E. M. HEWLETT & C. H. HILL.

CIRCUIT BREAKER.

APPLICATION FILED MAR. 28, 1905.

**1,011,784.**

Patented Dec. 12, 1911.

3 SHEETS—SHEET 1.

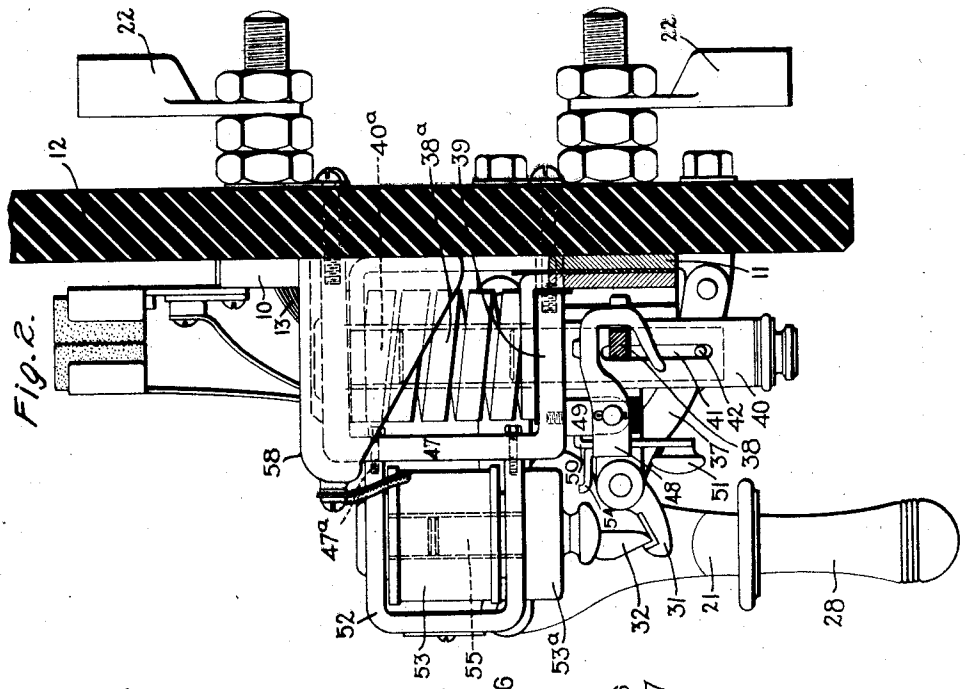


Fig. 2.

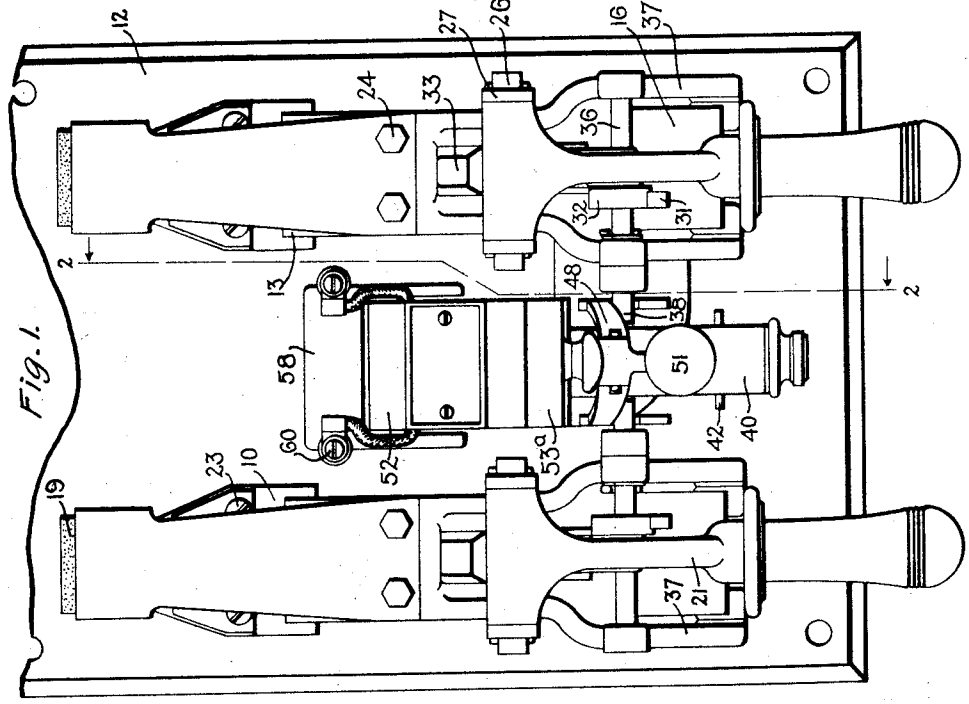


Fig. 1.

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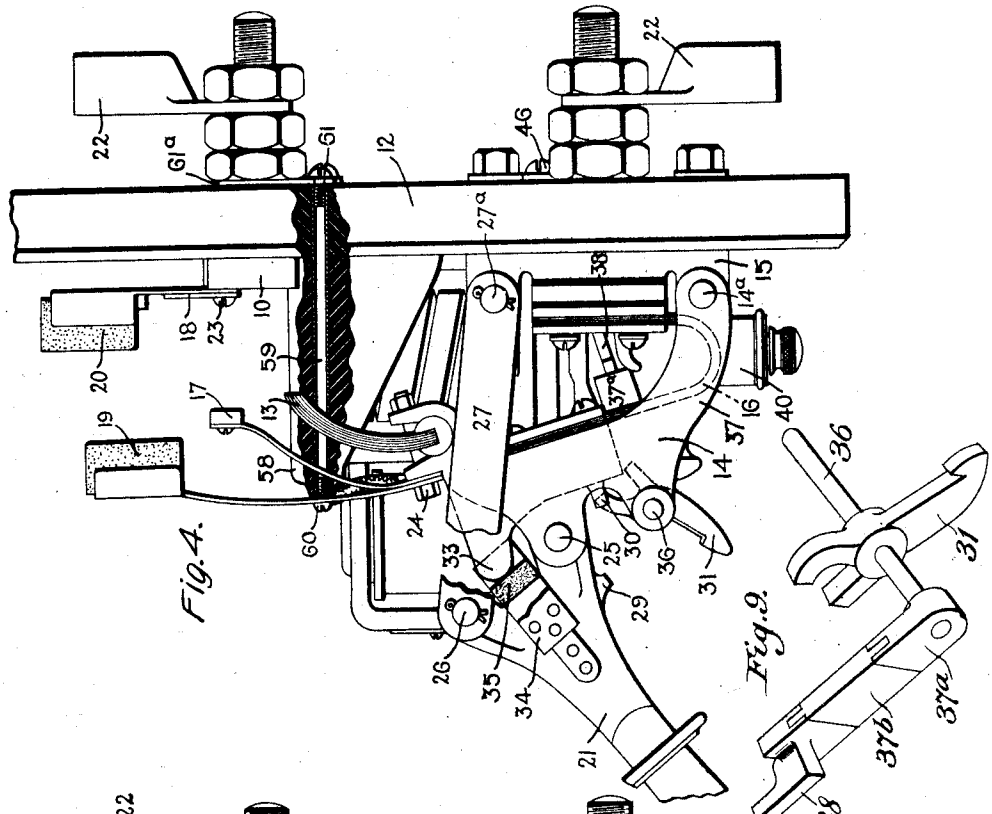

Fig. 4.

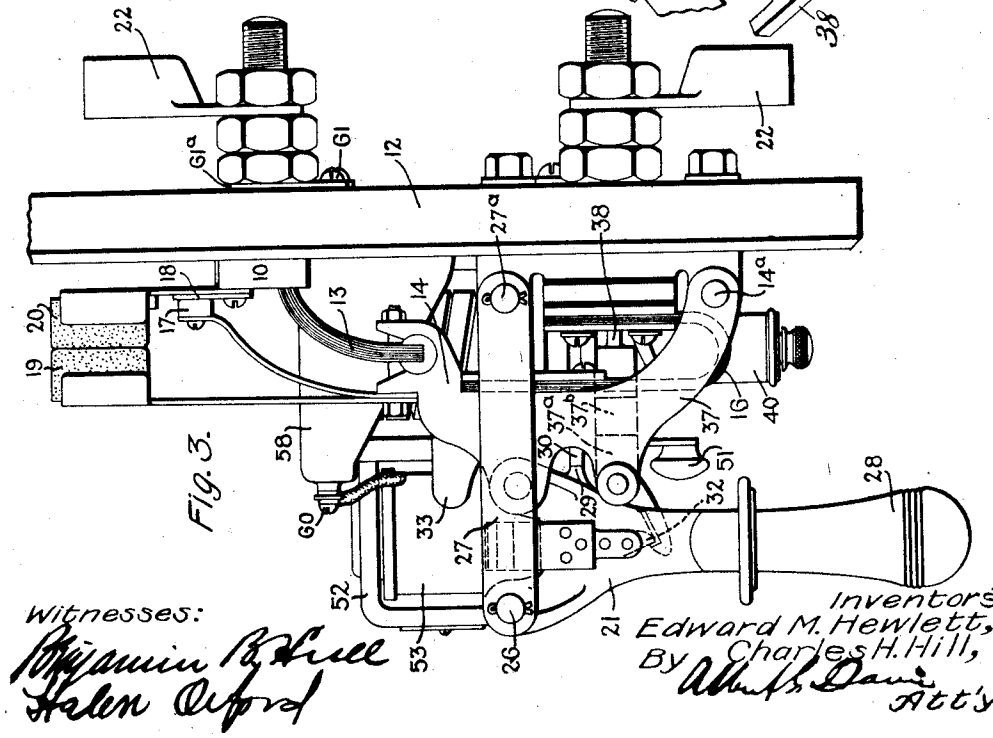

Fig. 3.



Fig. 9.

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3 SHEETS—SHEET 3.

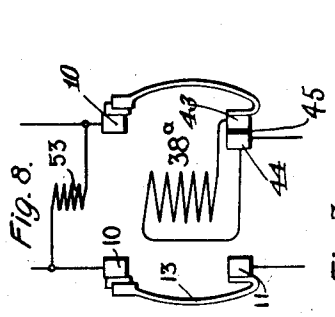


Fig. 8.

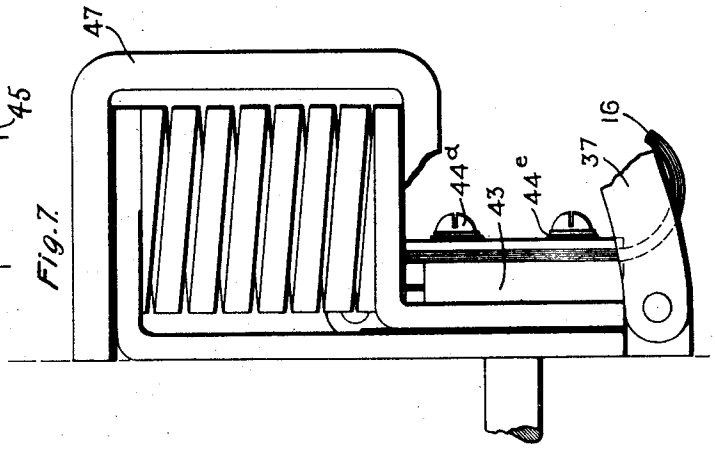


Fig. 7.

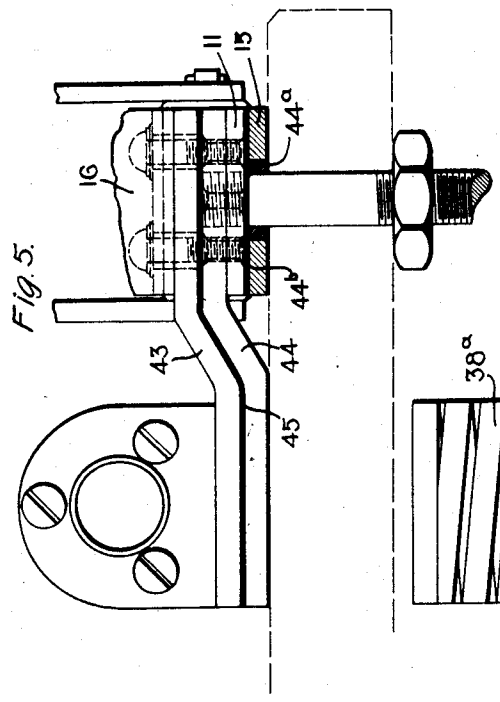


Fig. 5.

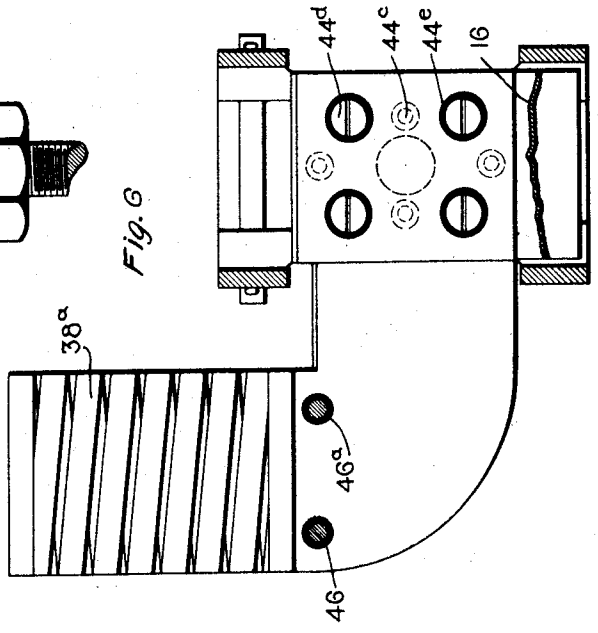


Fig. 6.

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# UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT AND CHARLES H. HILL, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## CIRCUIT-BREAKER.

1,011,784. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed March 28, 1905. Serial No. 252,477.

*To all whom it may concern:*

Be it known that we, EDWARD M. HEWLETT and CHARLES H. HILL, citizens of the United States, residing 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.

The present invention relates generally to circuit breakers and more particularly to that type of breaker in which one or more shunt contacts are provided and in which the final break is made between carbon surfaces.

The object of the invention is to improve circuit breakers of this type generally and to this end it comprises certain structural features which are capable of general application and a certain novel organization in which a plurality of circuit breakers are controlled by common tripping devices, all of which will be more fully understood upon reference to the following detailed description taken in connection with the accompanying drawing, the novelty of the invention being definitely pointed out in the appended claims.

Referring to said drawing, Figure 1 is a front elevation of this circuit breaker organization showing two circuit breakers operated by common tripping mechanism; Fig. 2 is a sectional elevation of the same, the plane of section being taken on the line 2 2 of Fig. 1, and viewed in the direction of the arrows therein shown; Figs. 3 and 4 are side elevations of the parts shown in Fig. 1, Fig. 3 showing the breaker closed and Fig. 4 showing the breaker open; Figs. 5, 6 and 7 are respectively a plan, front elevation and side elevation of the overload trip coil and its connections with an adjacent contact stud; Fig. 8 is a diagram of circuits, and Fig. 9 is a view in elevation of a tripping latch and the arm for moving it.

Throughout these figures like characters designate like parts.

The breakers illustrated are substantially identical in construction, and each consists essentially of vertically arranged contact studs 10 and 11 secured to a common support 12 of slate or other suitable insulating material, a movable brush contact 13 adapted to engage the upper contact stud 10 and secured at its lower end to a supporting frame 14 pivoted at the point $14^a$ adjacent to the lower contact stud 11 to a base 15 and electrically connected to the lower stud by a flexible connection 16, primary shunt contacts 17 18, secondary shunt contacts 19 and 20 and an operating lever 21 for cramping the contacts into engagement.

The contact studs 10 and 11 are provided with the usual threaded shanks which extend through the support 12 and are provided on their rear ends with suitable terminals 22. The fixed shunt contacts 18 and 20 are removably secured directly to the face of the upper contact stud 10 by means of screws 23. The coöperating shunt contacts 17 and 19 are carried at the upper ends of spring arms which are firmly secured at their lower ends by bolts 24 to the swinging frame 14, and these arms are given sufficient resiliency so that a good contact is obtained when the circuit breaker is forced to closed position. These bolts 24 also adjustably clamp the lower end of the movable laminated contact 13 between two portions of the contact carrying frame 14 and by adjusting the position of the contact 13 any desired pressure may be obtained between it and its coöperating stud 10.

The operating lever 21, which is instrumental in cramping the movable contacts of the circuit breaker into electrical engagement with the fixed contacts, is pivoted to the frame 14 at a point 25 and at the point 26 to the outer ends of a pair of links 27 which are pivotally secured at their inner ends at the point $27^a$ to the base 15. These links extend on opposite sides of the frame 14 and together with the pivot pin 26 form a cramping frame which coöperates with the operating lever and the supporting frame to set the breaker. This is accomplished by a downward and inward pressure upon the handle 28 of the operating lever. This closing movement of the breaker is limited by the coöperating stops 29 and 30 located, respectively, on the lever 21 and frame 14, and positioned so as to leave the parts slightly underset and ready to fly open when released. In order to hold the parts in this position a latch 31 pivoted to the frame 14 and cooperating with the projection 32 on the operating lever 21 is provided. The opening movement of the circuit breaker is limited by means of a buffer on the lever 21 coöperating with the projection 33 on the frame 14. This buffer comprises two spring plates or clips

34 secured to the opposite sides of the lever 21 and extending upward about midway between the pivotal points 25 and 26 and arranged so as to slightly diverge and to be engaged on their inner faces by the projection 33 and thereby take up the sudden blow of the parts when the breaker is allowed to fly open under the action of gravity. In order to prevent injury due to the impact of the parts of the breaker in case the clips 34 are broken or rendered ineffective, a block of rubber 35 is provided between them at their base against which the end of the projection 33 may strike. In normal operation, however, the clips alone are relied upon to take up the shock.

An important characteristic of the present breaker is the ease with which it may be set. This is brought about by so arranging the parts that when the circuit breaker is open, the points $14^a$, 25, and 26 are in substantially a right line or at least the distance of the point 25 from a straight line joining the points $14^a$ and 26 is not great as compared with the distance between the points $14^a$ and 26 or between the points 26 and $27^a$. Where the construction is such that lines joining the points $14^a$, 25, 26 and $27^a$ more nearly define a rectangle, it is very difficult to close the breaker, a simple downward pull, which is all that is required in the present case, being insufficient. This arrangement of parts provides what may be termed a compound toggle, consisting of two toggles having a common member. One of these toggles acts between the points $14^a$ and 26 and comprises as one member the portion of the frame 14 lying between the points $14^a$ and 25, and as the other member the portion of the operating lever 21 lying between the points 25 and 26. The second toggle is a reentrant toggle operating between the points 25 and $27^a$ and comprises as one member the portion of the operating lever 21 between the points 25 and 26 and as the other member the links 27. This compound toggle structure provides means for exerting a very effective pressure upon the circuit breaker contacts and at the same time it provides a very compact structure due to the short leverages required.

Each of the latches 31 is secured to an arbor 36 which extends between the opposite legs 37 of the supporting frame 14, and the adjacent ends of the arbors 36 of the two circuit breakers are provided with rearwardly extending arms $37^a$ which are in turn provided at their rear ends with projections 38 which extend toward each other and into position to be tripped by a common tripping mechanism. In order to prevent the possibility of a short circuit between the lower contact studs of the two breakers by way of the supporting frames 14, the arms $37^a$ and this common tripping mechanism, each of the arms $37^a$ is provided with a section $37^b$ of insulating material. This common tripping mechanism in the present instance comprises an overload magnet consisting of a solenoid $38^a$ having a movable core 39 (shown in dotted lines in Fig. 2) which is drawn downward into a guide tube 40 by the action of gravity and is drawn upward against such action by the magnetism of the coil into engagement with the fixed pole-piece $40^a$. The guiding tube 40 is provided with longitudinal slots 41 located on its opposite sides. Through these slots pins 42 secured to the movable core 39, extend far enough to engage the projections 38 of the latch mechanism in the upward movement of the core 39. As clearly shown in Fig. 8, the solenoid $38^a$ is included in series with the contacts of one of the breakers. This connection is obtained in a novel way as clearly illustrated in Figs. 5, 6 and 7. Two overlapping strips 43, 44 extend over one of the lower contact studs 11 and one of these, as the strip 44, is in electrical engagement with said stud; the other strip 43 is insulated from the stud and the strip 44 by suitable insulation 45 and the distant ends of the strips 43 and 44 are electrically connected to the opposite ends of the solenoid $38^a$. From this it will be seen that circuit is completed from the stud through the strip 44 thence through the solenoid $38^a$ to the strip 43 and from this strip to the flexible connection 16, thence through the frame 14 and movable contact 13 to the upper stud 10. As seen in Figs. 5 and 6, the parts 16, 43, 44, 15 and 11 are mechanically connected without interfering with this circuit. The shank of the contact stud 11 in this particular instance extends through the base 15 into threaded engagement with its head and the strip 44, and said head and strip are suitably insulated from the frame by means of the insulation $44^a$, $44^b$. The head of the stud and the strip 44 are held together by rivets $44^c$. The flexible connection 16 and the upper conducting strip 43 are held in position by a plurality of screws $44^d$ which extend through openings in said connection and strips into threaded engagement with the strip 44 and the head of the stud. These screws are insulated from the strip 43 and the connection 16 by suitable interposed insulation $44^e$.

The solenoid $38^a$ is secured to the support 12 by means of screws 46 which extend through the support into engagement with the supporting magnet frame 47 to which the solenoid is secured and from which it is suitably insulated, the lower pair of screws 46 passing first through the strips 43, 44 with suitable interposed insulation $46^a$ as clearly shown in Fig. 6.

In addition to the overload trip mechanism the circuit breakers may be tripped

manually through the agency of a bifurcated lever 48 pivoted to the lower end of a supporting post 49 which is secured to the under side of the magnet frame 47. The bifurcated arms of the lever 48 extend over and partially around the projections 38 of the latch mechanism and their lower ends are of sufficient length to remain always in engagement with these projections, whatever the position of the circuit breaker parts, so that the projections 38 can never pass out of position to be operated by this manually actuated lever and these projecting ends will further serve to guide the projections into their proper operative position while the breaker is being closed. The movement of the lever in one direction is limited by the stop 50 engaging the supporting post 49 and in the other direction by its bifurcated arms engaging the under side of the overload magnet frame 47. The lever is also provided with a push-button 51.

In the organization shown, in addition to the trip mechanism already described, a no voltage release device is shown. This comprises an electromagnet having its frame 52 removably secured to the face of the magnet frame 47 by screws 47[a], a coil 53 located therein and included in circuit between the two sides of the line as shown in Fig. 8, and a weighted armature 53[a] which is adapted to engage a projection 54 upon the manually operated lever 48 so as to throw it into tripping position whenever the circuit of the coil 53 is broken or its pull is otherwise rendered insufficient to hold the armature out of engagement with said stop 54. The downward movement of the weighted armature 53[a] which includes the movable core 55, shown in dotted lines in Fig. 2, is limited by the projection 54.

For the purpose of protecting the overload magnet from the possibility of an arc jumping from one of the adjacent contact studs 10, a housing 58 is arranged so as to cover its top and a portion of its sides. This housing is composed of insulating material and is held in position upon the support 12 by means of a plurality of connecting members which extend from the front of the housing through suitable openings therein to and through the support 12. In the present instance these members consist of tubes 59 into the opposite ends of which are screwed screws 60 and 61. In addition to the function of mechanically holding the housing 58 in place these connecting members serve to conduct current from the rear of the support 12 to the leads of the coil 53 on the front of the housing, the screws 61 at the rear of the support being electrically connected to the adjacent studs 10 by conducting strips 61[a]. By reason of this construction and the removability of the frame 52 of the no-voltage release magnet, the latter may be readily detached whenever it is desired to employ the breaker with an overload trip coil only.

Obviously certain of the structural features above described are capable of a more general operation than that illustrated and furthermore certain modifications and alterations may be made in the structure shown without departing from the spirit and scope of our invention. We therefore do not wish to be limited to the specific matter shown but aim to cover by the terms of the appended claims all such alterations and modifications.

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

1. In a circuit breaker, the combination with a flat support and two contact studs extending through said support, of flat conducting strips mounted upon one of said studs to overlap and to extend along the face of said support at right angles to a line joining said studs, insulation between the overlapping portions of said strips, and a trip coil mounted on the face of said support and in circuit with said strips.

2. In a circuit breaker, the combination with a flat support and two contact studs extending through said support, of a flat strip mounted upon one of said studs, a second strip insulated from and mounted upon said stud to overlap said first strip at one end, both said strips being mounted to extend along the face of said support at right angles to a line joining said contact studs, and a trip coil mounted between the non-adjacent ends of said strips with its axis parallel to a line joining said contact studs.

3. In a circuit breaker, the combination with a flat support and two contact studs extending through said support, of a trip coil mounted with its axis parallel to a line joining said studs, conducting strips for supporting said coil connected to opposite ends of said coil and lying flat along the face of said support, said strips being bent at right angles in the plane of the strips and overlapping upon one of said studs, insulation between the overlapping portions of said strips, a movable member for completing the circuit between the face of the uppermost strip and the non-adjacent stud, and connections whereby said trip coil controls said movable member.

4. In a circuit breaker, the combination with a flat support and two contact studs extending through said support, of two flat overlapping strips of different lengths mounted flat on the surface of said support with adjacent ends in alinement and the non-adjacent ends bent at right angles to the strips to extend perpendicularly from said support, one of said strips being connected to one of said studs, insulation between the overlapping portions of said strips and a

trip coil secured between the non-adjacent ends of said strips with its axis parallel to the face of said support.

5. In a circuit breaker, the combination with a flat support, four contact studs mounted on said support to form a rectangle and extending through said support, and two movable bridging members on opposite sides of the rectangle, of overlapping strips insulated from each other and secured to one of said contact studs to extend along the face of said support to a point between said bridging members, a trip coil mounted between the ends of said strips, and means whereby said trip coil controls said bridging members.

6. In a double pole circuit breaker, the combination with a flat support, two pairs of contact studs mounted side by side on said support to extend through it, and two coöperating bridging members each arranged to bridge a pair of studs, of two strips mounted on one of said studs to overlap thereon and to extend across the face of said support toward the other pair of studs, the lower support being connected to the side on which it is mounted, insulation between the overlapping portions of said strips, a trip coil mounted between said pairs of contacts with its ends connected to said strips, and connections whereby said trip coil controls said bridging members.

7. In a circuit breaker, the combination with a flat support and two contact studs extending through said support, of a trip coil located on the face of said support with its axis parallel to the line joining said studs, flat strips connected to the opposite ends of said coil and extending along the face of said support at right angles to a line joining said studs to overlap each other upon one of said studs, and insulation between the overlapping portions of said strips.

8. In a circuit breaker, the combination with a flat support, and two contact studs extending through said support, of two flat conducting strips mounted upon one of said studs to lie flat against the face of said support and to overlap upon one of said studs, insulation between the overlapping portions of said strips, a trip coil carried by and in circuit with said strips, a movable contact arranged to engage the other contact stud, a flexible conducting strip in circuit with said movable contact and secured at one end to the face of the uppermost conducting strip, and connections whereby said trip coil controls said movable contact.

9. The combination with a support, fixed and movable switch elements, and a latch for holding the parts in closed position, of a tripping magnet secured to said support, an armature therefor, operating means for said latch projecting from said latch into the path of movement of said armature, a manually operated lever pivoted to a fixed point and engaging said operating means to actuate said latch independently of said armature, a second tripping magnet, and an armature therefor movable against said manually operable lever to actuate said latch.

10. The combination with a circuit breaker comprising a support, fixed and movable contacts biased to open when closed, and a latch for holding the parts in closed position, of tripping mechanism comprising two tripping magnets secured to said support, an armature actuated by one of said magnets to engage and trip said latch, a manually operated lever to engage and trip said latch, and an armature actuated by the other magnet to actuate said manually operated lever to trip said latch.

11. In a circuit breaker, the combination with relatively movable coöperating contacts biased to open when closed, of a latch for holding said contacts closed, two electromagnets arranged in alinement and mounted to bring one in front of the other to render both electromagnets equidistant from the plane of movement of said contacts, and connections whereby either of said electromagnets actuates said latch to release said contacts.

12. In a circuit breaker, the combination with a support, relatively movable coöperating contacts mounted on said support and biased to open when closed, of a latch for holding said contacts closed, an electromagnet mounted on said support, a second electromagnet mounted in alinement with said first electromagnet and in front of it to bring said first electromagnet between the second electromagnet and said support, and connections whereby either of said electromagnets actuates said latch to release said contacts.

13. A circuit breaker comprising a flat support, relatively movable coöperating contacts mounted on said support to move perpendicularly to said support and biased to open when closed, a latch for holding said contacts closed, two electromagnets arranged in alinement and mounted to project from said support to bring one electromagnet in front of the other, and connections whereby either of said electromagnets actuates said latch to release said contacts.

14. A double pole circuit breaker comprising a support, two pairs of relatively movable coöperating contacts mounted side by side on said support to move perpendicularly thereto and biased to open when closed, a latch for holding each pair of contacts closed, two electromagnets arranged in alinement and mounted between said pairs of movable contacts to project perpen-

dicularly from said support and thereby bring one electromagnet in front of the other, and connections whereby either of said electromagnets actuates both latches to release both pairs of contacts.

15. In an electric switch, the combination with a support, of a tripping magnet, a supporting frame therefor secured to said support, an armature therefor located at the lower end of said magnet, a tripping lever pivoted to the lower part of said magnet frame and extending outward beyond its face, a second tripping magnet secured to the face of said frame, and an armature therefor mounted to engage the outwardly extending end of said lever.

16. The combination with two independently movable juxtaposed switches, each having a latch for holding it closed, of two independent electroresponsive devices mounted one in front of the other between said switches, one of said devices having an armature moved in response to predetermined conditions on the circuit, another device having an armature released in response to different predetermined conditions to move independently of the first armature, and connections whereby either armature moves both latches and thereby trips both switches.

17. The combination with two independently operated switches, each having a latch for holding it closed, of two independent electroresponsive devices arranged one in front of the other between said switches, one of said devices being connected in series with one of said switches, and the other device being connected between the lines controlled by said switches, each of said devices having a member movable independently of the other, and connections whereby the movable member of either device actuates both latches and thereby trips both switches.

18. The combination with two independently operable juxtaposed switches, each comprising fixed contact studs and a movable contact for completing the circuit between said studs, of independent means on each switch for operating said movable contact, means for holding the switch closed, an electroresponsive device mounted between said switches and connected in series with one of said switches, a second electroresponsive device mounted in alinement with and in front of the first electroresponsive device and connected between the lines controlled by said switches, each of said studs having a movable member movable independently of the other and connections whereby either of said members controls said latching means and thereby trips both switches.

19. The combination with two independently operable juxtaposed switches, each having a latch for holding it closed, of two electroresponsive devices arranged in alinement between said switches and mounted one in front of the other, each of said devices having a member movable independently of the other and in the opposite direction and a lever pivoted at a point between said members in a position to be actuated by either one and arranged to actuate both latches and thereby trip both switches simultaneously.

20. The combination with two independently operable juxtaposed switches, each having a latch for holding it closed, of an electroresponsive device mounted between said switches and having a member movable in one direction upon the occurrence of predetermined conditions in the circuit, a second electroresponsive device mounted in alinement with and in front of the first electroresponsive device and having a member movable independently of the first device and in the opposite direction upon the occurrence of other predetermined conditions in the circuit, and a tripping lever pivoted between said members in a position to be actuated by either member and arranged to trip both the switches simultaneously when actuated.

21. In a circuit breaker, a block of insulating material, a stationary contact and two superimposed conducting strips mounted on one side thereof, terminals entering said insulating block from the other side and connected with said contact and with one of said strips, a movable coöperating contact for controlling the circuit between said stationary contact and the other one of said strips, and a tripping magnet having its terminals connected respectively to said two conducting strips.

22. In a circuit breaker, a block of insulating material, a stationary contact and two insulated superimposed conducting strips mounted on one side thereof, a lever carrying a movable contact which coöperates with said stationary contact and one of said strips to control the circuit, terminals entering said insulated block from the other side and connected with said stationary contact and the other of said strips, and a tripping magnet having terminals connected respectively to the two conducting strips.

23. In a circuit breaker, a block of insulating material, a stationary contact and two insulated superimposed conducting strips mounted on one side thereof, terminals entering said insulating block from the other side, one of said terminals being connected with said stationary contact and the other terminal being connected with the lowermost conducting strip, a tripping magnet having terminals connected respectively to the two conducting strips, and a movable contact for completing the circuit between

the uppermost of said conducting strips and said stationary contact.

24. In a circuit breaker, a block of insulating material coöperating stationary and movable contacts mounted on one side thereof, terminals entering said insulating block from the other side, one of said terminals being connected to said stationary contact, two insulated superimposed conducting strips mounted on the same side of said block as said contacts with one of said strips connected to the other terminal, a flexible connection between one of said strips and said movable contact, and a tripping magnet having terminals connected respectively to the two conducting strips.

25. The combination with a support, of an electro-magnet, a frame therefor secured to said support, a housing for said magnet, a second electromagnet secured to the face of said frame, and means for securing said housing to said support constituting an electrical connection between said second magnet and the back of said support.

26. The combination with a support, of an electromagnet, a frame therefor secured to said support, a housing for said magnet, a second electromagnet secured to the face of said frame, and mechanical connections therefor extending through the walls of said housing and through said support providing electrical terminals for the connection of said second electromagnet.

27. In a circuit-breaker, a support, a fixed contact carried thereby, a contact-carrying frame carried by said support, a pivoted latch carried by said frame, a tripping arm for said latch, and a tripping lever carried by said support, a part of said lever having a surface in engagement with the end of said tripping arm, said surface being so formed that the end of the tripping arm is always in contact therewith.

28. In a circuit-breaker, a support, a fixed contact carried thereby, a contact-carrying frame pivoted to said support, a pivoted latch carried by said frame, a lug with which said latch engages to hold the circuit-breaker closed, a projection carried by said latch, and a tripping lever carried by said support, said tripping lever and said projection being always in engagement.

In witness whereof, we have hereunto set our hands this 27th day of March, 1905.

EDWARD M. HEWLETT.
CHARLES H. HILL.

Witnesses:
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HELEN ORFORD.