

Oct. 28, 1941.

A. B. RYPINSKI

2,260,583

CIRCUIT BREAKER

Filed Dec. 16, 1939

3 Sheets-Sheet 1

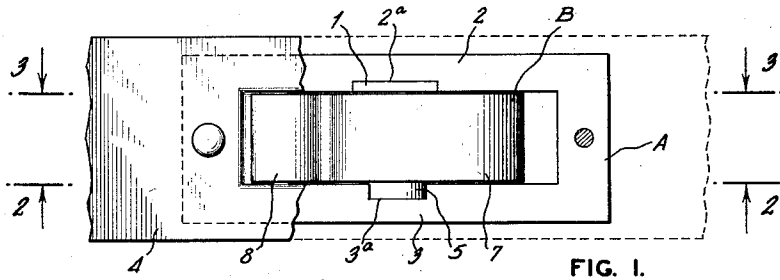


FIG. 1.

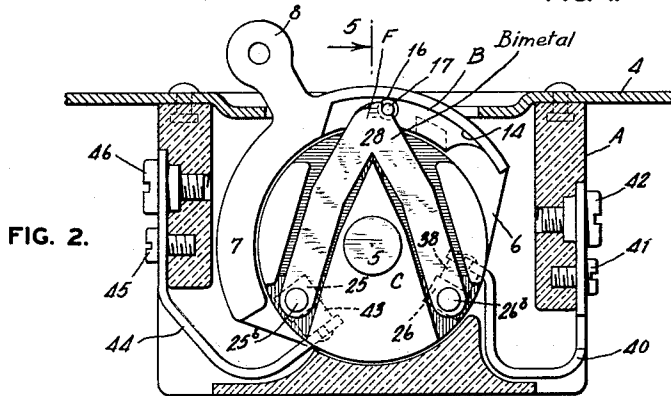


FIG. 2.

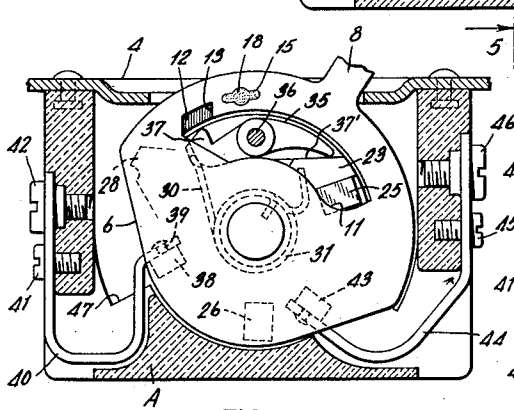


FIG. 4.

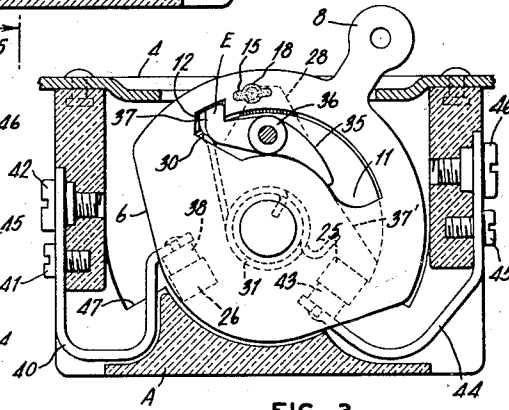


FIG. 3.

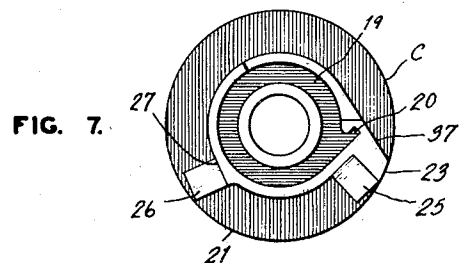


FIG. 7.

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3 Sheets-Sheet 2

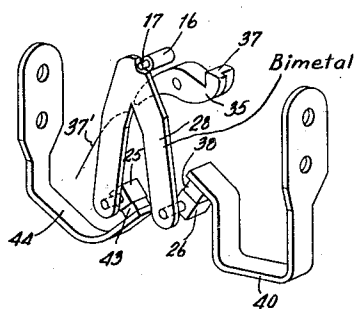


FIG. 8.

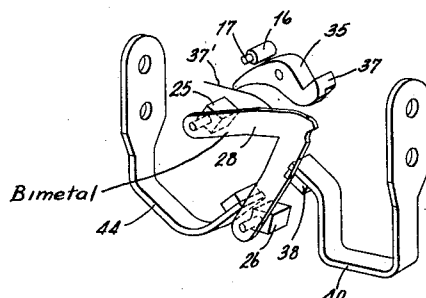


FIG. 9.

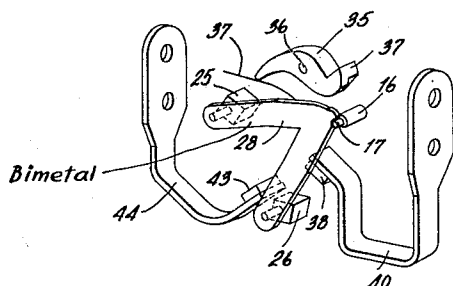


FIG. 10.

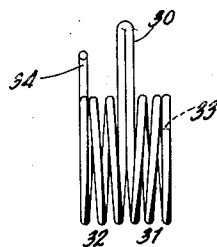


FIG. 11.

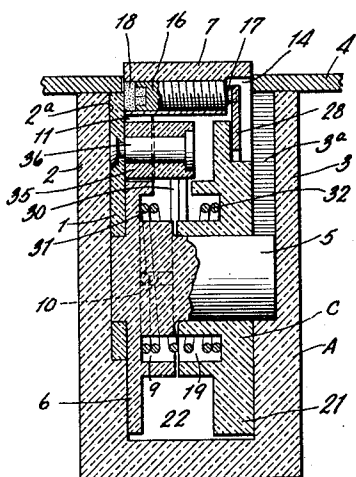


FIG. 5.

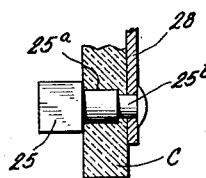


FIG. 12.

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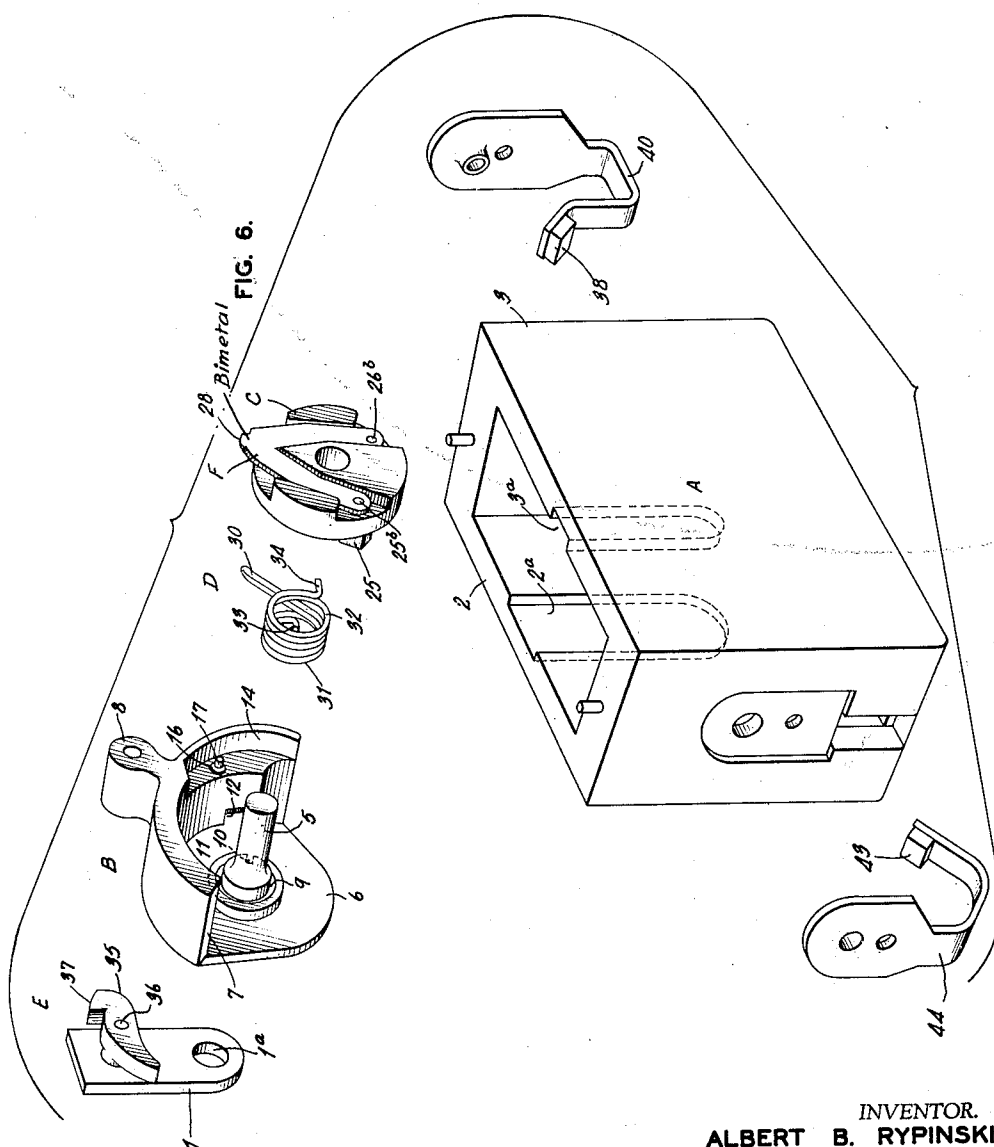
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CIRCUIT BREAKER

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,260,583

CIRCUIT BREAKER

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Application December 16, 1939, Serial No. 309,521

34 Claims. (Cl. 200—116)

The invention herein disclosed relates to a manually operable circuit breaker of the protective type which operates automatically to open the circuit upon overloads and short circuits independently of the manual operation.

One of the primary objects of the invention is to provide such a circuit breaker with a minimum number of moving parts and which may have non-corrosive bearing surfaces for such moving parts. Other objects of the invention are to provide a circuit breaker that is compact, readily assembled, dependable in operation, and is less expensive to manufacture than breakers of this type available prior to this invention. More specific objects of the invention are to provide such a circuit breaker with a minimum total number of parts; with the several parts interrelated to secure a minimum width of circuit breaker; with less parts in the tripping mechanism than have heretofore been considered necessary; and to provide such a circuit breaker in which the primary moving parts operate from a common point in parallel paths and preferably rotate about a common center. Additional objects of the invention are to provide a circuit breaker which breaks the circuit at two points and within arc chutes that direct such arcs as are produced in a direction away from the lever for manual operation; to provide a circuit breaker in which the outer of two primary elements renders the inner element inaccessible; to provide a circuit breaker having a single spring to actuate the various movable elements and control the functioning of the tripping means; and to provide a circuit breaker in which one of the moving parts is releasably latched to a stationary element through a single latch piece.

These and other objects and certain advantages which will hereinafter appear are realized in the circuit breaker, constituting one specific example of an embodiment of the invention, illustrated in the accompanying drawings and described in detail below. The drawings include:

Fig. 1 which is a plan of the circuit breaker with the cover partly broken away;

Fig. 2 which is a sectional side elevation taken along the line 2—2 of Fig. 1;

Fig. 3 which is a similar sectional side elevation taken along the line 3—3 of Fig. 1;

Fig. 4 which is a side elevation similar to Fig. 3 showing the parts in an intermediate position;

Fig. 5 which is a transverse section taken on the line 5—5 of Fig. 2;

Fig. 6 which is an exploded isometric of the circuit breaker;

Fig. 7 which is a side elevation of the switch element of the circuit breaker;

Fig. 8 which is a skeleton isometric view of the circuit breaker in the "On" position;

Fig. 9 which is a skeleton isometric view of the circuit breaker just after automatic opening of the breaker;

Fig. 10 which is a skeleton isometric view of the circuit breaker in the "Off" position;

Fig. 11 which is a side elevation of the spring element of the circuit breaker; and

Fig. 12 which is a fragmentary sectional elevation of a part of the switch element.

The circuit breaker illustrated in the drawings (Fig. 6) is enclosed within a case A and includes two principal moving parts, an operating handle B having a finger piece through which it may be manually actuated, and a rotary switch element C. These elements are arranged to be independently movable about a common axis between open-circuit and closed-circuit positions. A spring element D acts upon these movable elements to resiliently urge each element, independently, towards open-circuit position. Releasable, interengaging means E are provided on a part fixed with respect to the case and on the handle for the purpose of retaining the handle, under normal conditions, in closed-circuit position. The switch element is, under normal conditions, retained by the handle in circuit-closing position through current releasable interengaging latching means F arranged to secure the switch element against movement relative to the handle and towards open-circuit position. This latching means includes a bimetal element, which upon the passage of excess current through the circuit warps and operates to release the switch element from the handle. Thus, upon an overload or short circuit wherein excessive current passes through the circuit breaker, the current controlled restraining means is actuated and the switch element moves under the force of the spring element to open-circuit position. This movement of the switch element breaks the circuit (Figs. 8, 9 and 10). Upon movement of the switch element to open-circuit position, the restraining means for the handle is actuated. The handle is released from the case, and, under the action of the spring, follows the switch element to open-circuit position. Upon arriving at open-circuit position and upon the return of the current actuated restraining means to normal, the handle and switch element are again latched. Subsequent movement of the handle to closed-circuit position, therefore, moves the switch element to closed-

circuit position. Likewise, if the handle is manually moved from closed-circuit to open-circuit position, the switch element will follow the handle to open-circuit position.

The entire circuit breaker, with the exception of the spring, the bimetal element, its cooperating detent, the contacts and the necessary fastening means, is preferably made of Bakelite or from some equally efficacious and strong electrical insulating, non-corrosive material.

The circuit breaker is adapted for assembly as a unit (Fig. 6). On one side, there is a bearing plate 1 having a bearing opening 1a therethrough that is received in a groove 2a in the side wall 2 of the case A. The opposite side wall 3 of the case A has formed therein a groove 3a which is rounded at the inner end and which receives and forms a journal on three sides for the shaft of the circuit breaker. The parts assembled in the unit have a total width such as to provide only a working clearance with the side walls of the case A. When the assembled unit is slipped in place in the case (Fig. 5) and the entire circuit breaker fastened to a cover 4 the bearing plate 1 holds one side of the assembled unit in its correct position and in conjunction with the close fit of the moving parts with the sides of the case holds all other parts in their correct positions.

The handle B (Figs. 5 and 6) includes in one piece a shaft 5 journaled in the bearing opening 1a in the plate 1 and in the groove 3a in the side wall 3, a disk-like, radial, supporting wall 6 adjacent one end of the shaft, a substantially axially extending flange 7, and a finger piece 8 extending radially outwardly from the flange 7 and having a sealing opening therethrough. Between the shaft and the outer end of the supporting wall 6 there is formed in the wall a circular cavity indicated by the numeral 9. The shaft 5 is enlarged at this point and has a keyway 10 formed therein. Through the supporting wall, adjacent the flange 7, there is formed an arcuate opening 11 of the shape illustrated. The radially inner surface of the flange 7 is undercut at 12 (Figs. 3 and 4) from the outer face and through the supporting wall, forming a shoulder 13 which constitutes a latch engaging surface. On the other face of the handle there is formed a recess 14 having the configuration illustrated in Fig. 6. At one point in this recess, there is a hole pierced and threaded through flange 7. The end 15 (Figs. 3 and 4) of this hole, at the wall 6, is irregularly shaped. A set screw 16 (Figs. 5 and 6) having its end 17 shaped as shown and commonly known as a dog-point hardened set screw is mounted in the threaded hole. The shaped end 17 of the screw serves as a detent, and part of the current releasable means F, and by turning the screw the current releasable means F may be adjusted for a purpose that will hereinafter appear. When the screw is adjusted to the proper position, cement 18 is forced into the irregular opening 15 in flange 7 and into the sunken socket in the set screw and when this cement hardens it renders the screw inaccessible.

The switch element C (Figs. 2, 5, 6 and 7) is in the form of a rotor. It is bored axially and rotatably mounted upon the shaft 5. It is in effect housed, or partially encased, in the handle. The rotor has a circular spring cavity 19 formed in one side wall thereof and it is mounted upon the shaft so that the cavity 9 in the disk-like supporting wall 6 of the handle and the cavity 19 of the rotor form a complete spring housing. In

the outer wall of the spring cavity of the rotor, there is provided a keyway 20. Radially outwardly of the spring cavity there is formed between the wall 21 of the rotor (Fig. 5) and the supporting wall 6 of the handle a radially extending circumferential contact recess 22. This contact recess has an end wall 23 (Figs. 4 and 7) extending substantially radially. This contact recess, formed between the supporting wall 6 of the handle and the disk-like wall 21 of the rotor, constitutes an arc chute open only away from the handle 8 of the circuit breaker.

The switch element contacts are mounted on the rotor to be within this arc chute. One contact 25, which is rectangular, is mounted adjacent the end wall 23 of the arc chute. One of the flat surfaces thereof bears against the end wall 23 and prevents rotation of the contact. The other contact 26 which is likewise rectangular is angularly spaced from the contact 25. The contact 26 is prevented from rotating by the engagement of one of the flat surfaces thereof with a flat surface 27 formed substantially tangential to the inner circumferential wall of the arc chute.

Each contact has a reduced rounded and shouldered extension—the extension 25a—which passes through the rotor wall 21. The end portions of these rounded extensions (Fig. 12) are further reduced in diameter and form rivets 25b and 26b by which the ends of a bimetal strip 28 of substantially the shape of an inverted V are secured to the face of the rotor. Each contact thus has the function of acting as (1) a contact, (2) a rivet for securing one end of the bimetal strip to the face of the rotor and (3) an electrical conductor between the contact and the bimetal strip. The contacts may be soldered or brazed to the bimetal to prevent loosening. The reduced cross section of the rivet ends of the contacts minimizes the transfer of heat from the bimetal strip to the contact surfaces.

The recess 14 in flange 7 of element B provides clearance for the end of bimetal 28 as it travels independently of the handle to open-circuit position (Figs. 2, 5, 8 to 10). The bimetal strip extends radially to a point beyond the end 17 of screw 16. The edge of the bimetal is cut away as shown to conform with the shape of the detent screw, and the engaging edge thereof may be rounded to provide a point contact with the screw and so minimize friction tending to retard warping of the bimetal. The rear edge of the bimetal is wedge-shaped and bent away from the detent to form a lead-in and so effect ready relatching after the bimetal has escaped and cooled. Under bias of the spring the bimetal engages, in latching relation, the detent end 17 on screw 16 to effect movement of the rotor with the handle, under normal conditions, from open-circuit to closed-circuit position. By turning the screw 16 the extent of engagement between the bimetal and the detent 17 may be adjusted. In this way the amount the bimetal must move to be released from the detent may be changed and the value at which the breaker opens predetermined. This in turn establishes the capacity or rating of the breaker.

The greater portion of the bimetal is held away from the rotor by projections extending from the surface of the rotor. There are three such projections, one at each end of the bimetal where the bimetal is secured to the rotor and the other, of materially smaller area at the apex of the

bimetal. In this way the transfer of heat from the bimetal to the rotor is minimized.

The spring element D (Figs. 3, 4, 5, 6 and 11) is mounted within the spring housing formed by the aligned cavities of the rotor and supporting disk of the handle. The spring element consists of a single spring that includes a central tangential loop 30 and a torsional spring section on each side of the loop that is wound from the central loop outwardly. Both sections 31 and 32 of the springs are wound in the same direction. The end of the spring section 31 is bent at a sharp angle to form a radially inwardly extending key 33, and the end of the section 32 is bent to form an outwardly extending key 34. The key 33 is received in the keyway 10 in the handle and the key 34 is received in the keyway 20 in the rotor. It will be observed that with the center loop fixed or restrained, the two sections of the spring may be wound in the same direction against the loop to provide bias. In this way, independent bias, in the same direction, on the rotor and handle is attained with a single spring. Winding the spring up a partial revolution will ordinarily provide a sufficient bias for effecting dependable operation of the device.

The spring loop 30 acts upon the interengaging means E consisting of a single latching lever 35 and the shoulder 13. The spring loop is restrained by engagement with a shoulder formed on the lever which is pivotally mounted intermediate its ends upon a pivot 36 extending from and secured in the end bearing plate 1 adjacent the supporting wall 6 of the handle. The lever extends through the arcuate opening 11. It is mounted and arranged to remain clear of the flange 7 on the handle except when in latching position at which time a latching tooth 37 at one end thereof enters and latches against the shoulder or latching surface 13 in the flange of the handle. The lever is held from engagement (Fig. 4) with the inner surface of the flange of the handle by a cam action contact with the surface of the rotor when the rotor is in the "off" position.

The loop of the spring engages a cam surface formed on the edge of the lever at the latching tooth end. This cam surface is designed so as to resolve the force exerted by the spring to effect the necessary latching movement of the lever and to permit ready disengagement of the latch and the latching surface. The opposite end of the lever is shaped as illustrated for the purpose of engagement with a cam surface 37' on the rotor positioned and arranged such that in the open-circuit position of the rotor the cam engages the lever and moves the lever to the unlatched position (Fig. 4). This arrangement provides a positive means for effecting unlatching movement of the lever when the rotor moves to the open-circuit position.

When the rotor is released by virtue of the warping of the bimetal and moves to open-circuit position, the force exerted on lever tooth 37 by the loop 30 of the spring is lessened. The force exerted by the loop is dependent upon how tightly the coils 31 and 32 are wound. When the tension on one of the coils is lessened by unwinding, as by movement of the rotor to open-circuit position, the force exerted by the loop is accordingly decreased. Thus, the handle is more easily unlatched when the rotor moves to the open-circuit position.

The lever is constructed and mounted so that the spring engaging end surface thereof moves

substantially radially of the axis of the handle and rotor when the lever moves between latching and unlatching position. Since the spring is centered around the main axis of rotation, its end 30 which engages the lever, moves circumferentially around the axis. The spring engaging end surface of the lever, if shaped and arranged so as to move parallel to the loop, will not, upon movement of the lever about its pivot, effect any movement of the spring loop; nor will the spring be able to effect any movement of the lever. The shape of the spring engaging end of the lever may be varied from such relation to the arrangement in which movement of the lever about its pivot is translated into an extension at right angles to the spring loop under which conditions the total force of the spring acts on the lever to effect latching movement of the lever about its pivot. It is, of course, obvious that between these two extremes any desirable resolutions of the movement of the lever may be effected to obtain a greater or lesser movement of, and in consequence a greater or lesser force from, the spring loop. Thus, the shaping of this end surface of the lever can be made such that even with a heavy spring pressure the lever will not be pressed toward latching position with a correspondingly heavy pressure but will be pressed in with an amount of pressure depending on the judgment of the designer, and in accordance with the desired operation. In this way, it becomes possible to utilize as strong a spring as may be desired to operate the rotating parts and at the same time permit the release of the latching end of the lever with a minimum of force. The shape of the spring engaging end of the lever, its pivoted axis and the direction of the spring loop are interrelated factors affecting the pressure exerted by the spring to effect engaging movement of the lever. In the construction illustrated, the engaging surface of the latching tooth and the latching surface 13 of the handle are such as to provide a positive holding action. Yet, the several factors mentioned are arranged and designed such that the lever moves out of latching engagement upon a force of a particular magnitude being exerted on the finger piece 8 in a direction to move the handle to "off" position.

The case (Figs. 2, 3, 4, 5 and 6) for the circuit breaker is open at the top and has two openings near the bottom which are shaped, as illustrated, to provide a tortuous course in which the gases from arcs cool in passing out of the case. In these openings the stationary contacts are received. The contact 38 consists of a rectangular copper block having a reduced extension 39 thereon. This extension passes through an opening in a resilient contact strip 40 and it is headed over, and soldered or brazed if desired, to secure the contact to the strip. The contact strip is fitted into a recess in the side of the case and secured to the outside of the case as by riveting or by a screw 41 and is provided with a terminal screw 42 accessible on the outside of the case. A contact 43 is in like manner fitted in a recess in the side of the case and secured by a screw 45. A terminal screw 46 engages in a threaded opening in the strip 44. The case with the stationary contacts in place is ready to receive the circuit breaker assembled as a unit. The fixed contact 38 forms, in the assembled breaker, an end wall in the arc chute to prevent passage of gas toward the handle.

The assembly is accomplished as follows (Fig. 6): The bearing plate 1 carrying the latching lever 35 is laid down and the handle laid over it so that the lever enters the arcuate opening 11 in the handle. The spring is dropped in the handle spring cavity with its key 33 in the keyway 10. The loop 30 of the spring is now pulled back to a point at which it snaps in place in the recess in the latching tooth end of the lever. The end of the spring loop 30 is shaped to more or less conform to the curvature of the surface of lever 35 which it engages. The rotor, which has previously had the contacts 25 and 26 and the bimetal 28 assembled to it, is dropped in place over the spring and turned until the key 34 of the spring enters the keyway 20. This end of the spring is now located in the rotor and turning movement of the rotor winds up the spring. After it has been turned sufficiently, the rotor may be pressed into place, sliding along the shaft 5, to fully enclose the spring and assuring proper alignment of the movable parts. The spring now holds the bimetal 28 against detent 19 and by its tension on the parts serves to retain these several parts together in their assembled relation. It is now only necessary to pick up the assembled circuit breaker unit and slip it into the casing. In doing so, the handle is moved to the "off" position, at which point the contacts 25 and 26 on the rotor pass by the stationary contacts in the case. The complete breaker is now riveted to its cover or support.

It is, of course, desirable that the electrical testing of the breaker, to determine its correct calibration, be done before the breaker is permanently fastened in place. This may be done by placing the unit in the case, passing current through the breaker, and observing its tripping time on a definite current. If not correct it is only necessary to slip the breaker out of the case sufficiently to expose the adjusting screw 16, turn the screw the desired amount, slip the breaker in place and rivet the entire assembly to the cover or supporting means. This riveting operation renders the adjustment on the breaker inaccessible which is a requirement of the fire underwriters. Before the breaker is finally riveted, the screw hole 15 is filled with cement as previously stated.

The operation of the assembled breaker will now be described. If the handle is moved to the closed-circuit or "on" position, a circuit is established from terminal 42 through contact fitting 50 to bimetal 28, to contact fitting 44 and terminal 46. In this position contact strips 40 and 44 are under tension by reason of the engagement of switch element contacts 26 and 25 with the contacts 38 and 43, and exert a force on the rotor in a direction to move the rotor to "off" position. This force adds to the speed at which the terminals separate when the breaker trips.

The circuit breaker may be manually operated to open or close the circuit. As previously described, the relation of the engaging surface of the tooth 37 of the latching lever 35 is such that while providing a secure latch, it releases upon exerting a force upon the finger piece 8 in a direction to move the handle to open-circuit position. Thus, since the rotor under normal conditions is latched to and moves with the handle, by engagement of the bimetal 28 and detent 17, the circuit breaker may be actuated manually in the manner of an ordinary switch. To open the circuit breaker (Fig. 3) one merely

exerts a pressure with the fingers on the finger piece 8 to move the finger piece to the left as seen in Fig. 2. The force so exerted and transmitted to the tooth 37 is resolved, by virtue of the cam engaging surface of the tooth 37 and the engaging face 13 into a force acting on the lever 35 in a direction to disengage the tooth 37. Movement of the lever 35 is thus effected, the handle is released and moves to open-circuit position. The rotor in consequence likewise moves to open-circuit position. To close the circuit breaker the finger piece 8 and handle are moved to the "on" position wherein the lever 35 moves under the force of the spring to engage the handle. The rotor being latched to the handle by the bimetal moves with and is retained in "on" position by the handle.

When the circuit breaker is in the "on" position and an excessive current passes through it, the bimetal becomes heated, warps in a manner well known and usual with a bimetal, and becomes disengaged from the detent 17. The warping or bending of the bimetal may be rapid in the case of a heavy flow of current due to a short circuit or it may be slow or delayed where there is but a slight overload. In either event when the bimetal becomes released from the detent, the rotor is moved by the spring to the open-circuit position as illustrated in Figs. 4 and 9. As the rotor nears the open-circuit position, the cam surface 37' on the rotor engages the latching lever 35 and positively moves the lever to unlatching position. When this occurs, the handle is released and under the action of its end of the spring moves to open-circuit position against the stop 47 and in doing so the detent 17 passes the bimetal as shown in Fig. 10. When the bimetal cools and returns to its normal position, it again aligns with the detent. If it be cooled before the handle arrives at the "off" position, the lead-in on the strip permits the handle to pass the bimetal. The rotor is thus again latched with the handle for movement to "on" position. It will be apparent that while there is an overload or a short circuit, the breaker cannot be held in closed-circuit position because the contact carrying rotor is only latched to the handle by means of the bimetal, and holding the handle will not prevent the bimetal escaping and the rotor moving to "off" position.

While but a single unit has been described, it will be apparent that multiple units may be employed and interrelated in well known ways so that all of the units trip when one trips. Various other changes in the arrangement and changes in the details of the circuit breaker illustrated in the drawings and described in detail above may be made by those skilled in the art within the principle and scope of the invention as defined in the appended claims.

I claim:

1. In a circuit breaker of the type described, the combination comprising a pair of movably mounted elements, independently movable between closed-circuit and open-circuit positions, a latching lever and detent for restraining one of said movable elements in closed-circuit position, and a single spring arranged to independently urge said movable elements towards open-circuit position and to resiliently urge said latching lever into latching position.

2. In a circuit breaker of the type described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for

movement between closed-circuit and open-circuit positions, resilient means acting upon said movable element in a direction to move the element to open-circuit position, and releasable interengaging means on said movable element and said stationary mounting arranged to normally maintain said movable element in closed-circuit position, said interengaging means including a latch and a detent, the latch and detent having engaging cam surfaces shaped and arranged to effect disengaging movement of the latch upon a force being exerted on said manually engageable means in a direction to move the element to open-circuit position.

3. In a circuit breaker of the type described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith and mounted for movement between closed-circuit and open-circuit positions, resilient means acting upon said movable element in a direction to effect movement thereof toward open-circuit position, and releasable interengaging means on said movable element and said stationary mounting arranged to normally retain the movable element in closed-circuit position, said interengaging means including a pivotally mounted lever and a detent having engaging cam surfaces shaped and arranged to effect disengaging movement of the lever upon a force being exerted on said manually engageable means in a direction to move the element to open-circuit position.

4. In a circuit breaker of the type described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, said movable element including a flange having a recess therein, resilient means acting upon said movable element to effect movement thereof toward open-circuit position, a pivot associated with said stationary mounting and a lever mounted on the pivot and including a latching tooth arranged to engage an end surface of the recess in said flange in the closed-circuit position of the movable element, the engaging surfaces of the latching tooth of the lever and the recess being arranged to effect disengaging movement of the lever upon a force being exerted on said manually engageable means in a direction to move the element to open-circuit position.

5. In a circuit breaker of the type described, the combination comprising a stationary mounting, a rotatably mounted element having manually engageable means associated therewith and movable between closed circuit and open-circuit positions, said element including a flange extending axially thereof and having a recess in the inner surface thereof, resilient means acting upon said movable element to effect movement thereof toward open-circuit position, a pivot associated with the stationary mounting, and a lever pivotally mounted thereon and including a latching tooth arranged to engage in the recess in said flange in the closed-circuit position of the movable element, the engaging surfaces of the latching tooth of the lever and the recess being arranged to effect disengaging movement of the lever upon a force being exerted on said manually engageable means in a direction to move the element to open-circuit position.

6. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engage-

able means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable inter-engaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions, and means for effecting the release of said interengaging means upon movement of said second mentioned movable element to open-circuit position.

7. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions, resilient means acting thereon to effect movement thereof to open-circuit position and means for effecting the release of said interengaging means upon movement of said second movable element to open-circuit position.

8. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element having circuit controlling contacts thereon and movable between closed-circuit and open-circuit positions, resilient means acting thereon to effect movement thereof to open-circuit positions, and means for effecting the release of said interengaging means upon movement of said second mentioned movable element to open-circuit position.

9. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manu-

ally engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions, resilient means acting thereon to effect movement thereof towards open-circuit position, current-releasable interengaging means on said movable elements arranged to normally maintain said second movable element in position with said first mentioned movable element, and means for effecting the release of the interengaging means restraining said first-mentioned movable element upon movement of said second mentioned movable element to open-circuit position.

10. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting upon said movable element in a direction to effect movement thereof to open-circuit position, releasable, relatively movable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, another movable element movable between closed-circuit and open-circuit positions and means for effecting relative movement of said releasable interengaging means upon movement of said second mentioned movable element to open-circuit position.

11. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting upon said movable element in a direction to effect movement thereof to open-circuit position, releasable, relatively movable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions and a cam on said second mentioned movable element for effecting relative movement of said interengaging means upon movement of said second mentioned movable element to open-circuit position.

12. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means including a pivotally mounted lever and a detent having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions, and means on said second mentioned movable element for effecting releasing movement of said lever upon movement of said second mentioned movable element to open-circuit position.

13. In a circuit breaker of the kind described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to effect movement thereof to open-circuit position, releasable interengaging means on said movable element and said stationary mounting for normally holding said movable element in closed-circuit position, said interengaging means including a pivotally mounted lever and a detent having engaging surfaces arranged to effect the release thereof upon a force being exerted on said manually engageable means in the same direction as the action of said resilient means, another movable element movable between closed-circuit and open-circuit positions and a cam surface on said second mentioned element arranged to engage and effect releasing movement of the lever upon movement of said second mentioned movable element to open-circuit position.

14. In a circuit breaker of the kind described, the combination comprising a case, a movable element having manually engageable means associated therewith mounted within the case for movement between closed-circuit and open-circuit positions, resilient means acting thereon in a direction to move the element to open-circuit position, releasable, relatively movable, interengaging means on said movable element and said case for normally holding said movable element in closed-circuit position, another movable element mounted within the case for movement between closed-circuit and open-circuit positions, resilient means acting thereon to effect movement thereof to open-circuit position, and means for effecting relative movement of said interengaging means upon movement of said second mentioned movable element to open-circuit position.

15. In a circuit breaker of the kind described, the combination of operating parts comprising a movable element having manually engageable means associated therewith, a shaft extending therefrom, a switch element rotatably mounted on the shaft, releasable interengaging means between the elements, a recess between the movable elements and a spring within the recess engaging the movable elements and arranged to retain the elements in assembled relation.

16. In a circuit breaker of the kind described, the combination of operating parts comprising a movable handle, a shaft integral therewith, a switch element rotatably mounted on the shaft, an axial flange on the handle overhanging the switch element, a recess between the handle and switch element and a spring within the recess.

17. In a circuit breaker of the type described, the combination comprising a pair of movably mounted elements, independently movable between closed-circuit and open-circuit positions, interengaging means for restraining one of said elements in closed-circuit position, and a single spring arranged to independently urge said movable elements towards open-circuit position and to urge said interengaging means into engaging relation.

18. In a circuit breaker of the type described, a movable switch element comprising in combination a movably mounted block of electrical insulating material having an arc chute along one edge and a circuit-breaker contact mounted on the block of insulating material and arranged

with the contacting surface thereof in the arc chute.

19. In a circuit breaker of the type described, a movable switch element comprising in combination a movably mounted block of electrical insulating material having an arc chute along one edge, circuit controlling contacts mounted on the block of insulating material and arranged with the contacting surfaces thereof in the arc chute, and a current actuated device mounted on the block of insulating material and connected to the contacts.

20. In a circuit breaker of the type described, a rotary switch element comprising in combination a block of insulating material, angularly spaced circuit-controlling contacts mounted on the block of insulating material and arranged circumferentially on one side of a diametrical plane through the axis of rotation of the switch element, and current actuated releasing means mounted on said insulating block, connected to said angularly spaced circuit-controlling contacts and arranged with the active part thereof on the other side of the said diametrical plane.

21. In a circuit breaker of the type described, a circular, rotatably mounted switch element comprising in combination a block of electrical insulating material having an arc chute along a portion of the circumferential edge thereof, angularly spaced circuit controlling contacts mounted on the block of insulating material and arranged with the contacting surfaces thereof in the arc chute, and a current actuated device mounted on the block of insulating material and connected to the contacts.

22. In a circuit breaker of the type described, the combination comprising a movable element movable between closed-circuit and open-circuit positions, circuit controlling means associated with the movable element, means acting on the movable element to effect movement of the element from closed-circuit to open-circuit position, and interengaging means for retaining the element in closed-circuit position including a detent and a substantially V-shaped bimetal element arranged in a plane substantially perpendicular to the detent and for the edge thereof to engage the detent.

23. In a circuit breaker of the type described, the combination comprising a movable element movable between closed-circuit and open-circuit position, circuit-controlling means associated with the movable element, means acting on the movable element to effect movement of the element from closed-circuit to open-circuit position, and interengaging means for retaining the element in closed-circuit position including a detent and a bimetal element having the edge thereof engaging the detent at a point intermediate the ends of the bimetal, and means for adjusting the extent of engagement of the bimetal element and the detent.

24. In a circuit breaker of the type described, the combination comprising a movable element movable between closed-circuit and open-circuit positions, spaced circuit-controlling contacts carried by said movable element, means acting on the movable element to effect movement thereof to open-circuit position, and interengaging means for retaining the movable element in closed-circuit position including a detent, a bimetal element connected at each end to one of said circuit-controlling contacts and arranged intermediate its ends for engagement by the edge thereof with said detent and means carried by the movable

element for adjusting the extent of the engagement of the bimetal element and the detent.

25. In a circuit breaker of the type described, the combination comprising a rotatably mounted switch element movable between open-circuit and closed-circuit positions and having a recess in the edge thereof, circuit-controlling contacts on said switch element, a rotatably mounted, manually movable element partially enclosing said switch element and movable between open-circuit and closed-circuit positions, spring means acting upon said elements and arranged to effect movement of the elements independently from closed-circuit to open-circuit position, releasable means for retaining said manually movable element in closed-circuit position, and interengaging current-releasable means between the elements for retaining the switch element in closed-circuit position with the manually movable element including an adjustable detent and a bimetal element on the switch element having a detent engaging projection arranged for the edge thereof to engage the detent.

26. In a circuit breaker of the type described, the combination comprising a case, a manually rotatable element, a rotatable switch element, a spring acting upon the switch element, a dog-point, hardened set screw threaded into the manually rotatable element and forming a detent, and a flat V-shaped bimetal element mounted on the switch element and arranged with the edge thereof positioned to engage the detent.

27. In a circuit breaker of the type described, a movable switch element comprising in combination a block consisting of electrical insulating material, a bimetal latching element mounted on the block and circuit-controlling contacts mounted on the block and forming means for securing the bimetal element to the block.

28. In a circuit breaker of the kind described, the combination comprising a rotatably mounted, manually movable element for manual actuation of the circuit breaker movable between two positions, a rotatably mounted switch element, and current-releasable means for latching the switch element to the manually movable element including a flat bimetal element mounted to lie in a plane perpendicular to the axis of the switch element and rotatable about the axis of the switch element.

29. In a circuit breaker of the kind described, the combination comprising a rotatably mounted manually movable element for manual actuation of the circuit breaker, a rotatably mounted switch element, and current-releasable means for latching the switch element to the manually movable element including a flat bimetal element arranged to lie in a plane perpendicular to and rotatable about the axis of the switch element and arranged to effect relatching of the switch element to the manually movable element after automatic release thereof.

30. In a circuit breaker of the type described, the combination comprising a stationary mounting, a movable element having manually engageable means associated therewith mounted for movement between closed-circuit and open-circuit positions, resilient means acting upon said movable element in a direction to move the movable element toward open-circuit position, and releasable interengaging means independent of said manually engageable means on said movable element and said stationary mounting arranged to normally retain said movable element in closed-circuit position, said interengaging means ar-

ranged to be released upon a force being exerted on said manually engageable means in a direction to move the movable element to open-circuit position.

31. In a circuit breaker of the type described, the combination of operating parts comprising a movable element having manually engageable means associated therewith, a movable switch element arranged at one side of said movable element, releasable interengaging means between the movable element and the switch element, a recess between the elements, a spring within the recess engaging said movable elements and arranged to retain said elements in assembled relation through the tension exerted thereon.

32. In a circuit breaker of the kind described, a combination comprising a movably mounted operating handle movable between closed-circuit and open-circuit positions, a movably mounted switch element movable between closed-circuit and open-circuit positions, releasable interengaging means between the handle and switch element, and a single spring arranged to independently urge said movable elements towards open-circuit position.

33. In a circuit breaker of the type described, the combination comprising a case, a stationary

5 contact mounted on the case, a movable switch element within the case including a block of electrical insulating material having a recess therein and an arc chute along one edge, a spring mounted in the recess and arranged to bias the block of insulating material towards open-circuit position, and a circuit breaking contact mounted on the block of insulating material arranged with an engaging surface in the arc chute and positioned to engage the stationary contact in the closed-circuit position of the switch element.

34. In a circuit breaker of the type described, the combination comprising a rotatably mounted element movable between closed-circuit and open-circuit positions, circuit controlling means associated with the rotatable element, means acting on the rotatable element to effect movement of the element from closed-circuit to open-circuit position, and interengaging means for retaining the rotatable element in closed-circuit position including a detent arranged substantially parallel to the axis of the rotatable element and a bimetal element arranged in a plane radial of the axis of the rotatable element and positioned for the edge thereof to engage the detent.

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