No. 647,168. Patented Apr. 10, 1900.

E. THOMSON.

SAFETY APPLIANCE FOR ELECTRIC CIRCUITS.

(Application filed Jan. 18, 1899.)

(No Model.)

FIG. 1.

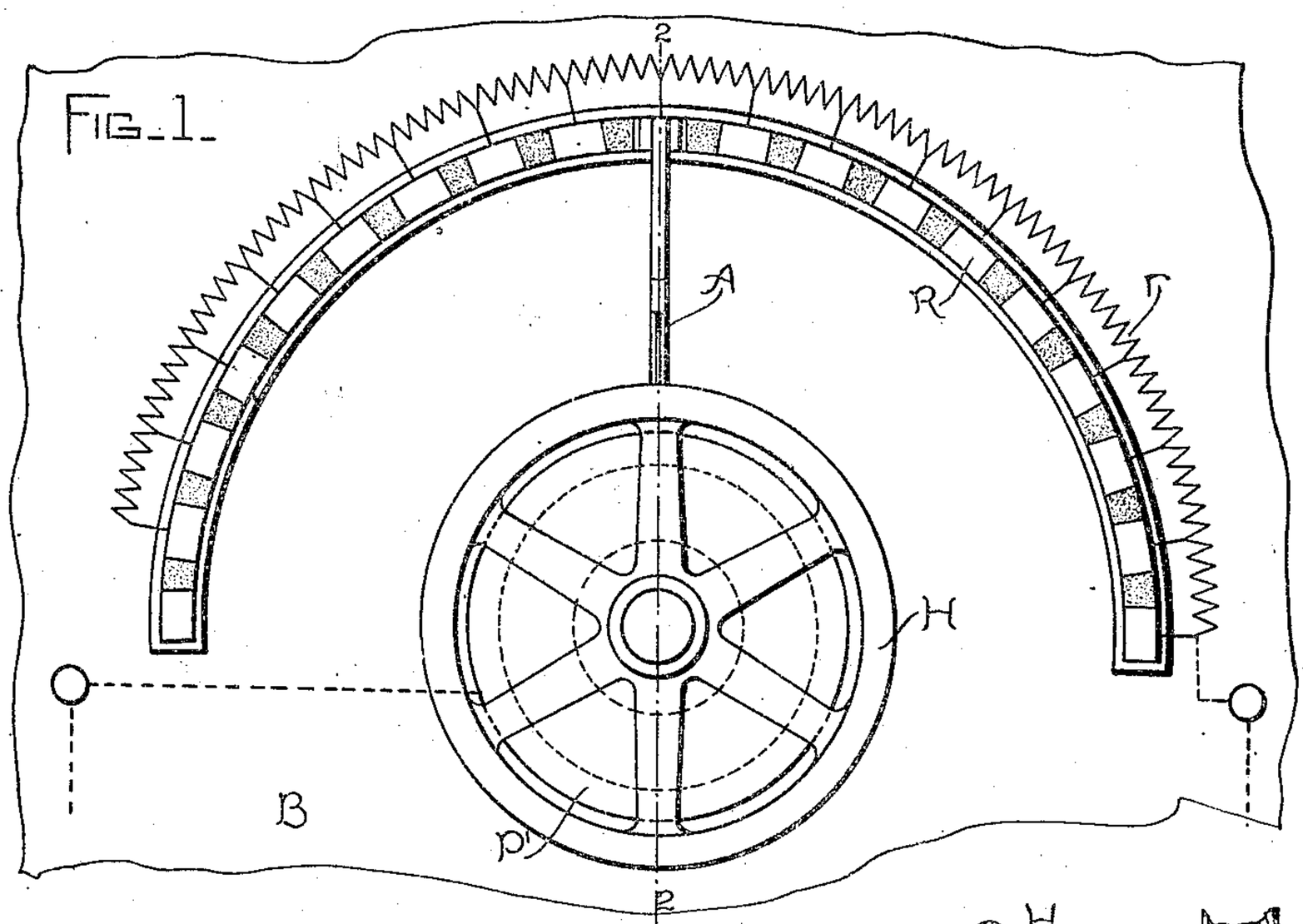


FIG. 4.

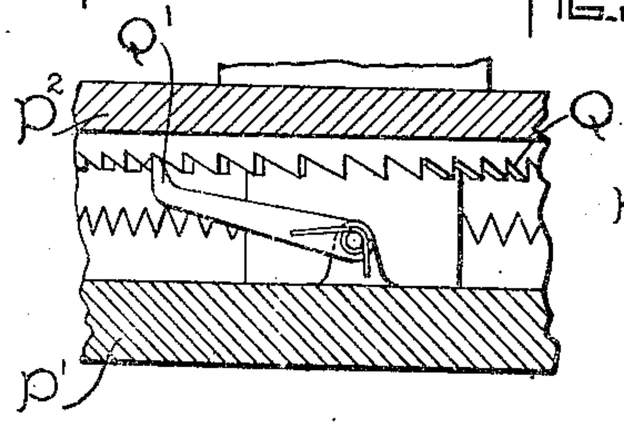


FIG. 2.

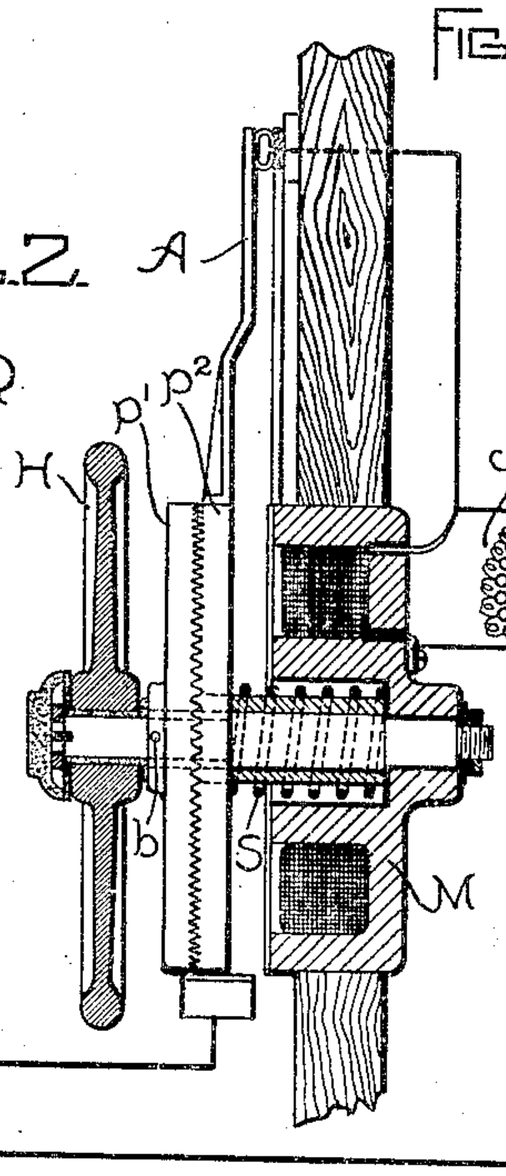
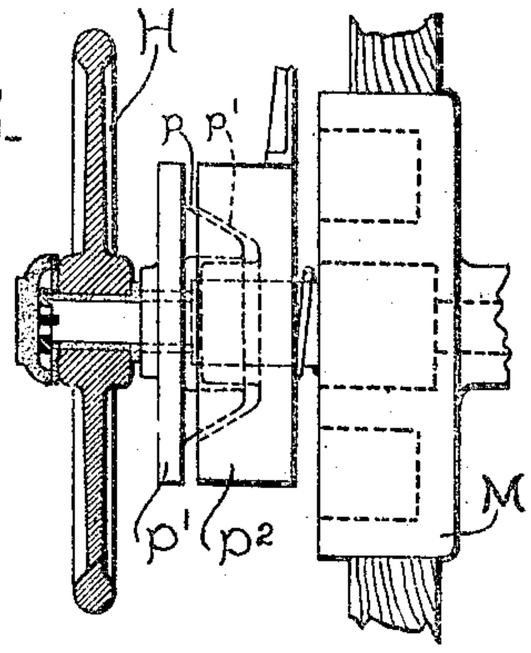
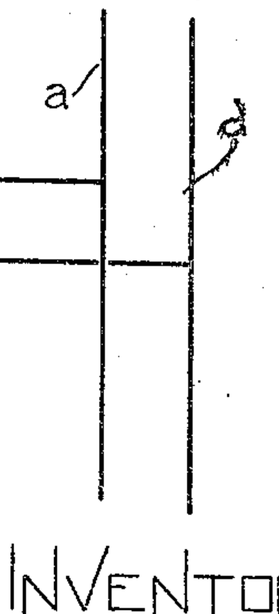


FIG. 3.





WITNESSES.
Edw. Williams, Jr.
A. F. Macdonald.

INVENTOR.
Elihu Thomson
by Atty, Davis
Atty.

UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

SAFETY APPLIANCE FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 647,168, dated April 10, 1900.

Application filed January 18, 1899. Serial No. 702,547. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Safety Appliances for Electric Circuits, (Case No. 1,063,) of which the following is a specification.

My present invention relates to controlling apparatus for electric motors, and has for its object to provide an arrangement by which the motor will not have at any time an undue supply of current. It is particularly applicable to starting devices of various kinds. I have illustrated it in this case as applied to a stationary motor; but of course it could be used in tram-cars or other electrically-propelled apparatus of any type.

It consists in general of a rheostat or other motor-regulating switch, the rheostat being the form illustrated, with a handle by which it is manipulated. The handle is connected to the switch-arm by a shifting connection, and a coil arranged in the main circuit controls this connection in such manner that if at any time the current in the coil exceeds a given value the connection between the handle and the switch is released, so that while the handle may be turned freely the switch remains stationary until the counter electromotive force of the motor rises sufficiently to reduce the current flow below the determinate amount at which the coil acts. As a convenient way of regulating the effect of the coil I use a shunting-resistance. By this means the coil may be made of smaller wire than where it is designed to carry the entire current. The clutch which I prefer to use is not in the ordinary sense a magnetic clutch—that is, it does not depend upon magnetism or eddy-current for its adherence. On the contrary, it is a mechanical clutch of one type or another which is electromagnetically released, and in this respect the present invention differs from all devices of this kind with which I am acquainted.

The accompanying drawings show a convenient embodiment of the invention, in which—

Figure 1 is a plan view of a rheostat to which it is applied, Fig. 2 being a section on the line 2 2 of Fig. 1 with the circuits shown in diagram, and Fig. 3 being a modified form. Fig. 4 is a detail, also shown partly in section.

Upon the usual base B are mounted the rheostat-contacts R, with a resistance r, all of the usual form, and the switch-arm A, manipulated by the hand-wheel H, is also of the type commonly employed. The handle is sleeved upon a stud and is secured to it by the pin b. The clutch is composed of two parts P' and P^2, to the lower one of which the arm A is attached. The upper one is fast to the handle. A spring S, surrounding the stud, presses the two into engagement, to securely effect which they are provided with small teeth. The lower part P^2 of the clutch is formed of magnetic material, while the other part may or may not be similarly made. A disk-like electromagnet M controls the motion of the part P^2, the coil of the magnet being shunted by the auxiliary regulable resistance J. The circuit is from the main a through the coil and the resistance J in multiple to the arm A, thence to the motor N and back to the main d. By moving the handle j of the auxiliary resistance different amounts of the latter may be included in the shunt, so that the coil may be set to act at different points or be entirely short-circuited, as may be desired, in which latter case the apparatus will be inoperative and the regulation of the motor will be effected in the usual way by turning the resistance-switch to the desired point.

In the modified form shown in Fig. 3 the same parts are employed, but instead of a clutch with teeth, such as that shown in Fig. 2, a friction-clutch with tapered portions $p\,p'$ is employed. This has certain slight advantages, in that it can engage at any point and the meshing of the teeth does not move the rheostat-arm, as might otherwise occur when the parts of the other clutch come into engagement. In practice, however, but little difference is observed in the operation of the two devices.

As thus far described the invention, though useful and operative, would be open to one defect—that is, that by releasing the clutch

all control of the rheostat-switch would be also released. I therefore provide the device shown in Fig. 4, which consists, in brief, of a pawl upon one part of the clutch and a ratchet upon the other so arranged that although in going on the pawl has no effect upon the switch-arm, yet there is always engagement between the two parts of the clutch permitting the backward rotation of the arm, if desired. It might occur, for instance, that owing to some unusual condition it would be desirable to immediately turn off the rheostat and cut out the motor, as when accident happens to the machinery, and this might occur just after turning on current and when the parts of the clutch are disengaged. Under these conditions without the arrangement shown in Fig. 4 or some equivalent arrangement it would be impossible to turn off the rheostat until the counter electro motive force of the motor rose, due to its rise in speed, to such a point as to bring the clutch again into engagement. In Fig. 4, therefore, Q is the ratchet or rack, and Q′ is the pawl, the rack Q being upon the part P^2 of the clutch, while the pawl is attached in any convenient manner to the part P′. Of course any equivalent device might be used, and it could be equally well used with the form of clutch shown in Fig. 3.

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

1. The combination with a switch for electrical apparatus, of a manual actuator therefor which is connected with the said switch by a mechanical clutch, and an electromagnet controlled by the current flowing in the apparatus for separating said switch and actuator.

2. A controller for translating devices, which comprises contacts, a movable contact-maker, an actuator by which said contact-maker is moved, and means whereby said contact-maker and said actuator are disconnected, while a predetermined current flows through the controller.

3. The combination of a motor-regulating switch, with an operating-handle having a shifting connection with the switch, and a current-measuring coil for releasing the connection when the current rises above a determinate value.

4. A motor-regulating switch, a handle, a mechanical clutch between the handle and the switch, a spring for forcing the parts of the clutch into engagement, and a current-measuring coil in series with the motor opposing the spring and opening the clutch when the current rises to a determinate value, so that the handle is free to move without moving the switch.

5. A mechanical clutch, a coil for opening the clutch at desired times, and a regulable shunting-resistance for determining the effect of the coil.

6. The combination of a rheostat and its handle, with a clutch between the handle and the switch-arm of the rheostat, a coil controlling the clutch, and a resistance shunting the coil.

7. In combination, a mechanical clutch, an electromagnet for releasing it at desired times, and a connection between the parts of the clutch such that when the magnet is in action, it will engage in one direction, but not in the other.

8. The combination of a mechanical clutch, and an electromagnet, with a ratchet and pawl on the respective parts of the clutch, so that when the clutch is disengaged it may be rotated backward but not forward.

9. In an electric-motor-controlling device, the combination of a motor-regulating switch with a clutch between the switch and the handle, and an electromagnet operated by undue rise of current in the motor-circuit, releasing the clutch and preventing further movement of the motor-switch, with a ratchet and pawl permitting its backward movement uncontrolled by the magnet.

10. A controller for translating devices, which comprises contacts, a movable contact-maker, an actuator by which said contact-maker is moved, means whereby said contact-maker and said actuator are disconnected, while a predetermined current flows through the controller, and means for adjusting said means to operate on the passage of any desired current.

11. A controller for translating devices, which comprises contacts, a movable contact-maker, an actuator by which said contact-maker is moved, means whereby said contact-maker and said actuator are disconnected while a predetermined current is passing through the controller, and means by which said contact-maker can be moved in one direction by said actuator while such current is passing.

12. A controller for translating devices, which comprises contacts, a movable contact-maker, an actuator by which said contact-maker is moved, means whereby said contact-maker is prevented from being moved in one direction by said actuator while a predetermined current is passing through the controller, and a ratchet-and-pawl connection between said contact-maker and actuator whereby the contact-maker may always be moved in one direction.

13. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage with said contact-maker, a coil for disengaging said contact-maker and actuator on the passage of a predetermined current, and an adjustable resistance for varying the current which passes through the coil.

14. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage with said contact-maker, a coil for disengaging said contact-maker and actuator during the passage of a predetermined cur-

rent, and connections between said contact-maker and actuator such that the contact-maker can always be moved in one direction by said actuator.

15. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage with said contact-maker, and an electromagnet for separating said contact-maker and actuator at desired times.

16. A controller for one or more translating devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage with said contact-maker, and an electromagnet adapted to separate said contact-maker and actuator, and having its coil in series with the translating device or devices.

17. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage frictionally therewith, and an electromagnet electrically connected with said devices and adapted to separate the contact-maker and actuator.

18. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to engage frictionally therewith, means for forcing the actuator and contact-maker together, and means controlled by the current passing through the electrical devices, for overcoming said means and separating said actuator and contact-maker.

19. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator therefor adapted to normally engage therewith, and means controlled by the current passing through said devices for separating said contact-maker and actuator.

20. The combination with a movable controller for translating devices, of an actuator normally in engagement therewith, an electromagnet for disengaging said parts, the operation of said magnet being controlled by the current flow through the translating devices.

21. The combination with a movable controller for translating devices, of an actuator normally in engagement therewith, an electromagnet for disengaging said parts, and means for determining in advance the point at which the electromagnet shall be actuated.

22. The combination with translating devices, of a controller therefor, an actuator normally engaged with said controller, an electromagnet for disengaging said controller and actuator, and means for causing sufficient current to flow through the coil of said magnet when the current flowing through the translating devices reaches a predetermined maximum, to disengage said controller and actuator.

23. A controller for electrical apparatus, which comprises contacts, a movable contact-maker, an actuator connected therewith by a mechanical clutch, and an electromagnet for separating said contact-maker and actuator at desired times.

24. A controller for electrical devices, which comprises contacts, a movable contact-maker, an actuator adapted to normally engage therewith, and an electromagnet for disengaging said contact-maker and actuator on the passage of a predetermined current.

25. The combination with a controlling-switch for electric apparatus, of a manual actuator normally connected with said switch, and means controlled by an excess of current in the apparatus due to a too-rapid movement of the actuator, for separating said actuator and switch.

In witness whereof I have hereunto set my hand this 14th day of January, 1899.

ELIHU THOMSON.

Witnesses:
DUGALD MCKILLOP,
HENRY O. WESTENDARP.