

Sept. 22, 1936.

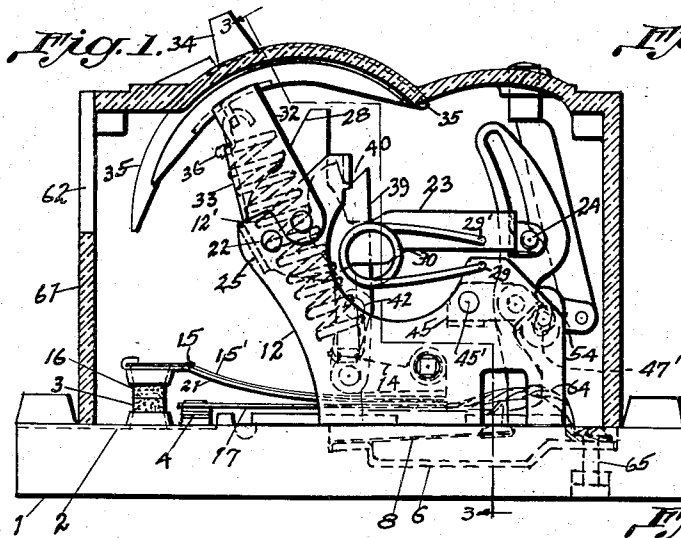
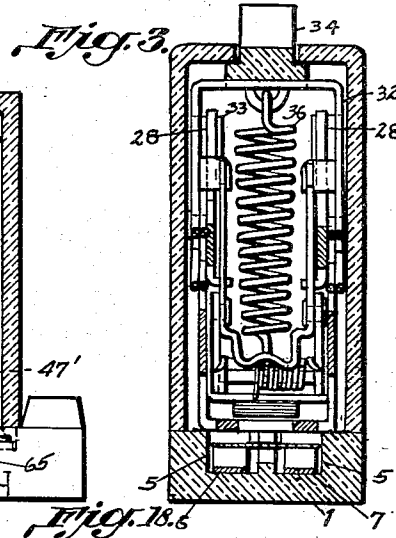
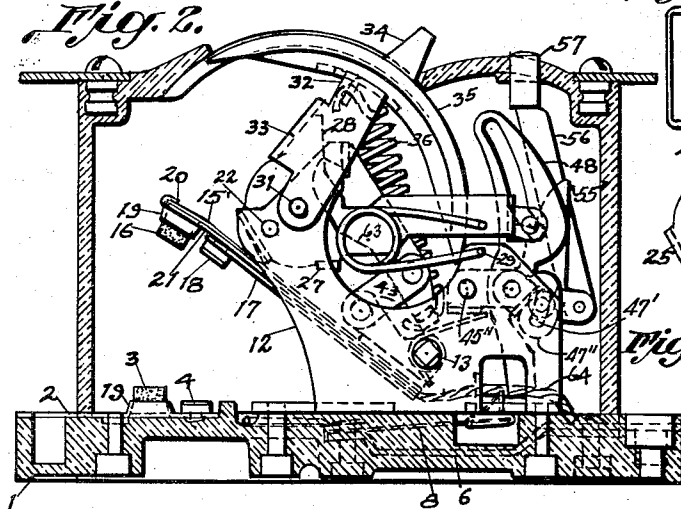
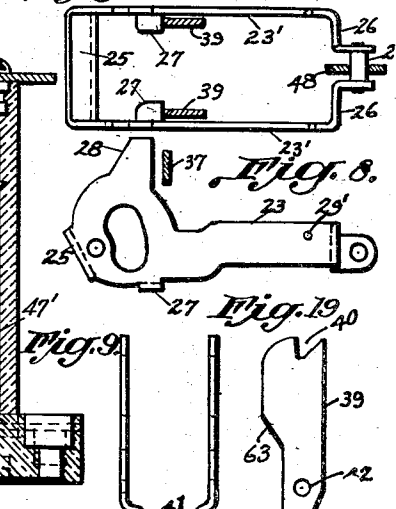
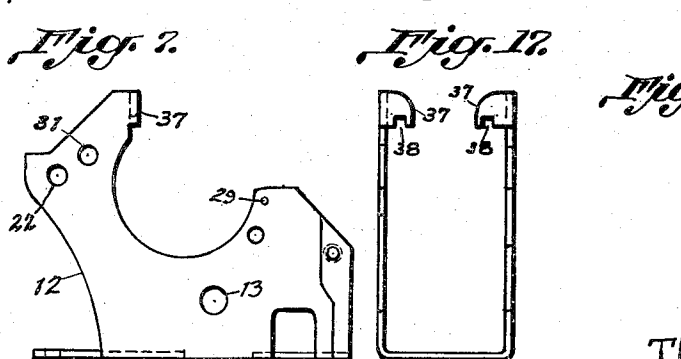
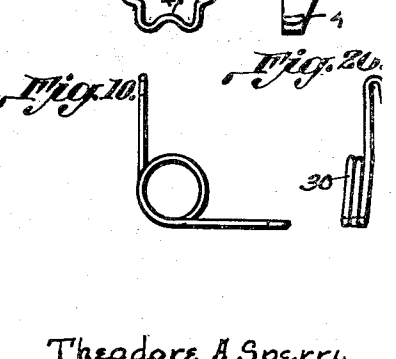
T. A. SPERRY

2,055,183

ELECTRIC CIRCUIT BREAKER

Filed March 25, 1933

2 Sheets-Sheet 1



Theodore A Sperry,
INVENTOR,
T. A. Sperry
Attorney.

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2 Sheets-Sheet 2

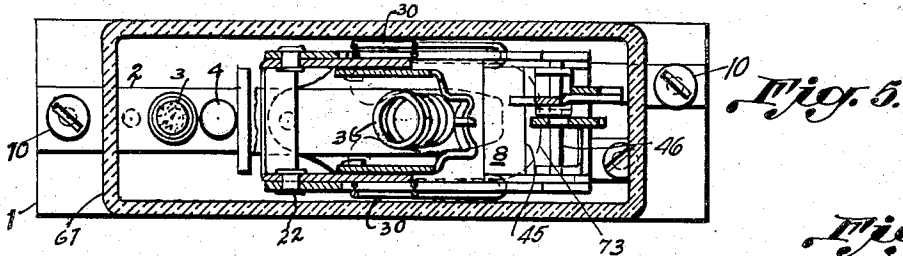
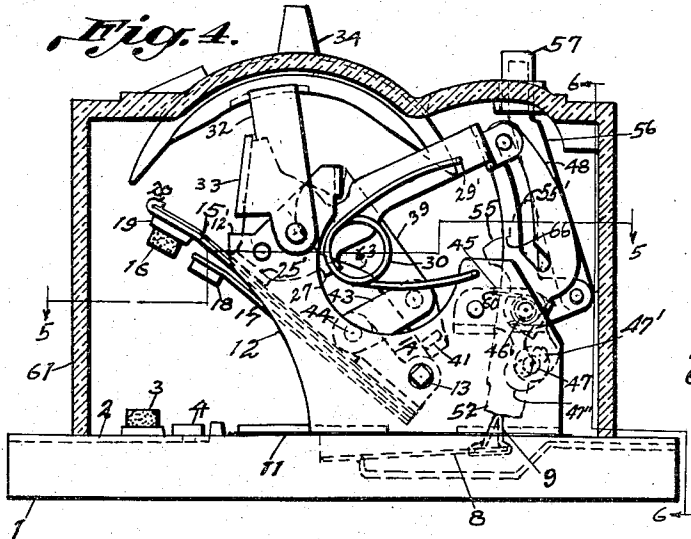
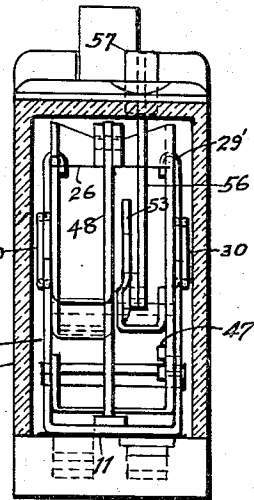


Fig. 12 Fig. 16.

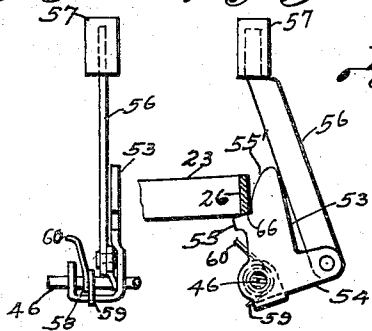


Fig. 11. Fig. 21.

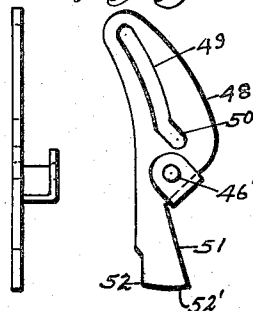
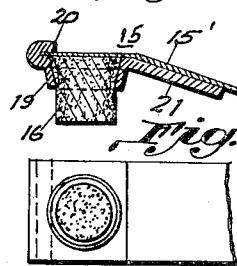
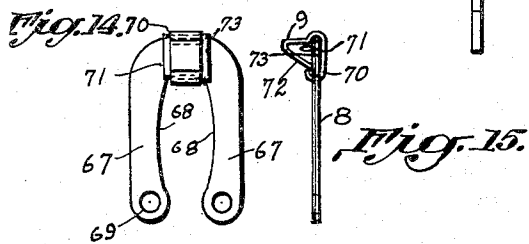


Fig. 22.



Theodore A. Sperry.
Inventor.
J. A. Sperry.
Attorney.

UNITED STATES PATENT OFFICE

2,055,183

ELECTRIC CIRCUIT BREAKER

Theodore A. Sperry, Indianapolis, Ind., assignor
to Electric Devices Corporation, Indianapolis,
Ind., a corporation of Indiana

Application March 25, 1933, Serial No. 662,792

19 Claims. (Cl. 200—116)

The invention relates in general to devices for automatically and for optionally opening and controlling electric circuits, and has for a primary object to provide a device which will function either as a manually controlled switch or as an automatic circuit breaker under imposition of excessive current conditions. Other objects are to provide circuit breaking means in which the automatic action is entirely independent of the manually controlling means; to provide circuit breaking means which are positively and mechanically forced to open circuit position when the device is released by the current under abnormal current conditions; to provide circuit breaking means for overload and short circuit conditions which are independent of and separate from the normal circuit breaking means; to provide means within a circuit breaker to automatically and instantly open the circuit breaking contacts in case of failure of the normal operating means of said breaker; to provide circuit opening means the sole function of which is to open the current contacts in case of overload or short circuit conditions within the breaker; to provide a circuit breaker having a dual, independently operated control system; to provide inexpensive means within a circuit breaker to automatically shield and protect the main current carrying contacts from arcing and destructive influences during the making and breaking of the current through said contacts; to provide overload operating means which will automatically open the current contacts before the manual operating handle starts toward its off or open circuit position; to provide means whereby the contacts will open with a wider gap when opened automatically than when opened manually; and to provide a circuit breaker of simple, rugged construction with easy manufacturing facilities and installation means.

With these and other objects in view, the accompanying drawings illustrate a preferred form of the device, wherein Figure 1 is a side elevation in closed circuit position, the cover being shown in section; Figure 2 is a similar elevation, in manually opened open circuit position, the cover and base being shown in section; Figure 3 is a sectional end elevation on line 3—3 of Fig. 1; Figure 4 is the same view as Fig. 1 in automatically opened open circuit position; Figure 5 is a plan view on line 5—5 of Fig. 4; and Figure 6 is an end elevation on line 6—6 of Fig. 4. Figures 7 and 17 are side and end elevations of the breaker housing; Figures 8 and 18 are side and plan views of the release arm; Figures 9 and 19 are front

and side elevations of the upper toggle link; Figures 10 and 20 are two views of the release arm spring; Figures 11 and 21 are front and side elevations of the trip lever; Figures 12 and 16 are fragmentary assemblies of the indicator means; Figures 13 and 22 are plan and sectional side views of the carbon holder means; and Figures 14 and 15 are front and side views of the thermal element. It is manifest that these views are subject to modification in form and arrangement to cover such alternative forms of construction as logically come within the scope of the appended claims.

With further reference to these drawings, in which like numerals refer to like parts throughout, the numeral 1 indicates a base of insulating material, this base carrying a metallic conductor 2 supporting a non-metallic stationary contact 3 and a stationary metallic contact 4. A dual recess or chamber 5 is formed within said base to receive a pair of current conductors 6 and 7 and a warping, current actuated thermal element 8 in series therewith, said element being positioned wholly within said recess, and having an insulated trip catch 9 at its central transverse portion, the conductors 2 and 7 each having means, as by screws 10, to attach the breaker in operative connection in the circuit. A breaker housing or frame 12 is mounted on base 1 above recess 5, an insulation sheet 11 being positioned therebetween, said housing carrying a bracket 13, pivotally mounted as at 13, upon which is secured an arcuately movable contact member 15 consisting of a spring blade 15' and a contact carrying blade 21 which is preferably perforately embossed, as at 19, to receive a shaped carbon contact 16, said carbon being maintained therein by the blade 15' which is fixedly held by the inverted end 20 of the blade 21, the said carbon registering, when in closed position, with the contact 3. A supplementary blade 17 carries a metallic contact 18 which registers, when in closed position, with the contact 4. A releasable overarm 23, pivotally mounted on housing 12, as at 22, has plural side arms 23' which are integrally secured by a cross member 25 and are inwardly bent at their opposite ends 26 to carry a pin 24. The members 23' each carry a toggle actuating strike 27 and a resetting projection 28. A coiled spring 30 is pivotally mounted on the housing 12, as at 29, and also on the overarm 23, as at 29', to pivotally actuate said overarm, a pair of said springs being preferably employed. A manually operable handle 32 is pivotally mounted, as at 31, on the housing 12, and carries a plurality of lateral

wings or strikes 33 to operatively engage the projections 26 to reset said overarm 23 after overload operation of said device. A finger knob 34, having lateral wings 35, is secured upon said handle, and an operative helical spring 36 pivotally connects said handle to the cross bar 41 of a toggle linkage yoke 39 which is supported, as by the notch 40, upon a plurality of formed lateral wings 37 each provided with pivotal notches 38. Pivotaly connected to said yoke 39, as at 42, are a plurality of link members 43 which are pivotally connected, as at 44, to the bracket 14, said yoke and said links forming a multiple link toggle inter-connecting said contact member 15, handle 32, and overarm 23. An adjustable bracket 45, carrying a cross shaft 46, is pivotally mounted in housing 12 as by rivets 45' to permit a limited arcuate adjustment for the purpose of slightly raising or lowering the position of shaft 46 with relation to the catch 9 on thermal element 3, and may be secured in adjusted or calibrated position, as by screw 47 positioned within an arcuate slot 47' in a projecting wing 47'' of said bracket 45, said shaft supporting a trip lever 48, pivotally mounted as at 46', said lever being provided with an arcuate slot 49 having an angularly positioned offset portion 50 to receive and coact with the pin 24 in the overarm 23, said lever being provided with a depending leg 51 terminating in an arcuate sector 52' and a strike 52 to engage the catch 9 when said breaker is in operative position. Pivotaly mounted on shaft 46 is an arcuately movable member 53 having an arm 54 to which may be pivotally secured an indicator or flag bar 56 carrying an insulating button or knob 57, a shoulder or stop 55 being provided on the member 53 to engage and coact with the bent extremities 26 of the overarm 23, a spring 58 engaging the member 53 as at 59 and secured to bracket 45, as at 60, serving to stress said member toward said extremities 26, a wing 55' being provided to insure desired engagement of said stop 55 with said overarm members 26. An insulating cover 61, having suitable ventilating openings 62, is provided to cover and protect said breaker, and may be secured upon said base in any desired manner. The knob 34 and the button 57 operatively project through provided openings in said cover. A shoulder 12' is formed on housing 12 to engage with the wing 33 to limit the travel of handle 32, and a flexible conductor 64 and screw 65 are employed to connect the contact member 15 with the conductor 6. An angularly disposed cam face 63 is formed on yoke 39 to coact with strikes or stops 27 to quickly and completely flex the toggle linkage on overload operation of the device.

It will be observed that the present application is more or less closely related to applicant's co-pending application, Serial No. 582,716, filed Dec. 23, 1931, and should be considered therewith. In the present application with the breaker in closed circuit position the current enters through conductor 2 and passes through contacts 4 and 18 (or 3 and 16), arms 17 and 21, cable 64, conductor 6, thermal element 3, and out through conductor 7. In manual operation, a clockwise rotation of the handle 32 carries the spring 36 past the toggle pivots 38 when the tension of said spring causes the flexing or collapse of the toggle linkage 39 and 43, and produces an arcuate opening, with a snap action, of the contacts 18 and 16. A reverse movement of the handle closes said contacts also with a snap action. The toggle yoke 39 is pivoted and operates

upon the housing pivots 38, and is checked in its closing movement by the stops 27 on overarm 23 which engage said yoke in operative relation to the cam faces 63 thereon. The yoke 39 is extended materially beyond the knee joint 42 thereof and has an integrally formed crossbar 41 to which one end of spring 36 is secured. It should be observed that the stops 27 are so positioned that the median axes of the toggle links 39 and 43 are never allowed to come into or assume a rectilinear alignment one with another, but continually remain in a flexed or angular relationship with the knee joint tending toward collapsed position, being held in said position by the angularity of stress of said main spring on the extended cross-bar 41 of said toggle. The flexing of the contact blades, 15', 17 and 21, tend to exert an opening pressure on the toggle knee through the link 43, and as the main spring axis approaches the pivot point 38, this pressure is sufficient to further flex said knee joint and cause the collapse of said toggle before the main spring passes over said pivot, and causing said spring to be not classed as of the "overcenter" type. It will be noted, too, that the relative flexure of the blades 15' and 21, as compared to that of blade 17, causes the metallic contact 18 to separate from contact 4 before the carbon contacts 3 and 16 separate, and to re-close in inverse order.

Under automatic operation, due to overload or short circuit conditions within the breaker, the warping element 8 flexes downward and releases the strike 52 of trip lever 48 allowing the lever to swing arcuately to release pin 24 from the offset portion 50 of slot 49, when the overarm 23 is forced arcuately upward under the action of springs 30. The toggle links 39 and 43 are constantly in partially flexed position, and as overarm 23 swings arcuately under impulsion of springs 30, the strikes 27, moving arcuately with said overarm, engage and traverse the cam faces 63 and instantly and positively force the toggle linkage into fully collapsed position, whether the handle 32 is held or free, and opening the contacts with a positive and instant action.

As the overarm 23 moves upward, the transverse portion 26 moves out of engagement with the stop 55 of the member 53, and allows this member to rock forward under action of spring 53 to carry the indicator button 57 upward through the cover 61, and as the portion 26 returns to normal reset position it comes in contact with the upper edge of stop 55, as at 66, which prevents a complete reset of the overarm until the button 57 is manually depressed, rocking the member 53 backward to allow complete reset of said overarm to retain said button in said depressed position. The bracket 45 provides definite means for adjustment and calibration of the trip lever, and for securing said lever in said calibrated position, and the embedding of the thermal element in the base securely protects it from accidental or intentional injury or manipulation, and places it where it is largely free from external ambient temperature conditions and fluctuations. It is also evident that the movement of the cross-bar 25 under overload operation will allow said contacts to open with a wider gap under overload operation than under manual operation, as readily shown at 25'. It is also evident that with the breaker automatically opened, as in Fig. 4, the contact member 15 will be held fixedly, or locked, in open circuit position by the action of the springs 30 on the arms 23 maintaining the stops 27 in opposition to move-

ment of the yoke or link 39 so said contacts cannot be forced or sprung to closed or contact position until the release arm 23 is returned toward its normal or reset position. It should be noted, too, that the pin 24, carried by lever 23, remains constantly within the slot 49 of the trip lever 48 and so controls the movement and action of this lever at all times. The offset portion 50 of slot 49 is positioned angularly to the slot 49 and to the motion of pin 24, this angular position serving both to restrain lever 23 in closed circuit position, and to reduce the horizontal component of the pressure of springs 30 to an operative minimum as the strike 52 rests in contact with catch 9 of the thermal element 8, and also serves as a means whereby pin 24 resets the trip lever and strike in operative position after automatic operation of said circuit breaker device.

The thermal element 8 is preferably of U-shape, having a pair of parallel arms 67 the inner edge of each of which is formed, as by an arc of a circle or other desired conformation, to produce a narrowed or restricted cross-section 68 at or near the middle portion of the arms 67 so that these arms gradually taper each way toward this central portion from the extremities 69 and from the cross portion 73 of said U-shape. A suitable clamp 70 is secured upon the cross portion 73 but insulated therefrom by the insulation 71, and carries the trip catch 9 to which may be formed the truss brace 72 to support this catch in set position against any pressure of the strike 52. The element 8 is bimetallic in character, and is mounted, as by the extremities 69, in electric series with the current through the breaker, warping laterally under the heat engendered therein by said current and drawing the catch 9 out of engagement with the strike 52 upon the passage of an excess of current through said element.

In operation, it will be observed, the current enters from the desired source through the conductor 2 and the contacts 3 and 4, and passes through the contacts 16 and 18, blades 17 and 15', flexible cable 64, conductor 6, thermal element 8, and out through the conductor 7. With the breaker in operative position, the pin 24 is restrained within the offset slot 50, with the strike 52 in engagement with the catch 9. A manual movement of handle 34 in clock-wise direction carries the central axis of spring 36 nearly into alignment with the pivot point 38, essentially eliminating temporarily the horizontal component of lateral pressure of said spring, when the flexing action of the blades 15', 17 and 21 acting on the dis-aligned link 43 start an opening or collapsing movement of the toggle links, and further movement of spring 36 completes the collapse of said toggle linkage and the opening of the contacts with a snap action. On overload or short-circuit conditions of current, however, with the breaker in operative position, the warping of element 8 releases the catch 9 from strike 52, allowing lever 48 to rotate under pressure of the springs 30 which force the release lever 23 arcuately upward and simultaneously rotate the strikes or stops 27 into sliding action on the beveled cams 63, mechanically forcing the operative rotation of the link 39 upon its pivot 38 to open said contacts with a positive and essentially instantaneous action. The wings 33 of handle 32, engaging the projections 28 of release arm 23, upon manual operation of the knob 34 in clock-wise rotation, will reposition the member 23 and the lever 48 so the contacts may again be closed

manually by a reverse movement of said knob. The device is trip free of the handle and non-holdable against load.

I claim as new:—

1. In a circuit breaker having fixed and movable contacts to open and close the circuit through said breaker, a housing carrying a toggle linkage and an arcuately movable release arm, an operative spring for said toggle linkage, a movable stop for said toggle linkage integral with said release arm, an auxiliary spring to move said movable stop to flex said toggle to open said contacts with a wider gap when operated by said auxiliary spring than when opened manually under normal current conditions.

2. A circuit breaker having a housing carrying a movable contact member, a releasable lever pivoted within said housing, a trip lever engaging said releasable lever, a spring secured upon said releasable lever constantly stressing said lever to open circuit position, and thermal means for releasably retaining said trip lever in engagement with said releasable lever, said releasable lever carrying a strike for retaining said movable contact member in non-closable open circuit position after overload operation until said release lever is returned toward re-engagement with said trip lever.

3. An electric switch and circuit breaker having a housing pivotally supporting a releasable lever, a spring pivotally engaging said lever and said housing to stress said lever to released position, a trip lever normally retaining said releasable lever in closed circuit position, a movable stop rigid with said releasable lever, a movable contact pivoted within said housing, said stop forcing said contact to open circuit position on actuation of said releasable lever and maintaining said contact in open circuit position against an external force until said releasable lever is returned toward its normal reset position.

4. In a circuit breaker and switch having an operating handle and a movable contact, an operating spring interconnecting said handle and said contact to actuate said contact under normal current conditions, a pivotal release lever carrying an arcuately movable stop, and a differently positioned stressing means to actuate said release lever to independently force said contact to open circuit position on an abnormal condition of current within said breaker.

5. In an electric switch mechanism having a pivoted operating handle, an operative spring carried by said handle, a housing, a toggle linkage pivoted on said housing, said operative spring flexing said toggle upon manual operation of said handle, and means separate from said spring for flexing said toggle upon abnormal conditions of current through said device though said handle and said operative spring be restrained from their operative function.

6. A switch mechanism in which the main operative spring is operatively attached to a manually operable handle, a housing pivotally supporting a toggle linkage, said spring interconnecting said linkage and said handle to open and to close a movable current carrying contact, a release arm mounted on said housing, an independent spring supported on said release arm and on said housing to automatically actuate said linkage and move said contact to open circuit position on abnormal current conditions, and means to return said release arm to normal operative position.

7. A circuit breaker having stationary and movable contacts, a housing with parallel side walls, inwardly projecting ears rigid with said side walls, a multiple link toggle pivotally engaging said ears, a releasable lever pivoted upon said side walls, said lever being provided with stops to engage said toggle adjacent its knee joint to prevent the links of said toggle from assuming a rectilinear alignment, an operative spring engaging said toggle to maintain said links in closed contact position, and independently stressed cam actuated means to collapse said toggle and open said contacts with the passage of an abnormal current through said breaker.

8. In an electrical device having a housing carrying a manually operable handle, a toggle linkage pivotally mounted on said housing, an operative spring operatively connecting said handle and said toggle, an overarm pivoted upon said housing and carrying an arcuately movable stop for said toggle, said stop preventing the links forming said toggle from ever assuming a rectilinear alignment, a flexibly mounted movable contact arm, said arm when in closed circuit position stressing said toggle toward open circuit position and causing said toggle to flex and move said contact before said operative spring passes over said toggle linkage pivot point upon manual operation of said handle, and independent automatic means for moving said contact under abnormal conditions of current within said device.

9. A thermally controlled circuit breaker having a stationary contact and a flexibly supported movable contact, a housing supporting an operating handle and an arcuately movable release member, a toggle linkage pivotally supported upon said housing adjacent said handle, an operating spring connecting said handle and said toggle linkage, said spring opening and closing said contacts under operation of said handle, an independent actuating means engaging said release member to stress said member constantly toward open circuit position, a cam operated lever to normally engage and restrain said release member, a current actuated means releasably restraining said cam operated lever, said release member automatically forcing said movable contact to open circuit position independently of said operating spring on release on said cam operated lever by said current actuated means, and means associated with said release member to manually return said member and said cam operated lever to reset position.

10. An automatic circuit breaker having a multiple link toggle one end of one link of which is pivotally mounted on a stationary housing, and one end of the other link of said toggle pivotally actuates a movable current carrying arm, a formed cam rigid with said first mentioned link, a lever arm pivotally mounted on said housing, a plurality of lateral projections rigid with said lever arm to coact with said cam to restrain said toggle linkage in closed circuit position and to operatively force said toggle linkage and said contact arm into open circuit position when said lever arm is released on overload conditions of current within said breaker.

11. A circuit breaker having a stationary and a movable contact member, a housing having a plurality of pivotal projections rigid thereon, a toggle linkage engaging said projections and said movable contact member, cam means rigid with one of said toggle links, a lever pivotally mounted on said housing, stop lugs rigid with

said lever to engage said toggle link cam means, a manually operable handle secured upon said housing, inwardly projecting wings on said handle to engage corresponding resetting cams on said lever, an operating spring secured upon said handle and to said movable contact member, an auxiliary spring pivotally engaging said housing and said lever to continually stress said lever to open circuit position, and to move said lever to open circuit position independently of said operating spring when said lever is released upon abnormal current conditions, said stop lugs coacting with said toggle link cams simultaneously forcing said toggle and said movable contact to full open circuit position, and means for repositioning said toggle links and said lever.

12. In a circuit breaker having fixed and movable contacts, a housing carrying a manually operable handle, a releasable overarm, a current releasable trip lever to normally retain said overarm in set position, means for producing automatic operation of said breaker upon abnormal conditions of current within said breaker, an indicator member to indicate automatic as distinguished from manual operation of said device, and means associated with said indicator member to prevent the full return of said overarm to set position until said indicator member has been returned to non-indicating position.

13. In a circuit breaker having a flexible current actuated member, a trip lever releasably restrained by said current actuated member, an overload operative member releasably maintained in set position by said trip lever, an arcuate slot in said trip lever to coact constantly with a pin in said overload member, an angularly positioned offset portion in said slot to reduce the horizontal component of pressure of said trip lever against said current actuated member to an operative minimum, an overload release indicating member coactable with an arcuately movable stop member to prevent the full resetting movement of said overload operative member until said release indicating member has been returned to non-indicating position, and means for independently stressing said overload member constantly toward its current released position.

14. A circuit breaker having fixed and movable current carrying contacts, said fixed contact consisting of a metallic contact member and a non-metallic contact member, and said movable contacts consisting of essentially similar plural contact members, said metallic members registering together and said non-metallic members registering together when in closed circuit position, said metallic members opening before and closing subsequent to said non-metallic members, said non-metallic members being supported in operative position by a cone-shaped base under wedging action, manual means and a current actuated means for separating said contacts with a snap action, indicator means released by said current actuated means to distinguish current actuated operation of said breaker from manual operation thereof, and means connected with said indicator means to prevent complete resetting of said breaker in operative condition until said indicator means has been restored to non-indicating position, essentially as described.

15. In a circuit breaker having fixed and movable contacts, a housing carrying a fixed pivot for a toggle linkage, a toggle link to engage said fixed pivot, an inclined cam face rigid with said link, a release arm carried by said housing, said arm having a rigid stop thereon to engage said

cam face, current actuated means to release said release arm upon abnormal conditions of current within said breaker, means stressing said arm toward open circuit position to force said toggle linkage to open circuit position, said stop engaging said cam face continually during the automatic release operation of said breaker.

16. A current operated control element for an electric circuit breaker comprising a bimetallic member of essentially U-shape through which the current passes from end to end, said member being mounted adjacent the extremities of said U-shape in series with the current through said breaker, the parallel side members of said U-shape member each having its inner edge formed to a curvilinear line which is essentially symmetrical to a transverse axis at right-angles to said parallel side members adjacent the central portion thereof, said side members tapering from either side of said central portion toward said central portion, and a strike member rigidly and insulatedly clamped upon the mid-portion of said U-shape between said side members, said strike member having an integrally formed projecting element supported adjacent its outer end by an inclined brace connected with said strike member.

17. A current operated release element for an electric circuit breaker consisting of a bimetallic member of essentially U-shape secured adjacent its extremities in series with the current con-

ductors within said breaker, the side member of said U-shape member each tapering in approximate symmetry toward a transverse axis at right-angles to said side members adjacent their central portion, said side members flexing to a greater degree, under the influence of the thermal action of an electric current through said member, adjacent their central portion than adjacent either extremity of said side member, and more resistant to flexing action adjacent either extremity thereof than adjacent the central portion thereof, and an insulated catch secured upon the transverse mid-portion of said U-shape member.

18. In a circuit breaker having a movable contact, a primary stressing means actuating said contact under manual operation only of said breaker, a housing carrying a releasable arm, a stop member movable with said releasable arm, a secondary stressing means engaging said housing and said releasable arm to actuate said stop member upon abnormal current conditions only within said breaker to positively force said contact to open circuit position independently of action of said primary stressing means.

19. A circuit breaker as described in claim 18 in which the movable contact is opened to a greater degree when operated by overload conditions than when manually opened.

THEODORE A. SPERRY.