring.

(b) See that the battery is properly connected and all connections clean and tight.

(c) Examine solution level in all battery cells. Fill if necessary. Look for cracked or leaky jars where solution is found very low.

(d) Take a pair of pliers and shake each lead battery connector to locate a loose connection or broken pillar post.

70. CAR WILL NOT RUN AT ALL; VOLTMETER READS NORMALLY, AMMETER READS ZERO.

(a) Jack up rear wheels.

(b) The trouble is in the controller, cut-out switch, reverse switch, motor or wiring.

(c) See that brakes are released and the cut-out or small pedal all the way back.

(d) Examine all controller fingers to see that they are making good contact.

(e) Examine cut-out switch to see that its fingers are making proper contact.

(f) Examine reverse switch to see that it is making proper contact.

(g) Examine motor to see that the brushes are working freely and making proper contact with the commutator.

(h) Examine the car wiring for breaks or loose connections.

71. CAR WILL NOT RUN AT ALL; AMMETER READING VERY HIGH.

(a) Examine brakes to see that they have released properly.

(b) Jack up one rear wheel to see if it can be turned. If it cannot, and the brakes are free, remove the rear axle, and examine the universal joint, gears and bearings.

(c) If Model 60, examine reverse switches and make sure both are in proper adjustment in all positions.

72. CAR WILL RUN ON FIRST THREE SPEEDS ONLY.

(a) Look for bad contact at controller finger No. 2 or 3.
(b) Examine battery. See No. 69 (a), (b), (c) and (d).

73. SPEED AND MILEAGE LOW; CURRENT DRAFT HIGH.

(a) See that the brakes release properly and do not drag.
(b) Examine the tires to see if they are properly inflated. Make sure they are high efficiency electric car tires as distinguished from regular gas car tires.
(c) Make sure the front wheels are properly lined up.
(d) Examine the rear axle and make sure it is filled to the proper height with the correct kind of grease, or oil.
(e) Examine all bearings in the driving system and wheels for improper adjustment, wear and lack of lubrication.
(f) This complaint may be due simply to unusual road or weather conditions.

74. SPEED AND MILEAGE LOW; CURRENT NORMAL.

(a) Examine solution level in all battery cells. Fill if necessary. Look for cracked or leaky jars where solution is found very low.
(b) Make sure that all battery trays are properly connected according to the wiring diagram.
(c) Examine the motor commutator to see that it is smooth and clean. See that all the brushes have sufficient tension, are working freely and are not worn too short.
(d) This complaint may be due simply to lack of charge or to a worn out battery.

75. CAR WILL RUN FORWARD BUT WILL NOT REVERSE.

(a) Make sure the control lever is raised to proper point where it engages with the reverse stop.
(b) Examine the reverse switch (two of them in Model 60) to see that it is properly adjusted and that it makes good contact in the reversing position.

76. MODEL 60 CAN BE OPERATED FROM ONE DRIVING POSITION BUT NOT FROM THE OTHER.

(a) Examine both reverse switches to see that they are properly adjusted so that good contact is made in both the forward and

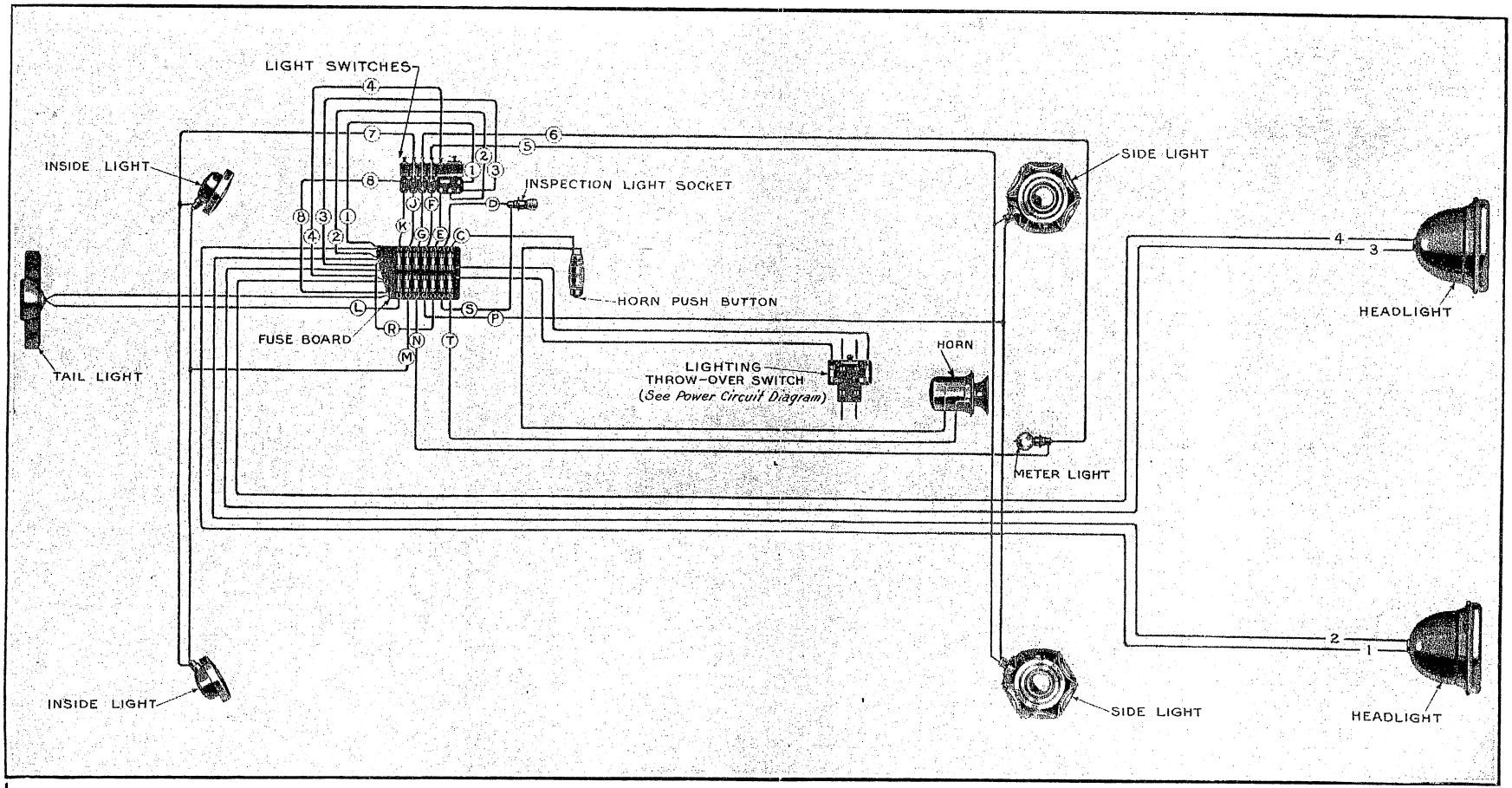
the reverse driving position and see that all contact is broken when control lever is locked in the vertical position.

77. SQUEAKS.

If springs squeak, lubricate between the leaves by means of a spreading tool. If squeak is at the shackle bolt and turning up the grease cup does not remedy, use oil can. If necessary, remove shackle bolt and clean it.

If body squeaks on the frame, tighten up body-bolts.

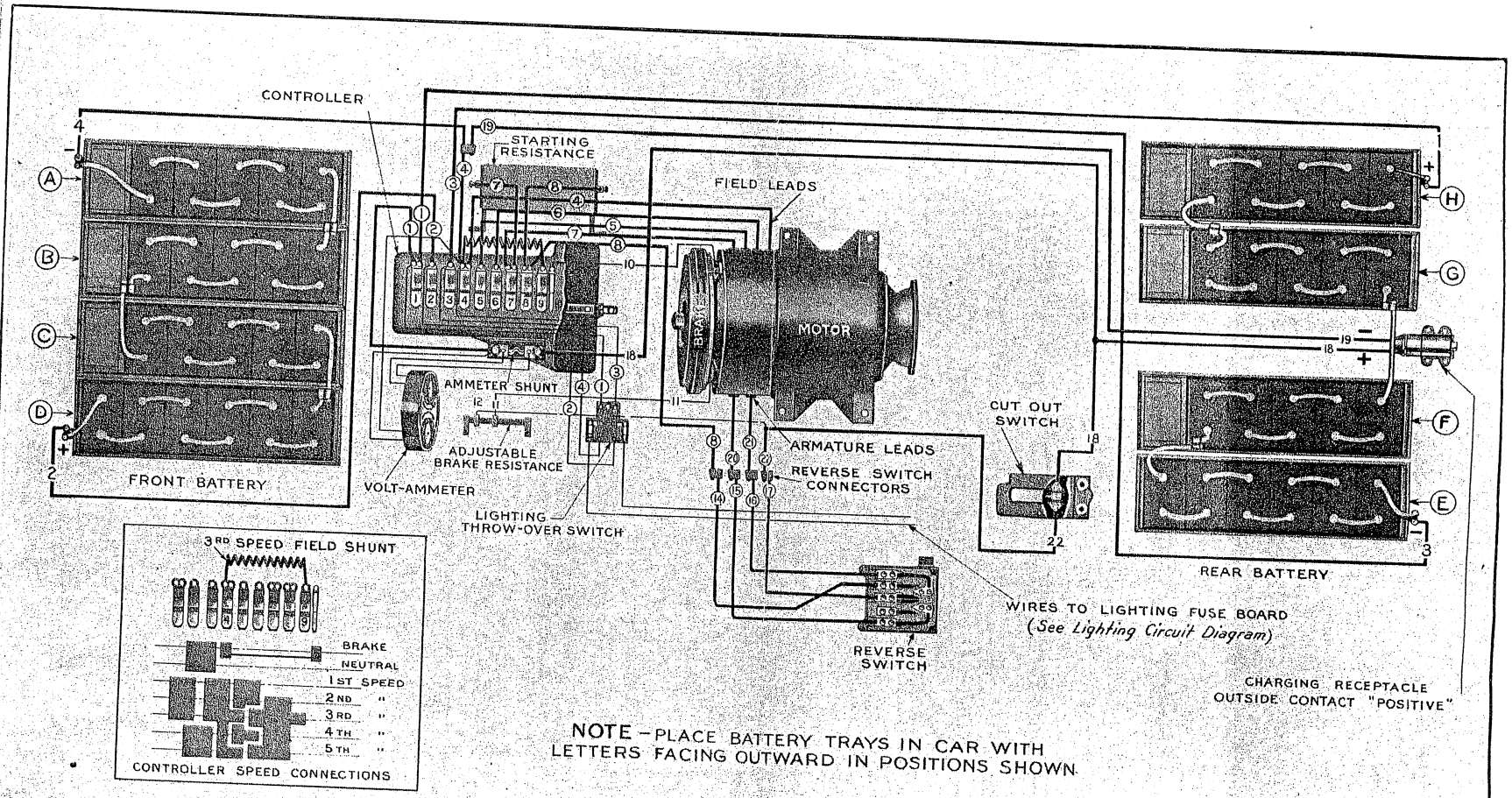
If hoods squeak or rattle, oil the hood hold-downs and the springs back of them. Renew the rubber bumpers on the front hood.



THE Detroit ELECTRIC

LIGHTING CIRCUIT WIRING DIAGRAM
MODELS 56, 57, 58, 59, 60
WITH STANDARD LEAD AND EDISON BATTERY EQUIPMENT
ANDERSON ELECTRIC CAR CO., DETROIT, MICH.

47100



NOTE – PLACE BATTERY TRAYS IN CAR WITH LETTERS FACING OUTWARD IN POSITIONS SHOWN.

THE Detroit ELECTRIC

POWER CIRCUIT WIRING DIAGRAM
MODELS 56, 57, 58, 59, 60
42 CELLS, 15 WTX LEAD BATTERY EQUIPMENT
ANDERSON ELECTRIC CAR CO., DETROIT, MICH.

47102