H. P. BALL & G. WRIGHT.

CIRCUIT BREAKER.

APPLICATION FILED JUNE 17, 1908.

982,116.

Patented Jan. 17, 1911.

2 SHEETS—SHEET 1.

Fig. 3.

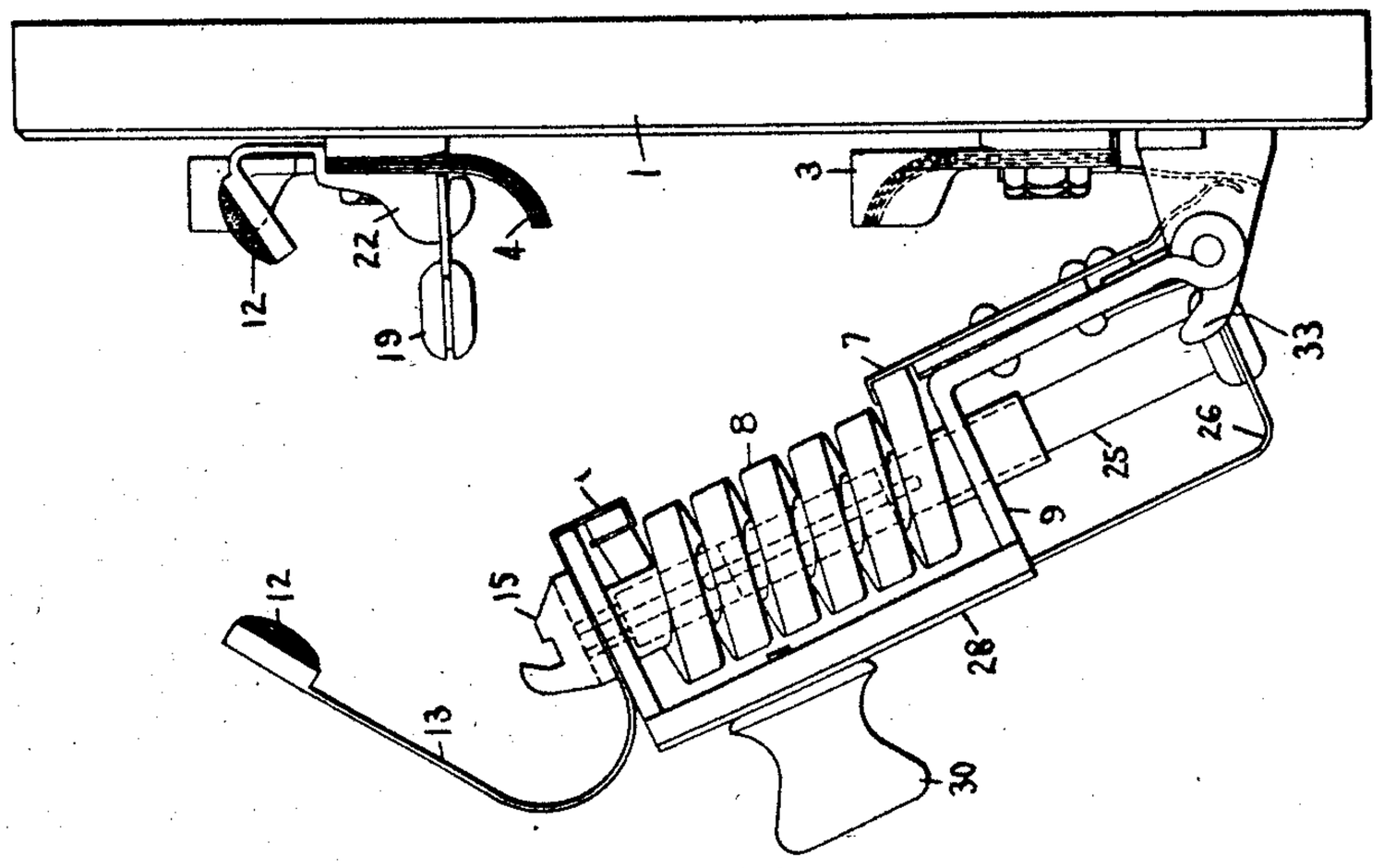


Fig. 2.

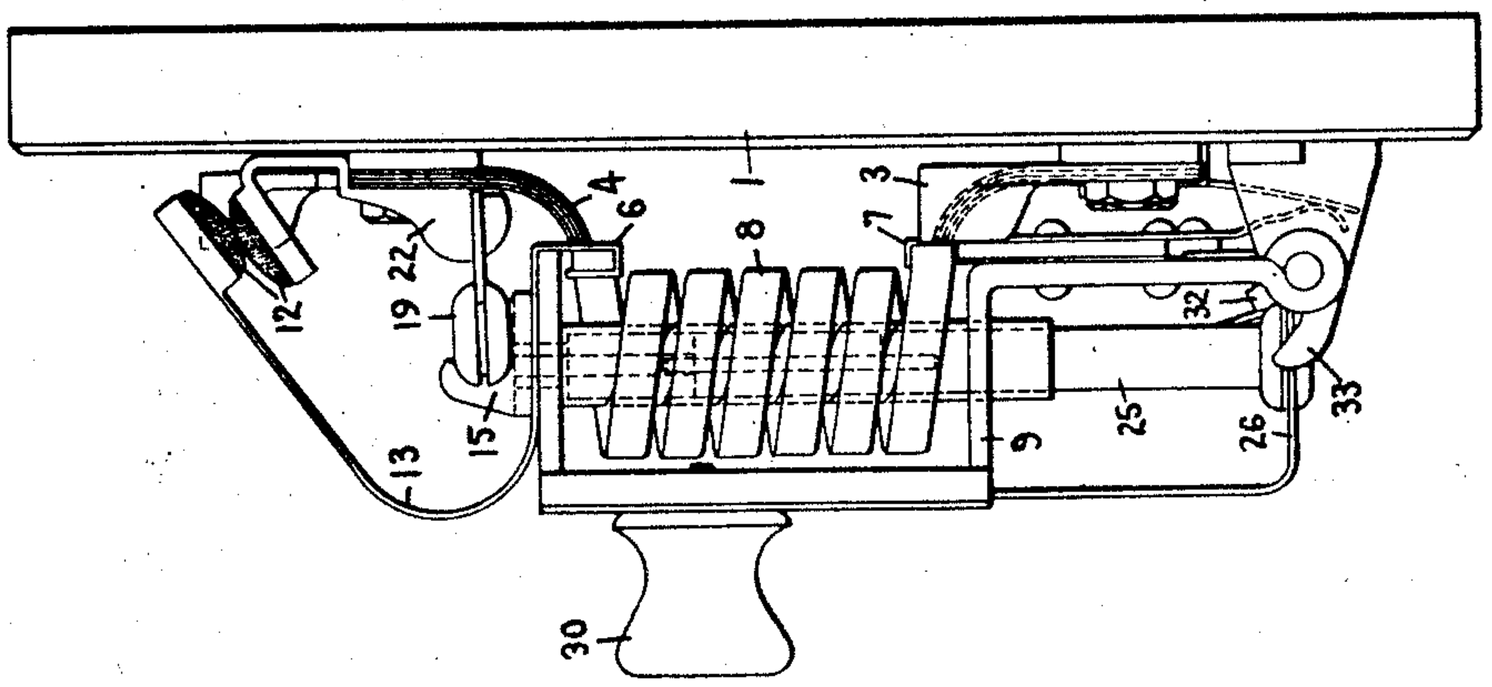
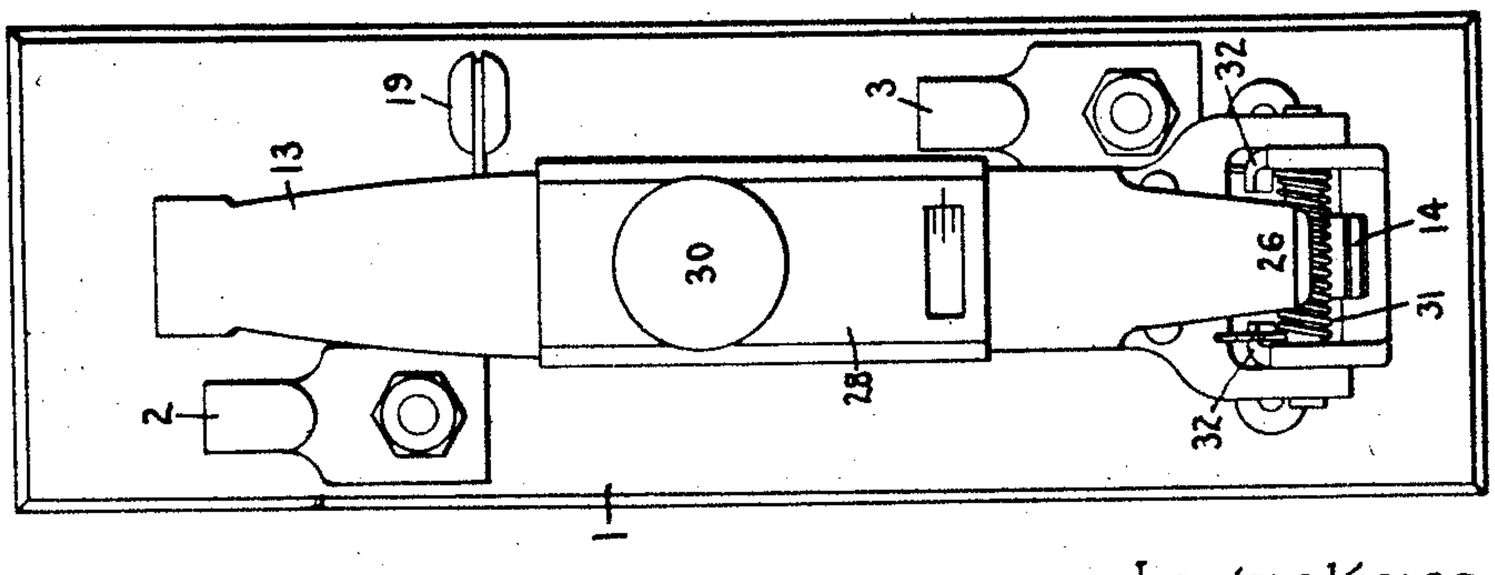


Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 5.

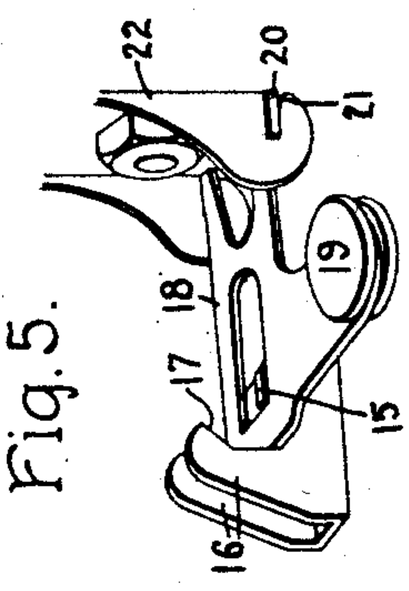


Fig. 6.

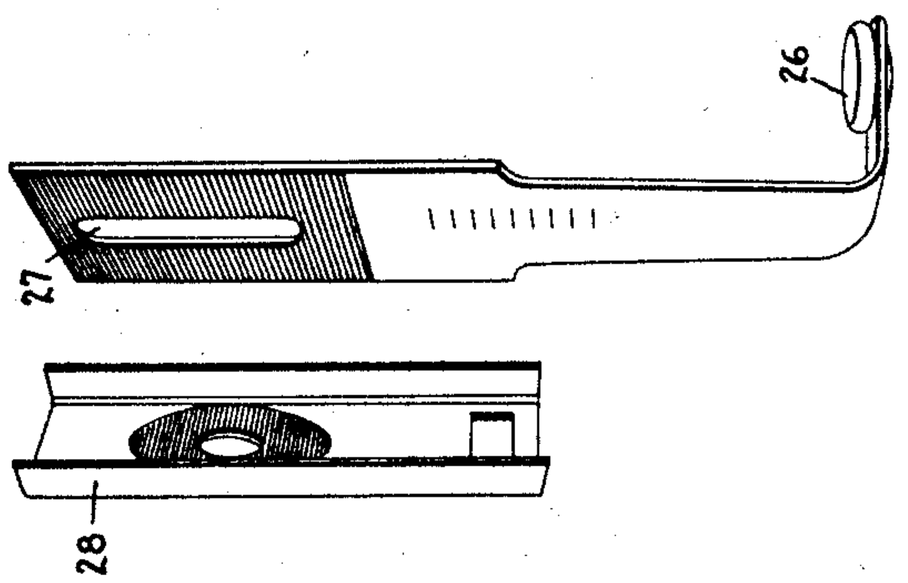
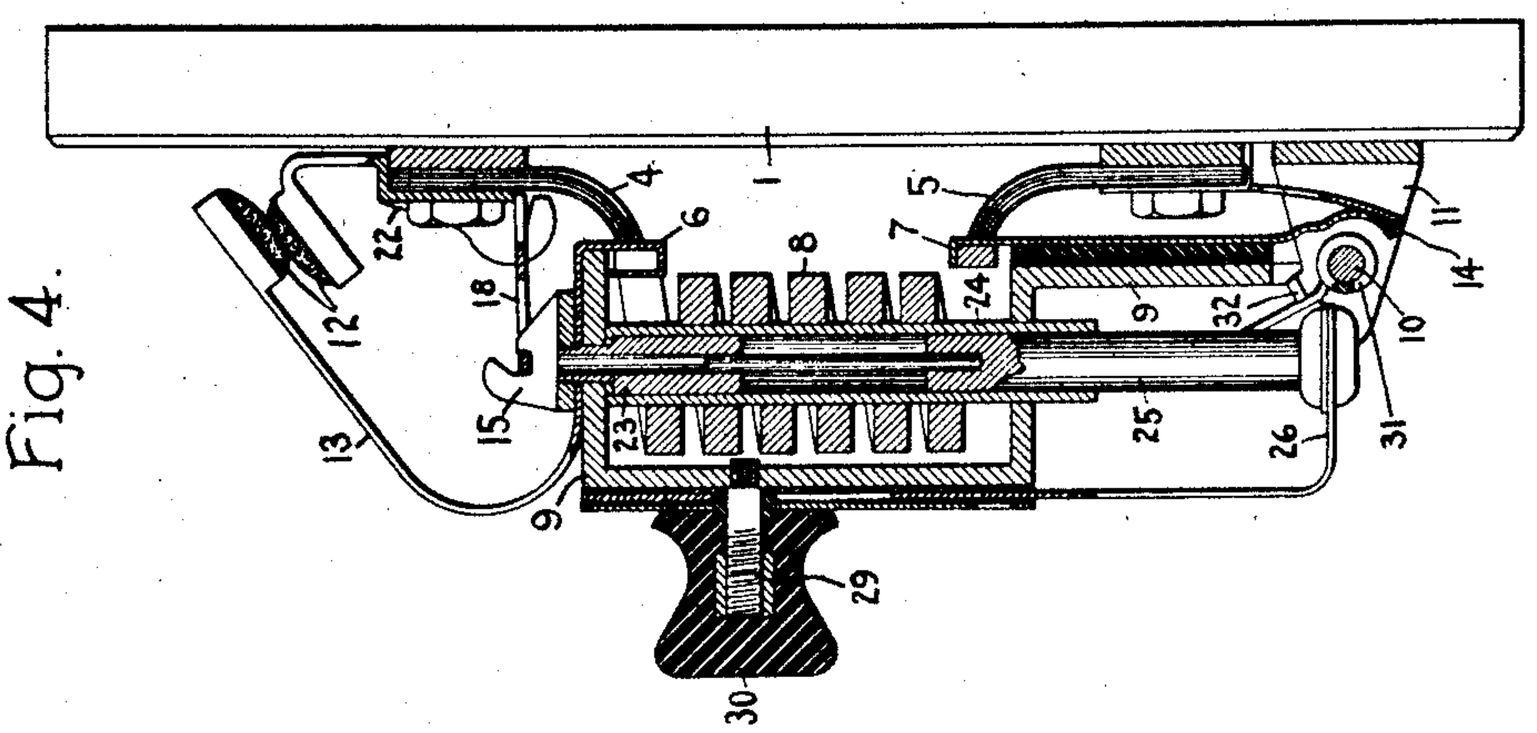


Fig. 4.



Witnesses:
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UNITED STATES PATENT OFFICE.

HENRY PRICE BALL, OF NEW YORK, AND GILBERT WRIGHT, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CIRCUIT-BREAKER.

982,116. Specification of Letters Patent. Patented Jan. 17, 1911.

Application filed June 17, 1908. Serial No. 438,900.

To all whom it may concern:

Be it known that we, HENRY P. BALL and GILBERT WRIGHT, citizens of the United States, residing, respectively, at New York, county of New York, State of New York, and at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Circuit-Breakers, of which the following is a specification.

Our invention relates to automatic circuit-breakers and its object is to provide a simple and cheap circuit-breaker of small capacity in which the various parts may be cheaply made by dies and automatic machinery, the current responsive coil may be quickly and easily calibrated, the latching mechanism will operate positively regardless of the speed with which the circuit-breaker is closed, and in which the brush contacts cannot be subjected to destructive pressure.

In carrying out our invention the movable circuit-controlling member of the circuit-breaker is shaped in a punch press and forms part of the magnetic circuit of the current responsive coil, which is mounted on said member and is connected in series between the contacts of the circuit-breaker when the circuit is closed. The current responsive coil has an armature for tripping the circuit-breaker and is calibrated by means of an adjustable stop which engages the armature and is clamped in immovable relation to the current responsive coil in any suitable manner, preferably by being clamped to the support for the magnet by means of the operating handle of the circuit-breaker, which is mounted directly on the movable circuit controlling member and acts as a clamping device when rotated about its axis. The latch of the circuit-breaker is positively forced into latching position by actuating means operated by the circuit controlling member as it moves into circuit closing position, thereby insuring proper action of the latch regardless of the speed with which the breaker is closed, and also acts as a stop to prevent the closing of the breaker with a pressure which would injure the contacts. The actuating means for the latch may assume various forms, but is preferably in the form of a cam or inclined surface which engages the pivoted bolt of the latch as the circuit-breaker is closed and forces the bolt into latching position.

Our invention will best be understood in connection with the accompanying drawings which are merely illustrative of one form in which the invention may be embodied, and in which—

Figure 1 is a plan view of a circuit-breaker embodying our invention; Fig. 2 is a side view of the same circuit-breaker in the closed position; Fig. 3 a side view of the same circuit-breaker in the open position; Fig. 4 is a longitudinal section of the circuit-breaker shown in Fig. 2; Fig. 5 is a view in elevation of the latch for holding the circuit-breaker closed; and Fig. 6 a view in elevation of the parts of the calibrating device.

The circuit-breaker is preferably mounted upon a stationary support or insulating base 1 of slate or similar material and is connected to the circuit to be controlled through terminal clips 2 and 3 in engagement with fixed contacts 4 and 5, preferably made in the form of laminated brushes and rigidly clamped to the insulating base 1. The movable circuit controlling member, which coöperates with the fixed contacts 4 and 5 to close the circuit by bridging the gap between said contacts, has movable contacts 6 and 7 carried upon the terminals of a current responsive coil 8, mounted on a movable switch arm 9 which is preferably stamped into shape from wrought iron and forms part of the magnetic circuit of the current responsive coil. The switch arm 9 is mounted to swing about a pivot 10 carried in a suitable support or clip 11 mounted on the insulating base 1, and as the coöperating contacts 4 and 6, at the upper end of the switch arm separate, the final arc is broken by means of carbon shunt contacts 12, one of which is carried upon a spring blade 13 clamped to the upper end of the switch arm 9 and bent to form the upper movable contact 6 which is connected to the upper end of the current responsive coil. The lower movable contact 7, which is mounted on a sheet of insulation on the switch arm as shown in Fig. 4, comprises a plate with one end acting as a contact and connected to the lower end of the current responsive coil and with the other end formed as one blade of a pair of spring blades 14 which, as shown

in Figs. 3 and 4, remain in contact in different positions of the switch arm and thereby maintain the current responsive coil in electrical connection with the terminal clip 3 in all positions of the circuit-breaker.

It has been found that the spring-pressed latches heretofore used on circuit-breakers often fail to engage if the circuit-breaker is closed very quickly because the pivoted bolt of the latch is thrown away from the catch when the circuit-breaker in quickly closed and does not fall back into latching position in time to prevent a rebound of the switch arm and consequent opening of the circuit-breaker. In a circuit-breaker, embodying our invention, this defect is overcome by providing means actuated, as the circuit-breaker is closed, to positively force the latch into latching position regardless of the speed with which the circuit-breaker is closed. In the specific form of latch shown in the drawings, a catch 15, preferably formed of sheet metal stamped into shape, is secured to the upper end of the movable switch arm 9, which also carries actuating means for forcing the bolt of the latch into engagement with the catch as the bolt and catch move toward each other. The specific form of actuating means shown comprises projections or cams 16 adjacent the catch 15 and having inclined surfaces 17 to engage the pivoted bolt 18 of the latch as the switch arm swings toward circuit closing position, thereby forcing the bolt toward the catch and into latching position, as shown in Figs. 4 and 5. The pivoted bolt 18 is provided with a tripping handle 19 and is pivoted on lugs 20, preferably rectangular in shape, which are loosely mounted in open ended V-shaped recesses or slots 21 formed in a clamp 22 rigidly secured to the base or support 1. This construction permits all parts of the latch to be made of punchings or by dies and to be assembled very easily. To reduce the number of parts required the clamp 22 is preferably used to clamp the fixed contact brush 4 in position and also to carry one of the carbon shunt contacts 12. The bolt 18 cannot be displaced because the open ends of the recesses or slots 21 are adjacent the clamp support or fixed contact 4 when the parts are in position, while the bolt 18 has a pivotal movement about the lugs 20 to an extent determined by the shape of the lugs and of the recesses, which are preferably so proportioned that the bolt can be lifted to clear the catch 15 but cannot be lifted high enough to swing out of range of the cams or other actuating means 16, so that in all positions of the pivoted bolt 18 the positive closing action of the projection or cam 16 is exerted on it. The projections 16 are mounted adjacent the catch 15 in a position to act as a stop which engages the pivoted bolt when said bolt is substantially in alinement with the direction of movement of said stop, so that the pressure on the bolt is transmitted directly to the base, and the switch arm 9 is prevented from moving too close to the base and thereby injuring the laminated contacts by excessive pressure.

The current responsive coil 8 for tripping the circuit breaker is provided with a fixed core 23 threaded into and held in position by the catch 15 and provided with a shoulder for holding in position a guide tube 24 for the movable core or armature 25, which engages the bolt 18 near its outer end and trips the circuit breaker open when the current through the core exceeds a predetermined limit.

The device is calibrated by means of a stop 26 which determines the normal position of the armature with reference to the coil, and is slidably mounted on some support, preferably the switch arm 9, which is immovable with reference to the coil. The stop 26, preferably formed as shown in Fig. 6, has a slot 27 cut in it to permit the stop to slide on the switch arm lengthwise of the slot, and is clamped in adjusted position to the switch arm 9 by any suitable clamping means. When the clamp is loosened the operator can slide the stop from one position to another and clamp it in the new position much more quickly than where the stop is adjusted by a screw. In the preferred form of clamp a pressure plate 28, formed as shown in Fig. 6 and provided with a corrugated surface which engages similar corrugations on the stop 26, has a circular hole through it and is prevented from moving with the stop 26 by means of a stud 29 firmly secured to the switch arm 9 and extending through the slot 27 and the hole in the pressure plate. The stud 29 forms a guide to permit the pressure plate to move into and out of clamping relation to the stop 26 and to prevent movement of the pressure plate lengthwise of the slot 27. The pressure plate is held in firm engagement with the stop by the operating handle 30 of the circuit breaker which, as shown in Fig. 4, is threaded upon the stud 29 so that rotation of the handle forces the pressure plate toward the switch arm 9 and rigidly clamps the stop between the pressure plate and the arm, while the spring action of the pressure plate causes it to act like a spring washer to prevent loosening of the operating handle. The pressure plate may have an opening through which a scale upon the stop 26 is read, the opening preferably being of such a size that only one set of figures or marks is visible at one time and, therefore, the point at which the stop is set may be determined at a glance.

The circuit breaker above described will open under the influence of gravity when the latch is tripped, but in order to secure a

quick opening and also a cushioning of the switch arm as it opens a coil spring 31 is mounted on the pivot 10 with its ends engaging opposite sides of lugs 32 on the clip 11 and extending into engagement with the switch arm 9. The parts are so proportioned that when the circuit breaker is closed, the spring 31 is under a strain tending to open the circuit, but when the circuit breaker opens the lugs 32 and the ends of the spring coöperate in such a manner that the spring acts as a yielding buffer for stopping the opening movement of the switch arm of the circuit breaker. The fixed stop 33 on the clip 11 engages the switch arm in the position shown in Fig. 3 and prevents injury to the spring 31 by excessive movement of the switch arm.

Our invention may be embodied in many other forms than that shown and described, and we therefore do not wish to be restricted to the exact form shown but intend to cover by the appended claims all changes and modifications within the spirit and scope of our invention.

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

1. In a calibrating device for electromagnets, the combination with an electromagnet having a movable armature and a member immovable with reference to said electromagnet, of a stop for said armature slidably mounted on said member, a resilient pressure plate for engaging said stop to hold it in frictional engagement with said member, and a screw threaded clamping member arranged to engage said pressure plate.

2. In a calibrating device for electromagnets, the combination with an electromagnet having a movable armature and a member immovable with reference to said electromagnet, of a stop for said armature mounted on said member to slide in the direction of movement of said armature, a pressure plate mounted on said member to engage said stop, and means for clamping said stop between said plate and said member.

3. In a calibrating device for electromagnets, the combination with a support, of a slotted armature stop mounted on said support, a pressure plate having an opening transverse the slot in said stop, a stud on said support extending through said slot and said opening to permit movement of said stop and prevent movement of said plate lengthwise of said slot, and means for clamping said stop between said plate and said support.

4. In a calibrating device for electromagnets, the combination with a support, of a slotted armature stop mounted on said support, a pressure plate having an opening transverse the slot in said stop, a stud on said support extending through said slot and said opening to permit movement of said stop and prevent movement of said plate lengthwise of said slot, and means on said stud for moving said plate toward said support to clamp said stop to the support.

5. In a calibrating device for electromagnets, the combination with an operating handle for the circuit-breaker and an electromagnet having an armature responsive to abnormal current to trip the circuit-breaker, of an adjustable stop for said armature, and means controlled by said handle to lock said stop in adjusted position.

6. In a circuit-breaker, the combination with a movable contact carrying member and an operating handle for said circuit-breaker rotatably mounted on said member, of a trip coil responsive to current in the circuit mounted on said member, an armature for said coil, a stop for said armature adjustably mounted on said member, and means controlled by the rotation of said handle to clamp said stop to said member.

7. In a circuit-breaker, the combination with a movable member, a trip coil mounted on said member and an operating handle rotatably secured to said member, of a calibrating device for said coil comprising an adjustable stop clamped in immovable relation to said member by the rotation of said handle.

8. In a circuit-breaker, the combination with a movable member, a trip coil mounted on said member and an operating handle rotatably secured to said member, of a stop adjustably mounted on said member, a pressure plate between said stop and said handle, a stud fixed to said member to extend through said stop and said plate, and an operating handle threaded on said stud, whereby rotation of said handle clamps said stop between said plate and said member.

9. In a circuit breaker, the combination with relatively movable coöperating contacts, one of which comprises a laminated brush, a catch secured to one of said contacts, a stop rigidly secured to one of said contacts adjacent said catch, and a bolt pivotally secured to the other of said contacts to engage said catch and to be held in alinement with the direction of movement of said stop when said contacts are in engagement and thereby prevent oversetting of said contact.

10. In a circuit breaker, the combination of a base, a stationary contact comprising a laminated contact brush secured to said base, a contact controlling member pivoted to said base and comprising a movable contact for coöperating with said laminated brush, a catch mounted on said movable member, a stop mounted on said movable member adjacent said catch, a bolt pivotally secured to said stationary contact to coöperate with said catch and said stop and to be immovable in the direction of move-

ment of said stop, said bolt being held in alinement with the direction of movement of said stop when said contacts are in engagement, means on said movable member for engaging said bolt to force it into latching position, and means upon said movable member for coöperating with the outer end of said bolt to force it out of engagement with said catch and thereby permit the circuit breaker to open.

11. In a circuit breaker, the combination of a base, a stationary contact secured to said base and comprising a laminated brush, a circuit controlling member pivoted to said base and comprising a contact for coöperating with said brush, a catch mounted on said movable member, a stop mounted on said movable member adjacent said catch, a bolt pivotally mounted on said base to cooperate with said catch and to normally be in alinement with the direction of movement of said stop and thereby bring the outer end of said bolt into engagement with said stop and prevent oversetting of said contacts, and an electroresponsive device mounted on said movable member for cooperating with the outer end of said bolt to move said bolt out of engagement with said catch.

12. In a circuit breaker, the combination with a vertical base, a stationary contact secured to said base and comprising a laminated brush, a circuit controlling member pivotally mounted on said base and comprising a contact for coöperating with said brush, a bolt secured to said base to normally assume a substantially horizontal position and to be immovable in a horizontal direction, a catch mounted on said movable member to coöperate with said bolt, a stop mounted adjacent said catch to engage the outer end of said bolt when said contacts are in engagement, an electromagnet mounted on said movable member and connected in series with said contacts, and an armature for said magnet mounted to engage the outer end of said bolt and lift it out of engagement with said catch when said electromagnet is energized.

13. In a circuit-breaker, the combination with relatively movable members for making and breaking the circuit, of a catch mounted on one of said members, a coöperating bolt with lugs, and a clamp having recesses for said lugs secured to said other member with the open ends of said recesses adjacent to said member to pivotally mount said bolt on said member in position to latch said members together.

14. In a circuit-breaker, the combination with relatively movable members for making and breaking the circuit, of a catch secured to one of said members, a coöperating bolt with rectangular lugs, and a clamp having V shaped slots for said lugs secured to said other member with the open ends of said slots adjacent said member to pivot said bolt in position to latch said members to each other.

15. In a circuit-breaker, the combination with relatively movable members for making and breaking the circuit, of a latch for said members comprising a catch secured to one of said members, a coöperating bolt having lugs, and a clamp secured to said other member with the open ends of recesses in said clamp for receiving said lugs adjacent said member, said lugs and said recesses being proportioned to permit pivotal movement of said bolt within predetermined limits.

16. In a circuit-breaker, the combination with relatively movable members pivoted to each other, of separable contacts mounted on said members adjacent said pivot, one of said contacts comprising a plate with one end moved into and out of engagement with the other contact by relative movement of said members, and with its other end formed as a spring blade which slides upon and thereby maintains electrical connection with said other contact.

17. In a circuit-breaker, the combination with relatively movable members pivoted to each other, of a latch for said members, an overload coil mounted on one of said members to control said latch, and separable contacts mounted on said members, one of said contacts comprising a plate with one end bent to form a support for one end of said coil.

18. In a circuit-breaker, the combination with relatively movable members pivoted to each other, of a latch for said members, an overload coil mounted on one of said members to control said latch, and separable cooperating contacts mounted on said members, one of said contacts comprising a plate with one end rigidly connected to one end of said coil and the other end formed as a spring plate arranged to slide upon and thereby engage the other coöperating contact in all positions of said members.

In witness whereof I, HENRY P. BALL, have hereunto set my hand this 12th day of June, 1908, and I, GILBERT WRIGHT, have hereunto set my hand this 16th day of June, 1908.

HENRY PRICE BALL.
GILBERT WRIGHT.

Witnesses to Ball:
WILLARD F. WALLACE,
H. T. BROWN.

Witnesses to Wright:
BENJAMIN B. HULL,
HELEN ORFORD.