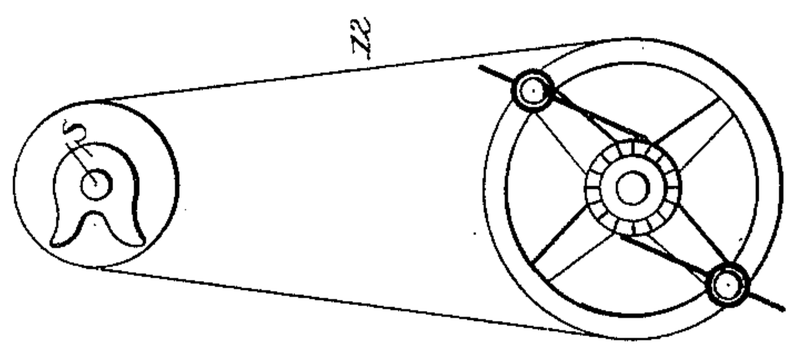
(No Model.)

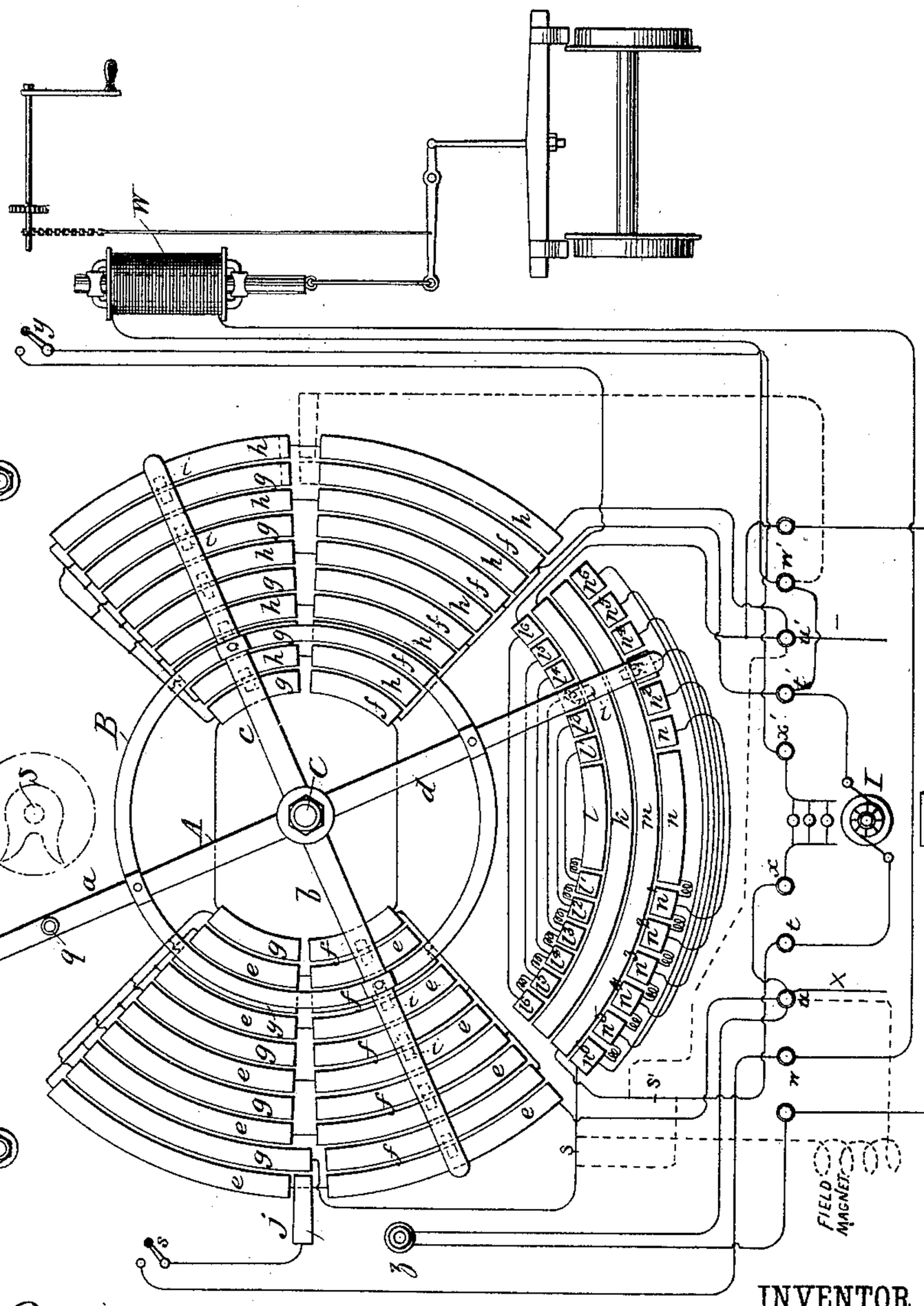
W. M. SCHLESINGER.

REGULATING DEVICE FOR ELECTRIC RAILWAY CARS.

No. 406,961. Patented July 16, 1889.

Fig. 2.





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REGULATING DEVICE FOR ELECTRIC-RAILWAY CARS.

SPECIFICATION forming part of Letters Patent No. 406,961, dated July 16, 1889.

Application filed November 6, 1886. Serial No. 218,131. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. SCHLESINGER, a subject of the Queen of Great Britain, residing in Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Regulating Devices for Electric-Railway Cars; and I do hereby declare that the following is a full, clear, and exact description of my invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of the device is, broadly, to furnish means whereby unskilled operators—such as ordinary car-drivers—may be enabled to run electric-railway cars without danger of mistake. To this end I have constructed an apparatus in which all the electrical operations necessary in running such cars are controlled by the movements of a single lever. This lever is so connected electrically with the motor-circuit and with circuit-controllers therein that a movement thereof in one direction will cause the motor to propel the car forward, a movement in the opposite direction and to a certain distance will reverse the action of the motor, and a movement to a certain fixed point will break the motor-circuit and automatically apply an electric brake, while the speed of the motor is dependent upon the distance to which the lever is moved in either direction. Thus by simple movements of a single lever a driver can control without difficulty the movements of an electric car. At the same time by causing the motor-circuit to be interrupted before and while the electric brake is applied (in a manner to be hereinafter described) I protect the appliances from accident through wrong use. Whenever electric lights are used on a car, by means of the same lever above referred to I regulate the lights for different speeds of the car or different distances from the feeding-station.

The means by which I attain the above-mentioned objects are illustrated in the accompanying drawings, in which—

Figure 1 is an elevation of my circuit-controlling mechanism, and Fig. 2 is a detail view.

The circuit-controlling devices above referred to are located, preferably, upon the front platform of a railway-car, so as to be within easy reach of an operator stationed at that point, and they are supported in a regulator-box (not shown) or upon any suitable back or base.

A is the operating-lever of the circuit-controller, which lever is constructed in the form of a cross and has its four arms connected or braced by a circular strip B. The lever is mounted on a shaft C. One of the arms of the lever A is formed at the end into a handle A′, by means of which it can be moved back and forth. This arm in its movement passes along by the side of a notched segmental bar D, as shown in Fig. 1. Upon the handle A′ is pivoted an angular piece or catch *o*, which is pressed by a spring *p*, so that its lower end will catch into the notches of the bar D. By pressing the upper part of the angular piece against the handle A′ the catch is raised out of engagement with the notched bar and allows the lever to be moved freely. The normal position of the lever is that which it occupies when the catch *o* engages with the central notch *r* on the bar D. It will be observed that the notches *r′* in the bar D are so cut as to interrupt the motion of the lever by detaining the catch *o* when the lever is moved in either direction from the point where it is held by the notch *r*. The function of this construction will be explained hereinafter.

For the sake of clearness, I will designate that arm of the lever on which the handle is formed as *a*, and the other three arms as *b*, *c*, and *d*, respectively. Beneath or behind the arms *b* and *c* and extending for the most part along the whole path of motion of the said arms are a series of segmental strips *e e f f g g h h*, arranged about a common center. Strips that are similarly lettered are all connected by suitable conductors, as shown. I employ a large number of conducting-strips (usually more than eight,) so as to interrupt the circuit at several places, and thus reduce sparking. On the bottom or at the rear of the arms *b* and *c* a number of bridges *i i* are so arranged as to make contact when in proper position between segments belonging to different groups. For example, in the position illustrated in Fig. 1 the bridges *i* on the arm *b* serve to connect strips *e* with strips *f*, while the bridges on the arm *c* make electrical connection between the strips *g* and *h*. When

the lever is turned to the right beyond the notch *r*, the bridges on the said arms make contact between the strips *e* and *g* on one side and *f* and *h* on the other. By a similar construction and arrangement of parts a pair of bridges on the arm *d* makes contact respectively between a segmental strip *k* and any one of a series of contacts *l l'* l^2, &c., and between a segmental strip *m* and any one of a series of contact-pieces *n n'* n^2, &c. The contact-pieces *l l'*, &c., and *n n'*, &c., are connected with resistance-coils in a manner well understood. It will be seen that the segmental pieces arranged along the path of the arms *b* and *c* are not continuous on either side, but that the segments are arranged in pairs with an opening between the members of each pair. When the catch *o* is detained by the notch *r*, the position of the arms *b* and *c* is such that it stands directly over or in front of these openings. In this position the bridges *i i* are of course thrown out of connection with the circuit, except where provision is made for making contact between one of the segments and the break-circuit, as will be explained hereinafter.

As has been said already, the parts above described are located, preferably, upon the front platform of a railway-car. They may, however, be put at any other convenient place, as may be preferred. It is immaterial, also, whether the parts are arranged to be in a vertical or a horizontal position, and whether the lever is arranged in front of or behind, above, or below the contact-strips. Moreover, the form of the strips is not essential and may be varied at will. I have adopted in practice the vertical arrangement of the parts and the segmental form of the strips and a lever mounted on a shaft simply for convenience of operation.

The details of construction of my circuit-controlling device having been set forth, I will now describe the circuit-connections and the mode of operation of the parts. Beneath the car or in any convenient position for operating it is located an electric motor I. The motor is fed by a current derived from conductors which run through a conduit (not shown) along the railway-track. The circuit from the motor-armature passes to the circuit-controlling devices by way of the binding-posts *t t'*. The circuit from the conduit-conductors enters at the binding-posts *u u'*. The circuit entering at binding-post *u* divides and passes first to one of the segmental strips *e*, and, as a consequence, to all of the strips designated by that letter. The circuit from binding-post *u'* passes to the segmental strips lettered *h*. The strips *f* are connected directly with the armature binding-post *t'*, and the strips *g* are indirectly connected with the armature binding-post *t*, being first joined to the series of contact-pieces n^6 n^5, &c., and thence by bridge *i* of the arm *d* with the segmental strip *m*. The latter is connected directly with the binding-post *t*.

When, now, the lever A is in the position shown, the circuit traverses the apparatus from the binding-post *u*, as follows: To the stops *e*, bridges *i*, strips *f*, armature binding-post *t'*, the armature itself, binding-post *t*, segmental strip *m*, bridge *i*, and contact-pieces n^3, through the resistance-coils to the contact-piece n^6, from there to the segmental strips *g*, bridges *i*, strips *h*, and back to the other conduit binding-post *u'*. When the lever is in its reversed position on the other side of the notch *r*, the circuit will go through the armature in the opposite direction. It will then pass from the strips *e* through the bridges *i* to the strips *g*, from there to contact-piece n^6, and in a reverse direction by way of resistances, bridge *i*, strip *m*, and binding-post *t*, through the armature of the motor I, thence to binding-post *t'* and strip *f*, and by way of bridges *i* and strips *h* back to the binding-post *u'*. It will thus be seen that a reversal of the lever A from one side to the other of the notch *r* reverses the current through the armature of the motor.

The speed of the car is regulated by the resistances *n n'* n^2, and so on, which, as has been seen, are connected up in the armature-circuit. The farther the lever A is moved in either direction away from its central position the more of these resistances are cut out, and the greater of course is the speed of the motor. It is obvious that instead of regulating the speed of the motor by interposing more or less resistance in the armature-circuit, I might accomplish the same result by altering the strength of the current through the field-magnets. This arrangement is illustrated by the dotted lines in the lower part of Fig. 1 at the left. The original circuit is interrupted at *s* and *s'*, and circuits are formed, as shown by the dotted lines. The circuit from the conduit will pass from *u* through the field-magnet of the motor, and by the resistances n^6 n^5, &c., to *n*, and from there to *u'*.

As shown in Fig. 1, contact-pieces *n'* n^2, &c., are placed on both sides of contact-piece *n*, so that a movement of the lever A to a certain distance in either direction will bring the motor to the same degree of speed, whether going forward or backward.

From the above it appears that the farther the lever A is moved from *r* in either direction the greater will be the speed of the car or the larger the load at the same speed independent of direction. It is a well-known fact that the practical neutral line of a motor shifts to one side or the other of the theoretical neutral line according to the direction of the current. To prevent undue sparking, therefore, the lever A is made to operate a device for shifting the brushes of the motor where only two are used, or for reversing them where four brushes are employed. The device consists of a fork S, (shown in Figs. 1 and 2,) which is operated by a pin *q* on the arm *a*. When the lever is at the center of its movement, the fork stands upward, but when

the lever is moved to either side it tilts the fork in one direction or the other. The fork is so shaped that the tilting is at first rapid and afterward more slow, to correspond with the rapid and afterward gradual shifting of the neutral line. Fork S is rigidly connected with a drum or pulley, from which a cord 12 passes to the brush-holder. That part of the pin *q* which operates the fork S is located behind the arm *a*.

In order to prevent danger to the apparatus, which would exist if the electric brake were applied while the motor-circuit was complete, I cause the main circuit to be broken when the lever is brought to its central position, and close a new circuit from the armature to the brake, which will operate the same when the switch at *s* is closed. It will be seen that I prolong one of the strips *g* at the left of Fig. 1, and place near its extension a contact-piece *j*, which is connected directly with the switch-arm *s*. When the lever is in its central position, these contact-pieces will be bridged by one of the pieces *i* on the arm *b*, and there will then be a circuit from the armature to the electric brake (if the switch *s* is closed) as follows: To the binding-post *t*, to the segmental strip *m*, bridge *i*, contact-piece *n*, and resistances to and including n^6; from there to strip *g*, by bridge *i*, to contact-piece *j*, to switch *s*, and to binding-post *w*. Thence the circuit proceeds through the brake W to binding-post *w'*, and from there to binding-post *t'* and the armature. The armature will always have some momentum, which will cause it to rotate after it has ceased to be acted on by the main current, and this momentum will actuate it so as to generate in the motor a current of sufficient force to retard the motion of the car.

When for any reason—for example, by the slowing of the speed—the amount of power consumed by the motor is altered, the difference of potential between the electric terminals of the car (in this instance the binding-posts *u* and *u'*) is varied. If, therefore, any part of the current from the conduit-conductors is utilized to furnish means for incandescent lighting on the car, the lamps would flicker, varying in brightness whenever the speed or load of the car should change. I have shown at X in Fig. 1 such a system of lights connected up between the car terminals. To prevent its being affected by the causes above referred to, I have put into the lamp-circuit a regulating device consisting of a series of resistances which can be thrown into circuit with the lamps according to the difference of potential between the terminals. As this difference of potential changes with the different speeds of the motor, and as the speed is dependent on the position of the lever A, the regulating device for the lamps is so constructed that the farther the lever is moved from its central position the less resistance is left in the light-circuit. The lamps will be regulated to burn with their normal brightness when the lever is at the center of its movement with a certain amount of resistance in the circuit. As the lever is moved away from the center this resistance is reduced so that the lights will always glow with about the same intensity, whatever may be the speed of the car. Tracing now the light-circuit, it passes from the binding-post *u* to the binding-post *x*, and through the lamp-circuit to the binding-post *x'*. Thence it passes to a light-switch *y* and back to a series of resistances l^6 l^5, &c. By way of a bridge *i* it passes to the segmental strip *k*, and thence to the other terminal binding-post *u'*.

The operation of the regulating device is similar to that of the regulator already described for controlling the resistance of the armature-circuit.

z is an open-circuit push-button, which, when operated, closes a circuit from the conduit-conductors through an electric bell *z'*, located on the front of the car. The electrical connections are obvious, and need not be described. The object of the bell is to call the attention of the drivers of wagons or other vehicles which may be obstructing the movements of the car. This electric bell forms no essential part of my present invention, and no claims are based upon it.

The protection of both the motor and the generator from the sudden shock and flaming at the brushes that would be caused by suddenly reversing the current while the car is in motion has been provided for by the construction of the segmental bar D and the catch *o* already described. The central notch *r* is constructed with vertical sides, so that when the lever A is moved to a central position the spring-catch *o* is forced into it, and the lever cannot be moved to one side until the catch is released by pressing on the upper part of the angular piece *o;* nor can the lever be moved to either of its extreme positions without keeping the angular piece constantly pressed against the handle.

An operator soon learns by experience how far to push the lever in order to obtain a certain degree of speed with a given load, and he will move the lever slowly to that position and release the catch. On the other hand, in moving toward the center, the motion can be as quick as desired and the catch will still be detained by the notch *r*, as above described. By this means the danger of reversing the current too suddenly is obviated.

In practice I prefer to inclose the four arms of the cross A in a box and to connect them mechanically with an operating-lever on the outside of the box. This is done to protect the contact devices from the deleterious effects of dust, moisture, and other like causes which endanger good electrical contact.

Having now described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an electric-motor circuit, the combination, with circuit making and breaking de-

vices, a pole-changer, a regulator for controlling the speed of the motor, and a regulator for controlling the resistance of the derived circuit containing lamps, of an operating-lever controlling the said devices, the said lever serving also, when operated, to move the brushes of the motor, whereby the moving of the lever to different positions will start the motor, break the circuit of the same, reverse the motor, determine its speed, set the brushes for different directions of the current, and regulate the brilliancy of electric lights.

2. In an electric-motor circuit, the combination, with a speed-regulator for the motor, and a regulator for controlling the resistance of a derived circuit containing lamps, of an operating-lever controlling both the said regulators, whereby the resistance of the lamp-circuit will be adjusted to the speed of the motor.

3. In an electric-motor apparatus, the combination, with strips *e e f f g g h h*, contacts *l l' l²*, &c., and *n n' n²*, &c., strips *k* and *m*, bridges *i i*, and lever A, of contact-piece *j*, switch *s*, and brake W, and electrical connections, as and for the purpose set forth.

4. In an electric-motor apparatus, the combination, with circuit making and breaking devices, of the prolonged strip *g*, contact-piece *j*, bridge *i*, lever A, brake W, and electrical connections to the brake, the extension of strip *g* and the contact-piece *j* being so placed as to be bridged only after the circuit-controller is on open circuit, as and for the purpose set forth.

5. The combination, with a circuit-controlling lever, as A, of a spring-catch, as *o*, and a segmental bar, as D, provided with notches *r* and *r'*, the notch *r'* being central and adapted to resist the motion of the lever only when moving from the center, as and for the purpose set forth.

6. The combination, with a circuit-controlling lever, as A, of a spring-catch, as *o*, and a segmental bar, as D, having a point at which the lever is adapted to rest normally, the said bar being also provided with notches which allow the lever to be pushed rapidly toward the said point, but resist its movement in the opposite direction, as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM M. SCHLESINGER.

Witnesses:

CHAS. F. VAN HORN,

GEO. LOCHMAN.