

1915 Rauch & Lang J5

Service-content reading copy

MODERN EDITORIAL DISCLOSURE - 17 OCTOBER 2026

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The original front cover and title come from the color-paper photographic scan. The illustration, introduction, complete numbered sequence 4-35, and 1915 Double Drive Wiring Diagram come from the higher-resolution monochrome scan. Every overlapping spread and the wiring sheet were visually matched.

The rear cover is unavailable. Unprovided blank/cover surfaces are omitted. A modern question-mark placeholder from the photographic PDF is excluded. This is not a complete physical facsimile; no missing historical content has been invented.

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Historical instructions are reproduced for reference. They have not been validated as present-day maintenance or safety guidance.

Source: EarlyElectric.com, Downloads, Rauch and Lang Instruction Manuals. Original files: 1915RLInstructions2.pdf (cover/title) and 1915RLManual.pdf (body/wiring). The complete source PDFs and the page/crop map accompany this reading copy.

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

1915
INSTRUCTIONS

"J5"
Selective Dual
Control
Worm Drive

*Rauch & Lang
Electrics*

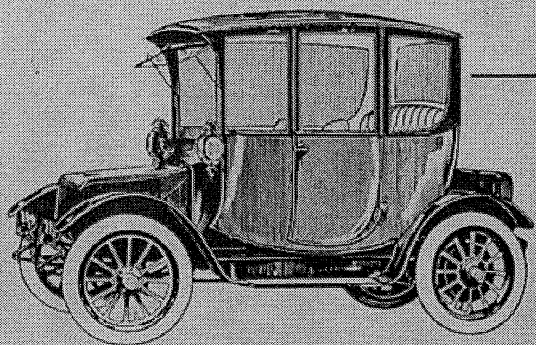
The Rauch & Lang Carriage Co.
Cleveland, Ohio

1915
INSTRUCTIONS

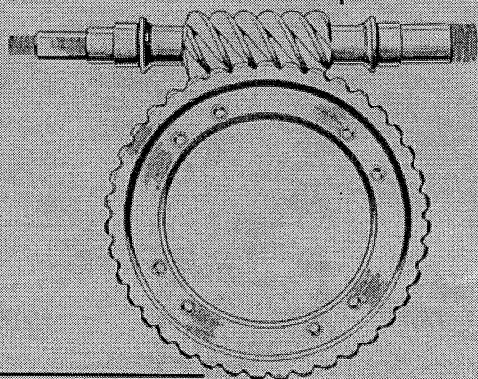
"J5"
Selective Dual
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Electrics*

The Rauch & Lang Carriage Co.
Cleveland, Ohio



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Electrics*



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 $1\frac{1}{3}$ 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