From
The Baker-Raulang Co
Foot of West 80th St
Cleveland Ohio

1915
INSTRUCTIONS

"J5"
Selective Dual Control
Worm Drive

Rauch & Lang Electrics

The Rauch & Lang Carriage Co.
Cleveland, Ohio

New Company
Rauch & Lang Inc.
Chicopee
Mass.

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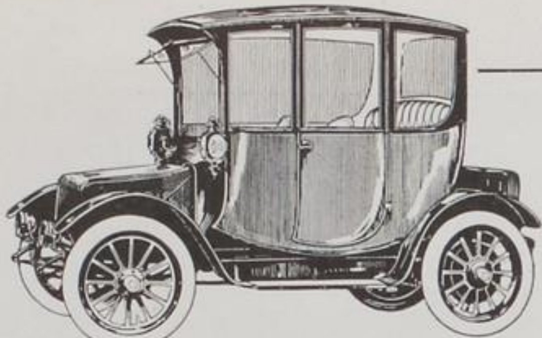

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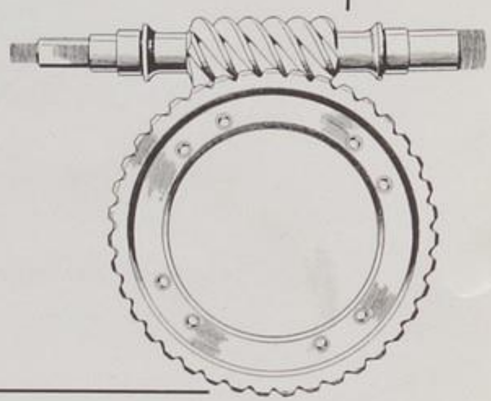


Introduction

IN THE accompanying pages we have endeavored to present those things which are necessary to give you excellent satisfaction of your worm-driven Rauch & Lang Electric.

To know why your Electric refuses to go—or goes too slowly, or not sufficiently far—gives a degree of confidence which is not possible to secure in any other manner.

The data presented has been so arranged that it can be easily understood by the layman. The knowledge of volts—amperes—and other electrical quantities is excellent, but is not nearly as essential as what to do when trouble with your car arises.

The
Rauch & Lang
Carriage Co.

THE three essential features which convert a vehicle into an electric automobile are the **battery, the motor and the system of transmitting power from the motor to the propelling wheels.**

In order to move a body from one location to another, it is necessary to apply power to overcome the various opposing forces that always exist. In putting any body, say a carriage, into motion, we are at once opposed by the effect of its weight, called inertia, which requires an application of force directly proportional to the rate at which the vehicle is accelerated. Besides this, there is a group of forces which are active not only on starting and increasing the speed, but when a uniform motion has been attained. These are windage, friction of tires on earth, internal friction of tires, losses in the various moving parts of the mechanical structure, electrical losses in battery, wiring and motor, and sometimes it is required to ascend a grade, so that gravity comes into play. All these forces which are met when the vehicle is under motion absorb more or less power, and, as in an electric machine the quantity of energy that can be stored is limited, it is of the greatest importance that the designing engineer should bear in mind the vital necessity of cutting down these opposing forces as much as he possibly can.

Battery

A BATTERY is composed of a group of cells, each of which is a complete unit in itself, consisting of two sets of lead plates chemically modified, electrically separated from one another and suspended in a solution of sulphuric acid in water called the electrolyte. When the cell is being charged, the electric current passes from the plates connected to the positive terminal marked -|- or P, through the solution to the negative terminal marked — or N, or sometimes not marked at all, and produces chemical substances on the surface of the plates which are of a somewhat unstable character, so that when the source of electricity is disconnected, a current will begin to flow from the negative side through the liquid to the positive side as soon as an external path is provided for it from the positive back to the negative terminal. This, in short, is the theory of the lead storage batteries.

The power capacity of an electric machine can be determined quite closely by the weight of battery it carries; the amount of energy actually available, however, depends as well on how the battery is treated, how it is **charged** and how **discharged.** If the rate of **charge** or **discharge** is **high,** the total energy capacity is reduced, hence, **if the rate of energy expenditure can be decreased we derive a double benefit.**

The action of electric current has often been compared to a flow of water in a pipe, and for our present purposes the analogy is as near perfect as can be desired.

Volts

Electric pressure is measured in volts and corresponds very closely to the pressure of water measured in pounds per square inch. Each cell of storage battery develops close to two volts and when for instance, forty such cells are connected in series, the negative of one to the positive of the next, we have the analogue of forty force pumps connected, the intake of the one to the delivery pipe of the next, where if each pump could produce a pressure to say two pounds, the forty pumps would create a total of eighty pounds pressure. Similarly, the forty cells of battery gives us a total of eighty volts. In both cases the volume of water and the current of electricity is that produced by one unit, pump or cell.

Amperes

The rate of flow is measured in amperes and is the analogue of gallons per minute.

Returning to the illustrations of the pumps:— If the forty were all connected with their delivery pipes into one main and their intakes into another, so that they would work in parallel, the total pressure developed would be that of one pump, while the total volume would be forty times that of any one. If all the cells were connected in parallel, that is, with all the positive terminals to one wire and all the negative terminals to the other, the resulting voltage would be but two, but the amperes that could be delivered would be forty times the capacity of one cell. In the case first considered, we can raise a limited amount of water a great height, while in the latter case, forty times as much water can be raised only one-

fortieth as far, the total work done in any time being the same in both instances.

It is obvious that a number of series of parallel combinations can be effected by dividing the forty cells in groups consisting of even divisors of forty such as, for an example, four sets of ten each, the cells of each group being in series, giving twenty volts and the four sets of ten being in parallel, giving the current output of four cells.

Electrical Resistance

Resistance is that which impedes or opposes the flow of electricity, and just as no pipe is capable of carrying water without friction, so no wire will conduct current without loss; in both cases this loss is dissipated as heat, and in both cases we can improve matters by providing a shorter pipe or shorter wire of larger cross-section. Elbows and turns exert a great retarding influence in water, but a bent or twisted wire is as good a conductor as a straight one. The greatest source of loss in wires that have been properly chosen is in the joints and connections and sliding contacts. A little dirt under a contact may cause heating and arcing which will roughen the metal so that matters will get rapidly worse.

Watts or Horse Power

The amount of work done by a pump per second is the measure of the power consumed and is the product of the pounds pressure encountered by the amount of water in pounds moved per second, and can be expressed as foot pounds per second; similarly the power consumption electrically is measured in watts and is the product of volts and amperes and is equal to .737 foot-pound per second, a kilowatt of 1,000 watts, or about 1⅓ horsepower.

Motor

The motor is the mechanism which converts the energy of the electric current into active motion. The action of this, as well as all ordinary electric motors, depends on the attraction and repulsion existing between magnets and wires carrying electric current.

The stationary portion of this motor called the frame consists of a hand-forged steel ring enclosing four sets of coils which surround four inward pointing projections of laminated iron called poles. Current flowing through these coils converts the frame and poles into a very powerful electro-magnet. Between these poles and almost touching them is the armature which consists of a large number of copper wires embedded in a mass of laminated iron and insulated therefrom. As the armature is expected to rotate, a sliding contact mechanism called the commutator is provided to receive the current from its external source.

When current is carried through the armature wires, the reaction with the field produces motion of the armature, and the torque or pulling power is proportional both to the strength of the poles and the amount of armature current.

On the commutator are placed the brushes which serve to carry the current to and from the armature. They are made of carbon composition imbedded with fine copper wires.

We have mentioned the fact that when a carriage is started or if its speed is increased,

a certain amount of energy is absorbed to produce this acceleration. The total amount of energy required is in proportion to the total weight and to the square of the velocity, so that to double the weight of a vehicle means doubling power required for starting, and doubling the velocity means four times the power. A carriage constructed so as to accelerate very quickly, not only gives the passenger an unpleasant jerk, but puts a heavy overdraft on the battery.

In the days of the horse-drawn vehicle, the matter of friction in the moving parts was not considered of great importance, although we find many of them equipped with anti-friction bearings. There are a number of reasons why the automobile should have brought improved bearings prominently before the designer. The increased weight and speed required larger and better designed bearings; besides, on account of the presence of a transmission system more bearings were required, some of which run at high speed and are not readily accessible. It was also understood from the beginning that every bit of power lost required that much more power to be carried by the vehicle in order to attain the desired mileage or speed. All this has led to the general adoption of ball and roller bearings.

Windage

The resistance of the air at normal speed is not a very serious matter, but with an increase of speed or with a head wind, the loss becomes quite large and racing cars are built with the idea in view of reducing the area exposed to the wind and so shaping the exposed parts that the machine will cut its way through with the smallest amount of retardation.

Tire Friction

The most important loss, perhaps, and one that is least understood is the effect of tires. It is clear that the portion of any tire which is in contact with the earth must be flattened, but in order to do this, not only must some other parts of the outer surface of the tire assume a deformed shape by creeping, but there must be a change in the relative position of the internal particles. If the tire is a double tube, pneumatic, the inner tube will rub against the casing and the casing will have more or less play against its fastening.

In every pneumatic tire, besides the rubber composition there must be a certain amount of tough cotton fabric which gives the entire structure its strength. In most tires of standard make this material is inserted in the shape of canvas fairly closely woven and quite stiff. In these tires the elasticity of the rubber is restrained and controlled by this cloth, and it is readily seen that there is but little of the power of flattening or adapting itself to the road that would be possible by the same tire were rubber used alone.

Thread and cord fabric tires have been developed with the intention of retaining the strength of the cotton and at the same time permit of more freedom of motion than canvas will allow. The idea is to use independent threads or cords and surround them with rubber. The one layer of such threads being wound in the direction

of the thread on a right hand screw and the next layer at right angles to these. The action of all the threads will then resemble very much a strip of loosely woven cloth cut bias.

There are losses in the electric motor, controller and wiring which in importance rank next to tire losses; besides the design of the motor should be such that outside of the question of its own efficiency its propelling power should be so regulated that the maximum distance may be covered on a single charge.

In the design of these machines it has been the object of the builders to attain the greatest possible mileage consistent with durability; and the matter of lightness combined with strength and efficiency in every part has been kept in prominence, hence we find that manganese bronze, aluminum, seamless tubing and drop-forged steel are the materials that go largely into its construction.

General Specification

THE frame is composed of pressed steel side members joined by cross pieces of the same material. The outriders and spring stubs are forged steel, the springs being made of the best steel, ground all over.

Motor and Control

The motor is designed to receive the combined voltage of all the cells in the battery, i. e., the battery is at all times in series and as the voltage is 2 volts per cell, the running voltage of the models equipped with 41 cells would be 82 volts and on those models having 42 cells the voltage would be 84 volts. This is of great advantage, as it eliminates the usual troubles caused by all unbalanced condition of the battery as when several sections are operated in parallel.

The first speed includes a high resistance and is intended for starting duty alone.

The second speed has less resistance and although intended to grade the starting is very convenient for occasional use in congested districts, but too slow for ordinary running.

The next stop cuts out all the resistance and the motor runs on the series fields alone, the two sections being in series.

The next or fourth parallels the two sections of series field.

On the fifth speed the series fields are in parallel with an external shunt resistance across them. This weakens the strength of the series fields and reduces the resistance of the circuit.

The sixth or highest speed of the car is obtained by means of an accelerator button located in the floor of the car. Its action is that of a switch closing the circuit of a light shunt field on the motor. The direction of the flow of current in this field is such that its strength opposes that of a series, thus weakening it and producing an increase of speed on light running; but due to the differential action between the two, a very great dropping off in speed is affected when climbing a grade or traveling a heavy road. In this manner we get great driving power and low current consumption on the grades on the high speed. This latter result is one of great value, for, if a car runs 20 miles per hour on the level and 15 miles on a certain grade, its current on the level may be the normal rate of the battery,

and the current consumption on the grade may be three or four times the normal rate; while another car may have a 20-mile rate on the level but only 10 miles on the grade, and its current consumption on the grade may be more than twice the normal rate. As already stated, the total capacity of the battery at double the normal rate of discharge, is considerably reduced.

Controller

The controller is of the type heretofore used on these same vehicles. Our contact finger, tipped with a heavy copper shoe, has done away with the heating and loss so often experienced in the fingers of a controller of the drum type; besides the steps are so arranged that from the first step to the last, there is no break in the circuit, hence no arc on the contacts and a steady torque or pull of the motor, which means an absence of jerks from one step to the next and an entire impossibility of stoppage between steps or notches on the controller.

To Operate

The carriage is started by throwing forward the controller lever, which is located on the left-hand side of the seat. To coast, the handle is pulled back to the "off" position; a further backward motion will apply first the electric brake and finally the mechanical motor brake.

Electric Brake

The electric braking is accomplished by short circuiting the armature across resistance and applying the battery current to the shunt field. In this manner, the vehicle is retarded, but not stopped, and when the lever is pressed as far back as possible, the mechanical brake is applied to the wheel on the motor shaft and motion is arrested. The electric brake acts most powerfully when at high speed, and it is here that the mechanical brake would experience the most strain, so that by bringing the vehicle to a slow speed before applying the latter, wear and re-adjustment are avoided.

Reversing

To back the carriage, the handle must first be brought to the brake position on account of interlocking action, the foot piece may then be depressed, and on again throwing the handle forward, three reverse speeds are obtained. On reversing, the foot piece returns automatically to the forward running position.

Transmission

Power is transmitted from the motor directly to the rear axle by means of a propeller shaft fitted with a slip joint and two universals.

This construction assures perfect freedom of motion of the rear axle relative to the motor and adds materially to the life of all the parts by not subjecting those parts above the springs to the shocks which the rear axle must withstand.

In the axle and above the worm wheel is the worm, which is of the straight type and is carried on radial and thrust ball bearings mounted in a unit construction with the worm wheel and differential which are fitted with the same bearing equipment. The whole unit is

designed to obviate adjustments subsequent to its being initially adjusted at the factory.

The torsion rod is swiveled on the axle housing and at its forward end it swings from the motor on a ball and socket hanger and it is so hung as to counteract only the tendency of the axle to turn on its own axis.

The six spline type of shaft end is used in the propeller and drive shafts, the latter being arranged so that they together with their hub flanges can be withdrawn without disturbing either wheels or the differential.

Brakes

A pair of powerful internal expansion brakes operate in drums on the rear wheel hubs, each brake consisting of a pair of shoes lined with asbestos and brass wire composition and connected through a suitable train of levers to a foot piece. The shoes are expanded by a cam which can adjust itself so as to equalize the pressure and can be adjusted from without by forcing down a screw which spreads them apart.

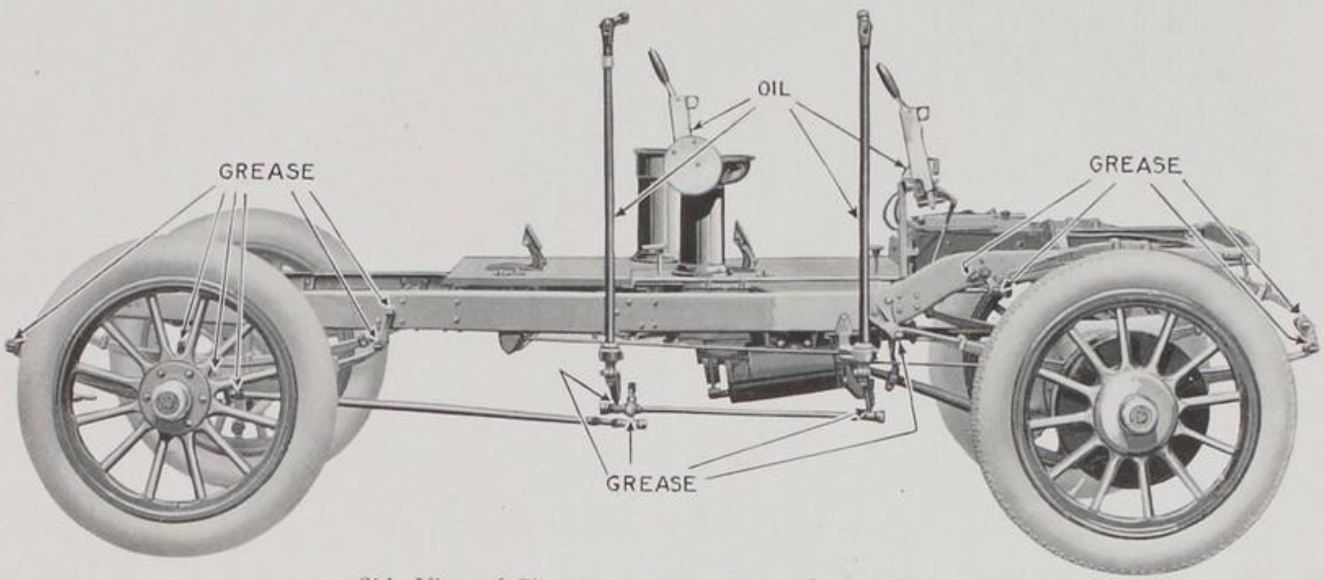
Steering

No pains have been spared to make the steering gear as simple as possible, and at the same time making the joints perfectly secure.

A ball thrust bearing is provided at each of the steering spindles to make the handling of the car as easy as possible.

The ball and socket joints are large and their adjustments are carefully locked.

A proper proportioning of the length of the various levers has resulted in a system that works freely, and at all times brings the carriage under ready control.



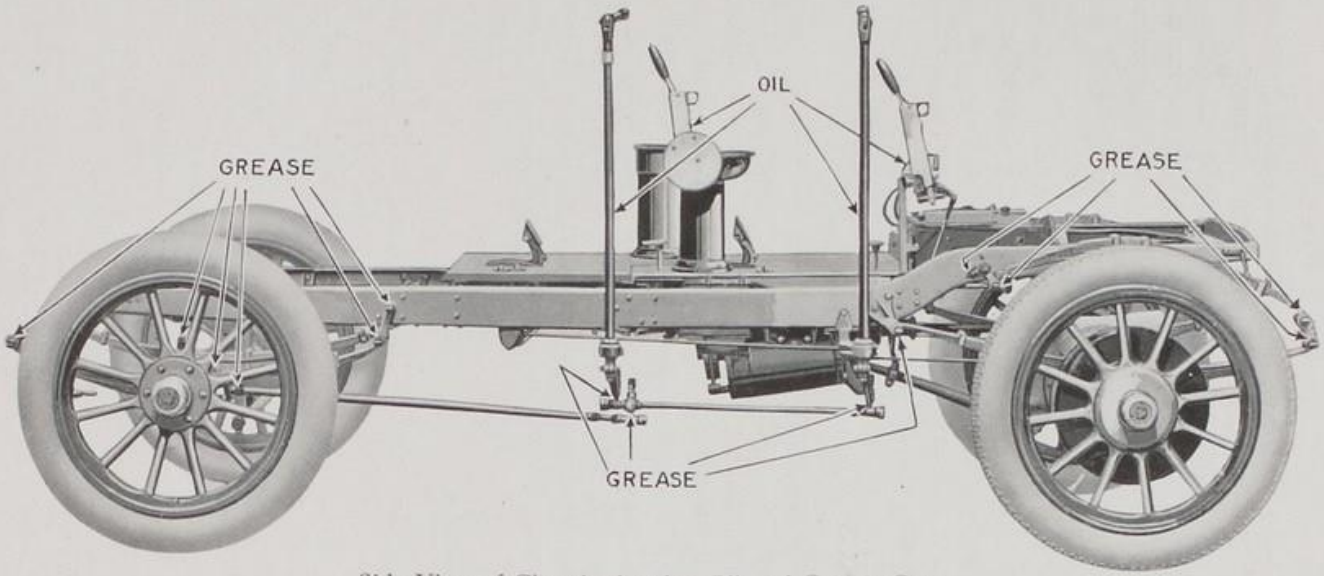
Side View of Chassis showing Oil and Grease Cups

General Care

Oil cups and grease cups have been provided at all points wherever wear is possible and free use of lubricants is necessary.

In oil cups use a good grade of engine oil.

In grease cups use cup grease.



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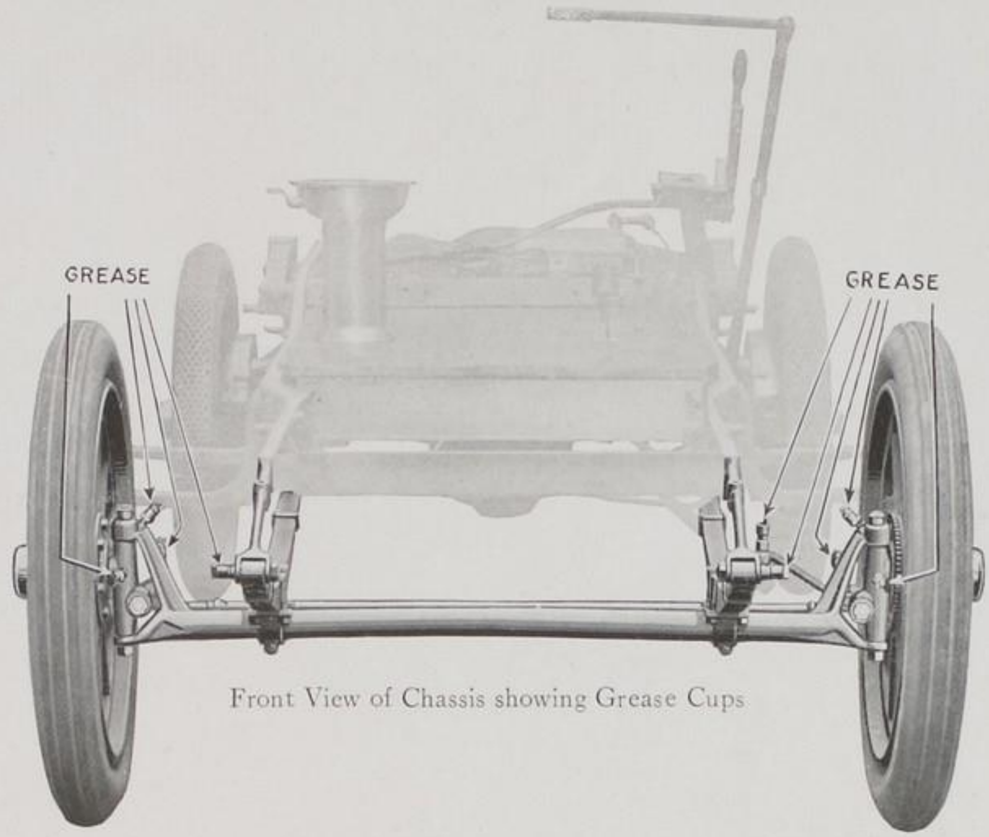


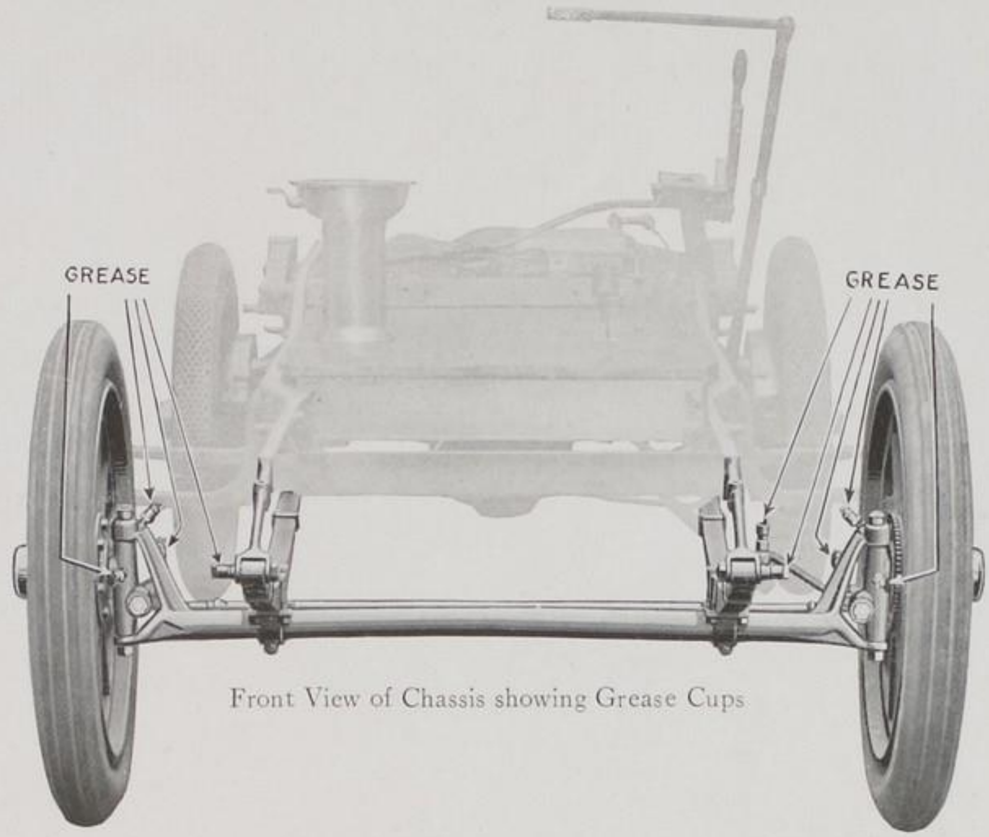
Front View of Chassis showing Grease Cups

General Care of Steering Gear

In spring bolts use cup grease.

In the oil cups use good grade engine oil.

All points of wear have been provided with adjustments and take-up devices. Any radical adjustments should be undertaken only by some one familiar with mechanics.



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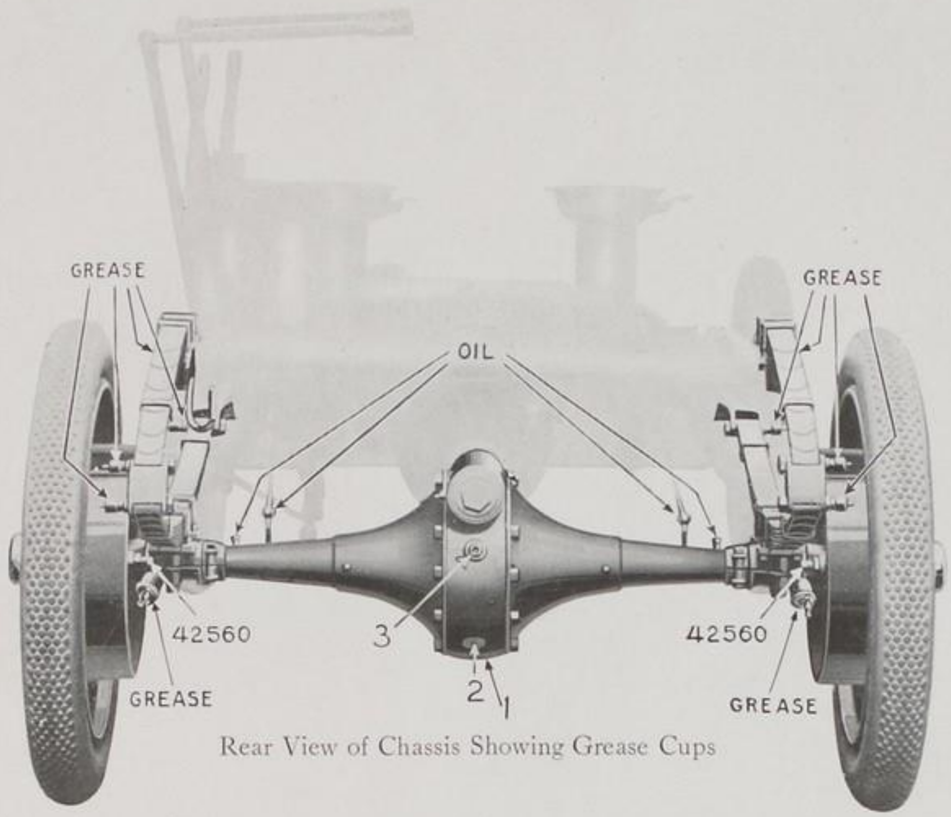


Rear View of Chassis Showing Grease Cups

Hub Brake Adjustment

To adjust hub brake shoes for wear: Raise both wheels from the floor by means of jacks. Then turn adjustment screw No. 42560 until satisfactory braking effect is obtained. (This can best be judged by running the motor with the rear wheels jacked from the floor and operating foot brake from the seat.) Adjust so that wheels have about equal speed when brake is applied. A locknut is provided for maintaining the adjustment of the screw No. 42560. This adjustment should be made only in case shoes become worn. After making any of these adjustments, be sure that the wheels turn freely when foot brake is in off position. (Do not run motor on the two highest speed positions.)

General Care

Three openings into the rear axle are provided. These openings are fitted with generous-sized pipe plugs. The axle may be drained completely of old or dirty oil through No. 1 and when it is drained to refill or replenish the supply of oil in the axle, take out No. 2 and No. 3 plugs and pour oil in No. 3 until it overflows out of No. 2.

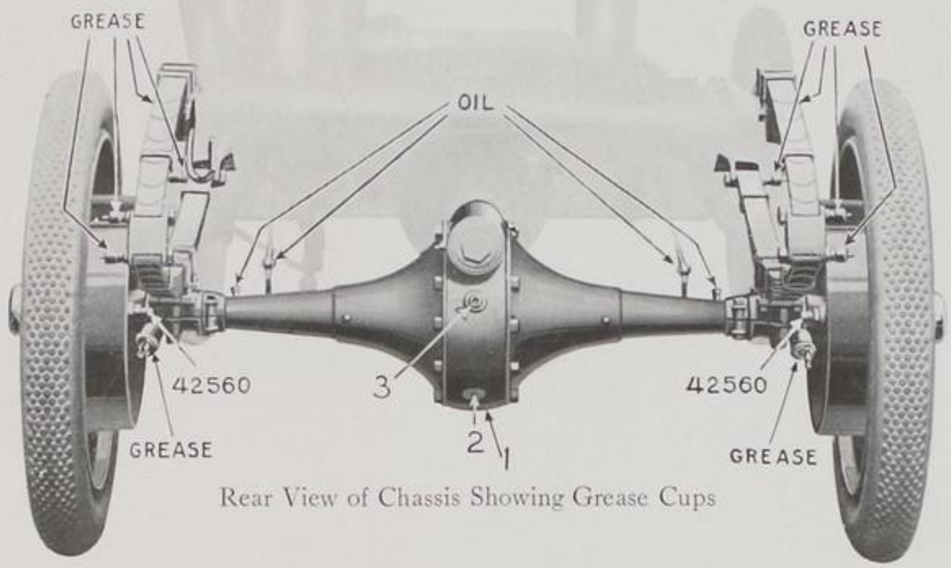
A pure castor oil (unadulterated with mineral or animal oil) should be used in the rear axle worm housing, under ordinary conditions of temperature. During extremely cold weather a good mineral oil should be used. A change in spring and fall is recommended. At all other places on the rear axle cup grease and suitable bearing oils may be used.

The joints at the ends of the brake rods should be oiled frequently.

Use cup grease in all grease cups.

Use good grade of engine oil in all oilers.

To oil rear wheel bearings remove pipe plug in end of hubs inside of hub caps.



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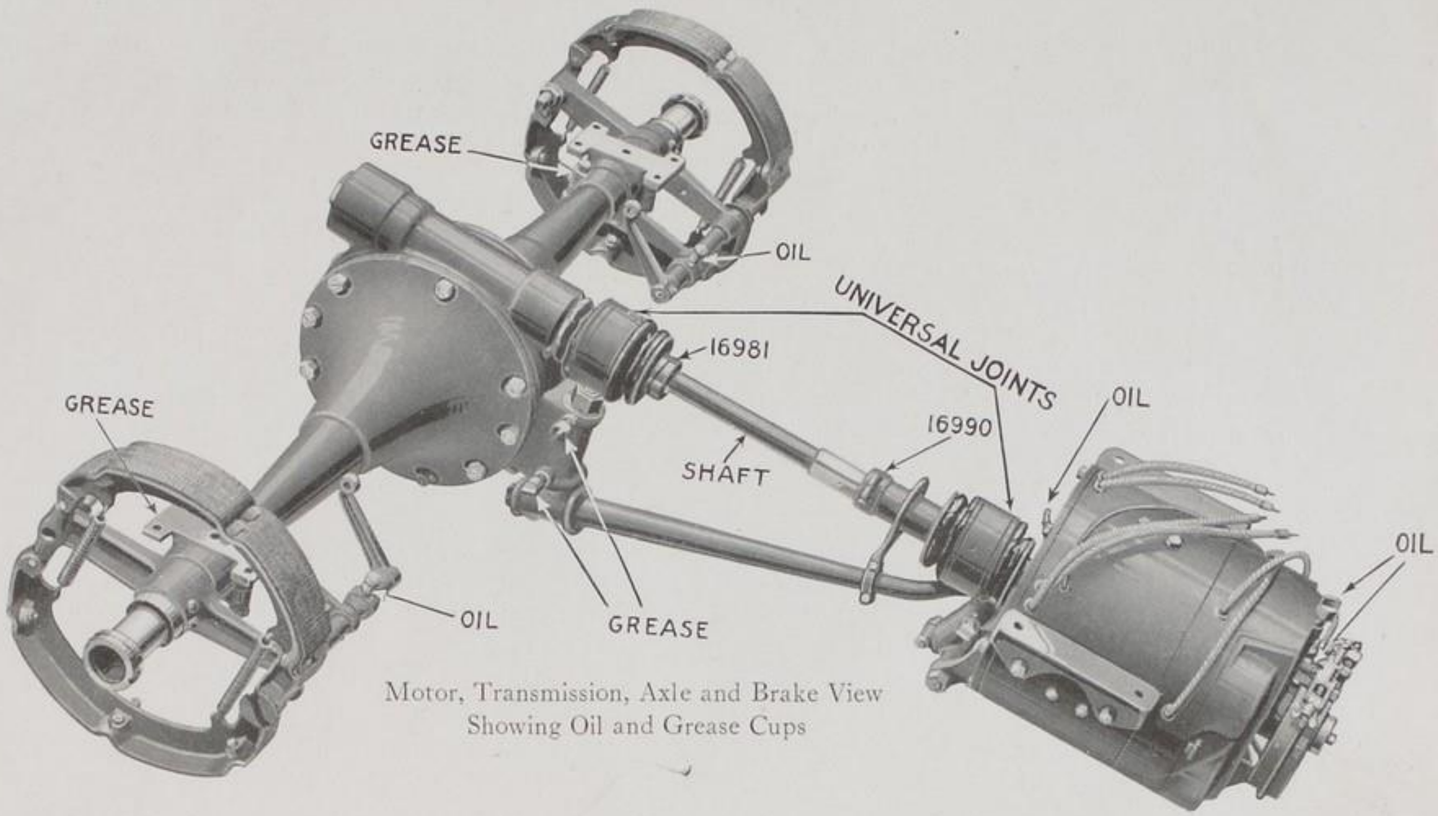
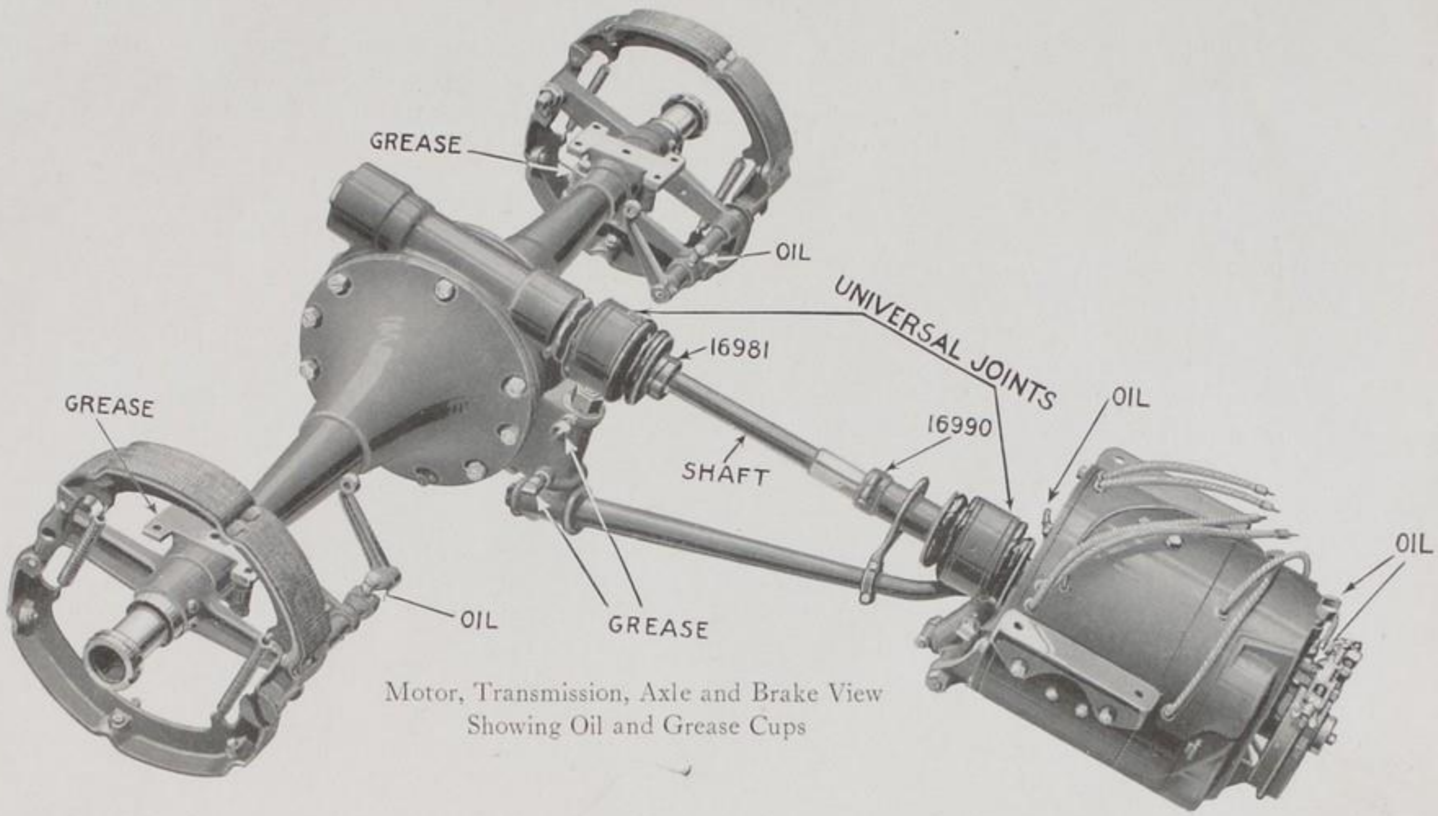


Motor, Transmission, Axle and Brake View
Showing Oil and Grease Cups

An extra supply of grease should be put in the universal joints, each 90 days. This may be done by removing the nuts Nos. 16981 and 16990 and pushing the shaft forward into the joints at rear of motor until the rear end of shaft is free of the rear joint. The shaft may then be pulled out of the front joint. Both joints may then be filled with grease and the shaft replaced, nuts put in place and securely locked. All oil and grease cups should be supplied with lubricant at least once every week or two.



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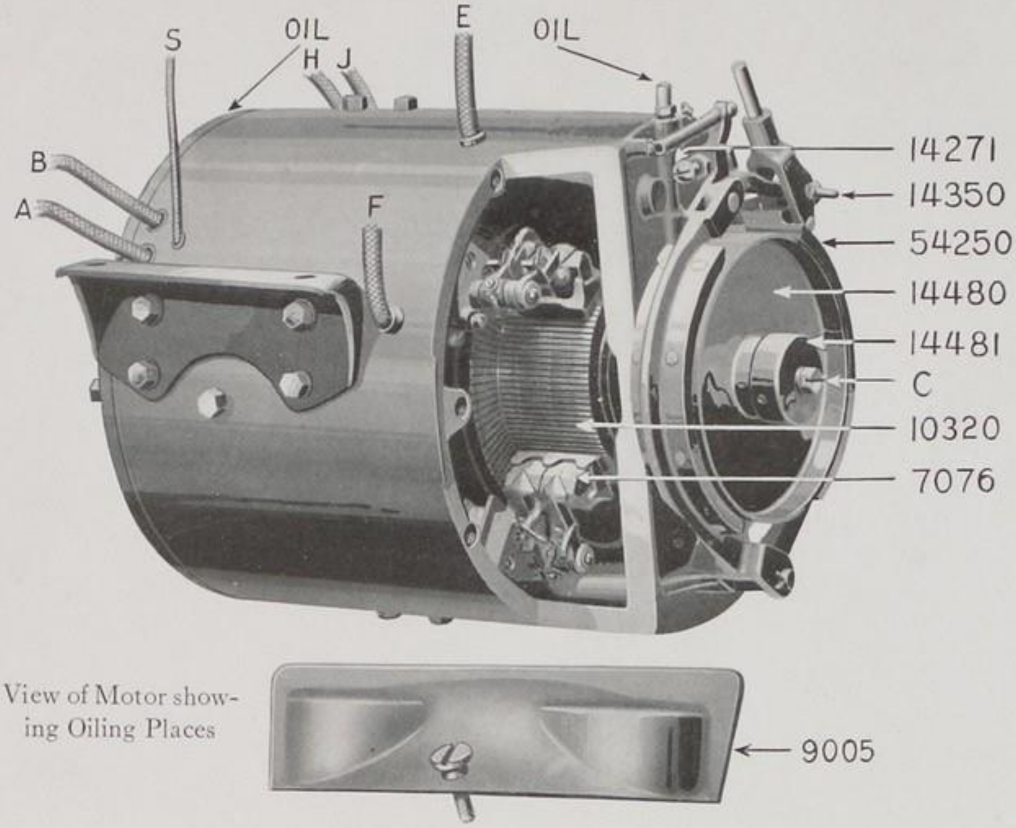


View of Motor showing Oiling Places

General Care of Motor

The two oil covers lead to the ball bearings in the motor yokes. A good grade of light cylinder oil is recommended for these bearings.

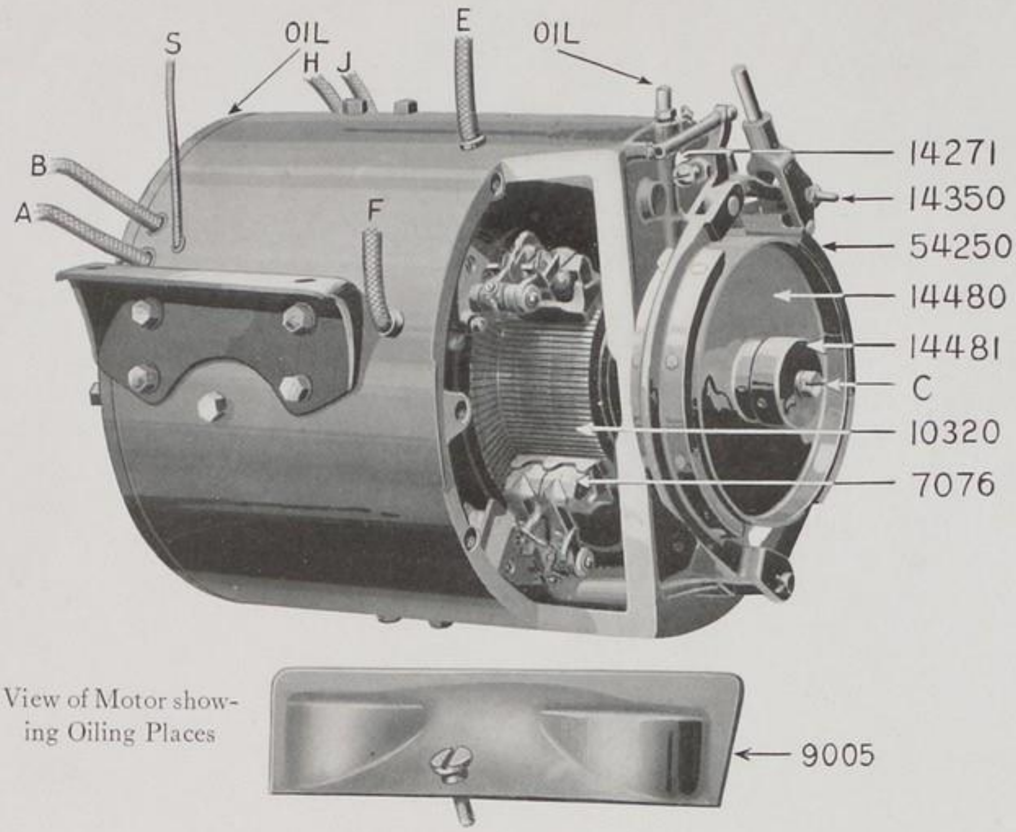
The commutator No. 10320 should be at all times kept clean, free from any gummy or gritty substance. The carbon brushes No. 7076 should make perfect contact with the surface of the commutator and should be replaced with new ones when worn out. These brushes are originally 1⅝ inches long and should be replaced with new ones as soon as the measurement is reduced to 1¼ inches. It is safer to replace these brushes often, rather than allow them to become too short. Very serious damage may result from using brushes that are too short or ones that make poor contact with the commutator. Brushes that are too short or that are making poor contact will pit, burn and blacken the surface of the commutator. Replacement of brushes should be made only by an experienced person.

The motor leads are lead out of motor through insulated holes. These holes, lettered J, H, B, A, S, E and F correspond to the letter contacts on the controller into which they are connected.

The motor brake may be adjusted for wear by means of the winged nut No. 14350.

Clearance between brake jaws and wheel may be adjusted by means of the screw No. 14271.

To remove brake wheel from armature shaft, take the $\frac{5}{16}$ screw C out of the cap 14481. A ½-inch, 12-pitch bolt, 3 inches or longer, or a cap screw may then be screwed through the threads in the cap and up against the end of the armature shaft. Continue to turn this screw and the pulley will be drawn off the shaft.



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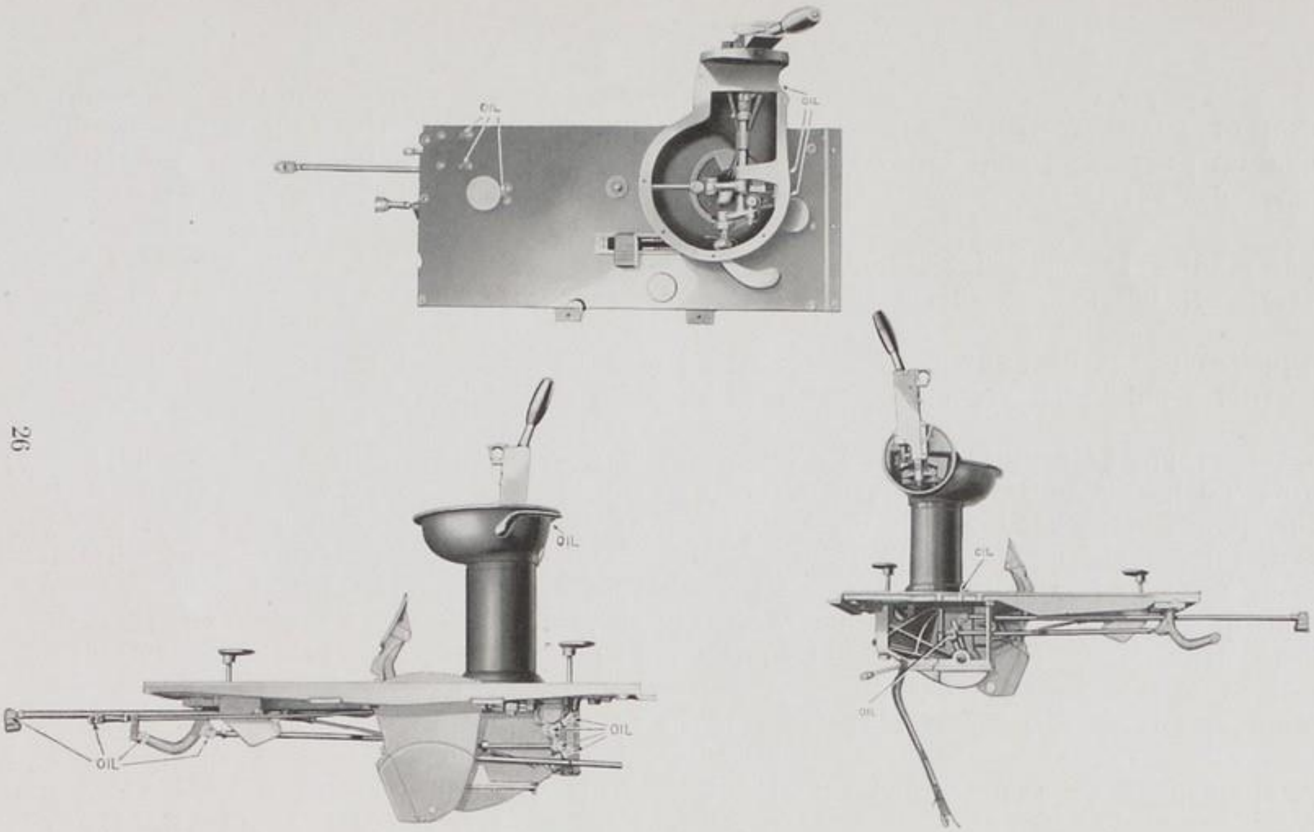
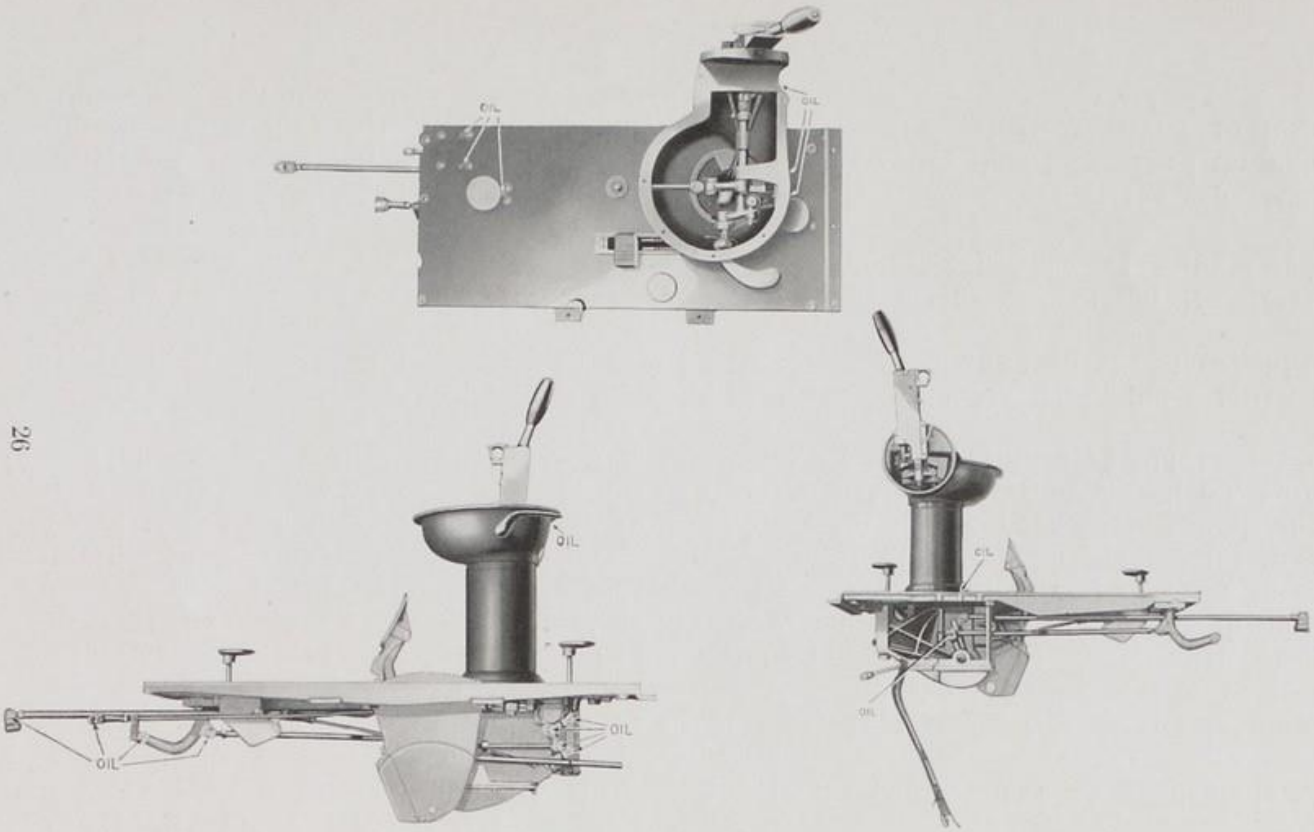


Three Views of the Pedestal Controller Mechanism

The forward driving seat pedestal and controller handle together with the interlocking foot brake and reverse levers and shifting clutch that connects controller to the controller handles are all assembled to a section of metal flooring, forming a complete unit.

The three views shown above are intended to clearly indicate the general arrangement as viewed from above and from each side. The various joints necessary to accomplish results are so small that it would have been impractical to equip them with oilers. As far as possible, they have been enclosed in casings, provided with covers, which may be removed at convenient times of general car inspection and the joints oiled with a pump oiler. Experience has shown that oiling the parts that are enclosed about every four months and the exposed joints about every two months is sufficient unless abnormal conditions exist.



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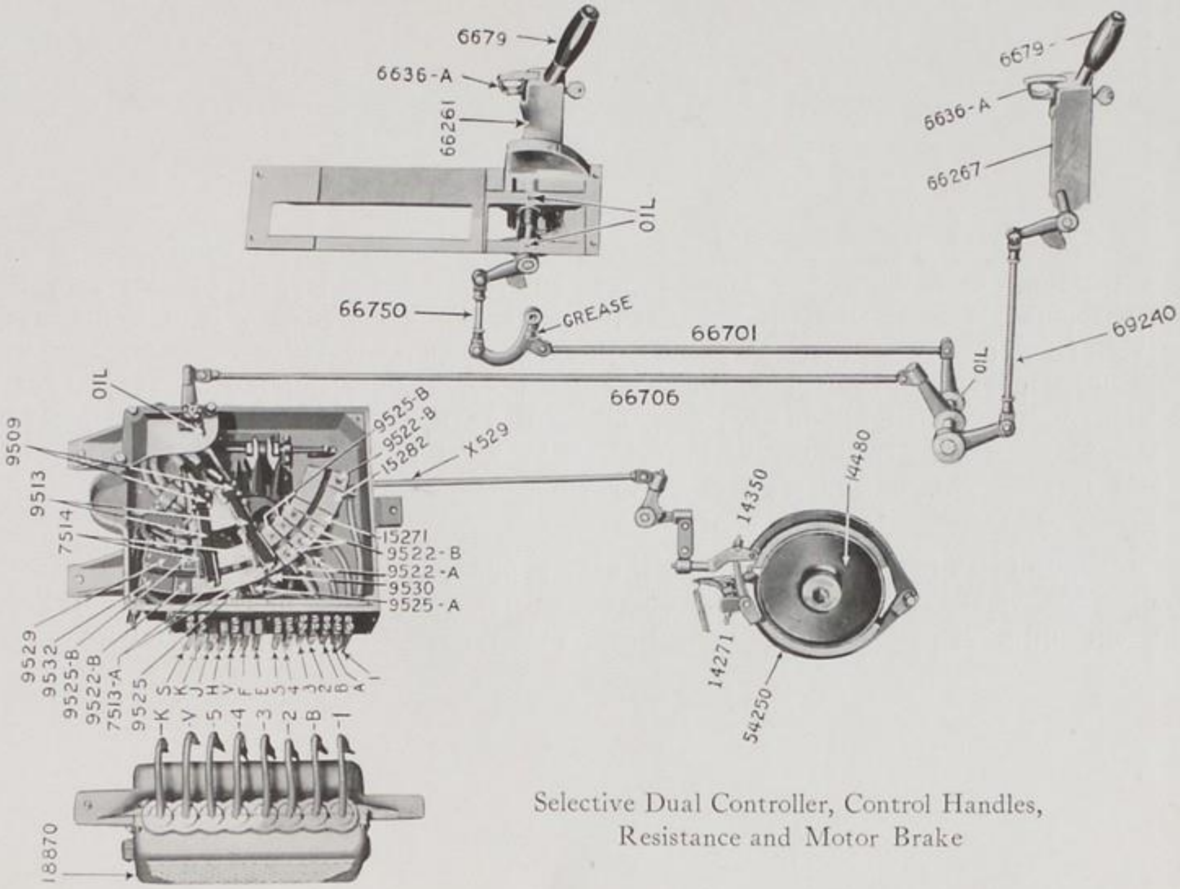


Selective Dual Controller, Control Handles, Resistance and Motor Brake

General Care

Keep the plates Nos. 9522-B and 9525-B on the face of the controller and the shoes No. 7513-A on the movable arm clean and free from burned and rough edges. The contact plates Nos. 9522-B and 9525-B and the shoes No. 7513-A are the ones that become damaged first. They are removable and when badly worn may be replaced with new ones.

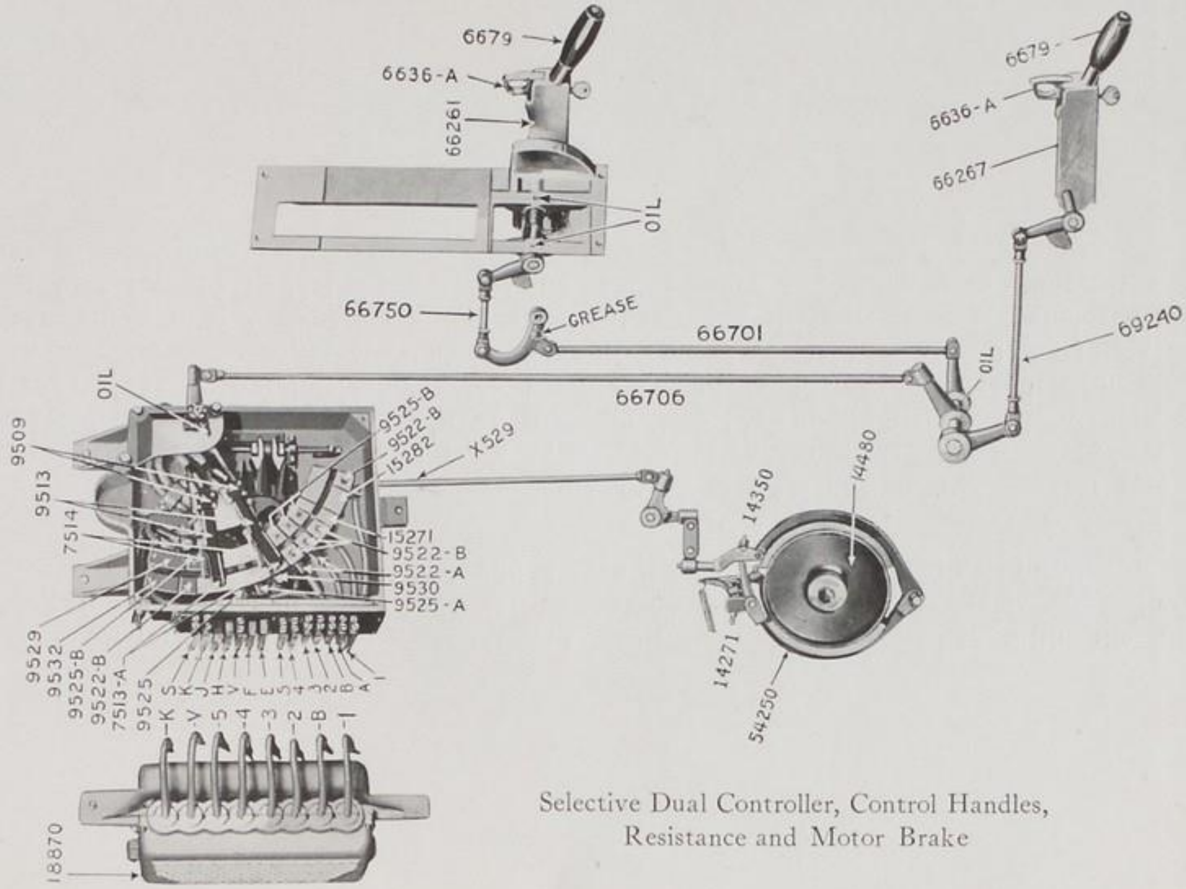
Instructions for Adjustment of Motor Brake and Controller to Controller Handle

Set the controller arm fingers No. 9513 in neutral position, as shown in cut, remove key from controller handle No. 66267 and pull handle back to brake position and then push it forward to the stop, which is its neutral position. Have the driver's seat locked in forward running position and then the connecting rod No. 66706 may be adjusted to such a length that the handle No. 66267 and the controller arm fingers No. 9513 will be in their respective neutral positions at the same time.

After the above adjustments have been correctly made, the forward driver's seat should be turned to the position it will assume when car is to be operated from the rear seat and the length o the connection rod No. 66750 adjusted to such a length that both controller arm fingers No. 9513 and the rear controller handle No. 66261 will be in their respective neutral positions at the same time. When these adjustments are correctly made the front driver's seat will turn freely from forward driving position to rear driving position at the time that both controller handles Nos. 66267 and 66261 are in their neutral positions.

Adjust motor brake shoes for wear by means of the winged nut No. 14350. Clearance of shoes is obtained by the adjusting screw No. 14271. These adjustments should be such that the brake is perfectly free when controller arm fingers No. 9513 are in their neutral position, as shown in cut. When brake is applied the top finger No. 9513 will have traveled upward across the contact plate No. 9525-B and just to the plate No. 9529.

The wires leading from the controlling resistance 18870 are marked to correspond to the connectors on the side of the controller into which they are connected.



Selective Dual Controller, Control Handles,
Resistance and Motor Brake

General Care

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To Operate Electric

(1) Be seated.

(2) Place steering lever in position to give ready control.

(3) Insert key in controller handle and unlock.

(4) Pull controller handle back to brake or off position and raise slide. (This closes the circuit and electric is ready to move.)

(5) Be sure that the foot brake is released.

(6) Forward movement of the controller handle gives two starting speeds and three running speeds.

(7) To stop electric, pull controller handle backward past off position. First the electric brake will come into action and then a mechanical motor brake.

(8) To reverse, bring electric to standstill. Press down the foot lever. Move controller handle forward same as when running forward. Two starting and one running speed will be obtained when backing up.

(9) To stop reversing, pull controller handle to extreme backward position. Take foot off reverse lever, which will automatically return to forward position and electric is ready to be operated in a forward direction.

(10) Steering: Push steering arm from you to turn to the left and pull steering arm toward you to turn to the right.

(11) When leaving the electric, be sure to always force down slide of controller handle and take key out of lock.

(12) Release foot brake before applying power.

(13) To charge batteries:—

(1) Be sure that slide of controller handle is down and key out of lock.

(2) Insert charging plug in socket at rear of electric and if the connections from the plug to the charging source are correct the Ampere meter should show reading below the zero on the scale.

(3) Follow the instructions for charging and care of battery that are furnished by the manufacturers of the battery regardless of what **we** or any one else may say.

Note.—There are two push buttons in the floor of the car that may be operated by a slight pressure of the left foot. One increases the speed of the car and the other lights the meter lamp.

To Locate Trouble

If vehicle runs too slow, look for the following:—

Deflated tires.

Slow tires, due to other makes having been substituted for those furnished by the manufacturer of the vehicle.

Broken bearings in wheels, countershaft or motor.

Shoes not making perfect contact on face of controller.

Brushes not making perfect contact on commutator due to being too short, or commutator being dirty.

Broken battery jar, solution having partly leaked out.

Brakes rubbing when they are supposed to be thrown off.

Battery exhausted.

If the current "AMPERES" is higher than usual when running on the level, look for the following:—

Tight bearings.

Brakes rubbing.

Silent chains too tight.

Front wheels out of alignment.

Tires deflated.

If needle on **AMMETER** vibrates more than usual, moving up and down very rapidly, look for the following:—

Blackened commutator.

Commutator brushes worn too short.

Loose connections at battery terminals or at connections on controller.

Or broken wire leading to meter.

If vehicle refuses to run at all, look for the following:—

Broken jar in battery.

Broken connections between cells.

Broken terminals.

Open motor leads.

Broken connections on any part of vehicle.

In case vehicle does not run on any of the speeds, we strongly urge upon the user of the vehicle a policy of examining those connections that are easiest to get at. The connections that we refer to are:—

Those at the end of the batteries.

The connecting straps, connecting one cell to another.

The wires going into the circuit closing switch.

The springs No. 9513 on the controller arm and the copper shoes No. 7513-A.

Be sure that they make contact with plates on the controller face.

See that there are no wires hanging loose, that appear to belong in the controller.

If the trouble is not found in some one of these points, it would be best to have an expert examine the machine.

If the usual graduation of speeds are not obtained when running on the level, read carefully the instructions accompanying illustrations of controller.—If AMMETER on the vehicle does not register properly, look for the following:—

Broken or partly broken connections in the wire leading from meter to shunt block, under floor of carriage.

The ammeter pointer sticking or working irregularly, due to dirt inside of ammeter, in which case it must go to the factory.

If the voltmeter does not register at all, look for broken connections in wires leading to connection points under floor.

If voltmeter reads too high, there is something wrong inside of it and it should immediately be sent to the factory.

No meter on an electric vehicle is infallible as the service is very hard and the adjustments liable to get

loose; and, as the general instructions as to care of battery, especially in charging, are to charge until voltage reads a certain amount, it is of the highest importance that the meter should read correctly.

As soon as any irregularities are noticed in its readings, have it examined immediately by an expert, or send it to the factory.

When it is necessary to return it to the factory, be sure to send the shunt block with it, as this is part of the meter.

Even if no irregularities are noticed, it would be well to have the meter examined at the factory and recalibrated at least once every year.

If none of the lights burn and the bell refuses to ring, look for a burnt fuse wire.

If one light refuses to burn while the others are working correctly, try a new lamp, or examine connecting theater plug that connects body wiring to chassis wiring.

If both side lights refuse to burn, all other lamps being in working order, the trouble is sure to be in the connector.

If bell refuses to ring, all lamps being in working order, examine the theater plug connecting body and chassis wiring and make sure that the wires leading to the switch contacts at bottom of controller handle have not been taken out or broken off. The bell can be tested by disconnecting from it the wires that are there, connecting two temporary wires to these same binding posts and touching these to the battery terminals. If the bell does not ring then it should be taken off and replaced with a new one or readjusted.

Mileage and Battery

If you do not obtain proper mileage when all mechanical parts are working freely, it is undoubtedly due to the battery being undercharged and not being brought up to full voltage as indicated on the meter. In this case, it is best to discharge the battery until voltage indicates 1.8 per cell; open the hoods over the battery, remove plugs from cells and cover the plates with pure water to within one-half inch of the inside top cover. Charge the battery in usual way until it reaches a maximum voltage as given on your charging card, then charge 4 hours longer at the lowest rate shown on the charging card. Try the battery; if this does not improve the mileage sufficiently, repeat the operation as before. If, after repeating this operation three times, you do not get the mileage you should, and after examining the vehicle thoroughly you do not find the trouble elsewhere, consult the maker of the battery at once.

A storage battery can be ruined in three hours after it has been put in use by being **left on charge at a high rate after it is full.** This is one of the most common causes of trouble. The user of the vehicle should keep careful track of the charging and, if possible, watch it personally.

In all cases follow strictly the instructions that are furnished by the battery maker.

Battery

Keep the battery and connections clean.

Go over the same and see that they are bolted up tight.

If there are any low cells in the battery, attend to them at once.

Keep the electrolyte, or battery solution at the proper height above the tops of the plates.

Keep the density of the electrolyte, or battery solution, at the proper point.

Do not charge at a rate that will make the cells exceed 100 degrees F. in temperature.

Do not let your battery stand completely discharged.

Do not let your battery stand in a partly discharged condition for any length of time.

Do not go away on a visit and allow your batteries to stand inactive.

A battery must be worked constantly to get satisfactory services and when going away for two weeks or more, it is best to make arrangements to have the battery looked after by some one familiar with it.

In charging, always connect the positive wire of the charging source to the positive terminal of the battery and vice versa.

Be careful not to overcharge at a high rate.

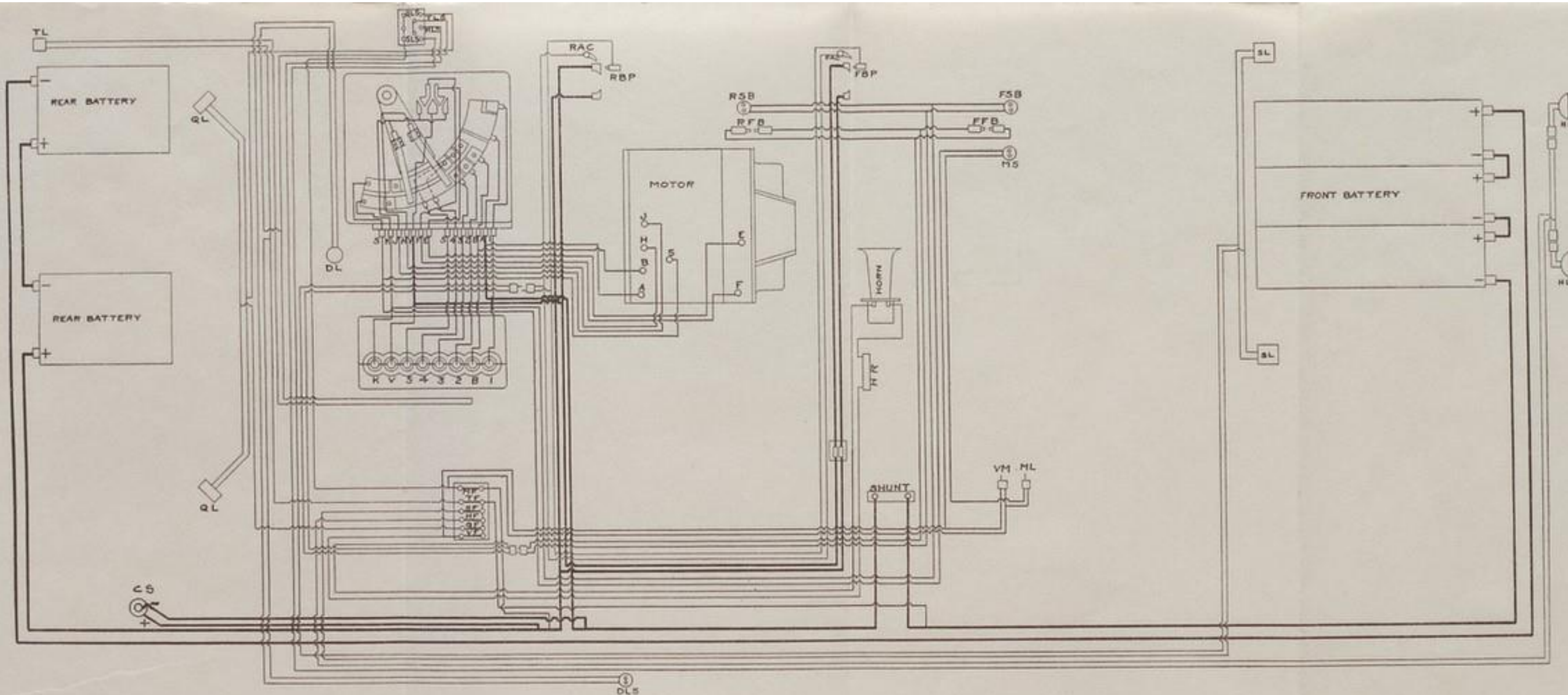
If the battery becomes dead, or loses mileage, consult the makers.

Charge battery in a warm room in winter.

In consulting the makers, be sure to give full particulars.

THE RAUCH & LANG CARRIAGE CO.
CLEVELAND, OHIO

All above information applies to lead batteries. Whenever car is equipped with Edison Batteries either consult the Edison Battery Co., of Orange, New Jersey, or the Rauch & Lang Carriage Co.



AB-SERIES FIELD LEADS
CS-CHARGING SOCKET
DL-DOME LAMP
DLS-DOME LAMP SWITCH
EF-ARMATURE LEADS

FAC-FRONT AUTOMATIC CUT OUT
FBP-FRONT BELL PRESS
FFB-FRONT FOOT BRAKE BELL CONTACT
FSB-FRONT SPEED BUTTON
HF-HEAD LAMP FUSE

HJ-SERIES FIELD LEADS
HL-HEAD LAMPS
HLS-HEAD LAMP SWITCH
HR-HORN RESISTANCE
MF-MAIN FUSE

ML-METER LIGHT
MS-METER LIGHT SWITCH
QF-QUARTER LAMP FUSE
QL-QUARTER LAMP
QLS-QUARTER LAMP SWITCH

RAC-REAR AUTOMATIC CUT OUT
RBP-REAR BELL PRESS
RFB-REAR FOOT BRAKE BELL CONTACT
RSB-REAR SPEED BUTTON
S-SHUNT FIELD LEAD

SF-SIDE LAMP FUSE
SL-SIDE LAMP
SLS-SIDE LAMP SWITCH
TF-TAIL LAMP FUSE
TL-TAIL LAMP

TLS-TAIL LAMP SWITCH
VF-VOLT METER FUSE
VM-VOLT METER
1-B-2-3-RESISTANCE TERMINALS
4-5-V-K-RESISTANCE TERMINALS

1915 Double Drive Wiring Diagram