No. 622,369. Patented Apr. 4, 1899.

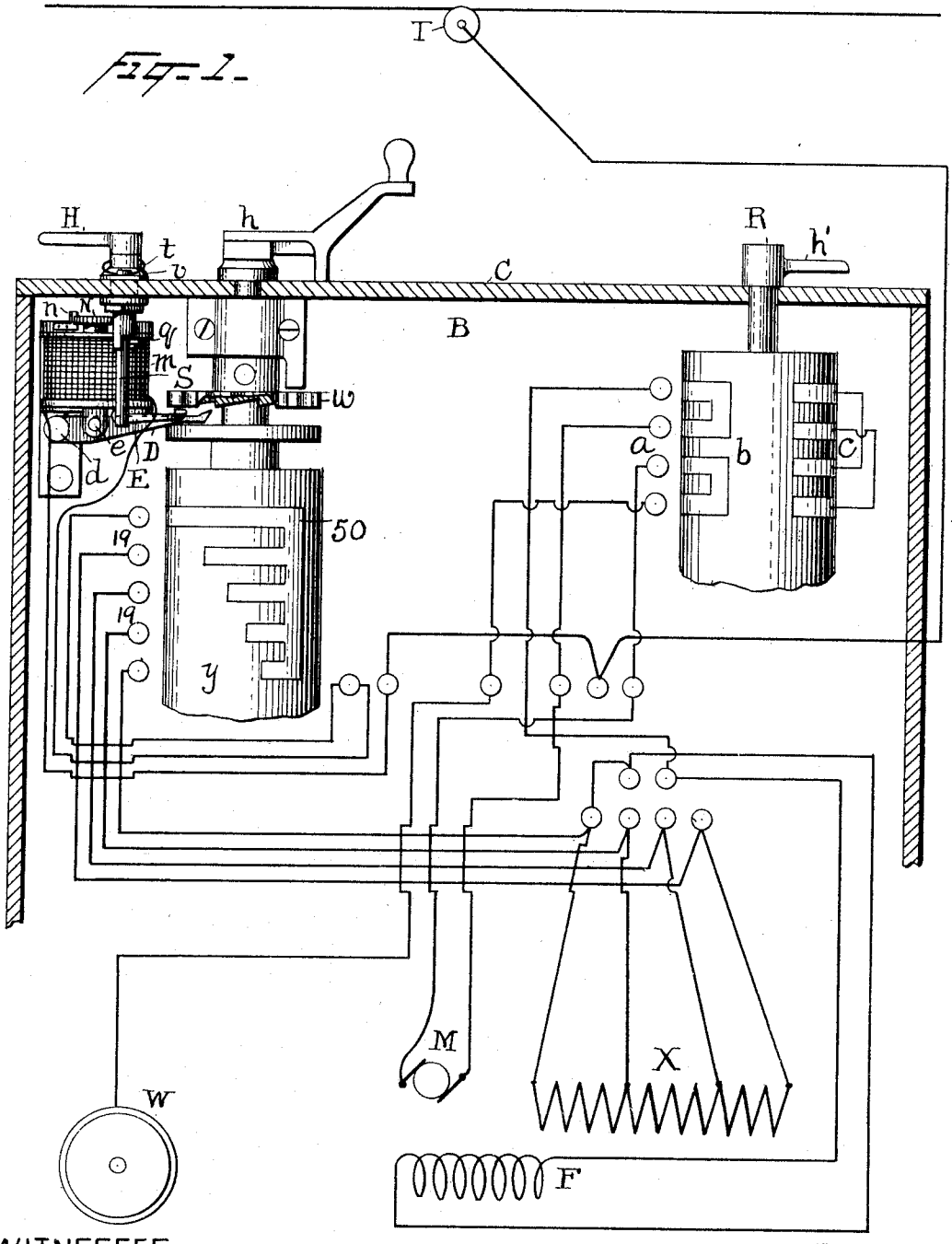
R. HUTCHISON.

CONTROLLING SWITCH FOR ELECTRIC MOTORS.

(Application filed Nov. 26, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



WITNESSES

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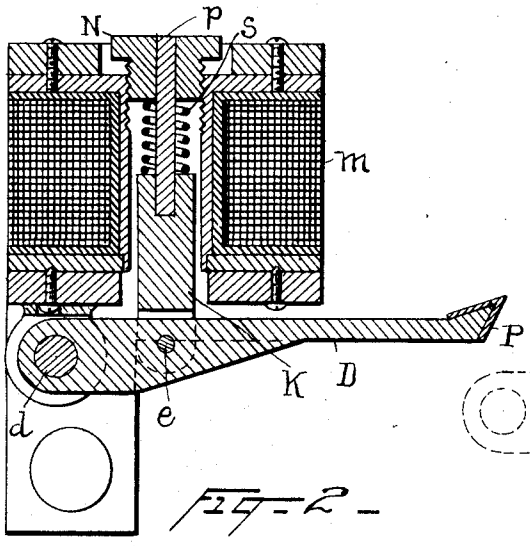

Fig. 2.

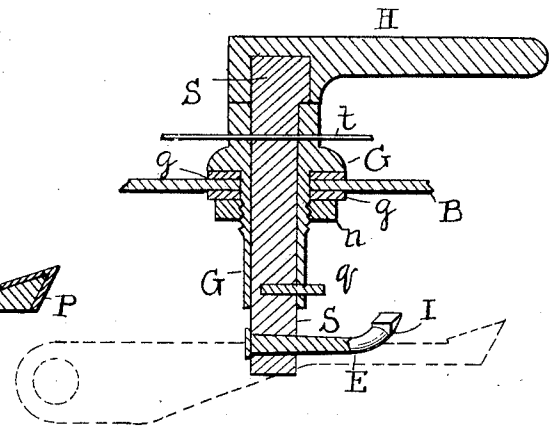

Fig. 3.

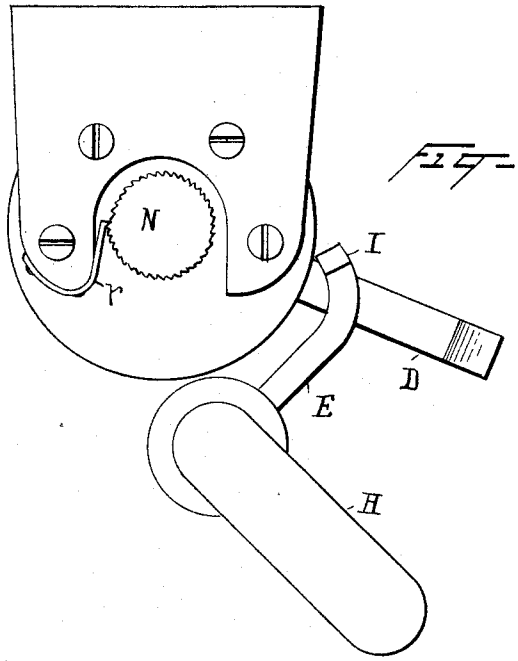

Fig. 4.

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UNITED STATES PATENT OFFICE.

REESE HUTCHISON, OF MOBILE, ALABAMA.

CONTROLLING-SWITCH FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 622,369, dated April 4, 1899.

Application filed November 26, 1898. Serial No. 697,509. (No model.)

To all whom it may concern:

Be it known that I, REESE HUTCHISON, a citizen of the United States, and a resident of Mobile, in the county of Mobile and State of Alabama, have made certain new and useful Improvements in Controlling-Switches for Electric Motors, of which the following is a specification.

My invention is an improvement upon the motor-controlling switch and apparatus which I have described and claimed in United States Letters Patent No. 612,203, dated October 11, 1898. The improvement described in said patent consists in applying to a controlling-switch for electric motors, such as is commonly employed in street-car propulsion, an automatic locking device under control of an electromagnet located in the motor-circuit, the object sought and attained being the establishment of a check or automatic control upon a careless or ignorant motorman, whereby the controlling-handle can only be advanced from one point to another upon the establishment of a predetermined strength of current.

The object of my present invention is to provide for emergencies—as, for instance, an imminent collision or a demand for excessive current in the motor-coils when it becomes necessary and desirable to instantly liberate the controller from the automatic locking device described. The locking device employed consists of a ratchet having teeth corresponding to the contact positions of the switch and a pivoted dog or finger engaging with the teeth of said ratchet. The dog is controlled by the magnet to lock or unlock the switch by engaging or disengaging with the teeth of the ratchet. I provide mechanical means for directly unlocking the lock so formed by forcing the dog or finger out of engagement with the ratchet, the unlocking action being performed by mechanically and directly overcoming the force exerted by magnetism. The specific mechanism preferred consists of a cam-surface or an inclined plane surface upon a movable arm in position to engage with the surface of the dog or finger, an actuating-lever connected or fixed to the said movable lever, and a seal connected to the actuating-lever in its normal position, intended to be severed and operate as a "telltale" upon a change or disturbance of such normal condition.

The frame of the usual arrangement of car-controller and many of its parts are made of magnetic material and magnetized or become magnetized from the presence of electric currents or other causes. I have found in practice that a magnetic circuit or magnetic continuity is established through the ratchet and dog constituting part of my locking device, causing the movable part of the lock to hang or stick or become magnetically attracted in a locked position. To obviate this defect, I insert a section of non-magnetic metal in either the fixed or movable portions of the lock to prevent the establishment of a magnetic circuit. The dog itself is preferably made of non-magnetic material, like brass, and its contact or engaging point of hardened metal, like steel, to engage with the hard surface of the ratchet.

The accompanying drawings illustrate my invention.

Figure 1 is a complete view of a car-controller with my improvement attached thereto, the electrical connections being shown conventionally. Fig. 2 is a vertical cross-section of the solenoid-magnet, the dog or finger forming part of the lock, and the details of construction thereof. Fig. 3 shows the improved arrangement for directly and mechanically disengaging the lock, including the actuating-lever and the inclined plane or cam-surfaced movable arm. Fig. 4 is a top view of the magnet and disengaging device.

In Fig. 1, C is the well-known car-controller. It is composed of a rotating cylinder having a series of movable contacts 50, a series of fixed contacts 19, and an actuating-handle *h*. There is also a reversing-switch R, having two sets of movable contacts *b* and *c*, coöperating with a series of fixed contacts *a*. Both said series of fixed contacts are electrically connected with the sectional resistance X, the motor-field coil F, the motor-armature coils M, the collecting device T, commonly called the "trolley," and the return-circuit at W. By shifting the position of the handle *h'* and the contacts of the reversing-switch R the direction of current through the motor is reversed. By changing the radial position of the handle *h* of the controller to any one

of its contact positions the relative connections of the parts M, F, and X are so changed with respect to each other and the source of current that the effective strength of current flowing in the coils of the electric motor is varied. On the rotating shaft of the cylinder *y* there is a toothed wheel *w*, and there are as many teeth on its contact-surface as there are contact positions for the controller *h*.

D is a dog or finger pivoted at *d*. As shown in Fig. 2, it is composed of non-magnetic metal, as brass, and it has a hardened engaging point, preferably of steel P.

m is a solenoid-magnet. Its core K is hinged to the dog D at *e*. The core K is forced downward by a helical spring *s*, and the nut N, working in a screw-thread in the shell of the solenoid-magnet, serves to adjust the force of the spring. The periphery of the nut N is toothed and engages with a retaining-spring *r*, as shown in Fig. 4. The coils of the solenoid *m* are located in series with the motor at all times. As shown, they are in circuit between the trolley T and the first fixed contact 19. The strength of current flowing in the motor-circuit is dependent upon the arrangement of the artificial resistance, the motor-coils, and the counter electromotive force developed by the motor. To prevent the flow of too strong a current from the trolley to the motor, the magnet *m* is adjusted to bring the dog D into engagement with the toothed wheel *w* whenever a predetermined strength of current is present in its coils and to thus lock the controller-handle *h* in position upon any one of its contacts, this locked position being maintained until the effective strength of current falls to or below the predetermined point, when the handle *h* may again be changed.

It sometimes occurs, as when the motor and car are under headway and an accident is imminent, that it is necessary to instantly liberate the controller from the influence of the automatic lock. It is for this purpose I provide an auxiliary device for instantly and certainly liberating the controller. This consists of a movable arm E in position to engage the surface of the dog D and mechanically and directly force it out of engagement with the wheel *w* against the force exerted by the magnet *m*. The movable arm E is provided with an inclined plane or cam-shaped engaging surface I and is fixed on the end of a vertical spindle S. This spindle passes through a plug or bearing G, which fits closely in the case of the controller B, a gasket *g* being provided to render the junction water-tight. The bearing G is held in position by a nut *n*.

q is a pin fixed in the spindle S and moving in a slot in the bearing G, the object being to limit the extent of movement of the spindle.

H is the actuating-handle, fixed to the spindle S. A registering hole is bored through the spindle S and through the bearing G when the handle H is in its normal position. Through this hole is passed a wire *t* of soft metal, easily severable, its opposite ends being sealed, as at *v*, the object being to form a telltale to furnish evidence of the movement of the handle H.

The operation of the arrangement is as follows: Assume that the car is under headway and a strength of current is flowing in the motor-circuit exceeding the predetermined limit. The controller-handle *h* is locked in position. An accident is imminent. It is necessary to change the movement of the car instantly; but as the controller is locked and an appreciable interval must pass before this is possible the motorman turns the handle H from its normal position to its opposite limit. The seal *t* is broken in the act. The inclined or cam surface I of the movable arm E engages the upper surface of the dog D and forces it downward and out of engagement with the wheel *w*. The handle *h* of the controller is unlocked or freed and it becomes possible to instantly change the movement of the car.

As the frame of the controller C is magnetic and the shaft on which the cylinder *y* is located is magnetic, and as it is common to employ electromagnetic devices in close proximity to the contact-point to prevent arcing, a locking device of magnetic material will frequently become unmanageable. To obviate this, I have inserted a section of non-magnetic metal to prevent the establishment of a magnetic circuit through the fixed and movable part of the locking device or through the wheel and the dog.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of an electric motor, a motor-circuit therefor, means for varying the effective strength of current in said circuit, including a multiple-contact switch, an automatic electromagnetic locking device for locking or holding said switch in any contact position, and means for mechanically disengaging said locking device, substantially as described.

2. The combination of an electric motor, a motor-circuit therefor, means for varying the effective strength of current in said circuit, including a multiple-contact switch, an automatic electromagnetic locking device for holding said switch in any contact position and means for disengaging said locking device by directly and mechanically displacing the movable member thereof, substantially as described.

3. The combination of an electric motor, a motor-circuit therefor, means for varying the effective strength of current in said circuit, including a multiple-contact switch, an automatic electromagnetic locking device for holding said switch in any contact position, and means for disengaging said locking device consisting of a manually-operated arm in position to engage and displace the movable member of said locking device and an

actuating-handle for said arm, arranged substantially as described.

4. The combination of an electric motor, a motor-circuit therefor, means for varying the effective strength of current in said circuit, including a multiple-contact switch, an automatic locking device controlled by an electromagnet for holding said switch in either contact position and means for instantly unlocking said locking device by overcoming its electromagnetic control consisting of a manually-operated arm in position to engage the movable member of the locking device and force it out of engagement, substantially as described.

5. The combination of an electric motor, a suitable circuit therefor, means for varying the effective strength of current in said circuit, including a multiple-contact switch, an automatic locking device controlled by an electromagnet for holding said switch in any contact position and means for instantly unlocking said locking device by directly and mechanically overcoming its electromagnetic control consisting of a movable arm having a cam-shaped or inclined plane surface in position to engage a movable part or member of said locking device and an operating-lever fixed to said movable arm, substantially as described.

6. In a motor-controlling switch having a series of contact positions and electrical connections with the motor and with the source of electricity, the combination of an automatic, electromagnetic locking device including a toothed ratchet, a vibrating finger or dog to engage therewith and a section of non-magnetic metal in position to prevent the establishment of magnetic continuity through the ratchet and dog, substantially as described.

7. In a motor-controlling switch having a series of contact positions and electrical connections with the motor and with the source of electricity, the combination of an automatic electromagnetic locking device, including a toothed ratchet and a vibrating finger or dog, said dog being composed of a section of non-magnetic material and a hardened contact-point to engage with said ratchet, substantially as described.

REESE HUTCHISON.

Witnesses:
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B. T. BARRET.