(No Model.)

W. B. POTTER.

SAFETY APPLIANCE FOR ELECTRIC BRAKES.

No. 555,585. Patented Mar. 3, 1896.

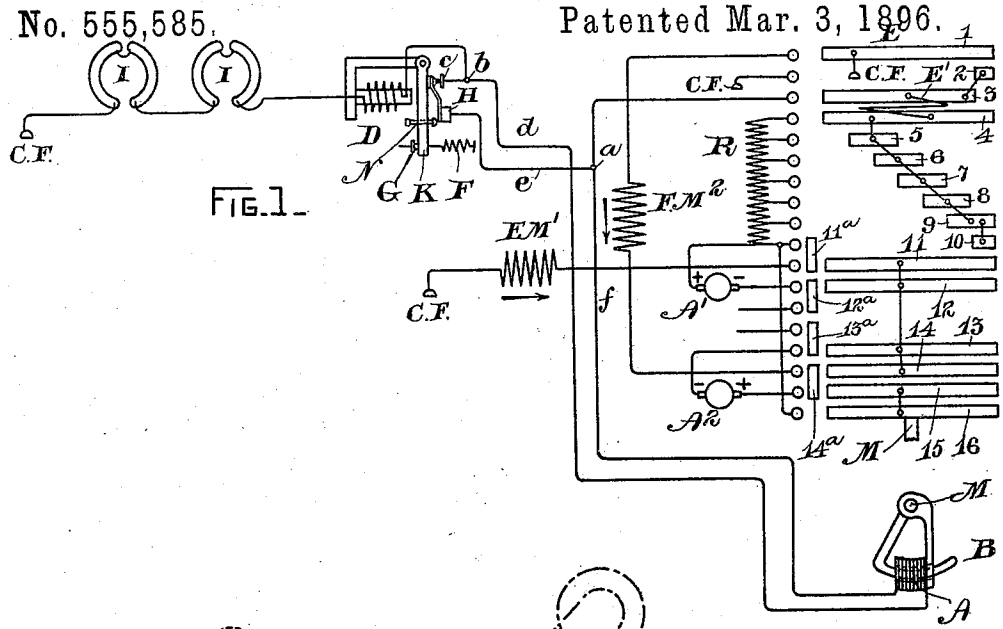

FIG. 1.

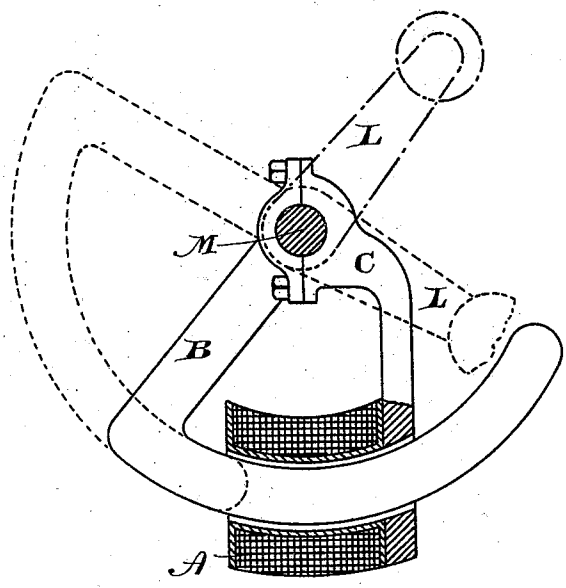

FIG. 2.

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SAFETY APPLIANCE FOR ELECTRIC BRAKES.

SPECIFICATION forming part of Letters Patent No. 555,585, dated March 3, 1896.

Application filed April 22, 1895. Serial No. 546,658. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Safety Appliances for Electric Brakes, of which the following is a specification.

My invention relates to electric brakes, and has especial reference to devices designed to prevent such brakes operating with too great power or with such excessive power as to altogether stop the rotation of the wheels.

It is well known in railway circles that a maximum braking effect is obtained when the wheels are allowed to run at a rate nearly or quite that of the progress of the car, while the friction of the brake-shoe is kept as great as possible consistent with the continuance of this rotation, and that when the wheels skid not only is a flat spot worn in the tread, but the surface of the flat spot becomes polished, so that the momentum of the car carries it much farther than if the wheels be allowed to turn. For the purposes of my invention I arrange electric means designed to limit the current, which may be supplied to braking-magnets of any desired form, though preferably of the now well-known disk form applied to the axle of the car. Such current-limiting devices for the purpose designed have heretofore been devised, but all such with which I am acquainted are open to objection. First, in the form in which they are applied by hand their operation is uncertain and is to so great a degree dependent upon the judgment of the motorman or operator that they become superfluous, and it is safer as well as cheaper and simpler to trust to the same man's judgment in operating the brake-handle to get the particular effect desired, and, second, in their automatic form they have been beyond the control of the motorman and have operated to cut in resistance, and thus limit the current positively and definitely without indicating to the operator the condition of the current-limiting device. In all such appliances with which I am acquainted this current-limiting effect has not been dependent upon the rotation of the wheels or the condition of the track, nor can it be adjusted for variations of load with any degree of certainty.

To overcome the objections thus pointed out I have devised my present apparatus, which consists of a solenoid having its core connected directly to the brake-handle. This solenoid is normally short-circuited by contacts which themselves are controlled by a relay-magnet in the main circuit. Upon increase of current to a certain maximum the relay-magnet attracts its armature, opens the contacts, and throws the solenoid into the main circuit. The current passing through the solenoid attracts the core, so that the brake-handle is itself drawn back or its further operation practically prevented. It is, of course, feasible to so construct the apparatus that it will be beyond the power of the motorman to actuate the brake-handle at all while the current passes in the solenoid. Normally, however, I do not so design to construct it. I prefer, for reasons which will be well understood, to employ just such strength of magnetic attraction as will act to check the rotation of the handle, but not to absolutely stop it if the motorman exerts his strength. With this degree of attraction I have found that if with the ordinary application of power to the handle it be moved so far as to cut in the solenoid the handle will be drawn a notch or two back and more resistance will be inserted in the circuit. At the same time, where the emergency stop—such as I have described and defined in my Patent No. 543,352, issued July 23, 1895—is incorporated in the braking apparatus it is possible for the motorman, by a single quick motion, to throw the handle to its last position, or the position which is ordinarily not used, and in which the motors are short-circuited and the braking-magnets cut out.

By limiting the current in the manner just described I am enabled to keep the wheels always turning, and to do this without undue complication. It is of course designed to make the relay-magnet adjustable for different amounts of current, not only because this enables me to construct standard apparatus which may be adjusted to adapt it to different requirements without alteration, but because by this means the apparatus may be

quickly and readily adjusted after installation for the different conditions of track which obtain in electric-railway operation. For instance, upon some days when the track is wet and slippery, a less amount of current is sufficient to slip the wheels, while where the track is rough and sandy a very great amount of current will be necessary.

I have illustrated the improved safety appliance of my invention as applied to a controller like that shown and claimed in my patent above referred to, but I do not mean thereby to exclude its application to other forms of apparatus.

The accompanying drawings show embodiments of my invention, Figure 1 being a diagram of the controller and circuits of the car-wiring with my improved safety appliance attached, only one end of the car being shown; and Fig. 2 being an enlarged detail of the solenoid, showing its connection with the braking-switch or controller.

I will first describe Fig. 2. Therein A is the solenoid, and B its core, attached to the shaft M of the braking-switch. C is the arm to which the solenoid is secured, and which supports it in position. The magnetic circuit of the apparatus is through the core B, the shaft of the switch and the arm C, which is of magnetic material.

L is the handle of the braking-switch. (Shown in dotted lines.)

The braking-switch is ordinarily operated in practice by drawing the handle from right to left or in the same direction as the hands of a watch revolve, and when the switch is thrown on, the handle L and attached parts take the dotted-line position of the figure.

Referring now to Fig. 1, E is the braking-switch or controller with the shaft M. The solenoid of Fig. 2 is shown at the bottom of the switch to indicate its proper attachment. The contacts of the switch are numbered from 1 to 16, the contacts 11^a to 14^a being those shown and described in my patent before referred to, and also in my Patent No. 546,247, issued September 10, 1895, as forming part of the motor-controlling switch. R is the resistance serving to limit the current-flow. The motor-armatures are designated by the reference-letters A′ A^2, and the field-magnets by FM′ FM^2. The letters CF indicate the controller-frame. E′ is a blow-out magnet-coil connected between the contacts 3 4 upon the braking-switch, as indicated in my prior patents. I I are the brake-shoes. All of these parts are such as are commonly used in the art, and my invention does not reside in them.

The controller or relay-magnet is illustrated between the braking-switch E and the brake-shoes. D is the controlling or relay magnet proper. K is its armature. The motion of the armature is opposed by the spring F, and the adjusting-screw G is provided for the spring, arranged in any suitable manner to increase or diminish its tension, according to circumstances. It is manifest that when the tension of the spring is diminished the magnet D will act with less current than when it is increased, and within reasonable limits the action of the current may be predetermined.

N is a set-screw of brass or other non-magnetic substance, designed to prevent the hysteresis in the magnet-core holding the armature down after the current has fallen below the predetermined maximum.

H shows the contacts controlled by the armature K. I shall trace only two of the circuits in this apparatus, inasmuch as all of them are traced in detail in my patents before referred to, and they do not form the essence of the present invention.

Starting, for instance, from the armature A′ at the plus-brush, the current passes through the resistance R to the contact-plate 4, through the blow-out magnet-coil E′ to the contact-plate 3, thence by the lead to the point *a*, thence down the lead *e* across the contacts H, by the lead *c* to the point *b*, thence around the relay-magnet D through the brake-shoes I I to the controller-frame, re-entering from the controller-frame to the field-magnet FM′, thence to the contact-plate 11 by cross connection to contact-plate 12 and back to the minus-brush of the armature. The path of the current from the armature A^2 may similarly be traced from the plus-brush to contact-plate 15, thence to contact-plate 16, thence through the resistance, and then as before to the controller-frame through the relay and the brake-shoes, re-entering from the controller-frame to contact-plate 1, thence through the field-magnet FM^2 to contact-plate 14 to contact-plate 13 and back to the minus-brush of the armature.

Thus it will be seen that the relay-magnet D is in series in the brake-shoe circuit at all times, while the solenoid A is in a circuit from the point *a* by the lead *f*, returning by the lead *d* to the point *b*, the leads *d* and *c* closing this circuit at the contact H. Ordinarily, therefore, no current will flow in the solenoid A, and its core will be unattracted and the motion of the switch will be free. When, however, the current in the circuit rises to such a point as to overcome by the relay-magnet the resistance of the spring F, the contacts H open. The solenoid A is then cut in as the current passes by the lead *f* through the solenoid and returns by the lead *d* to the point *b*, and thence around the relay-magnet. The motion of the solenoid-core B is then opposed by the attraction in the solenoid, and in practice this opposition is such as to control the motion of the handle L, so that, if the operator applies only moderate strength the handle will even be drawn back a notch or two, thus cutting in more of the resistance R by the operation of the contacts 5 to 9 in ways well understood in the art. As soon, however, as the current falls below the predetermined maximum, the contact H closes, the solenoid is cut out, and the switch may be freely turned.

As outlined in my patent before referred to, the contacts 2 and 10 act to apply an emergency stop by cutting out all the resistance in the circuit of the motors. If it is desired to apply this stop, a quick throw of the handle L will enable the solenoid-core to be withdrawn before the current has had time to rise to such a point as to affect the relay-magnet D. All of this apparatus will then be cut out of the circuit and can have no effect upon the operation of the brake.

I believe myself to be the first to have devised means for controlling the operation of the braking-switch by excess of current in the local circuit which the switch controls, and therefore the claims which I make in this particular I wish to be liberally construed. I am aware that mechanical appliances may be used, but as these are independent of the current in the circuit they have not been found efficacious. Where such mechanical appliances, however, are controlled by the current and are cut in by excess of current and cut out when the current falls off I consider them within the scope of the claims I have made.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. A safety appliance for an electric brake, comprising a braking-switch, brake-magnets and a source of electromotive force in circuit with the braking-switch, and means controlled by the current in the circuit for preventing the too rapid manipulation of the braking-switch.

2. A safety appliance for an electric brake, comprising a braking-switch, a circuit including brake-magnets and a source of electromotive force, a solenoid having its core attached to and controlling the braking-switch, and means for actuating the solenoid by excess of current in the circuit.

3. A safety appliance for an electric brake, comprising a braking-switch, a circuit including brake-magnets and a source of electromotive force controlled by the braking-switch, a solenoid, a core for the solenoid controlling the movements of the braking-switch, and adjustable means for actuating the solenoid by a predetermined excess of current.

4. A safety appliance for an electric brake, comprising a braking-switch, a circuit including the braking-switch, brake-magnets and a source of electromotive force, a solenoid, contacts normally short-circuiting the solenoid, a core for the solenoid controlling the braking-switch, a magnet in the circuit controlling the short-circuiting contacts, and means for adjusting the magnet for different amounts of current.

5. A safety appliance for an electric brake, comprising a braking-switch, braking-magnets and a source of electromotive force in circuit with the braking-switch, a solenoid, a core for the solenoid controlling the braking-switch, contacts normally short-circuiting the solenoid, a magnet in the circuit controlling the contacts by the movements of its armature, a spring opposing the motion of the armature under the magnetic pull, and means for adjusting the pull of the spring to correspond to different amounts of current and conditions of use.

In witness whereof I have hereunto set my hand this 19th day of April, 1895.

WILLIAM B. POTTER.

Witnesses:
B. B. HULL,
A. F. MACDONALD.