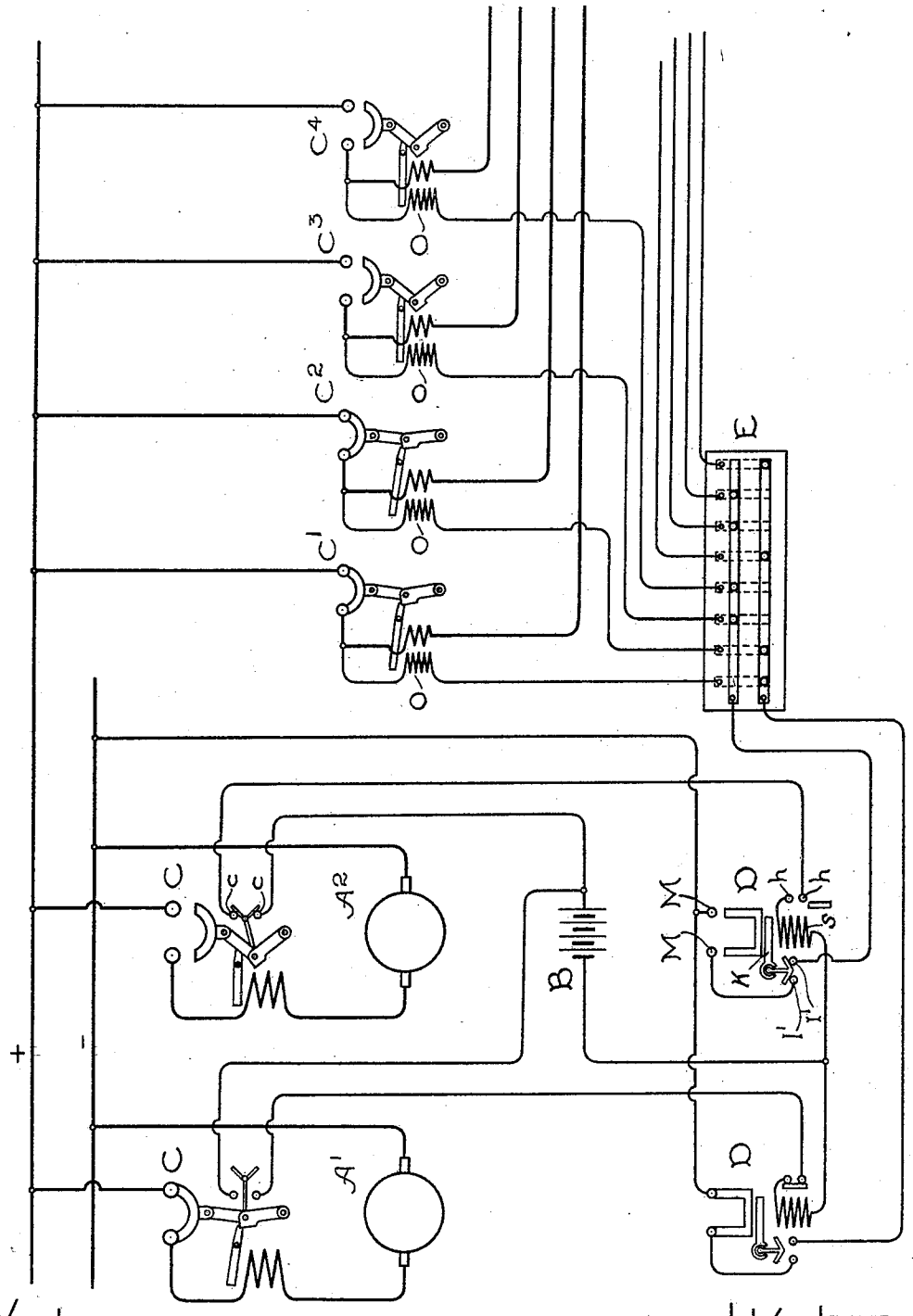
No. 643,133. Patented Feb. 13, 1900.

E. M. HEWLETT.

SAFETY DEVICE FOR ELECTRIC DISTRIBUTION SYSTEMS.

(Application filed Jan. 3, 1899.)

(No Model.) 2 Sheets—Sheet 1.



Witnesses.
A. H. Abell.
A. F. Macdonald.

Fig. 1.

Inventor.
Edward M. Hewlett,
by Albert G. Davis
Atty.

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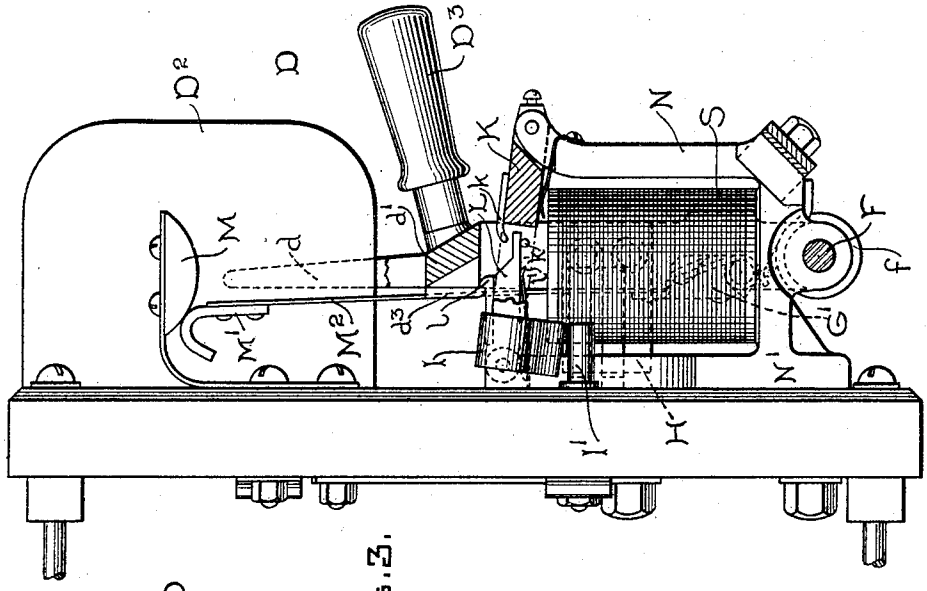

FIG. 3.

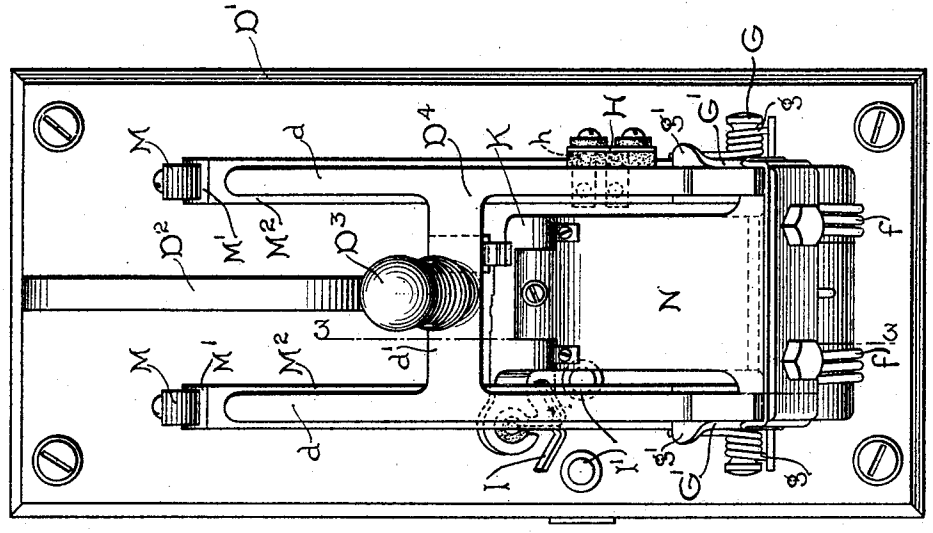

FIG. 2.

WITNESSES:
A. H. Abell.
A. F. Macdonald.

INVENTOR.
Edward M. Hewlett,
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, OF NEW YORK.

SAFETY DEVICE FOR ELECTRIC-DISTRIBUTION SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 643,133, dated February 13, 1900.

Application filed January 3, 1899. Serial No. 700,884. (No model.)

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Safety Devices for Electric-Distribution Systems, (Case No. 796,) of which the following is a specification.

My present invention relates to electric-distribution systems operated from a central station, and has for its object to protect the apparatus in the station against overloads and at the same time insure, so far as possible, the steady operation of the service without material interruption.

In the operation of central stations it may occur that one of the generator circuit-breakers will be opened by an overload which will not affect the other or others. For instance, generators of different capacities are frequently connected to common bus-bars, and the calibration of their respective circuit-breakers may be such as to have them normally open on different currents. While theoretically and to a great extent practically the load may be automatically divided between the different generators in proportion to their respective current capacities, it may occur that, owing to the features of design which give different shapes to the characteristic curves, the machines will not divide the load at all times in proper proportion. Thus two machines which run in multiple perfectly well at full load may at an overload or underload divide the current in quite different proportions. Inasmuch as all machines cannot be specially designed for any relation in which they may happen to be placed, this difficulty will sometimes arise and will cause the circuit-breaker of one generator to open when that of the other will not do so. When this occurs, however, it is manifest that the load which the now idle generator has been carrying is thrown suddenly upon the other machine. As this is only likely to occur when these machines are already nearly or quite fully loaded, they are apt to be overloaded by it. It frequently occurs in consequence that when one generator is thrown out all of the circuit-breakers in the station open and the entire distribution system is deprived of current. Of course this rarely occurs in a lighting-station, because the load comes on here with only moderate fluctuation, steadily rising to a maximum and as steadily falling off afterward, the changes being so gradual that it is easy to provide for them; but in an electric-railway distribution fluctuations are sudden and violent and the difficulty may arise at any time, though necessarily more likely to occur when the station is running at or near the peak of its load. If now the feeder circuit-breakers are all permitted to remain closed after the generators have been disconnected from the bus-bars, it is clear that it will be difficult to again connect the machines to the circuit, because when any one machine is thrown in by closing its circuit-breaker it will be immediately overloaded. As soon as the station-attendant releases his hold of the circuit-breaker handle the latter will blow. Even assuming that the circuits are all again properly closed, the difficulty is likely to arise at once in an electric-railway-distribution system, because as the cars have all been brought to a stand by the opening of the circuits the load will be thrown on the station by the starting of the cars, and perhaps to even a greater extent than before. To avoid these difficulties, I have devised means for throwing off part of the load upon the station whenever it is by any accident overloaded, thus protecting the generators against undue strain and preventing the shutting down of the station by the opening of all of the generator circuit-breakers.

My invention consists in the form in which I have illustrated it in this application in the combination, with the generator circuit-breakers, each of which operates upon its individual machine, of an apparatus by means of which part of the feeder circuit-breakers are opened whenever any one of the generator circuit-breakers is operated.

The apparatus is preferably of such form that any or all of the feeder circuit-breakers may be connected to any or all of the generator circuit-breakers in any desired combination.

The accompanying drawings show an apparatus embodying the invention which I have above briefly described.

Figure 1 is a diagram of the circuits; and Figs. 2 and 3 show in front and side elevation, respectively, the special circuit-breaker or switch which I have devised for carrying the invention into effect, the latter figure being partly in section on the line 3 3 of Fig. 2.

In Fig. 1, A' A^2 are the generators, connected to the plus and minus bus-bars by the usual leads, in one of which from each generator is a circuit-breaker C. Feeder circuit-breakers C' to C^4 are also provided. A plug-switch-board E is used as a means of connecting any one of the feeder circuit-breakers upon either of the generator-circuits here illustrated. All of the apparatus is shown in diagram as a convenient way of typifying any desired number of generators and circuit-breakers.

The special circuit-breakers are shown at D. A battery B is provided, the circuit of which in the normal operation of the machines is open; but when either of the circuit-breakers C opens and throws its corresponding machine out of action it closes the contacts *c c* and sends battery-current through the coil of the circuit-breaking apparatus D. This pulls down the trip and closes the contacts I' I', presently to be more fully described in connection with the mechanical illustrations. The upper contacts M M are still closed at this time, as are also the contacts *h h*. The circuit of the battery will then be through the contacts *h h* to the coil and back to the minus side of the battery, and the contacts I' I' will complete a shunt-circuit through an additional coil O upon one or more of the circuit-breakers, opening them in the usual way. The current through the coil of the circuit-breaker D trips the latter, so that the contacts M M and *h h* now open, thus opening the circuit of the battery, the arrangement being such that a momentary impulse of current is passed through the shunt-coils O O, and then all of the circuits of the apparatus are opened. In the diagram the circuit-breaker C of the machine A^2 is shown open, and the feeder circuit-breakers C^3 C^4 are also open.

Referring now to Figs. 2 and 3, D is the auxiliary circuit-breaker, of which D' is the base, of the usual insulating materials. D^2 is an insulating-partition between the contacts M M, already referred to, with which register moving or spring contacts M' M'. The frame D^4 is provided with a handle D^3, attached to its cross-bar *d'*, and fingers *d d* project upward. By means of these the spring-contacts M' M' are forced past the incline of the contacts M M when the circuit-breaker is being closed, the latter contacts having also some elasticity. A fixed frame N N' is secured to the base of the instrument, and in this is mounted the magnetizing-coil S, the circuits of which have already been described. An armature K carries the moving contact I, which connects the contacts I' I'. Another contact H (shown in dotted lines in Fig. 3) connects the contacts *h h*, referred to above. The frame D is mounted on the shaft F and is provided with a suitable spring *f*. It is retained in its closed position by the latch *l* and the detent d^3, fast to the frame. The bar L presses the latch upward, the spring *l'* furnishing the necessary pressure. A toe projects from the bar and bears against the pin *k'* on the armature K, preventing the latter from rising too far, while a projecting piece *k* upon the armature pulls down the bar L when the armature is retracted by the coil S.

The contacts M' M' are carried upon flexible arms M^2, pivoted about the shaft G, a punching G' being riveted to the spring-arms M^2 and journaled on the shaft. From the punching ears *g' g'* project, and the spring *g* serves to open the switch, as presently to be described. As will best be seen in Fig. 2, this latter spring bears at one end against the lug *g'* and at the other against the extension of the spring *f*, which passes through the frame N to furnish a bearing for the other spring.

The operation of the parts thus described is as follows: When the coil S is energized, the armature K is attracted, bridging the contacts I' I' by the moving contact I. At the same time the frame D^4 is released, the detent d^3 being released from the latch *l*. This strains the spring-arms M^2, so as to draw the contacts M' away from the contacts M, but the construction is such that the circuit is not immediately opened, giving time for the shunt-circuit (shown in Fig. 1) through the coils O O to be completed. It is of course intended that the resistance of this shunt-circuit shall be so high as to prevent any considerable flow of current. As soon as the contacts M' M' have passed the center of the curved contacts M they snap away from them, being forced outward by the spring *g*. A moment afterward the contact H, which is of considerable length, opens the contacts *h h*, thus opening the circuit of the coil S and of the battery. The contact I will then be withdrawn, and the contacts I' I^2 and all of the circuits of the apparatus will be opened.

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

1. In a system of distribution, a generator, a circuit-breaker, the controlling connection of said generator with the system, and means actuated by the circuit-breaker for cutting off a desired part of the station load when the circuit-breaker opens.

2. In a system of electric distribution, generators connected in multiple to bus-bars, circuit-breakers for the generators, and means actuated by the opening of any circuit-breaker for relieving the station of a desired part of the load.

3. A generator, a circuit-breaker in the generator-lead, feeders in multiple connected to the generator and each provided with its own circuit-breaker, and means automatically ac-

tuated by the opening of the generator circuit-breaker for opening one or more of the feeder circuit-breakers.

4. A generator, a circuit-breaker in the generator-lead, feeders in multiple connected to the generator and each provided with its own circuit-breaker, auxiliary coils upon the feeder circuit-breakers, and means actuated by the opening of the generator circuit-breaker for closing a circuit through any desired coil or coils.

5. A generator, a circuit-breaker in the generator-lead, a number of feeders extending from the generator, each provided with its own circuit-breaker, shunt-coils upon the feeder circuit-breakers, means actuated by the opening of the generator-circuit breaker for closing a shunt-circuit through any desired coil or coils of the feeder circuit-breakers, and means for opening the shunt-circuit after the impulse of current has traversed it.

6. The combination of a generator with a circuit-breaker in its lead, and one or more feeders provided with circuit-breakers having auxiliary shunt-coils, with a switching mechanism by which any one or more of the feeder circuit-breakers may be connected to the generator circuit-breaker, contacts upon the latter for closing the circuit, and an intermediate mechanism operated by the contacts on the generator circuit-breaker for closing a shunt-circuit through any desired feeder circuit-breaker and subsequently opening the shunt-circuit and the circuit of the contacts on the generator circuit-breaker.

7. The combination, with a generator circuit-breaker, of an auxiliary circuit-breaker in a feeder-circuit supplied by said generator, electromagnetic devices controlling the latter, and contacts operated by the generator circuit-breaker to first actuate said electromagnetic devices and then open the circuit.

8. An automatic switch comprising an operating-magnet including in its circuit a circuit-closer, a plurality of independent circuits controlled by the magnet's armature, and connections for operating the circuits in sequence when the magnet is energized.

9. An automatic switch comprising an operating-magnet, a switch-arm controlled thereby carrying an elastically-yielding snap-contact, a rigid projection on the switch-arm adapted to engage the contact and force it into locking relation with the coöperating contact in one direction of movement, and to move free therefrom in the opposite direction of movement.

10. The combination with a generator circuit-breaker and a number of feeder circuit-breakers to be operated therefrom, of a switch mechanism for connecting any one or more of the feeder circuit-breakers and the generator circuit-breaker, and a switch comprising a magnetizing-coil and an armature with contacts upon the feeder circuit-breaker for completing the circuit of the magnetizing-coil through a source of current, and contacts upon the switch for closing a shunt-circuit through the feeder circuit-breakers and subsequently opening the circuit of the magnetizing-coil and the shunt-circuit.

In witness whereof I have hereunto set my hand this 28th day of December, 1898.

EDWARD M. HEWLETT.

Witnesses:
B. B. HULL,
M. H. EMERSON.