

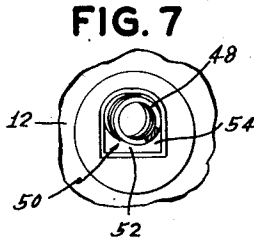
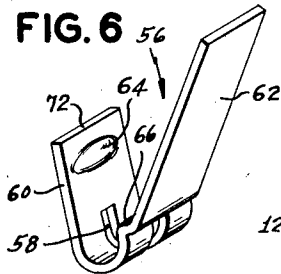
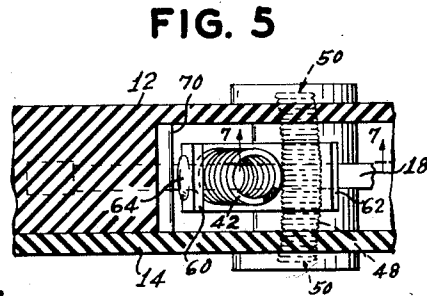
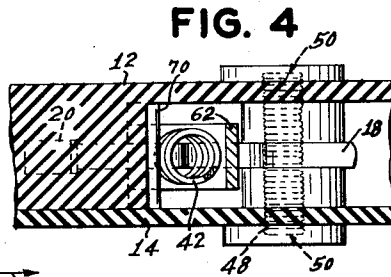
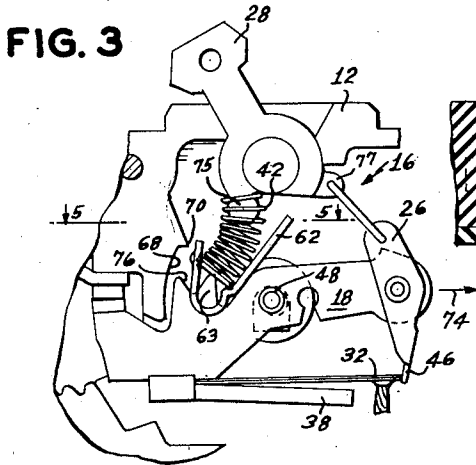
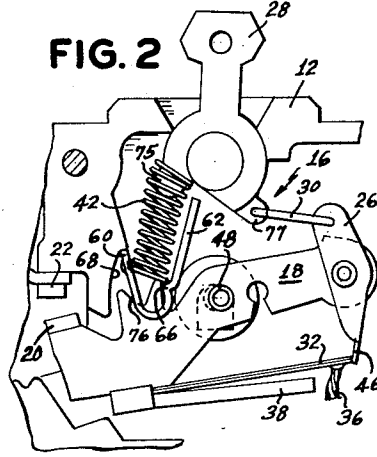
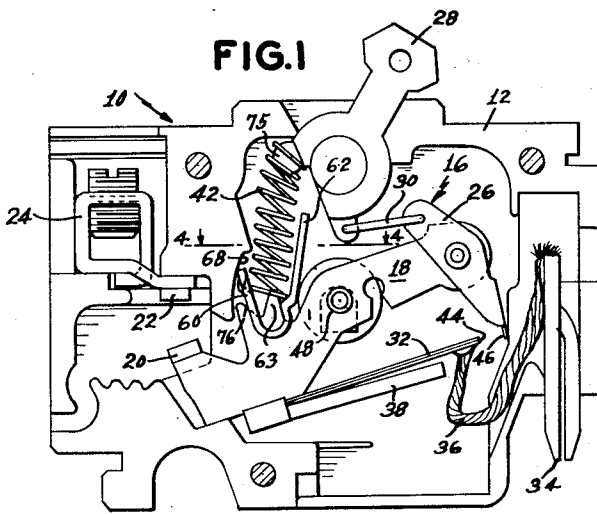
Oct. 29, 1957

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2,811,605

CIRCUIT BREAKER

Filed Dec. 11, 1953



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2,811,605

CIRCUIT BREAKER

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Application December 11, 1953, Serial No. 397,662

22 Claims. (Cl. 200—116)

The present invention relates generally to manually operated switches or circuit breakers and in particular to automatic circuit breakers.

In manually closing a circuit breaker or a switch, the closing operation to effect the engagement of the contacts should be smooth, even and positive. Persons who are inexperienced or timid in the operation of circuit making and breaking devices often have a tendency to close the device with hesitation and timidity when engaging the contacts for establishing or making the electric circuit. Hesitancy or pausing just before the contacts are closed, generally known in the art as "teasing," may permit the current to arc across the gap between the contacts. Current flow across the high resistance of the gap may produce sufficient heat at the contacts to weld or fuse them together on the engagement thereof. In the case of automatically operated circuit breakers, the fusing or "sticking" of the contacts prevents the automatic opening thereof upon overload and, therefore, removes the desired safety control or tripping action from the circuit.

In view of the foregoing, an object of the present invention is the provision of means for assuring a consistent and quick closing action for effecting the engagement of the contacts of manually operated switches and circuit breakers, regardless of hesitancy or uneven manual operation by the operator.

Another object is to provide a quick make circuit breaker which is handle free during the closing operation thereof to close the contacts thereof.

Another object is to provide for a positive "off" or opening operation of a circuit breaker on manual operation thereof to open the breaker whereby to effect opening of the breaker manually in case the contacts stick or are welded to each other and to provide added protection in the event that the main spring of the circuit breaker breaks or is defective.

Another object is the provision in an automatic circuit breaker of means for providing an extra sharp blow to the mechanism thereof in order to open the contacts, especially in the event that the contacts stick together or have a light or superficial weld to each other.

A further object is the provision of means to assist in the accelerated opening of the contacts of a circuit breaker upon automatic operation thereof and also on manual operation where the handle is not held in position.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description considered in connection with the accompanying illustrative drawings.

In the drawings which illustrate the best mode presently contemplated by us of carrying out our invention:

Fig. 1 is a side elevation of a circuit breaker pursuant to the present invention, a portion of the housing thereof being removed for purposes of illustration and the breaker being shown in the circuit open or interrupting condition thereof;

Fig. 2 is a view similar to Fig. 1 and illustrates an in-

intermediate position through which the breaker mechanism passes during the closing operation of the breaker;

Fig. 3 is a view similar to Fig. 1 and illustrates the closed or circuit making condition of the circuit breaker;

Fig. 4 is a fragmentary sectional view, on an enlarged scale taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged fragmentary sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is an enlarged view of the obstructing element in the circuit breaker; and

Fig. 7 is a fragmentary sectional view taken on the line 7—7 of Fig. 5.

Referring now to the drawings in detail, there is illustrated a circuit breaker **10** which is of the general type illustrated and described in Patent No. 2,647,186 to T. M. Cole, dated July 28, 1953, and in Patent No. 2,642,509, dated June 16, 1953 to T. M. Cole and P. M. Christensen, both of which are assigned to the assignee hereof. As here shown, the automatic circuit breaker **10** is provided with the body part **12** of a two part insulated casing or housing, the cover thereof being indicated at **14** in Figs. 4 and 5. The circuit breaker mechanism **16** provided in said body part, as here shown, comprises the movable contact arm or switch member **18**, mounted for pivotal movement, as hereinafter described in detail. Said contact arm is provided with the movable contact **20**, at one end thereof, for engagement with and disengagement from a companion stationary contact **22** provided on a solderless terminal connector **24**. At its other end, the movable arm **18** is provided with a pivotally mounted actuator **26** which is in operative engagement with the handle or manual operating member **28** by means of a link **30** which forms a toggle with said handle. The movable contact arm **18** is also provided with a current responsive or overload device, here shown as a bimetallic element or latch **32**, the free end **44** of which is in latched engagement with the actuator **26** in the circuit making or closed condition of the mechanism, as illustrated in Fig. 3. As here shown, the latch is connected to the stab element **34**, which constitutes the other terminal of the circuit breaker, by means of a flexible conductor **36**. Also, as here shown, the circuit breaker mechanism **16** is provided with electro-magnetic means for effecting the disengagement thereof, said means comprising an electro-magnetic member **38** which is secured at one end thereof to the latch and to the movable contact member and which constitutes a rigid armature. A spring **42** is interposed between the handle **28** and the movable member **18**, as illustrated in Figs. 1, 2 and 3.

The operation of the circuit breaker is described in detail in the above-mentioned patents. However, it will be understood that the bimetallic element **32** operates to latch the manually operable actuator **26** and to unlatch said actuator from the movable contact member **18**, the unlatching taking place upon deflection of the bimetallic element **32** causing the disengagement of the free end **44** thereof from the bottom part **46** of the actuator **26** upon the occurrence of an overload, or under other abnormal predetermined current conditions in the circuit controlled by the circuit breaker. When the bimetallic element **32** is deflected from engagement with the actuator **26**, spring **42** is effective to move the contact member **18** to its open position wherein the contact **20** is disengaged from the companion stationary contact **22**.

As here shown, the pivot for the movable contact member **18** is constituted by a helically coiled spring member **48**, the opposite ends of which are mounted in bearing recesses **50** provided in the casing parts **12** and **14**. Said recesses **50** are beveled in a downward direction, as at **52**, and in a lateral direction, as at **54**, so as to facilitate the bowing of the spring pivot **48** in said directions. Such spring pivot serves the purpose of resiliently pressing the

contacts together and to compensate for contact wear and other variables, as disclosed in Patent 2,681,396 issued June 15, 1954, to Cole and Christensen.

Pursuant to the present invention, provision is made for a temporary obstruction to the closing of the contacts in order to prevent the abnormally slow operation of the handle 28 from resulting (as heretofore) in an abnormally slow closing engagement of the contacts and therefore permitted the possible arcing of current across the gap between the contacts which served to heat the contacts and possibly resulted in the sticking thereof upon engagement thereof. More specifically, provision is made for a snap or anti-tease lever or obstructing member 56 which, as here shown, is generally of U-shape formation.

At its bight, the lever 56 is provided with a slot 58 which extends into the arms 60 and 62 thereof. The member 56 is mounted on the movable contact arm 18 by the engagement of a marginal edge projection 63 of the latter in the slot 58. The main spring 42 of the circuit breaker serves to releasably position the member 56 during the closing operation of the breaker. More specifically, a spring seat is defined in the member 56 by the recessed portion 64 defined in the arm 60 and the crimped portion 66 defined in the opposing arm 62, said portions cooperating to seat one end of spring 42. It will be noted from Figs. 1, 2 and 3 that the lower end of the main spring 42 seats in the recess 64 and on the crimped portion 66, the spring 42 serving to releasably hold the member 56 in position to prevent the closing movement of the contact member 18, as in Figs. 1 and 2, and as hereinafter described in detail. It will be noted also that the body part 12 of the circuit breaker 10 is provided with a camming surface 68 which terminates in a nose 70, which cooperates with said member 56, as hereinafter described to prevent temporarily the closing of the breaker.

In the open or circuit interrupting condition of the circuit breaker, the free end 72 of the arm 60 of member 56 abuts the camming surface 68. Now, as the handle 28 is operated in a counter-clockwise direction, viewing Figs. 1 and 2, in order to close the circuit breaker 10, the movable contact arm 18 is rotated thereby in a clockwise direction for effecting the engagement of the contacts 20 and 22 so that the free end 72 of the arm 60 rides up the camming surface 68 and engages the nose 70, the member 56 being retained in position by the spring 42. Said engagement of the arm 60 and the nose 70 provides a temporary obstruction to the closing of the circuit breaker, as will be apparent from Fig. 2, which represents an intermediate position through which the handle passes during the closing movement thereof. Continued movement of the handle in said closing direction results in the conditioning of the toggle, constituted by the handle and the link 30, toward overcentered condition thereof. Since the movable contact member 18 is temporarily prevented from the continued pivotal movement thereof toward the contact closing position thereof, the closing force transmitted to the movable contact member 18 through the link and the actuator 26 results in the bowing of the pivot spring 48 in the direction of the arrow 74 (Fig. 3) to effect limited bodily movement of the movable contact member 18 in said direction, as in Fig. 5. Said bodily movement of the movable contact member carries the free end 72 of the arm 60 past the nose 70 and out of engagement therewith so as to free the movable contact member 18 to complete the closing engagement thereof by removing the temporary obstruction which impeded said closing engagement thereof. By this time, the toggle has been conditioned in its overset condition. The engagement of the contacts is effected by the snap-locking action of the toggle that provides a fulcrum about which bowed spring 48 can pivotally drive member 18 to provide a swift positive snap engagement of the contacts which is independent of the control of the operator. It will be understood that continued oper-

ation of the handle 28 in the closing direction after obstruction element 60 is arrested by casing part 68—70 acts to bow and thereby stress spring 48, and that the closing of the contacts results from partial return of the spring to its unstressed condition. A portion of the stress remains for providing contact pressure.

While the described action of the spring pivot 48 in bodily shifting member 18 to the right might be sufficient in itself to release the member 56 from the nose 70, a positive action is preferred. This positive action is provided by the drive connection of the lug portion 75 of the handle 28 with the upper end of the arm 62 of obstructing member 56 to pivot the member 56 on its seat 63 on the movable contact member 18 in a clockwise direction for effecting the positive removal of the obstruction to the closing movement of the contact arm 18. It will be understood that the handle 28 may be provided with a suitable rigid part, which is actuated thereby in the described manner for effecting said pivotal movement of the member 56, in place of the lug 75 thereof which, as here shown also serves to mount the upper end of the spring 42 on the handle 28. In this connection, it will be understood that while the pivot spring 48 is desirable for assisting in the operation to relieve the temporary obstruction to the closing movement of the movable contact arm 18, it is not essential to the present invention since said action may be provided entirely by the engagement of the member 56 by the handle lug 75, or by an equivalent member operated by the handle.

As previously indicated, the pivot spring 48 is bowed and moves contact member 18 in the direction of arrow 74 in Fig. 3, when the breaker is closed. In said condition, the pivot spring 48 exerts a greater force than the tensioned main spring 42 and thus provides a desired contact pressure by overcoming the opening action of the main spring. However, when the bimetal latch 32 releases the actuator 26, the pivot spring returns to its relaxed condition and bodily moves the contact member 18 in a direction opposite the arrow 74. Consequently, if snap lever 56 was rigid with the contact arm 18, said snap lever might engage the shoulder or nose 70 and slow down the opening of the breaker. In some cases the breaker might not open at all, or might open only partially since the spring 42 might not be strong enough to overcome the frictional forces resulting from the engagement of arm 60 of member 56 with the part 70 of the casing half 12 under the action of the pivot spring 48. In order to eliminate any such possibilities the slot 58 defined in the member 56 is made long enough to allow a limited movement of said member to easily bypass the shoulder 70 on the casing when the breaker is being opened. More specifically, the member 56 pivots in a counter-clockwise direction, viewing Fig. 3, on the marginal edge projection 76 of the contact member 18. Consequently, it will be readily apparent that said pivotal movement of the member 56 prevents the contact arm from being held against opening movement thereof.

As stated in the previously listed objects of the present invention, provision is made for a positive opening operation of the circuit breaker mechanism on manual actuation to open the breaker, which is especially desirable in case the contacts should stick or weld to each other. This feature also provides added protection in case the main spring 42 should break or be defective. In addition, in the automatic opening of the breaker there is an extra sharp blow to open the contacts, which is an advantage in case the contacts should stick or have a light or superficial weld to each other, and also to assist in the accelerated opening of the breaker contacts upon automatic operation as well as upon manual operation of the handle. All of these highly desirable results are achieved by the fact that the arm 62 of the member 56 is elongated so that it is positioned in the path of movement of the handle lug 77 in which the link 30 is pivotally mounted. In this connection it will be understood that upon manual

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operation of the handle 28 from its closed position in Fig. 3 to its open position in Fig. 1, as well as upon automatic operation or opening of the breaker wherein the handle is moved from its closed to its open position by the expansion of the main spring 42, said lug 77 strikes an extra sharp blow, under the expansion of said spring, to the arm 62. Consequently, if for any reason, there is resistance to the opening of the contacts, as for example when said contacts are superficially welded to each other, or if on manual operation the spring 42 is ineffective, the effect or force of said blow is transmitted to the movable contact member 18 to assist or accelerate the opening movement of the latter.

As previously indicated the bowed pivot spring 48 exerts a greater force than the tensioned main spring. Consequently, in the event that the handle 28 should be physically retained in position substantially as in Fig. 2, when the member 56 disengages the cam shoulder 79 on closing operation of the breaker, the pivot spring will be effective to bodily move the contact member 18 to snap-engage the contacts and, therefore, to provide a breaker which is handle free during the closing thereof. The breaker is also handle free upon automatic operation thereof. In this connection it will be understood that if the handle 28 is held in its closed-circuit position, as illustrated in Fig. 3, and if an abnormal current condition such as an overload occurs, the bimetallic latch 32 is automatically deflected so as to disengage and release the actuator 26. Consequently, the present invention provides an automatic circuit breaker which is handle free both on closing and on automatic tripping thereof.

In addition, the combined operation of the toggle and the bowed pivot spring 48 when the member 56 is disengaged from the cam surface portion 70 provides a quick-make action. The operation of the handle 28 in striking the member 56 upon automatic opening assists the spring 42, to provide a quick-break action.

The subject matter of the present application relating to the provision of means to prevent the sticking or fusing of the contacts is also the subject matter of the applications of Alexander R. Norden, Serial No. 397,527 and Serial No. 397,673, and the application of Thomas M. Cole and Paul M. Christensen, Serial No. 397,551 all filed concomitantly herewith and all assigned to the assignee hereof.

While we have shown and described the preferred embodiment of our invention, it will be understood that various changes may be made in the present invention without departing from the underlying idea or principles of the invention within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent, is:

1. A circuit breaker comprising a housing, a stationary contact, a movable switch member provided with a contact for engagement with and disengagement from said stationary contact, a manual operating member for effecting operation of said movable member to open and close said breaker, means conditioned by the closing operation of said operating member to provide a snap-action engagement of said contacts, a part in said housing, and said movable switch member being provided with means operable during the closing operation of said operating member and adapted to cooperate with said part to obstruct the engagement of said contacts substantially until the conditioning of said snap-action means, whereby to effect the closing of said contacts by said snap-action means, said obstructing means being actuated by said operating member to relieve the obstruction thereof, said part being stationary and adapted to be releasably engaged by said obstructing means to prevent temporarily the engagement of said contacts, said obstructing means being disengaged from said stationary part by said manual operating member, and said obstructing means having a portion actuated by said manual

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operating member during the opening of the breaker whereby said obstructing means clears said stationary part during said opening of the breaker.

2. A circuit breaker comprising a housing, a stationary contact, a movable switch member provided with a contact for engagement with and disengagement from said stationary contact, a manual operating member for effecting operation of said movable member to open and close said breaker, means conditioned by the closing operation of said operating member to provide a snap-action engagement of said contacts, a camming surface in said housing, and a member pivotally mounted on said switch member for engagement with said camming surface during closing of the breaker to prevent temporarily the engagement of said contacts, said mounted member being pivoted by said manual operating member to disengage said camming surface substantially at the conditioning of said snap-action means whereby to effect the closing of said contacts by said snap-action means.

3. A circuit breaker comprising a housing, a stationary contact, a movable switch member provided with a contact for engagement with and disengagement from said stationary contact, a manual operating member for effecting operation of said movable member to open and close said breaker, means conditioned by the closing operation of said operating member to provide a snap-action engagement of said contacts, a camming surface in said housing, and a member pivotally mounted on said switch member for engagement with said camming surface during closing of the breaker to prevent temporarily the engagement of said contacts, said mounted member being pivoted by said manual operating member to disengage said camming surface substantially at the conditioning of said snap-action means whereby to effect the closing of said contacts by said snap-action means, said camming surface extending into the path of movement of said mounted member during the opening of the breaker, and said manual operating member having provision to pivot said mounted member during the opening of the breaker to clear said camming surface.

4. A circuit breaker comprising a housing, a stationary contact, a movable contact member engageable and disengageable therewith, a breaker handle, toggle means operated by said handle for effecting engagement of said contact and said contact member, a camming surface in said housing, a member pivotally mounted on said contact member and engageable with said camming surface to prevent the closing of said breaker, a flexible mounting for said movable contact member to effect bodily movement of said movable contact member substantially at the oversetting of said toggle means, whereby to disengage said preventing member from said camming surface to provide for snap engagement of said contact and contact member, and means for effecting pivotal movement of said preventing member during the opening of said breaker to clear said camming surface.

5. A circuit breaker comprising a housing, a stationary contact, a movable contact member engageable and disengageable therewith, a breaker handle toggle means operated by said handle for effecting engagement of said contact and said contact member, a camming surface in said housing, a member pivotally mounted on said contact member and engageable with said camming surface to prevent the closing of said breaker, a flexible mounting for said movable contact member to effect bodily movement of said movable contact member substantially at the oversetting of said toggle means, whereby to disengage said preventing member from said camming surface to provide for snap engagement of said contact and contact member, and means for effecting pivotal movement of said preventing member during the opening of said breaker to clear said camming surface, said last mentioned means being a portion of said preventing member which is actuated by said handle during the opening movement of said handle.

6. In an automatic circuit breaker having a housing, a stationary contact, a movable contact member for engagement and disengagement therewith, an actuating member carried by said movable contact member, a current responsive device for operatively connecting said actuating member releasably to said movable contact member for operating the latter except when said current responsive device is disconnected from said actuating member upon overload, a handle for effecting manual operation of said actuator, means interconnected between said handle and said actuator for effecting a snap-locking-engagement of said contact and contact member and spring means operable to open said breaker to move said handle to an off position thereof, and to automatically reset said breaker after automatic operation thereof; the combination of means in said housing and means releasably positioned by said spring means and adapted to cooperate with said means in said housing to prevent temporarily the engagement of said contact and contact member substantially until the conditioning of said interconnecting means to snap lock engage said contact and contact member into engagement, said preventing means being mounted on said movable contact member and being formed to constitute a seat for said spring means.

7. In an automatic circuit breaker having a housing, a stationary contact, a movable contact member for engagement and disengagement therewith, an actuating member carried by said movable contact member, a current responsive device for operatively connecting said actuating member releasably to said movable contact member for operating the latter except when said current responsive device is disconnected from said actuating member upon overload, a handle for effecting manual operation of said actuator, a connection between said handle and said actuator for effecting a snap-engagement of said contact and contact member and spring means operable to open said breaker to move said handle to an off position thereof, and to automatically reset said breaker after automatic operation thereof; the combination of means in said housing and means releasably positioned by said spring means and adapted to cooperate with said means in said housing to prevent temporarily the engagement of said contact and contact member substantially until the conditioning of said connection to snap engage said contact and contact member, said preventing means being pivotally mounted on said movable contact member and having a portion operated upon by said handle to pivot said preventing means from contact engagement preventing disposition thereof.

8. In a automatic circuit breaker having a housing, a stationary contact, a movable contact member provided with a contact for engagement with and disengagement from said stationary contact, manually operable means including a manual operating member operatively connected to said movable contact member for effecting manual operation of said movable contact member to open and close said contacts and spring means for effecting separation of said contacts upon operation of said manual operating member to open the breaker, that improvement which comprises means to positively move said movable contact member to disengage said contacts upon manual operation of said manual operating member to open the breaker, said last mentioned means comprising a part on said movable contact member extending into the path of movement of said manual operating member and acted upon by the latter during the opening movement thereof, said circuit breaker having means conditioned during the closing operation of said manual operating member to provide a snap-engagement of said contacts, a cooperating portion in said housing, and said part on said movable contact member being adapted to cooperate with said portion to prevent temporarily the closing of said breaker until the conditioning of said snap-engagement means.

9. In an automatic circuit breaker having a housing,

a stationary contact, a movable contact member provided with a contact for engagement with and disengagement from said stationary contact, manually operable means including a manual operation member operatively connected to said movable contact member for effecting manual operation of said movable contact member to open and close said contacts and spring means for effecting separation of said contacts upon automatic opening of said breaker, that improvement which comprises the provision of means operable upon automatic opening of said breaker to strike said movable contact member for disengaging the contacts, said spring means being operable upon said automatic opening of the breaker to move said manual operating member from a circuit making to a circuit breaking disposition thereof, and said movable contact member having a part extending into said path of movement of said manual operating member whereby said manual operating member is effective to strike said movable contact member to disengage said contacts, said circuit breaker having means conditioned during the closing operation of said manual operating member to provide a snap-engagement of said contacts, a cooperating portion in said housing and said part on said movable contact member being adapted to cooperate with said portion to prevent temporarily the closing of said breaker until the conditioning of said snap-engagement means.

10. In an automatic circuit breaker, relatively movable contact members provided with companion contacts, respectively, mechanism including control means for effecting automatic disengagement of said contacts upon the occurrence of predetermined current conditions, a handle for manually operating said mechanism to close and open the breaker, and means operable by said handle during breaker-opening movement thereof to exert a force in a direction to separate said contacts in the event that normal separation of said contacts is resisted, means conditioned in response to the closing operation of said mechanism to provide a snap-engagement of said contacts, and means operable to provide a temporary obstruction to prevent the engagement of said contacts until the conditioning of said snap-engagement means, whereby to effect the closing of said contacts by said snap-engagement.

11. An electric circuit breaker having a stationary contact, a movable contact member engageable and disengageable therewith, mechanism operable to engage said contacts, a breaker handle for operating said mechanism, a stationary part provided in said breaker, a member pivotally mounted on said contact member and engageable with said part to prevent the closing of said breaker, and a flexible mounting for said movable member to effect bodily movement of said movable contact member when said contact member is close to but out of engagement with said stationary contact, whereby to effect the instantaneous engagement of said contact member with said stationary contact by causing said mounted member to shift out of engagement with said part.

12. An electric circuit breaker having relatively movable contacts engageable with and disengageable from each other for closing and opening the circuit, means automatically operable in response to load conditions of the circuit to disengage said contacts, mechanism operable to engage said contacts, a handle mounted for movement in opposite directions, means to effect the operation of said mechanism by movement of said handle in one direction until said contacts are close to each other but out of engagement, and means to prevent the engagement of said contacts while they are close to each other, whereby the handle cannot be operated to tease-close said contacts, said preventing means comprising a part pivotally mounted by said mechanism and a stationary part disposed in the path of movement of said pivotally mounted part to engage said mounted part during operation of said mechanism to close said con-

tacts, said parts interacting with said mechanism to cause the instantaneous complete and firm engagement of said contacts upon pivotal movement of said pivotally mounted part to disengage said stationary part upon continued movement of said handle after said parts are engaged, and said handle being movable in the opposite direction to effect the operation of said mechanism to disengage said contacts.

13. An electric circuit breaker as defined in claim 12, further characterized in that the handle is mounted for pivotal movement and has a sustained connection to the operating mechanism in all phases of the operation thereof.

14. An electric circuit breaker having cooperable contacts, and operating mechanism for said contacts including a movable contact member operable to open and close the contacts, an operating handle movable between extreme positions in which said contacts are, respectively, open and closed, a drive mechanism interconnecting said handle and said movable contact member for progressively operating said movable contact member toward its closed position as the handle is moved toward its closed position, means automatically operable in response to the load condition of the circuit to open the contacts, and obstruction means coacting with said mechanism and initially effective to arrest the advance of the movable contact member during said closing motion of said handle and said obstruction means being thereafter released to allow closing of the contacts, said operating mechanism including yieldable spring means allowing said handle to advance despite arrest of said movable contact member and said spring means causing said snap-closing of the contacts after release of the movable contact member; said obstruction means including a fixed part in the circuit breaker and an obstructing element movable on said movable contact member and initially cooperable with said fixed part to prevent said movable contact member from moving in the contact-closing direction, and a drive connection between said operating handle and said obstructing element effective to remove said obstructing element from cooperation with said fixed part, thereby to release said movable contact member for snap closing under the influence of said yieldable spring means.

15. A circuit breaker in accordance with claim 14, wherein said handle has a further drive connection to said obstructing element effective during the opening stroke of said handle for providing positive drive for said movable contact member in the contact opening direction.

16. An electric circuit breaker including an enclosing housing, a pair of cooperable contacts and operating mechanism for said contacts within the housing, and a handle pivoted in the housing for operating said mechanism, said mechanism including a pivoted contact member, a current-responsive element and an actuator carried by said movable contact member and arranged for latching engagement when said circuit breaker is closed, toggle means connecting said handle and said actuator and arranged to progressively close and lock the contacts when the handle is moved from the open extreme to the closed extreme and effective to open the contacts when the handle is reversely operated between said extremes, said toggle acting before the full closing stroke of said handle is completed to condition said contacts for closing, said operating mechanism including yieldable spring means allowing the handle to complete its operating stroke in the closing direction, a V-shaped obstructing element rockably carried by said movable contact element, said obstructing element having one arm cooperable with a fixed part of said housing and effective to arrest the closing travel of the movable contact member and said V-shaped element having a second arm extending close to said operating handle, said operating handle having two spaced apart portions adapted to drive said second arm back and forth when said handle is operated in opposite directions, one of said handle por-

tions being effective during the closing operation of said handle to drive said obstructing element to release said arrested movable contact member when conditioned for contact-closing, and the other of said handle portions being cooperable with said second arm of said obstructing element when the handle is moved in the opening direction to provide positive drive for said movable contact member in the opening direction, and a contact opening compression spring confined between said one handle portion and the arms of said V-shaped obstructing element and effective to bias said handle in the opening direction and to bias said obstructing element against said movable contact member in the direction for engagement with said fixed part of the housing.

17. An electric circuit breaker including an enclosing housing containing a pair of cooperable contacts, automatic current-responsive circuit breaker releasing means, and operating mechanism including a movable member for moving one of said contacts to open and close the circuit breaker, a handle operable between open and closed extremes for operating said mechanism and said mechanism including a spring enabling advance of the handle in the closing direction without concurrent contact-closing advance of said movable member, a movable element cooperable with said movable member and with said handle in both opening and closing strokes thereof, and a stationary part cooperable with said movable element during closing operation of the handle to arrest said movable member temporarily and said handle being thereafter effective to release said movable member to allow snap-closing of said contacts, and said handle being cooperable with said movable member via said element to provide contact-opening drive in the event of sticking of the contacts when the handle is moved in the opening direction.

18. An electric circuit breaker including a pair of cooperable contacts, operating mechanism for closing and opening said contacts, including a movable member, automatic current responsive contact-opening means and a manual member operable between open and closed extremes for opening and closing said contacts, said mechanism causing engagement of the contacts before the handle reaches its closed extreme and said mechanism including a spring enabling advance of said manual member to its closed extreme after initial engagement of the contacts, a two-armed element carried by said movable member, one of the arms of said element being cooperable with a stationary part of the circuit breaker to arrest closing advance of the movable member and said manual member thereafter having a drive connection to the second arm of said two-armed element to discontinue said cooperation of said one arm and said stationary part and thereby release said member for snap-closing of the contacts, said manual member having a contact-opening connection to said second arm and thereby to said movable member in the event of sticking of the contacts.

19. An electric circuit breaker having cooperable contacts, and operating mechanism for said contacts including a movable contact member operable to open and close the contacts, an operating handle movable between open and closed extremes, a drive mechanism interconnecting said handle and said movable contact member for progressively operating said movable contact member toward its closed position as the handle is moved toward its closed position, said mechanism being arranged to provide initial engagement of the contacts before the handle has reached its closed extreme and said mechanism having spring means allowing further advance of the handle to the closed extreme after engagement of the contacts, means automatically operable in response to the load condition of the circuit to open the contacts, the combination with the foregoing of obstruction means coacting with said movable contact member and initially effective to arrest the advance of the movable contact member during the closing operation of said

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handle, said spring means being increasingly stressed during the arresting operation of said obstruction means, said spring means being effective to produce snap-closing of the contacts upon release of said obstruction means and said handle having drive connection to said obstruction means both in the closing and in the opening direction of operation of the handle and effective to release the obstruction means for contact closing as aforesaid and further effective during the opening stroke of the handle to provide contact-opening thrust.

20. A circuit breaker in accordance with claim 19 wherein said obstruction means includes a movable element carried by said movable contact member and a fixed part cooperable with said movable element for arresting advance of the movable contact member, and a spring acting between said handle and said movable element for biasing the handle in the contact-opening direction and for biasing the movable element in the direction to cooperate with said fixed part during initial closing operation of the circuit breaker.

21. A circuit breaker having cooperable contacts, and operating mechanism for said contacts including a moving contact member operable to open and close the contacts, an operating handle movable between extreme positions in which said contacts are, respectively, open and closed, a drive mechanism interconnecting said handle and said movable contact member and operable between open and closed extremes, a spring acting between said handle and said movable contact member for biasing both of said members in their contact-opening directions and said drive mechanism including toggle means and spring means arranged to cause initial engagement of the contacts when the handle is operated in the closing direction but before reaching the closed extreme and said toggle being thereafter effective to overset and thereby lock the contacts closed and to stress said spring means for building contact pressure, that improvement in combination with the foregoing of means causing snap closing of the contacts and preventing sticking of the contacts, said last-named means including an element movable on said movable contact member and having an arm cooperable with said handle, said movable element being adapted to cooperate with a fixed portion of the circuit breaker during closing operation of said handle and being thereby arranged to prevent ad-

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vance of said movable contact member in the contacts-closing direction until said drive mechanism has been sufficiently operated to produce initial engagement of the contacts and said movable element being thereafter operable by said handle to interrupt the cooperation thereof with said fixed portion thereby to cause snap closing of the contacts, the handle cooperating with said movable element during the opening stroke of the handle in the event of contacts sticking together for forceable drive of the movable contact member by said movable element to promote contact separation.

22. A circuit breaker in accordance with claim 21 wherein said movable element is provided with a seat receiving said spring and said spring thereby biasing said movable element against said movable contact member and biasing the movable element toward cooperation with said fixed circuit breaker portion during closing operation of the handle.

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