No. 615,395. Patented Dec. 6, 1898.

F. A. LA ROCHE.

CIRCUIT BREAKER.

(Application filed Dec. 28, 1897.)

(No Model.) 2 Sheets—Sheet 1.

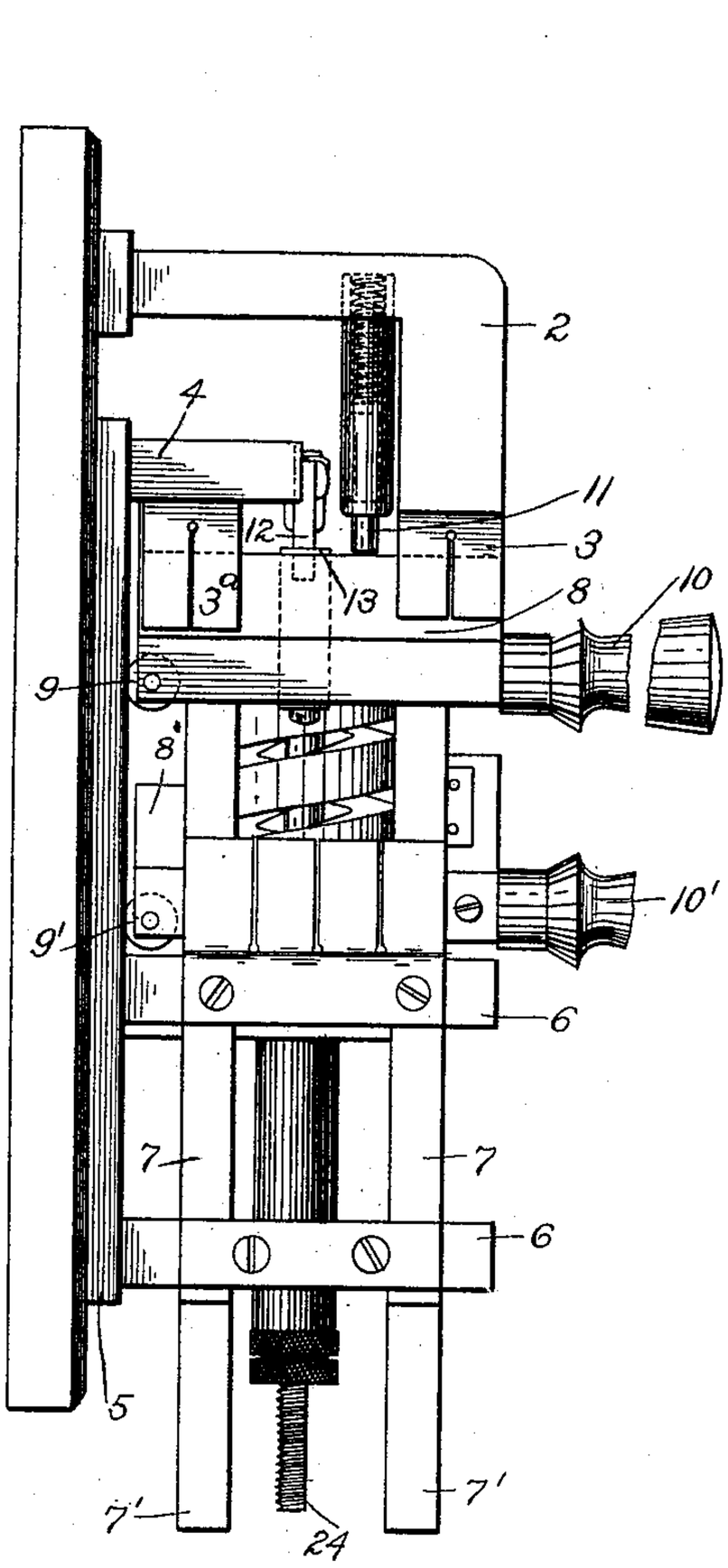

FIG. 2.

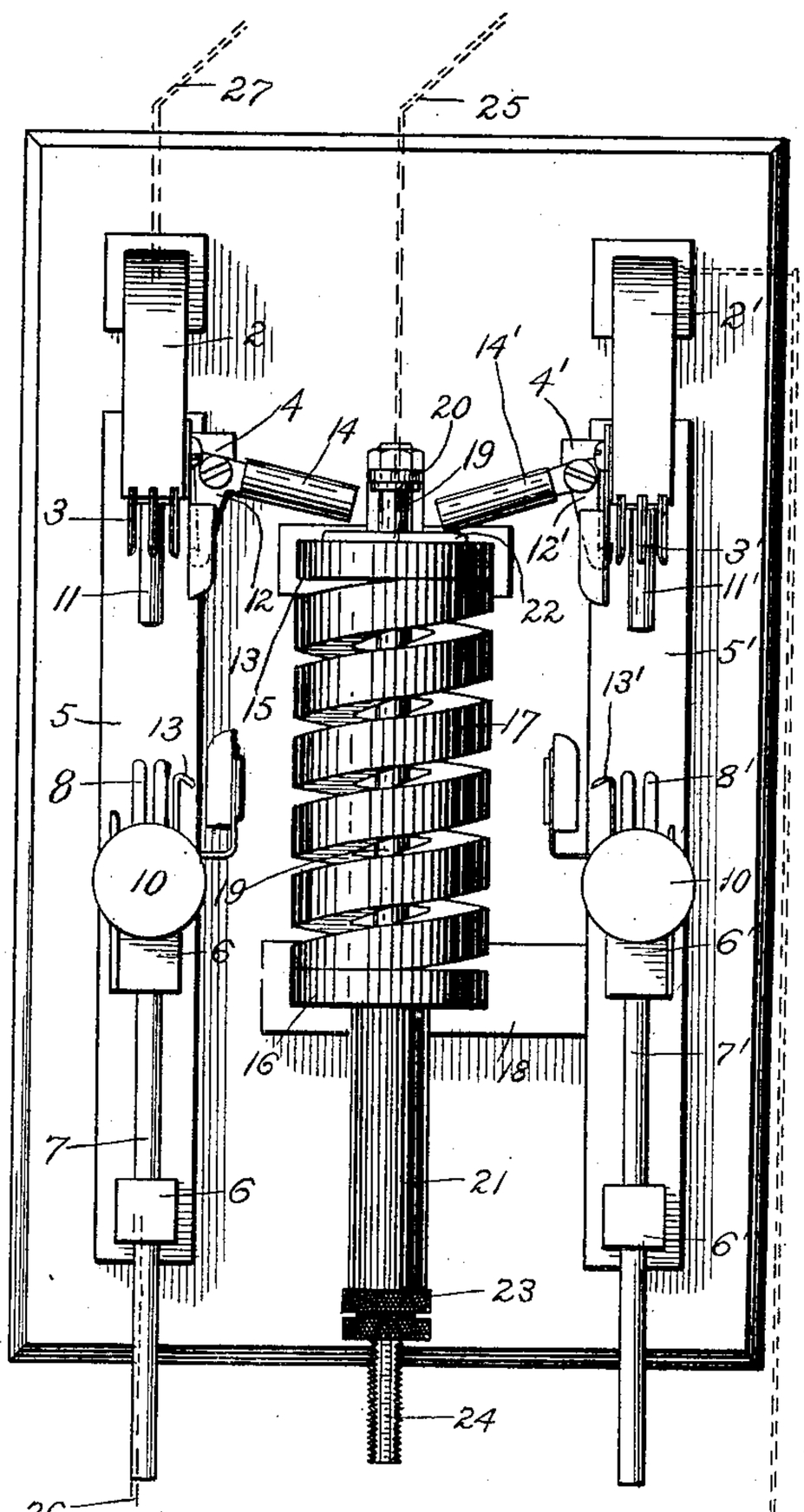

FIG. 1.

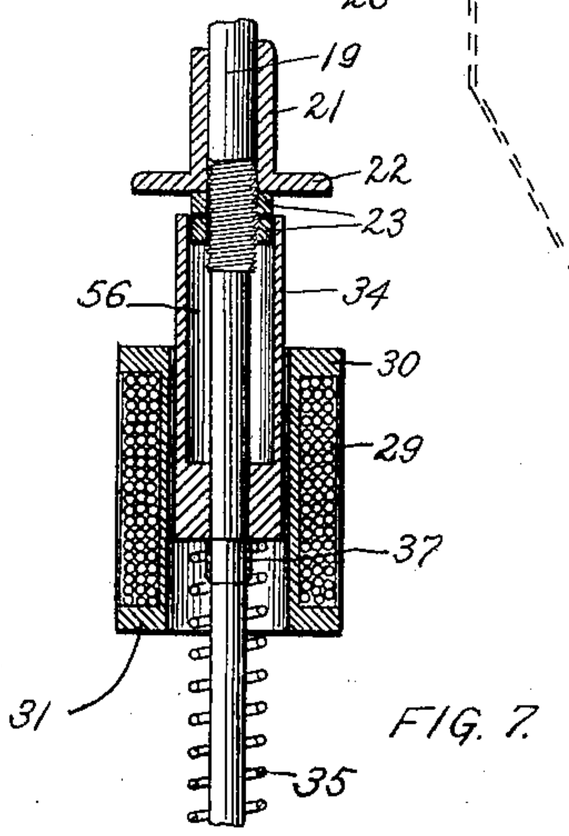

FIG. 7.

WITNESSES:
Percival Robert Moses
Louis J. Schroeder.

INVENTOR
Frederick A. LaRoche
BY
Henry F. Noyes
ATTORNEY.

No. 615,395. Patented Dec. 6, 1898.

F. A. LA ROCHE.

CIRCUIT BREAKER.

(Application filed Dec. 28, 1897.)

(No Model.) 2 Sheets—Sheet 2.

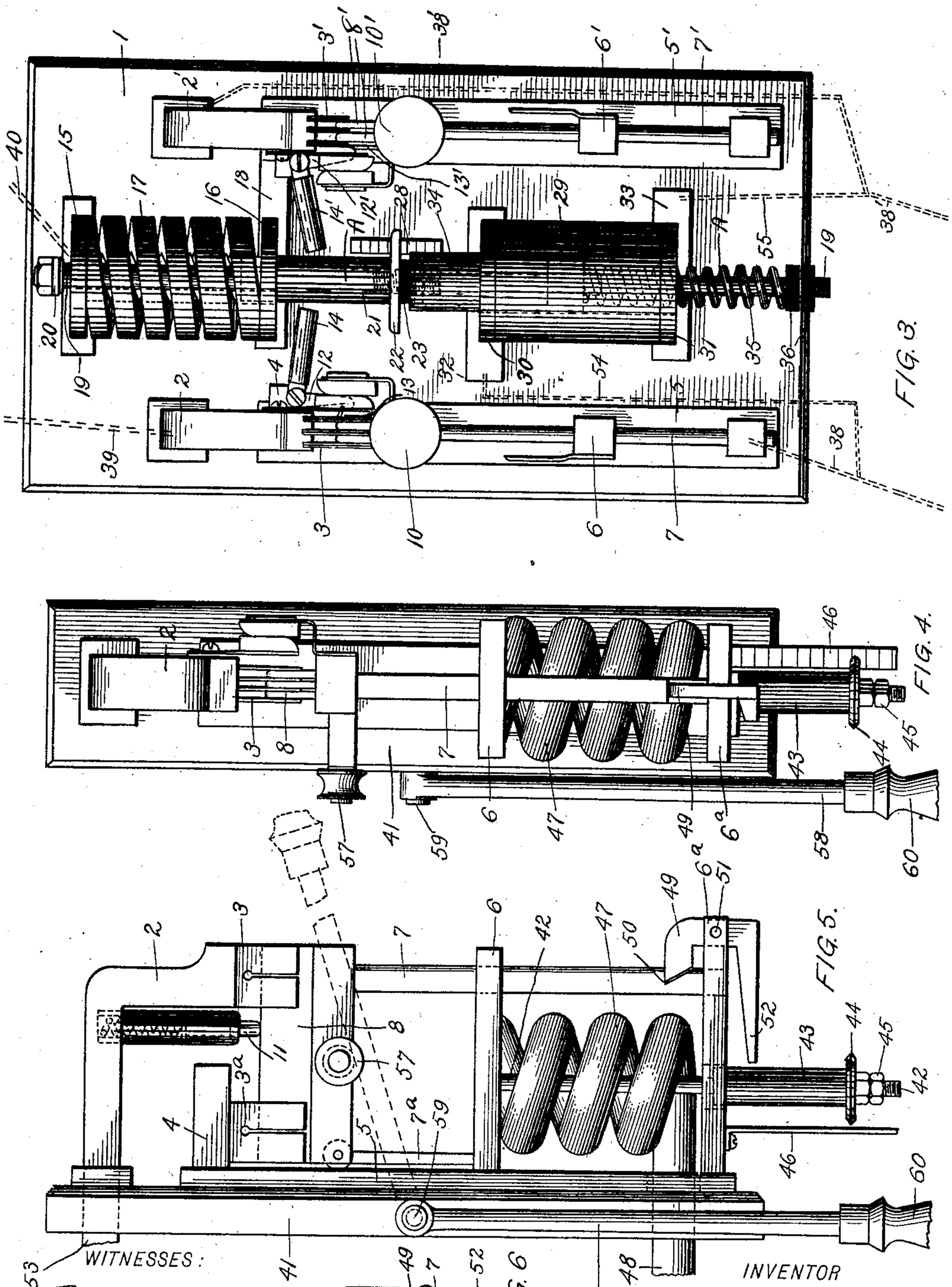

FIG. 3.

FIG. 4.

FIG. 5.

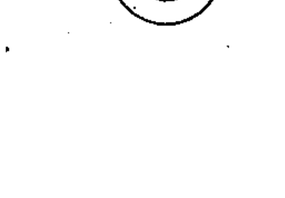

FIG. 6.

WITNESSES:

Percival Robertson

Louis J. Schroeder.

INVENTOR

Frederick A. LaRoche

BY

Henry F. Noyes

ATTORNEY.

UNITED STATES PATENT OFFICE.

FREDRICK A. LA ROCHE, OF NEW YORK, N. Y.

CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 615,395, dated December 6, 1898.

Application filed December 28, 1897. Serial No. 664,149. (No model.)

To all whom it may concern:

Be it known that I, FREDRICK A. LA ROCHE, a citizen of the United States, and a resident of New York, in the county and State of New York, have invented certain new and useful Improvements in Automatic Circuit-Breakers, of which the following is a specification.

This invention relates to automatic circuit-breakers, and particularly to their construction and to the means of closing them after the circuit has been opened in any manner.

In the circuit-breakers heretofore in general use, which are designed to automatically open the circuit when the current exceeds a predetermined limit, the controlling member consists of a swinging or rocking arm suitably pivoted and adapted to bridge the opening between a set of jaws. This arm is moved into contact by hand against the pressure of a spring and is held there by a latch or dog. This latch is usually arranged to be released by a plunger or other device attracted by a solenoid when the current exceeds a predetermined limit, and when the circuit is broken this arm is suddenly thrown outward by the release of the spring. In instruments which are adapted to carry a comparatively heavy current this swinging arm is large and heavy and when released moves outward with considerable momentum some distance from the instrument. As it is usual and necessary for the matter of convenience to have these circuit-breakers stationed in an easily-accessible position and as the circuit is liable to be broken unexpectedly and at any instant accidents, serious and sometimes fatal, have occurred to operatives or others who chanced to be in such proximity to an instrument as to be struck by the controlling-arm when such break occurred.

The object of this invention is to provide an automatic circuit-breaker which shall be adapted to open the circuit upon the appearance of an abnormally large current and which shall operate in a vertical direction, thereby requiring no more floor-space when the circuit is open than when it is closed.

A further object of this invention is to provide an automatic circuit-breaker which will operate when the strength of the current falls below a predetermined limit.

Further objects of this invention will be hereinafter mentioned.

This invention is clearly illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of one embodiment of my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a front elevation of an embodiment of my invention, which shows a means of breaking the circuit when the strength of the current rises above a predetermined limit or falls below another predetermined limit. Fig. 4 is a front elevation of a further embodiment of my invention, showing its construction as applied to an individual switch. Fig. 5 is a side elevation of the same. Fig. 6 is a detail of a latch used in the construction embodied in Figs. 4 and 5. Fig. 7 is a partial section of the lower solenoid and plunger, taken between the points A A of Fig. 3.

Referring to the drawings, Figs. 1 and 2, I provide a base 1, of any suitable material. Firmly fastened to the base are the bars 2 and 2′, provided with the contact-jaws 3 and 3′, respectively. The bars 5 and 5′ are also firmly fastened to the base 1, and extending outward perpendicularly to these bars are the bars 4 and 4′, provided with the jaws 3^a, and the bars 6 and 6′ are also arranged perpendicularly to the bars 5 and 5′, respectively. The bars 6 support and guide the pair of slides 7 and the bars 6′ the slides 7′. The bridge 8 is carried by the slides 7 and the bridge 8′ by the slides 7′. These bridges are provided with rollers 9 and 9′, which travel upon the bars 5 and 5′, respectively, and act to prevent the slides from binding in their supports during the operation of closing the switch. Suitable handles 10 and 10′ are provided to operate the switches.

Situated in sockets in the bars 2 and 2′ are the spring-pressed plungers 11 and 11′, in line with the bridges 8 and 8′ and adapted to be impinged by the latter when they are moved into position to close the circuit. To confine these bridges against the pressure of plungers, latches 12 and 12′, pivoted to the bars 4 and 4′, respectively, are adapted to engage the projections 13 and 13′, which are fastened to the bridges. These latches are provided with arms 14 and 14′, made of suitable non-

conducting material and to which reference will be made farther on.

Firmly fastened to the base 1 are the brackets 15 and 16, carrying the solenoid 17, the bracket 15 being suitably connected with one end of the main circuit 25, while the bar 18 connects the bracket 16 with the bar 5′. Fastened to the bracket 20, which is connected to the bracket 15, is the rod 19, arranged within the solenoid and extending below it, and sliding upon this rod is the plunger 21. At the upper end of the solenoid is the circular plate 22, normally resting upon the bracket 15. The lower end of the rod 19 is threaded and provided with nuts 23, by means of which the plunger may be adjusted higher or lower, as it is desired that a respectively smaller or larger amount of current will operate the plunger to open the circuit. To mark the position of these nuts, the rod 19 is provided with a flat place 24, which is suitably graduated.

The circuit connections may be made through the bar 2′ and wire 26′ to the dynamo, to wire 26 and bar 5, and the other end of the circuit 27 is connected with the bar 2.

In the operation of the invention the circuit is closed by sliding the bridges 8 and 8′ up until they are received by the jaws 3 and 3′. To more clearly show the construction, in Figs. 1 and 2 one of the bridges is shown in circuit, while the other is shown in the position it takes when the circuit is broken. Supposing both switches to be closed, when a current of more than the predetermined amount occurs in the solenoid the plunger 21 is attracted and, striking the plate 22, causes it to impinge on the arms 14 and 14′ and, raising them, throws the latches 12 and 12′ out of engagement with the connections 13 and 13′, and hence with the bridges 8 and 8′, when the unbalanced pressure of the spring-pressed plungers 11 and 11′ throws the bridges out of contact with the jaws 3 and 3′, and their own weight causes the bridges to drop and break the circuit.

In closing the circuit either side of the instrument may be closed first. We will suppose the left-hand side to be closed first. Then the right-hand side is closed, and in case there is still abnormal disturbance in the circuit the left-hand switch is immediately thrown out of circuit again and the circuit broken before injury is done to the dynamo.

Referring to Figs. 3 and 7, the parts which are similar to and have the same functions as the corresponding parts of the embodiment illustrated in Figs. 1 and 2 have been given the same reference-numbers and will not need further description. The latches 12 are placed below the solenoid 17, and the plate 22 is fastened to the lower part of the plunger 21 and the graduated plate 28 is provided to mark the position of the plunger. A second solenoid 29 is provided, which is fastened to the brackets 30 and 31, surrounding a portion of the rod 19. The bracket 30 is connected with the wire 38 by bar 32 and wire 54 and the bracket 31 with the wire 38′ by the bar 33 and wire 55. The plunger 34 is adapted to slide upon the rod 19, and when a current occurs in the solenoid 29 this plunger is attracted against the pressure of the spring 35, and the lower end of the rod 19 is threaded and provided with adjusting-nuts 36, which adjust the pressure of the spring 35. A collar 37, fixed to the rod 19, prevents the plunger from moving downward farther than the position shown in Figs. 3 and 7. The plunger 34 is also provided with a cylindrical recess 56, into which the nuts 23 slide as the plunger moves upward. The bar 5 is in circuit with the wire 38 and the bar 2′ with the wire 38′. The main circuit 39 connects with bar 2 and at the other end of the circuit 40 with the bracket 15.

In the illustration of this invention the right-hand switch has been shown open to better indicate the construction of the device. Supposing both switches to be closed, whenever a current of excessive strength occurs in the solenoid 17 the plunger 21 and the plate 22 are attracted upward until the plate impinges upon the arms 14, disengages the latches 12, and the switches are thrown out of contact and the circuit broken. The lower solenoid 29, which is in shunt-circuit through the bars 32 and 33, carries only a portion of the current, and the plunger 34 is shown in the position it takes when its usual current is passing through the solenoid 29, this being sufficient to attract the plunger with enough strength to compress the spring 35 until the plunger is stopped by the collar 37. In case the current is interrupted and this attraction becomes *nil* the pressure of the spring raises the plunger 34, causing it to strike the plate 22 and carry the latter upward until this plate strikes the arms 14 and the circuit is broken.

In closing the circuit it is evident that the switches will not remain closed unless at least a certain strength of current occurs in the solenoid 29.

In Figs. 4, 5, and 6 I have shown a still further embodiment and the preferred form of my invention adapted for individual switches. This consists of a base 41, bars 2 and 4, provided with the jaws 3 and 3ª, respectively, and bridge 8. The bar 4 is permanently fastened to the bar 5, which is attached to the base 41. Also fastened to the bar 5 and perpendicular to it are the bars or brackets 6 and 6ª, which are adapted to guide the slides 7 and 7ª, and these slides are connected by and guide the bridge 8. The bridge 8 is provided with a roller 57, suitably journaled. To operate the bridge, the rod 58 is provided, pivoted to the base 41 by the pin 59 and provided with the handle 60, suitable for handling the instrument. The roller 57 is in the line of oscillation of the rod 58, so that the latter contacts the roller as the handle is moved up into the position to close the switch. Fastened to the bracket 6 is the rod 42, and the

plunger 43 slides upon this rod and is provided with the plate 44. The lower end of the rod is threaded and provided with nuts 45 to adjust the position of the plate 44, and a graduated plate 46 is placed in proximity to mark the position of the plate 44. A solenoid 47 is also fastened to one end of the bracket 6, and the other end 48 passes through an opening in the bar 5. The latch 49 is adapted to fit into a notch 50 near the lower end of the slide 7. This latch is pivoted to the bracket 6ª at the point 51 and is provided with a long arm 52, extending to a point which lies in the line of travel of the plate 44. Fig. 6 shows more clearly the construction of the latch 49. Suitable connections with the circuit may be made with the bar 2 at the point 53 and with the end of the solenoid at the point 48. In the operation of this embodiment of my invention, which is shown in its closed position, it is evident that the occurrence of an abnormally large current attracts the plunger 43 and plate 44 until the latter strikes the arm 52 and disengages the latch from the slide 7 and the circuit is broken. The switch is closed by swinging the handle 60 and the rod 58 upward, and the latter, contacting the roller 57, pushes the switch upward until the circuit is closed and the latch engaged, which occurs when the handle 60 and the rod 58 are in the position shown by the broken lines. The switch is held in this position by the latch, so that the handle can then be dropped, when it falls by its own weight to the position shown in Fig. 5. By means of this arrangement the greatest possible compactness is obtainable, and no more floor-space is required when the circuit is open than when it is closed. By having the controlling-arm unconnected with the bridge the weight and momentum of the parts moving when the circuit is broken are greatly reduced and the possibility of injury to the person becomes very remote. The solenoid being in line with the line of travel of the bridge still further simplifies the arrangement.

While I have specified a solenoid as effecting the automatic operation of this invention, it is evident that a magnet might be arranged in place of the solenoid. I therefore do not wish to be limited to this particular arrangement, and while I have described other features of this invention with more or less completeness as regards the details thereof I do not desire to be limited thereto unduly, as I contemplate all proper changes and omission of parts and the substitution of equivalents as circumstances may suggest or necessity render expedient.

I claim—

1. In a circuit-breaker, a set of stationary contacts, a movable contact or bridge guided in a reciprocating motion to and from said stationary contacts by a suitable slide, a latch engaging said slide, in combination with a solenoid, a bracket connected with one end of said solenoid and a rod fastened to said bracket, and surrounded by said solenoid, and a plunger sliding upon said rod and operating said latch whenever the current in said solenoid exceeds a predetermined limit, as and for the purpose set forth.

2. In a circuit-breaker, a set of stationary contacts a movable contact or bridge guided in a reciprocating motion to and from said stationary contacts by a suitable slide, a latch holding said bridge in engagement with said stationary contacts, in combination with a solenoid, a rod suitably supported and a plunger sliding upon said rod, and operating said latch whenever a current which exceeds a predetermined limit occurs in said solenoid, as and for the purpose set forth.

3. In a circuit-breaker, a set of stationary contacts a movable contact or bridge guided in a reciprocating motion to and from said stationary contacts by a suitable slide, a latch holding said bridge in engagement with said stationary contacts, in combination with a solenoid, a bracket connected with said solenoid, and a rod fastened to said bracket, and a plunger sliding upon said rod, and operating said latch whenever the current in said solenoid exceeds a predetermined limit, as and for the purpose set forth.

4. In a circuit-breaker, a set of stationary contacts, a movable contact or bridge, a latch engaging said bridge, in combination with two solenoids, a rod suitably supported and situated within said solenoids, each solenoid provided with a plunger, guided by said rod, one of said plungers operating said latch whenever a current exceeding a predetermined limit occurs in its solenoid, and the other plunger operating said latch whenever the current in its solenoid is interrupted, as and for the purpose set forth.

FREDRICK A. LA ROCHE.

Witnesses:
FRANK B. HUTCHEON,
CHAS. H. SCHUM.