July 10, 1934. T. A. SPERRY ET AL 1,966,051

CIRCUIT BREAKER

Filed Nov. 29, 1932 2 Sheets-Sheet 1

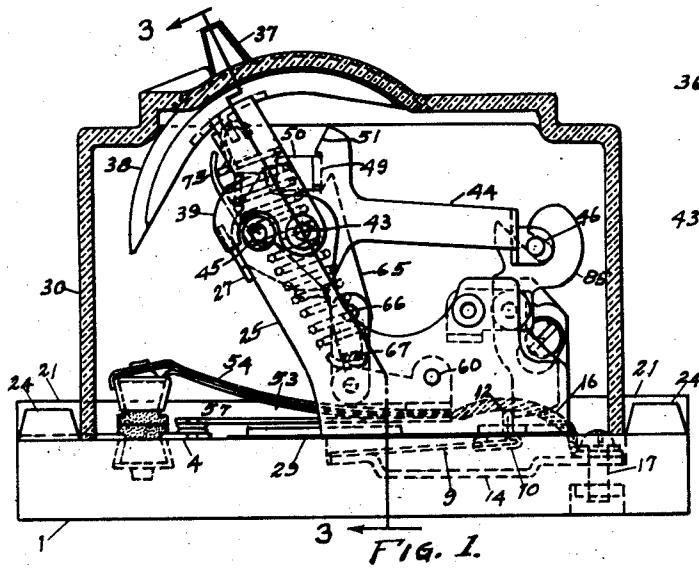


FIG. 1.

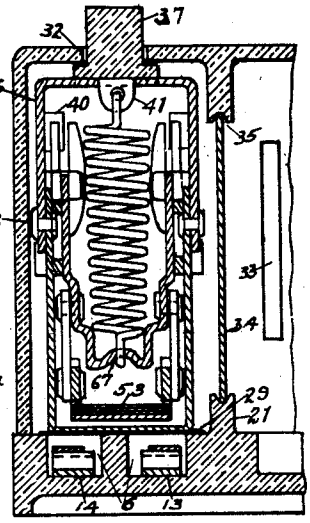


FIG. 3.

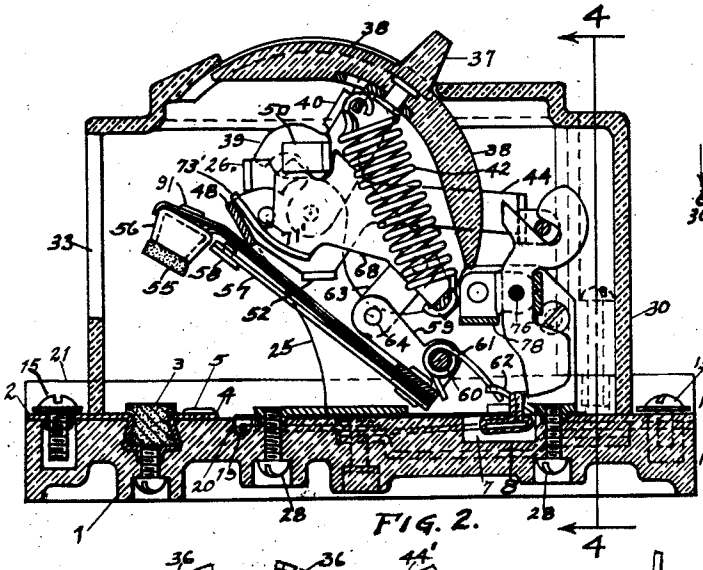


FIG. 2.

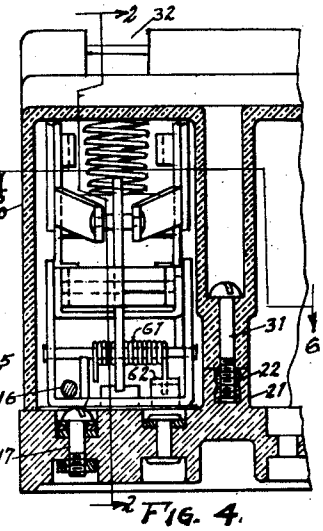


FIG. 4.

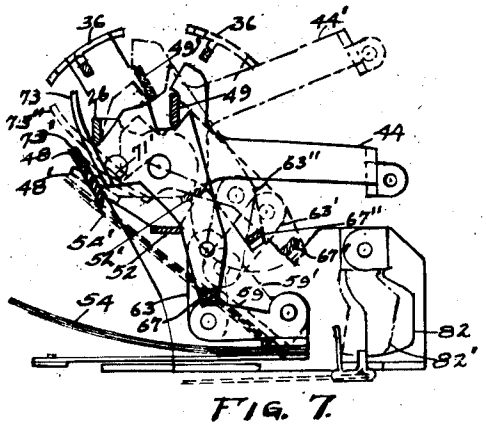


FIG. 7.

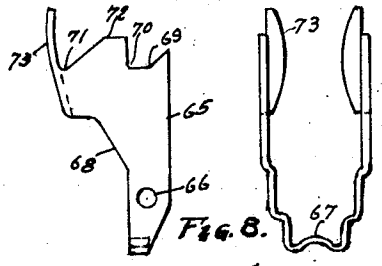


FIG. 8.

Theodore A. Sperry,
Richard C. Sperry,
Inventors.
By J. A. Sperry,
Attorney.

July 10, 1934. T. A. SPERRY ET AL 1,966,051

CIRCUIT BREAKER

Filed Nov. 29, 1932 2 Sheets-Sheet 2

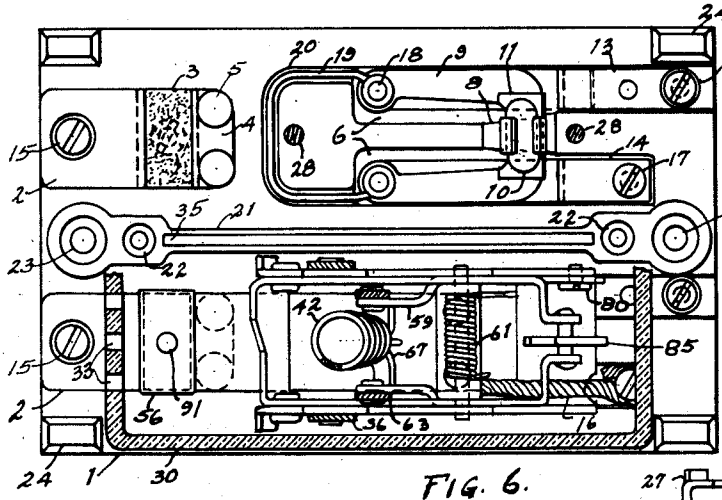


FIG. 6.

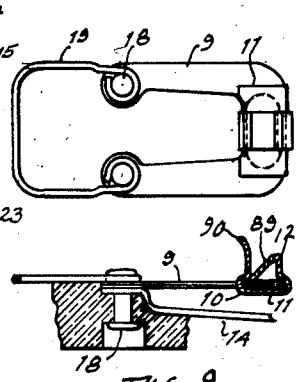


FIG. 9.

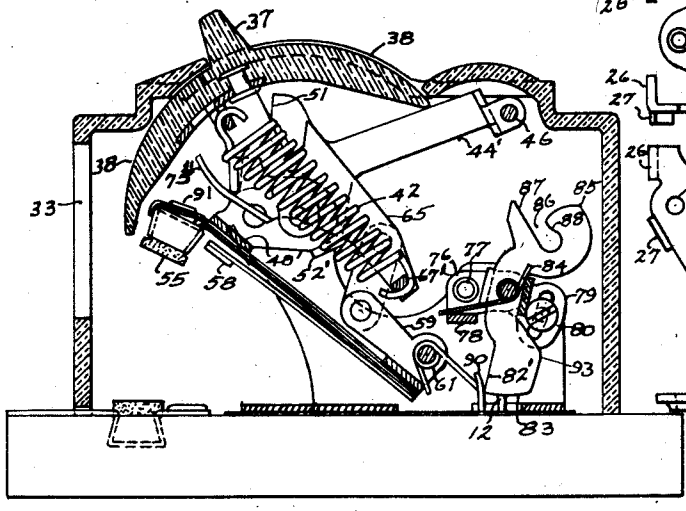


FIG. 5.

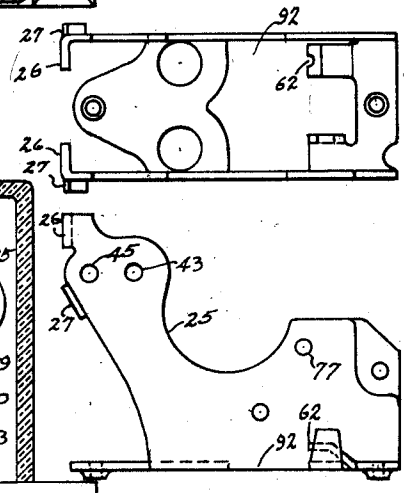
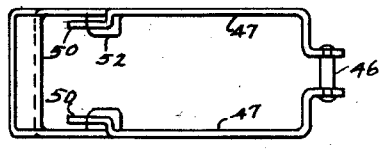


FIG. 10.



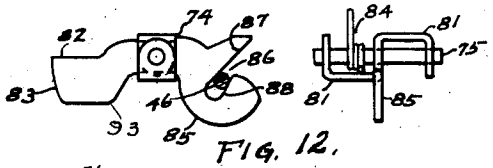


FIG. 12.

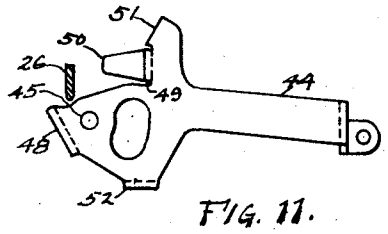


FIG. 11.

Theodore A. Sperry,
Richard C. Sperry,
Inventors.
By J. A. Sperry,
Attorney.

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UNITED STATES PATENT OFFICE

1,966,051

CIRCUIT BREAKER

Theodore A. Sperry and Richard C. Sperry, Indianapolis, Ind., assignors to Electric Devices Corporation, Indianapolis, Ind., a corporation of Indiana

Application November 29, 1932, Serial No. 644,908

44 Claims. (Cl. 200—116)

Our invention relates in general to devices for automatically and for optionally opening and controlling electric circuits, and has for primary objects the provision of a device which will function either automatically as a circuit breaker under imposition of excessive current conditions, or manually as a switch under normal current conditions; to provide automatic circuit breaking means in which the automatic action is entirely independent of the manually controlling means; to provide circuit breaking means in which the circuit breaking contacts are mechanically and positively forced to open circuit position when the device is subjected to excessive or abnormal current conditions; to provide a circuit breaker in which the circuit breaking means for overload and short-circuit current conditions are independent of and separate from the normal circuit breaking means; to provide means within a circuit breaker for automatically and instantly opening 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 contact 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 means within a circuit breaker to automatically shield and protect the main current carrying contacts from arcing and destructive influences during the making and the 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 to move towards its off position; to provide means whereby the current contacts will open with a wider opening or gap when operated under overload or automatic conditions than when they are manually operated; to provide a circuit breaker which will open the contacts more quickly under overload conditions than under manual operation; to provide an automatic circuit breaker in which the current responsive means is protected and shielded from manual manipulation or from accidental injury; to provide supplementary means for shielding and protecting the current responsive element from destruction or injury due to excessive or abnormal current conditions within the element; and to provide a breaker of simple, rugged construction with easy manufacturing means and installation facilities.

With these and other objects in view, the invention will be more adequately comprehended by reference to the accompanying drawings, illustrating a preferred form of the construction, and in which Figure 1 shows a side elevation of the breaker in closed position, a portion of the cover being removed; Figure 2 is a side elevation, in section approximately on line 2—2 of Figure 4, the breaker being shown in open circuit position; Figure 3 is a fragmentary end elevation approximately on line 3—3 of Figure 1; Figure 4 is an end elevation on line 4—4 of Figure 2; Figure 5 is an elevation similar to Figure 3, the breaker being shown after automatic operation with the handle restrained from returning to normal position; Figure 6 is a plan view of a dual unit, one breaker being shown in section on line 6—6 of Figure 4, and the other being removed from the base; Figure 7 is a diagrammatic elevation showing the operating parts superimposed in the three positions of Figures 1, 2 and 5; Figure 8 is a side and front elevation of the toggle yoke; Figure 9 is a plan and side elevation of an assembled thermal element and associated parts showing a modified form of the trip catch; Figure 10 is a plan and side elevation of the breaker housing; Figure 11 is a plan, side and end elevation of the automatic release lever; and Figure 12 is a plan and side elevation of the trip lever for the device. It is, of course, understood and manifest that these views and this construction are subject to modification in form and arrangement to cover such forms and constructions as logically come within the scope of this specification and its appended claims.

With continued reference to the drawings, in which like numerals refer to like parts throughout, the numeral 1 indicates a base of insulating material, carrying an entrance electric conductor 2 which holds an embedded carbon contact 3 and is provided with a contact wing 4 and a plurality of contact buttons 5. A recess 6, having a cross slot 7 and a bridge 8, is formed in the base 1 to receive the thermal element 9 on which is fixedly mounted a trip catch 10 which is insulated therefrom, as by the insulation 11, said catch being provided with a strike projection 12, which projection may have a truss brace, as at 89, and a trip lever stop 90, if desired. A pair of conductor bars 13 and 14 are secured within the base recess, one of which contacts with each extremity of the thermal element 9. Terminal screws 15 are provided to contact with the current connectors, and a screw 17 secures one end of a flexible conductor 16 to the conductor 14, the opposite end of said flexible conductor being secured to the movable contact arms 53. A formed groove 20 in the base 1 communicates with the recess 6, and carries an electric shunt member 19, the extremities of which are secured, as by rivets 18, to the fixed extremities of the U-shaped bimetallic element 9. A center rib 21 is provided to partially separate the two breakers on the twin base, these ribs being provided with threaded inserts 22 to receive screws 31 which secure the cover 30 to the base 1, holes 23 serving for screws by which the breakers may be mounted within their oper-

ating cabinet, and corner bosses 24 being provided to partially shield the terminal screws 15.

A housing 25 is secured upon the base 1, as by screws 28, and an insulating sheet 29 is provided to separate said housing from possible contact with said base members, said housing having a plurality of formed pivots 26 and also of formed stop members 27 to engage the release lever 44 and handle member 36 respectively. The cover 30 is provided with a plurality of openings 32 to receive the handle knobs 37, and also with breather slots 33 to provide expansion and escape room for burnt gases and heat caused by the arcing of the current when broken. Suitable slots 35 are formed within the cover to secure a partition 34 between the breakers when mounted on a single base. The knob 37 is provided with lateral wings 38 to continually close the openings 32, and plural strikes 39 are formed integrally with the handle 36 to engage the housing stops 27. An eye 41 is formed on the handle 36 to carry one extremity of a main operating spring 42, and a plurality of lateral wings 40 are provided to contact with formed cam strikes 51 on the release lever 44, said handle and said release lever being pivoted upon said housing, as at 43 and 45 respectively 43' and 45' indicating openings for the pivot pins at 43 and 45 respectively. The side bars 47 of the lever 44 are interconnected by a cross bar 48, and carry a fixed trip pin 46 at their outer extremities, and each side bar carries spaced pivots 49 and wings 50, and also stop strikes 52 to engage and co-act with a toggle yoke member 65.

The moveable contact arm 53 consists essentially of a plurality of spring arms or leaves 54 carrying a carbon contact 55 within a holder 56, and a plural fingered arm 57 provided with contact buttons 58 to contact with the buttons 5 on the wing 4. These leaves are preferably mounted upon a toggle plate 59 pivotally mounted on a cross shaft 60 supported in the housing 25, said shaft preferably carrying a supplementary spring 61, one end of which engages a stop 62 integral with the housing 25, and the opposite end rests upon the toggle plate 59. Toggle links 63 are pivotally secured to the toggle plate 59, as by rivets 64, and to the toggle yoke 65, as by rivets 66 through the pivot openings 66'. The side bars of the yoke 65 are inter-connected by a cross bar 67 formed for a seat for one end of the operating spring 42, and carry formed cam faces 68 to co-act with the strikes 52 on the lever 44. The side bars of yoke 65 each carry a pivotal seat 69 to engage with the pivot 49 on lever 44 and a pivotal seat 71 to engage with pivot 26 on housing 25, the pivotal seat 69 being made dual in form to provide a supplementary seat 70 to receive the pivot 49 when in overload released position, a center wing 72 existing between the seats 70 and 71 to engage the wings 50 on lever 44, a plurality of yoke horns 73 insuring correct realignment of seats and pivots during operation movements.

Pivotally mounted in the housing 25 is an adjusting bracket 76, secured as by rivets 77, having a cross member 78 and an arcuately slotted wing 79, with a clamp screw 80 to secure said bracket in adjusted position, said bracket carrying a cross shaft 75 to pivotally support a trip lever 74. Lever 74 consists essentially of a depending member 93 having an arcuately formed extremity 83 and a strike 82 to engage the projection 12 on element 9, and an uwpardly projecting member 85 carrying a formed slot 86 to co-act with the trip pin 46 on lever 44, said slot being formed with a resetting cam face 87 having a relatively steep angle of engagement with the line of movement of said pin 46, and a retaining cam face 88 having a relatively flat angle of engagement with said line of movement of said pin, a pair of lateral wings 81 serving to maintain said trip in proper alignment, and a spring 84 maintaining said trip in re-engagement position when released from said trip strike. 91 indicates a carbon holder rivet, and 92 shows an opening in the bottom of housing 25.

It will be observed that the present application is more or less closely related to the pending application of Theodore A. Sperry, Serial No. 582,716, filed December 23, 1931, and is to be construed in connection with the said application. In operation, the current enters through conductor 2 and passes through the contacts 5—58 or through the carbons 3—55, through the spring arms 53, flexible cable 16, conductor 14, thermal element 9, conductor 13, and out through terminal screw 15. With the contacts in closed position, a manual movement of the knob 37 in clockwise rotation will carry the upper end of spring 42 to the right, past the plane of the pivots 43 when the contractive stress of spring 42 combined with the effect of the flexed arm 54 and spring 61 will cause the cross bar 67 of yoke 65 to swing to the right, and move the arm 53 to open circuit position with a snap action. It will be noted that in this action the release lever 44 remains stationary, and that the toggle yoke 65 swings pivotally on shoulders 49 in engagement with the seats 69, and that the seat 71 rotates arcuately away from its pivot shoulder 26. A reverse motion of the handle 36 carries the upper end of spring 42 to the left, causing said spring to swing the yoke 65 to the left on the same pivots 69 and 49, closing the contacts with a snap action. In case of an excessive rush of current through the breaker the current heats the thermal element 9, and by reason of its bimetallic character causes the element to deflect downwardly and draw the catch 12 away from the strike 82 releasing the trip lever 74 to permit the pin 46 to escape from the slot 86. The release lever 44 is now free to rotate about its pivots 45 and the stress of spring 42 is instantly shifted from the seat 69 and pivot 49 to the seat 71 and the stationary pivot 26 on the housing 25. This pivot and seat are positioned on the opposite side of the line of stress of the spring 42 from pivot 49 and seat 69, and are closely adjacent the pivot point 45 of lever 44, so that the stress of said spring tends to instantly swing the yoke 65 pivotally about its pivot seat 71 and the housing pivot 26, whether the handle 36 be restrained from rotative action or not, causing the yoke seat 69 co-acting with its pivot 49, to carry the lever 44 rotatively upward, as shown in Figure 5, and opening the contact member 53 with a rapid snap action. It should also be noted that the cross bar 48 of lever 44 serves as a stop for the opening movement of the contact arm 53, and as the lever 44 rotates toward its fully released position 44' the cross bar 48 rotates toward the position 48' in essential parallelism to the open position 54' of the contact arm 53, thus allowing the contact arm and its attached contact members 55 and 58 to move further, or to open with a wider gap, than when the cross bar 48 is in normal position, as shown in Figures 5 and 7. As the spring 42 stresses the handle 36 and knob 37 to clock-wise rotation the wings 40 contact with cam faces 51 return-

ing the lever 44 to its normal or re-set position, and in so doing causes the pivot 49 to move from its elevated position 49′ to its normal position, and to move the yoke member 65 in an essentially longitudinal motion, as shown by the superimposed positions 67″ and 67′ of the cross bar 67, and 63″ and 63′ of link 63 in Figure 7. This action also carries the pivot seat 71 from its contact with pivot 26 to the position 71′ free from said pivot, and carries the locating horns from the position 73″ to position 73′, and the pin 46, engaging the steep-angled face 87 of the slot 86, caused the trip strike 82 to rotate arcuately into re-engagement with the catch 12. It should also be observed that the pressure of pin 46 on cam face 87 maintains the strike 82 free and separated from the projection 12 while the breaker is in open circuit position, so that no pressure exists on the element 9 except while the device is in closed or operative position. These resetting actions are all automatic when the breaker is free to act normally, a single motion of the knob 37 only being required to reset the breaker after operation.

The strike or stop 52 which limits the contact closing movement of the yoke 65 is formed integrally with the lever 44, said strike normally engaging said yoke adjacent the foot of the cam face 68. As the lever 44 rotates under overload release action this strike rotates therewith toward the position 52′, and co-acting with the cam face 68 positively and mechanically forces the collapsing of the toggle knee. The function of the auxiliary spring 61 is to constantly stress the contact members and toggle members toward their open circuit positions, as indicated at 54′ and 59′, so that in case of failure or rupture of the main spring 42 the contacts will be forced to inoperative position and rendered inoperative until the device is restored to operative condition. This spring also assists in hastening the normal opening of the contacts, as does also the flexing of the flexible arms 54 themselves. The toggle links are prevented from assuming a completely rectilinear position when closed, by the stop 52, being maintained in closed position by the stress of spring 42 on the projected extremity of the yoke 65, as at 67, the spaced pivot seats 69 and 71 forming a broad supporting base which prevents any accidental dislodgement of the yoke 65 when in closed circuit position. The shunt member 19 is of a high resistance material and of relatively small dimension, so that for normal current conditions the passage of current therethrough is of very negligible quantity, but in case of extreme short circuit or heavy overload conditions a relatively large portion of the rush of current will be by-passed or shunted through this member and so save the thermal element 9 from destructive heating, distortion and destruction.

It should be observed that the main operating spring is not of the "overcenter" type in its action, as it travels from any one position to any other position in its operative scope with its central axis in essential parallelism, and in its association with its affiliated toggles, in no case does either extremity of the spring meet or pass beyond the critical plane of the toggle linkage during either the manual or the automatic opening movements of the breaker. This action is due to the fact that the toggle links do not come into rectilinear alignment, and that the flexing of the contact arm, when in closed circuit position, produces a stress upon the toggle linkage, which stress is augmented by the action of spring 61, sufficient to flex the toggle knee joint 66 before the central axis of the spring 42 reaches the critical plane of the toggle to flex the said joint, thus causing the lower end of spring 42 to swing outward before the axis of said spring reaches the central plane of said toggle.

Having thus described our invention, what we claim as new is:—

1. In a circuit breaker having a stationary and a moveable contact member, means for automatically opening said contact members under excess current conditions by a multiple linkage pivoting on the frame of said breaker and coacting with an arcuately moveable stop means to permit a wider gap when operated on overload and short circuit conditions than when operated manually under normal current conditions.

2. A combined circuit breaker and switch having stationary and moveable contacts, a pressure increasing linkage supported upon the stationary frame of said breaker during overload operation, said linkage combining with a moveable stop member for the moveable contact which will permit the contacts to open to a greater degree when operated automatically as a circuit breaker on overload and short circuit conditions than when operated manually as a switch.

3. A unified electric switch and circuit breaker having a stationary contact and a moveable contact, an operating linkage supported on a stationary pivot and a releasably shiftable stop operated by said linkage by means of which said contacts are more quickly and positively opened when operated automatically under abnormal current conditions than when operated manually upon normal current conditions.

4. A combined switch and circuit breaker having stationary and moveable circuit closing contacts in which said moveable contact member is maintained in closed circuit position by a linkage member supported on a stationary pivot and a current releasable pivot whereby said contacts are opened more quickly and positively and with a greater degree of separation when opened automatically upon abnormal conditions of current than when said contacts are opened manually as a switch upon normal current conditions.

5. In a combination circuit breaker and switch having stationary contacts and moveable contacts, manually operated means for opening and closing said contacts and thermally operated means for automatically opening said contacts, a toggle linkage to actuate a release lever carrying a moveable stop for said moveable contact to permit said thermally controlled means to open said contacts to a greater degree than said manually operated means.

6. A circuit breaker having separable current carrying members and operative means for separating said members, and having stressing means the sole function of which is to open said current carrying members on overload and short-circuit conditions, said stressing means being independent of manual control and of the operative means for opening and closing said members, and opening said members more quickly and with a wider gap than when said members are opened by manual means.

7. An electric switch and circuit breaker having a pivoted handle, an operative spring carried between said handle and an operative member, said spring moving bodily with its operative member engaging extremity constantly in advance of

its handle engaging extremity as said handle moves arcuately to operate the contact members of said breaker from closed to open circuit positions.

8. A switch and circuit breaker in which the main operating spring is pivotally attached to an arcuately moveable handle and to a moveable toggle member, said spring moving laterally with its toggle engaging end continually in advance of its handle engaging end during opening movement and continually trailing said handle engaging end during closing movement of said breaker contacts as said breaker is operated between open and closed circuit positions, either under automatic overload operation or under manual operation.

9. A circuit breaker having a moveable contact carrying arm, a multiple link toggle operatively engaging said arm, a cam face integrally formed on one link of said toggle, a thermally releasable element having a stop member to engage said cam face, said stop cooperating and contacting with said cam face throughout the circuit opening movement of said toggle to force said toggle linkage into collapsed position on arcuate movement of said releasable element to move said contact carrying arm to open circuit position.

10. A circuit breaker having a stationary and a moveable contact, a flexible arm carrying said moveable contact, a multiple link toggle pivotally engaging said flexible arm, dual cam members rigid with one link of said toggle, cam engaging stops carried on a current releasable frame pivotally mounted in spaced relation to said toggle, said stops preventing the links of said toggle from assuming a rectilinear position and coacting with said cam members to force the collapse of said toggle links and the consequent moving of said contact member to open circuit position upon the movement of said current releasable frame.

11. In a circuit breaker having a multiple link toggle for the operation of the current carrying contact arm of said breaker, a pivotally mounted link member in said toggle which has a plurality of pivot seats at one end of said link, said seats engaging pivots spaced apart in said breaker mechanism.

12. In a toggle linkage for a current controlling mechanism, a plurality of spaced pivot seats in one extremity of one link of said toggle, said link being pivotally operable in said mechanism on either seat of said link depending on the mode of operation of said current controlling mechanism.

13. In an electric switch mechanism having a moveable contact arm controlled by a multiple link toggle, means incorporated in one link of said toggle by which said link may swing arcuately on one pivot point in said link upon manual operation of said switch, and upon a second pivot point in spaced relation thereto upon the automatic operation of said mechanism.

14. In a combined switch and circuit breaker having a moveable contact member operated by means of a toggle linkage, one link of said toggle being provided with a pivot seat on which said link oscillates when said device is operated as a switch and a second pivot seat upon which said link oscillates when said device is operated as a circuit breaker, the shift from one pivot point to the other being automatic in action.

15. A switch and circuit breaker having a housing carrying a fixed pivot point and a pivotally mounted release lever, a rigid pivot point on said release lever, a toggle link having a plurality of pivot seats in one end thereof, one of said seats registering with said fixed pivot point and the other of said seats registering with said release lever pivot point, said link oscillating on said release lever pivot when the device is operated as a switch, and on said housing pivot when the device operates automatically as a circuit breaker.

16. A circuit breaker having a housing mounted upon a base, a plurality of fixed pivot wings adjacent one end of said housing, a hingedly mounted member carrying a plurality of integral pivot wings within said housing, a thermally operable element positioned within said base, a trip coacting with said element to maintain said hingedly mounted member in operative position, means for releasing said trip, a circuit opening arm pivoted in said housing, a multiple link toggle engaging said arm, an end link in said toggle having plural pivot seats, one of said seats engaging the fixed pivot wings of said housing and the other of said seats engaging the integral pivot wings of said hingedly mounted member, said link oscillating on said last mentioned pivot when said hinged member is retained in operative position, and said link oscillating on said housing wings when said hinged member is released by said thermal element.

17. A circuit breaker having an arcuately moveable handle carrying a helical operating spring, a housing supporting said handle, said housing having a plurality of stationary pivot arms adjacent said handle, a frame pivoted in said housing, said frame carrying a plurality of pivot arms in spaced relation to said housing pivot arms, a swinging yoke pivotally engaging said housing pivot arms at one point and simultaneously engaging said frame pivot arms at another point, and means for releasing said frame pivot arms to allow rotation of said yoke about said housing pivot arms under stress of said helical spring.

18. A circuit breaker having stationary and moveable current carrying contacts, a housing with parallel side walls, inwardly projecting ears rigid with said side walls, a toggle link pivotally engaging said ears, means for moving said link longitudinally and arcuately away from contact with said ears, said means comprising a plurality of supplementary ears carried on a hingedly mounted frame supported in said housing and pivotally engaging said link at a second pivot point in spaced relation to said first mentioned pivot point, said link swinging on said supplementary ears when the breaker is operated manually and on said housing ears when operated automatically on overload.

19. A circuit breaker having an arcuately moveable handle carrying a helical operating spring, a housing to support said handle, said housing having a plurality of fixed pivot bearings thereon, a releasable lever pivotally mounted on said housing, a plurality of pivot bearings integral with said lever, current controlled means for releasing said lever, the line of stress of said helical spring, when the breaker is in closed circuit position, being between said housing pivot bearings and said lever pivot bearings, a toggle linkage member one end of which pivotally engages said helical spring and the opposite end of which is provided with plural seats one pair of which may engage the housing pivot bearings while the other pair of seats engage the lever pivot bearings, the toggle member pivoting on the lever pivot bearings if the handle is manually moved arcuately and on the housing pivot bearings when said lever is released automatically on overload conditions of the current through said breaker.

20. In a circuit breaker nd switch having a moveable contact arm, a housing, a releasable lever pivotally mounted on said housing, a toggle linkage coacting with said lever to actuate said contact arm, a trip lever mounted in said housing, one end of said trip lever engaging and coacting with a current operated thermal element to retain said releasable lever in operative position, the other end of said trip lever being provided with a cam slot to engage and coact with a latch pin secured in said releasable lever, said slot having one edge of relatively steep angularity to engage said pin on the resetting action of said releasable lever to easily reset said trip lever into re-engagement with said thermal element after release therefrom, and having the opposite edge of said slot of relatively low angularity to reduce the pressure of said trip lever arcuately against said thermal element to a desired minimum when in operative position, a plurality of lateral wings being provided on said trip lever to maintain it in aligned position, a spring on the trip lever shaft and a stop on the thermal element catch serving to limit and control the angular movement of said trip lever.

21. In a circuit breaker having a flexing thermal control element to automatically release the contact opening members under overload and short-circuit conditions of the electric current, a trip catch mounted on said thermal element adjacent its center point but insulated therefrom, a trip engaging projection integral therewith, a truss brace supporting said projection, and a projecting trip stop member to limit the motion of the trip when released from its engaging projection by the flexing of said thermal element under extreme current conditions.

22. In an automatic electric circuit breaker having mechanism for opening the circuit contacts, a current responsive member carrying a fixed projection to contact with the trip lever of said breaker, said projection being insulated from said current responsive member, an inclined brace to rigidly support the outer extremity of said projection against a portion of said current responsive member, and a second projection in spaced relation to said fixed projection to engage and limit the travel of said trip lever when released from said fixed projection.

23. In an automatic circuit breaker having a current breaking mechanism, a thermostatically flexing member in electric series with the current carrying members of said breaker, an arcuately moveable trip lever pivotally mounted in said breaker, a depending leg terminating in an arcuate sector with its center at the pivot point of said trip lever to form a strike to releasably engage a catch rigidly mounted upon said flexing member, said arcuate sector preventing said flexing member from returning to normal operative position after flexing until said trip lever shall have returned to reset position, automatic means for maintaining said trip lever in released position in relation to said catch, and means for returning said lever automatically beyond reset position and for maintaining an open gap between said trip lever and said catch when the operating handle of said breaker is moved to its open circuit position, said trip lever being simultaneously stressed toward contact with said catch.

24. In an electric circuit breaking device having stationary and moveable current contacts, means for opening and closing said contacts, a trip lever to automatically release said opening means on abnormal current conditions, a thermally flexible current carrying element to normally engage said trip lever, an arcuate sector formed on said trip lever to maintain said flexible element in flexed condition after the release of said trip lever until said trip lever shall be returned to normal reset position, an arcuately adjustable bracket to position said trip lever in calibrated relation to said flexible element, means for securing said bracket in adjusted position, and a cam slot in the breaker mechanism engaging end of said trip lever, said slot having a resetting face angularly positioned to the principal plane of said trip lever and an operative face at a different angular-position to said principal plane.

25. An electric circuit breaker having automatic means for opening the circuit on abnormal current conditions, a trip engaging pin carried by said automatic means, a trip member carried upon an adjustable bracket, means for securing said bracket in adjusted position, a cam slot having dual cam faces formed in said trip member, said pin coacting with said slot cam faces to normally maintain said automatic means in operative position, to release said automatic means under abnormal current conditions, and to reset said trip lever in operative position upon return of said automatic means to operative position, a thermally operable element in spaced relation to said trip lever, a catch fixed upon said thermal element to engage said trip lever, one of said slot cam faces being positioned at an angle to easily reposition said trip lever in relation to said catch after release therefrom and to maintain said trip lever free from and in spaced relation to said catch when said breaker is in normal open circuit position, and the other of said slot cam faces being positioned at an angle to reduce the pressure of said trip lever on said catch and said thermal element to a minimum when said circuit breaker is in normal operative position.

26. An automatic circuit breaker in combination with an electric switch having an operating handle pivotally mounted on a housing, an overarm pivotally mounted on said housing, a swinging yoke forming one link of a multiple link toggle pivotally and independently mounted on said overarm and on said housing, a helical spring pivotally engaging and connecting said handle and said yoke, a toggle link connecting said yoke and a plurality of flexible contact arms, a trip lever releasably engaging said overarm, an overload operable element releasably engaging said trip lever, means for passing an electric current through said overload element, said element automatically releasing said trip lever and said overarm on abnormal current conditions to open said contact arms to interrupt said current, manual movement of said handle causing said contacts to open and close with a snap action as a switch; and a current responsive movement of said overload element causing said contact arms to open with a snap action regardless of movement of said operating handle, said helical spring automatically repositioning said handle, said overarm and said trip lever in open circuit position after automatic overload operation of said device when said handle is left free of manual restraint.

27. A circuit breaker and switch having a housing and a releasable overarm pivotally mounted thereon, a swinging yoke forming one link of a multiple link toggle to actuate the circuit breaking contacts, a helical spring engaging said yoke said swinging yoke link pivotally engaging said overarm at a point on one side of the central plane of said helical spring, and pivotally engaging said

housing at a point on the opposite side of said central plane, said yoke swinging on said overarm pivot point when said device is operated manually as a switch, and swinging on said housing pivot point when said device operates automatically as a circuit breaker, the change from one pivot point to the other pivot point being automatic in operation.

28. A circuit breaker having a housing, an overarm pivotally mounted on said housing, a helical spring operatively engaging a toggle yoke, in which the toggle yoke, forming one link of the multiple link toggle, extends beyond the knee joint of said toggle, to form a projected seat for one end of said helical spring, a stop wing rigid with said overarm in spaced relation with said overarm mounting pivot to engage said yoke adjacent the knee joint of said toggle to prevent the links of said toggle from assuming a rectilinear position at any portion of the operating movements of said toggle, said helical spring acting on said projected seat as a leverage to prevent the collapse of said toggle linkage when in operative position until one of said yoke pivot points is released by the operation of said mechanism.

29. A circuit breaker having a housing, a manually operable handle and a releasable overarm pivotally mounted in spaced relation on said housing, and a helical spring engaging a multiple link toggle to operate a plurality of current carrying contacts, in which the upper link of the multiple link toggle of said breaker is provided with a plurality of lateral extensions, said extensions each carrying a plurality of spaced pivot seats forming a broadened base on which said link rests in stable repose under the stress of said helical spring when in normal closed circuit position, one set of said pivot seats coacting with plural pivot wings rigid with said housing adjacent said overarm pivots, said pivot seats moving away from and toward said pivot wings when said device is operated to open and to closed circuit positions respectively as a switch, and the other set of said pivot seats coacting with plural pivot wings integral with said overarm and positioned on the opposite side of the central plane of said helical spring from said housing pivot wings when in normal operative position, said overarm pivot wings and said overarm being forced arcuately upward when said device is operated as a circuit breaker, the stress of said helical spring being automatically imposed upon said housing pivot wings to produce arcuate rotation of said toggle link to open the circuit breaker contacts with a snap action when said overarm is released by said trip lever under abnormal current conditions, and means to return said parts automatically to normal open circuit position after said automatic overload release, and a plurality of formed projections rigid with said toggle upper link to preserve said link in aligned position and to insure positive reseating of said pivot seats upon said pivot wings after movement therefrom, a single arcuate movement only of said manually operable handle being required to reset said breaker in closed circuit position after such overload release and action.

30. In a circuit breaker the combination with a base of insulating material, a housing, a pivotally mounted releasable arm, an operating spring, a releasing trip member, and an operating linkage, said linkage being pivotally mounted for automatically selective rotation on plural pivot points on said housing and on said releasable arm, of an electro-responsive flexing element secured wholly within a recess in the base of said breaker, the housing fixedly mounted upon said base to insulatedly cover said recess, said base and said housing insulation entirely surrounding said element and rendering it inaccessible from without said recess, an insulated catch rigid with said flexible element projecting through an opening in said housing to engage a trip member to release the contact opening mechanism of said breaker on abnormal current conditions, and automatic means to re-engage said trip member in operative conjunction with said insulated catch after automatic operation of said breaker.

31. In a circuit breaker the combination with a base, a housing, an operating main spring, a plurality of circuit breaking contacts, a releasable lever arm, and a releasing trip member, of a circuit opening means consisting of an operative linkage for said contacts, said linkage operating pivotally on one pivot center when manually operated, and on a separate pivot center when operated automatically, and an auxiliary spring in operative contact with said current opening means, said spring constantly stressing the circuit breaking contacts of said breaker to open circuit position and assisting the main operating spring to open said contacts in a minimum of time, said spring automatically and independently opening the current contacts in case of failure or rupture of said main spring, and rendering said circuit breaker further inoperative and non-closable until said main operating spring shall have been again put into operative and normal condition.

32. A combination of circuit breaker and switch having a housing mounted on a base, an operating handle and a releasable overarm pivotally mounted on said housing, a toggle linkage provided with a swinging link, a helical spring engaging said link, said overarm carrying a plurality of cam faced projections to operatively engage a plurality of fixed wings on said operating handle when said overarm is releasably moved under abnormal current conditions, said wings under stress from said helical spring causing said overarm to return to normal operative position, when said operating handle is moved, either manually or automatically, to its open circuit position, a plurality of fixed pivots on said housing and a plurality of pivots integral with said overarm to independently and simultaneously engage a plurality of pivot seats on the swinging link of said toggle linkage, means for constantly and variably positioning said swinging link in relation to said pivot points, said link being operatively rotatable on either said housing pivots or said overarm pivots, and means connected with said overarm to operatively move said swinging link, when in collapsed position, bodily in a longitudinal movement to normal reset position, and longitudinally separating said housing pivot engaging seats away from and into spaced relation to said housing pivots automatically while said handle is moving to its open circuit position.

33. In a contact breaking mechanism, a frame member, a pivotally supported releasable member, a manually operable operator, and a multiple link pivotally connected structure pivotally anchored at one end to the frame member and pivotally supported at its opposite end jointly by said frame member and said releasable member for selective pivotal movement of said linkage construction.

34. In a breaker mechanism having a plurality of separable contacts, a fixed frame, a releasable

member pivotally anchored upon said frame member, a manually operable member, and a multiple link structure pivoted at one end upon said frame member and pivotally engaged at its opposite end jointly by said frame member and said releasable member for selective pivotal movement of said linkage upon said frame member or upon said releasable member, and a coil spring having its axis positionable between the selective pivotal points of said linkage on said frame and said releasable member, said spring operatively engaging said manually operable member and one link of said linkage structure, to selectively open or close said separable contacts, and to automatically open said contacts under predetermined conditions.

35. In a toggle linkage for a current interrupter, a plurality of spaced pivot seats in one link of said toggle linkage, a plurality of spaced pivots to co-act with said pivot seats, said link being moveably operable on either of said pivots, one of said pivot seats alternately receding away from and returning to its co-acting pivot as said link functions upon its other pivot seat.

36. In a toggle linkage of the type described in claim 35, a moveable stop to engage and to limit the movement of said toggle linkage, said linkage travel being limited by said moveable stop.

37. In a toggle linkage of the type described in claim 35, the spaced pivots for said linkage being secured upon two separate frame members, said linkage being independently supported thereby upon said two separate frame members, one of which frame members may be pivotally supported upon the other of said frame members.

38. In a mechanism of the type described in claim 35 having a fixed and a moveable contact, a flexible actuating arm for said moveable contact, said arm being actuated by said toggle linkage, said flexible arm forming a checking and cushioning member to modify the impact of said toggle linkage upon said spaced pivots and said moveable stops when said linkage is moved to operative position.

39. In a circuit breaker the combination with an insulating base, a housing pivotally supporting a releasable carriage, and an operating handle, a trip lever for said carriage, an actuating spring, a toggle linkage selectively operable on two independently functioning pivot positions, and an electrical overload responsive member responsive to abnormal conditions of the current passing through said circuit breaker, said overload responsive member being positioned within and entirely surrounded by the base of said breaker and physically protected thereby, and a shunt member of high resistance and proportioned capacity, across the terminals of said overload responsive member said shunt being embedded within and protected by said base, to protect said overload responsive member from injury or destruction due to action of abnormal conditions of current within said overload responsive member.

40. In an electric circuit breaker having a frame, an operating handle, an operating spring, a moveable contact and a toggle linkage connected therewith, a current actuated releasing member, a trip lever engaging said releasing member, a moveable frame normally restrained by said trip lever, said trip lever being biased by said frame toward engagement with said current actuated member when said breaker is in operative position, and independent means for biasing said trip lever to open circuit position to release said moveable frame instantly on abnormal current conditions within said breaker.

41. A circuit breaker having a releasable arm pivotally mounted within a frame, means stressing said arm to open circuit position when said breaker is in operative position, a latch normally restraining said releasable arm, a current actuated member flexibly engaging said latch, a circuit closing contact operably connected with said releasable arm, said latch being independently biased to open circuit position and automatically and independently releasing said releasable arm and said circuit closing contact upon the flexing of said current actuated member, the independent biasing of said latch automatically preventing the full repositioning of said current actuated member until said latch is fully repositioned by said releasable arm.

42. A circuit breaker having a stationary and a moveable contact, a flexible arm carrying said moveable contact, a multiple link toggle to operate said flexible arm, moveable stops carried by a current releasable frame to prevent the links of said toggle from assuming a rectilinear alignment and to force the collapse of said toggle upon movement of said releasable frame, a thermally actuable element to release said releasable frame upon abnormal current conditions within said breaker, a bypass of high electrical resistance secured in parallel with said thermal element, current conductors jointly engaging said thermal element and said bypass, and means for flexing said toggle independently of said releasable frame and said moveable stops.

43. An electric device having a housing mounted upon an insulating base, fixed pivot wings adjacent one end of said housing, a swinging frame carrying integral pivot wings within said housing, a current responsive element within said base, a shunt member of high electrical resistance across the terminals of said current responsive element, a trip co-acting with current responsive element to maintain said swinging frame in operative position, a circuit opening arm pivoted in said housing, a toggle linkage to engage said arm, a link of said toggle having plural pivot seats to engage said housing pivot wings and said swinging frame pivot wings, said link oscillating on said last mentioned pivot wing when said device is manually operated, and oscillating on said housing pivot wings when said swinging frame is released by actuation of said current responsive element.

44. A circuit breaker having a base of insulating material, a stationary contact secured in said base, a moveable contact actuated by a multiple link toggle, a plurality of current conductors positioned within said base, a thermally actuated element interconnecting said conductors at the extremity thereof, a shunt member of high electrical resistance in parallel with said thermal element, a manually operable handle pivotally mounted in relation to said thermal element, an operative spring interconnecting said handle and said toggle so that said spring moves laterally with one extremity constantly in advance of the opposite extremity of said spring, an auxiliary member constantly stressing said moveable contact to open circuit position, the axis of said operating spring constantly remaining on the same side of pivot point on which said toggle operates under overload and short-circuit actuation of said breaker.

THEODORE A. SPERRY.
RICHARD C. SPERRY.