A RECHARGING MOTOR FOR ELECTRIC VEHICLES.

The one great drawback to the present electric motor carriages is their inability to cover more than twenty-five or thirty miles on a single charge, under the most favorable conditions. When a hilly road is encountered, the capacity of the battery is considerably reduced, owing to the heavy discharges it is called upon to make in driving the carriage up hill, and there is a consequent reduction in mileage of from one-third to one-half. Of course, in descending the hills, the vehicle runs by gravity, and no current is taken from the battery. The weight of the vehicle is such, however, that even at comparatively slow speeds the momentum is great enough to generate considerable current if the motor is used as a dynamo. The makers of the Waverley vehicles were, we believe, the first in this country to make use of this principle on their carriages for braking purposes. Their machines are equipped with a set of resistance coils, through which the current generated by the motor may be made to pass, the braking effect becoming greater as more current is allowed to pass. This forms a very simple, easily controlled and powerful brake, with no wearing parts and nothing whatever to get out of order. It will work on the steepest hills as well as on the level, and will retard the motion of the carriage to any speed desired.

It is apparent that in such a system of electric braking, the current generated is wasted and its energy dissipated in the form of heat when it passes through the resistance coils. To conserve this electrical energy by utilizing it in charging the storage batteries, is one of the features of the improvements herewith illustrated, which have the merit of maintaining or equalizing in some degree the otherwise reduced mileage of the vehicle. The chief difficulty to be overcome lies in the double direction of the current. In order to recharge the batteries, the current must pass through tbe circuit in the opposite direction to what it does when the battery is discharging and operating the motor, while when simply a resistance coil is employed, the direction of the current does not matter.

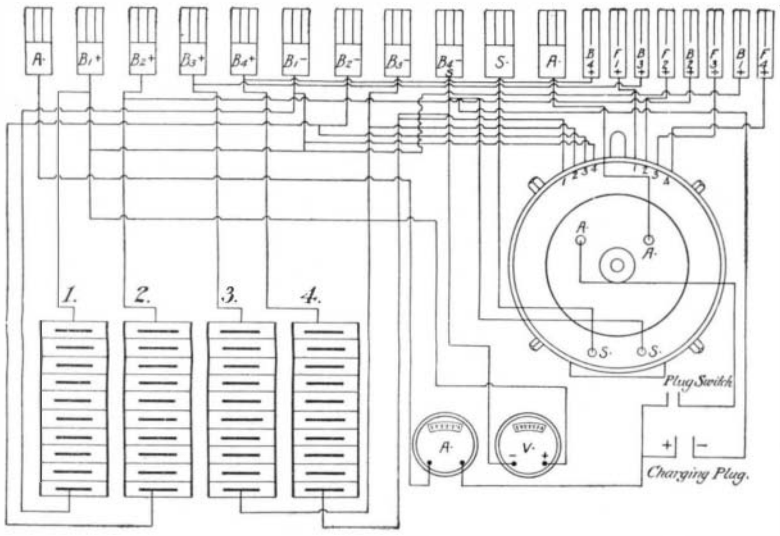
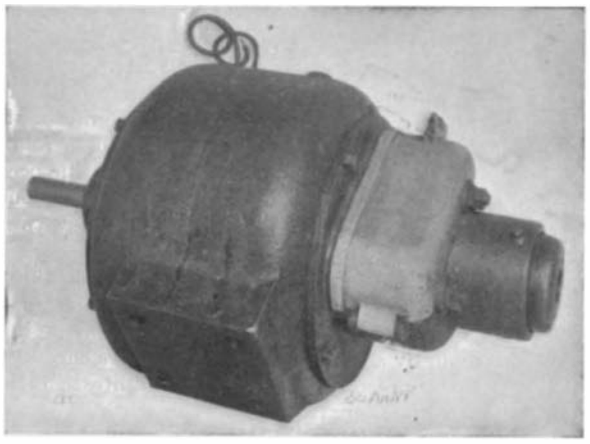


DIAGRAM OF CONTROLLER CIRCUITS OF RECHARGING MOTOR.

The motor which we illustrate is tbe invention of Mr. J. C. Lincoln, of Cleveland, Ohio, and is manufactured by the Lincoln Electric Company of that place. It is a four-pole compound wound machine of substantial construction. The four shunt coils are connected respectively to the four crates of the battery, numbered 1, 2, 3, 4 in the diagram, and are in circuit when the controller is on any of the six positions or notches—four forward and two backward. This connection is made at the controller by four disks against which press spring conductors, and which will be noted at tbe right-band end of the controller in the illustration. The coils take but a small amount of current, about three-fourths of an ampere. They are designated by the small figures 1, 2, 3, 4 on the motor in the diagram, while the series coils are marked S. The letter A on the motor refers to the armature. V refers to the voltmeter.

The tbree speeds are obtained by coupling tbe four crates of battery cells (ten in each crate), first in parallel, then two in parallel and two in series, and finally all four in series. Starting from the extreme left-hand terminal, marked A in the diagram, which is connected by the controller with the B_1+ terminal of the battery, the current passes first through the ammeter, then through the plug switch, thence through the motor armature to its right-hand A terminal. As this is connected by the controller with the terminal, S, the current continues through the series coil and returns to the B_4- terminal of the battery.

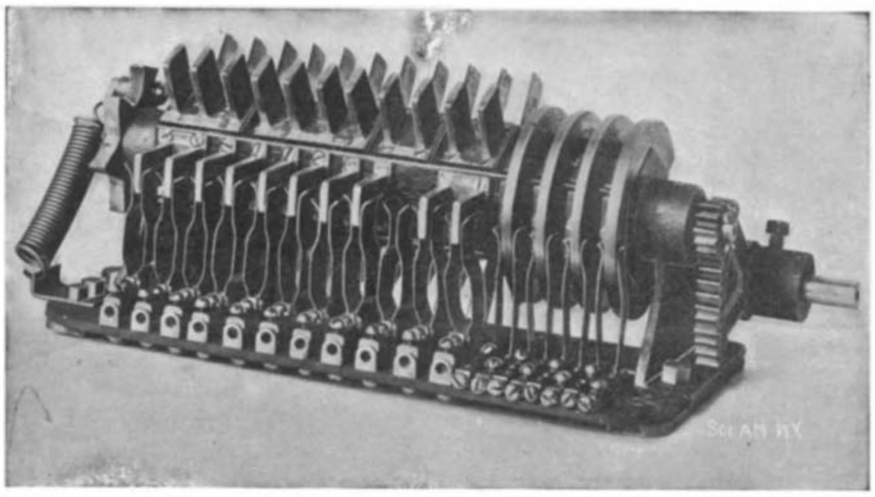
When the carriage descends a grade, if the current is kept on, the speed continues to increase until the counter electromotive force of the armature equals that of the battery, which would be 80 volts with tbe controller on the third position or notch. At this point the motor will take no current and the ammeter pointer will stand at 0. If the speed increases still further, the counter electromotive force of the motor will exceed that of the battery, and the armature will generate a current in the opposite direction. The motor will do this because the shunt coils of the electromagnet maintain their polarity the same, notwithstanding the fact that the series coils are now working against them.


THE CHARGING MOTOR.

The field magnets are somewhat weaker in this case, since their magnetism is now the difference of that produced by the shunt and series coils, whereas before it was the sum. By this arrangement, since the field magnetism is weaker, the amount of current generated is less than would be produced if the field coils operated in unison, and the charging proceeds for a longer period with a lighter current, while the speed of the vehicle gradually decreases.

Moving the controller to the second and first positions reduces the voltage of the battery 40 and 20 volts respectively, causing a heavier current to be generated by the armature, which will thus produce a much stronger braking effect, and the vehicle will stop quickly.

It will be readily seen that this motor is of great value in a hilly region, especially as a considerable percentage of the additional current consumed in ascending a hill can be recuperated in descending it. The motor is also said to be considerably more efficient than a series one when running under light loads on the level. Slowing down and stopping can be accomplished without using an extra brake lever, and the batteries each time receive a brief recharging, which, although not amounting to very much, perhaps, certainly has a tonic effect; for it seems to be the general experience that freshly charged batteries will yield considerably more current than when they have been standing some hours. The inventor claims that with this motor a carriage will run from twenty to forty per cent farther than with the usual series wound motor.


CONTROLLER FOR A RECHARGING MOTOR.


AUTOMATIC RECHARGING ELECTRIC VEHICLE.

Carloads of Molten Iron.

The construction of a new bridge across the Monongahela, to be opened for service within the next few days, directs attention afresh to a striking feature of modern metallurgy. The usual way to make steel is to melt up cold pig iron, to which other materials are added, and then purify the mixture by burning out certain undesirable elements. Pig iron, however, is itself the product of a previous heating process, in which the ore is melted with carbonate of lime to remove the oxygen. It occurred to some ingenious Yankee a few years ago that if the product of the blast furnace could be converted into steel before it had cooled sensibly, a great economy in fuel would be secured.

Tbe new bridge just mentioned bas been built for the Carnegie Company, and will be used to convey molten iron from the Carrie furnaces to the Homestead Steel Works, nearly a mile off. At the present time Homestead obtains molten metal from Duquesne, about four and one-balf miles away! The new route has been laid out so as to save time and distance, and, possibly, caloric, too. There has been for some time one "hot metal" bridge across the Monongahela, controlled by the Carnegie Company, and, besides the new one about to be opened, a third is in process of erection for the Jones & McLaughlin interest. It will thus be perceived that the practice has proved so successful that it is being rapidly extended.

One gets a vivid idea of this remarkable procedure when he reads about the precautions taken in the construction of the new bridge to prevent harm in case any of tbe melted metal leaks or slops over while in transit from the iron furnace to the steel works. The spaces between tbe ties are to be filled with sand, so that no iron may fall to the decks of passing steamers. The ties will be of wood, but are to be protected by a covering of sand. On either side of the track there will be raised a screen of heavy metal plates, faced with firebrick and reaching to a height of four feet. An extension of thinner plates will bring the screen up six feet farther. The cars are ladle-shaped, and the molten metal runs directly into them when the furnaces are tapped. A locomotive then draws the train to the steel works at a moderate pace. The glowing freight, says The New York Tribune, is still in a fluid condition when it reaches the mixers there. If it were not, the cars would be ruined.

Substitute for Gutta-percha Bottles.

For the preserving of hydrofluoric acid, which is frequently used for cleaning heliotype plates, in the manufacture of dry plates and for etching on glass, only the expensive gutta-percha bottles have been used heretofore, which, however, become brittle and hard in time, and therefore constitute danger. A very convenient substitute is obtained, according to the Deutsche Photographen Zeitung, by pouring hot wax into a glass bottle with suitable spout, and coating the inside with it, by allowing the wax to harden with constant turning. The neck, as well as the spout, is also coated with wax. Instead of cork or glass make a stopper of glazier's putty. The wax coating at the spout prevents drops from running down to the outside wall.

THE electric tramways of Berlin are to undergo extensive development and extension. Intercommunication with the heart of the city and the remotest suburbs is to be established, and a general two cent fare will be charged throughout the whole system. Unfortunately, however, the number of accidents is increasing proportionately with the extension of tbe system. During twelve weeks over sixty tramway accidents occurred, nearly thirty of which terminated fatally.