

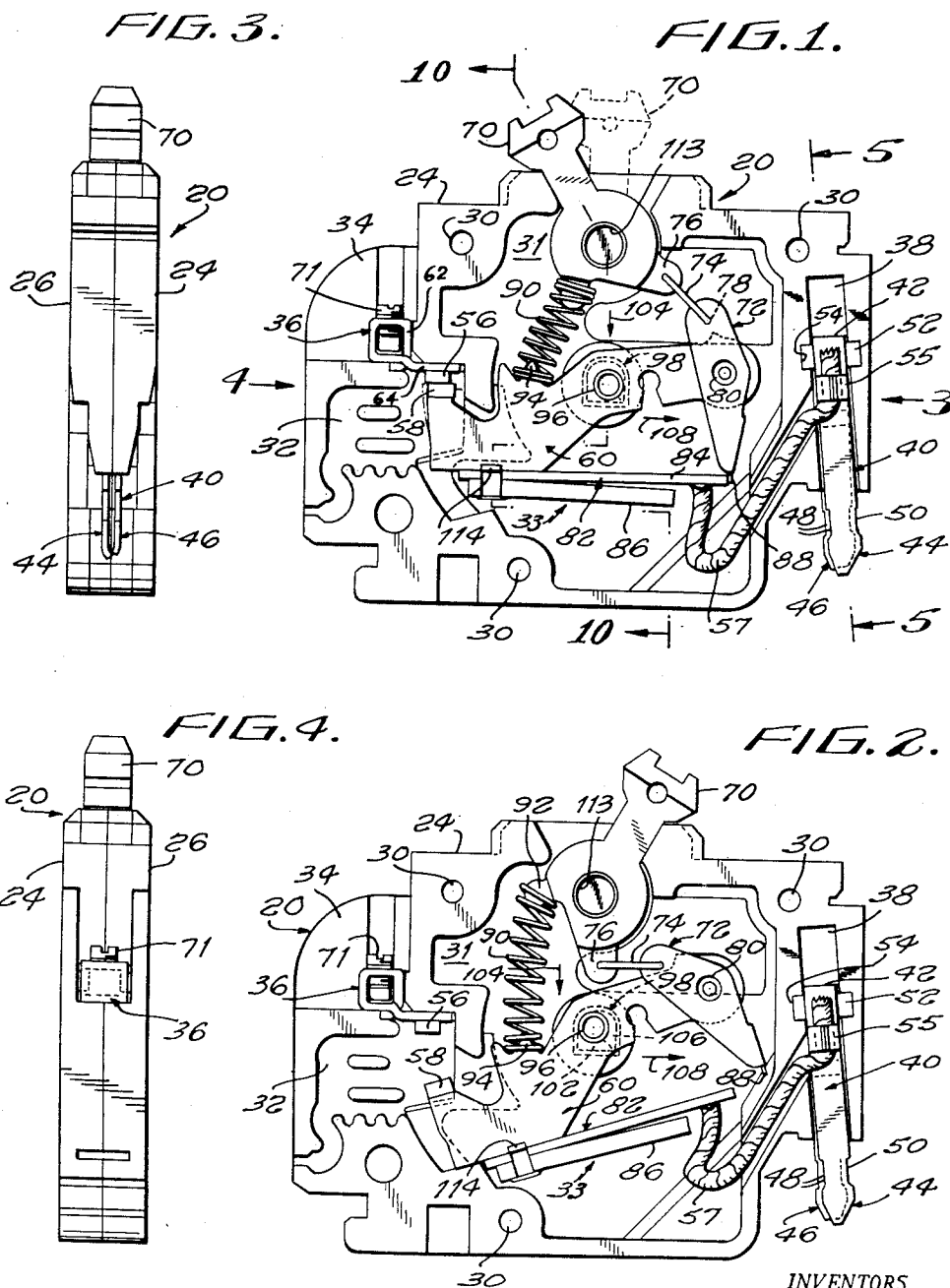
Jan. 25, 1955

T. M. COLE ET AL
AUTOMATIC CIRCUIT BREAKER

2,700,713

Filed July 10, 1953

3 Sheets-Sheet 1



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FIG. 5.

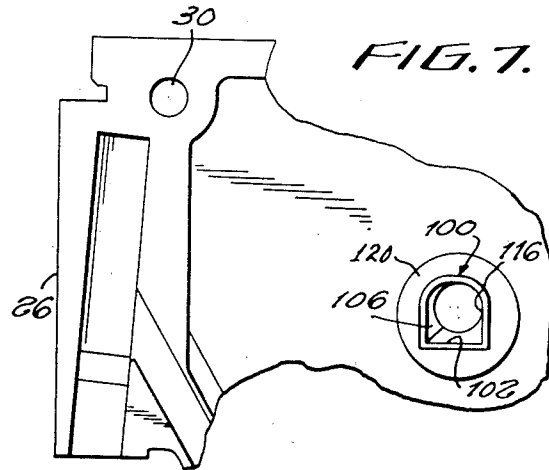
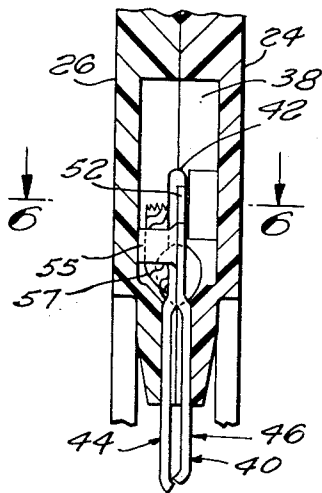


FIG. 7.

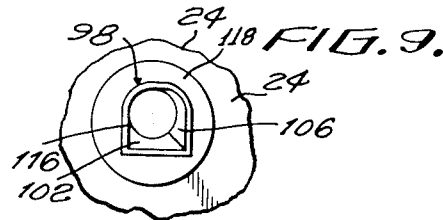
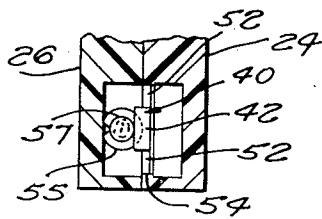


FIG. 9.

FIG. 6.

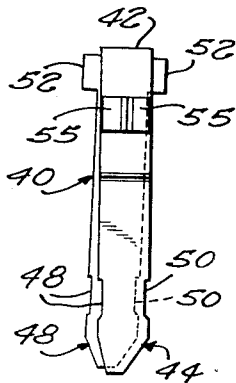


FIG. 8.

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3 Sheets-Sheet 3

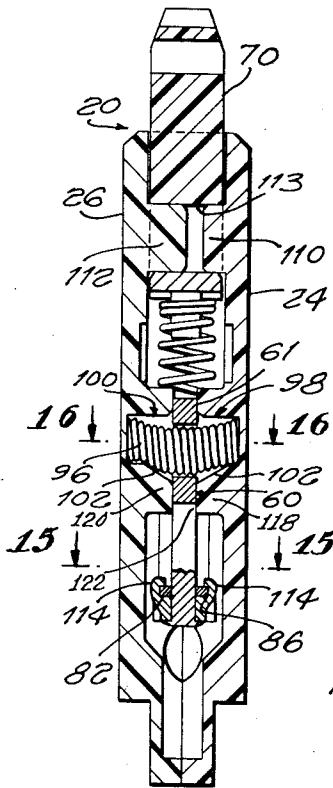


FIG. 10.

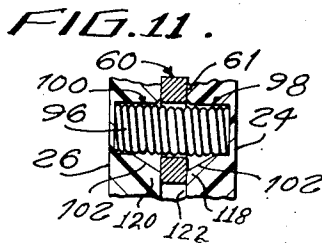


FIG. 11.

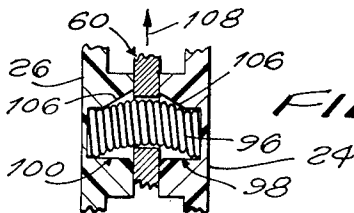


FIG. 16.

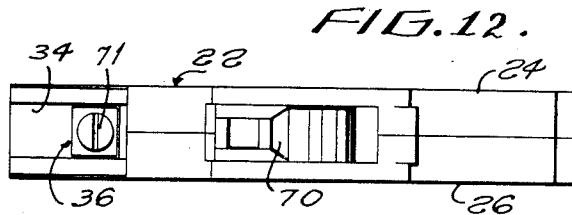


FIG. 12.

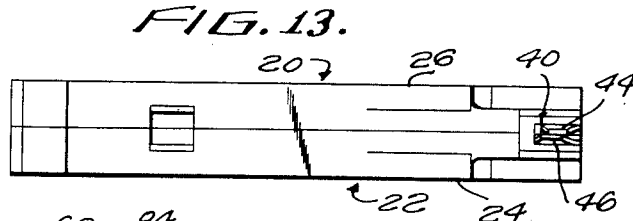


FIG. 13.

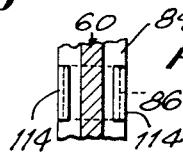


FIG. 15.

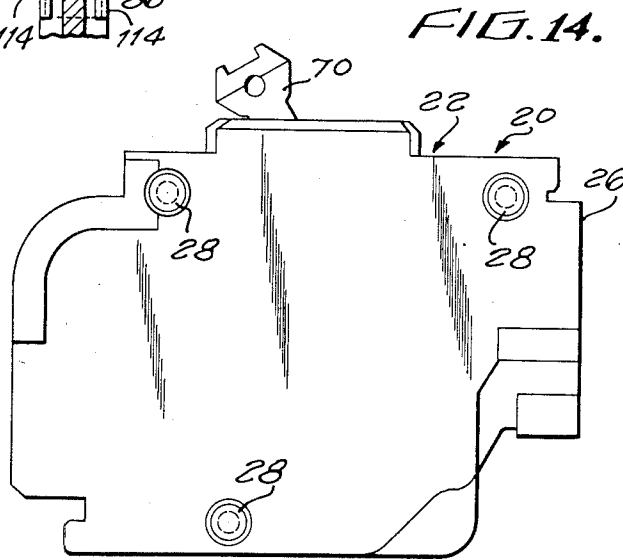


FIG. 14.

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2,700,713

AUTOMATIC CIRCUIT BREAKER

Thomas M. Cole, Harrison, N. Y., and Paul M. Christensen, West Orange, N. J., assignors to Federal Electric Products Company, Newark, N. J., a corporation of Delaware

Application July 10, 1953, Serial No. 367,324

25 Claims. (Cl. 200—116)

The present invention relates generally to automatic circuit breakers and, in particular, to circuit breakers of the type in which an actuator is pivotally carried by the movable contact member and is latched thereto under the control of a current-responsive device for the manual operation of the circuit breaker to open and close the latter.

Circuit breakers of the general type to which the present invention relates are shown in U. S. Pat. No. 2,209,319, to Paul M. Christensen, one of the joint inventors hereof, and are also shown in U. S. Pat. No. Re. 23,188, to Harold A. Humpage, both assigned to the assignee hereof, as well as in several patent applications assigned to the assignee of the present invention, one or more of which applications will be subsequently referred to as the description proceeds.

The subject application is a continuing application of our application Serial No. 285,418, filed May 1, 1952, now U. S. Patent No. 2,681,396 dated June 15, 1954, and, as indicated in said patent, in order to assure the required contact pressure for proper engagement between the companion contacts of the circuit breaker when the latter is closed, provision is made for a resilient pivot, which may be constituted by a spiral spring member, which mounts the movable contact member, which spring member flexes to provide for limited bodily movement of the movable contact member, and which serves to bias the movable contact member, to resiliently press the latter against the stationary contact for proper contact pressure when the circuit breaker is closed to compensate for wear of the contact, or for other inequalities.

Pursuant to the present invention, and an object thereof, provision is made for the flexing of the spiral spring pivot in an additional direction to provide for a sliding or "wiping" movement of the movable contact member, after the initial contact has been made between the companion contacts of the circuit breaker, in order to remove film which results from the oxidation of the material used to fabricate the contacts of the circuit breaker, for example, tungsten, said film resulting from oxidation of the material which tends to reduce the conductivity of the contacts.

Another object is the provision of a circuit breaker of generally reduced width or thickness. In accordance with the last mentioned object, it is a more specific object to provide a circuit breaker casing having spaced lateral walls provided with planar outer surfaces and having improved bearing means for mounting a pivoted handle between said walls without requiring thickened portions on the outer wall surfaces.

An additional specific object, in accordance with said last mentioned object, is the provision of a latch constituted by a thermal control member and a magnetic member, each of substantially the same width, and provided with improved means for securing said members together without increasing, to any substantial extent, the overall width thereof, whereby to permit for a circuit breaker construction of generally reduced thickness.

A further object is the provision of improved means for guiding the movable contact member for pivotal movement in a substantially fixed path between the casing walls where the pivot thereof is not constituted by a rigid element.

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.

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In the drawings:

Fig. 1 is a side view of a circuit breaker, pursuant to the present invention, a portion of the casing being removed, and the circuit breaker being illustrated in the circuit making condition thereof;

Fig. 2 is a view similar to Fig. 1, with the circuit breaker being illustrated in the circuit interrupting condition thereof;

Figs. 3 and 4 are end views of the circuit breaker, as seen in the direction of the arrows 3 and 4, respectively, in Fig. 1;

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a fragmentary sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is an inner side fragmentary view of the cover member of the circuit breaker casing, on an enlarged scale;

Fig. 8 is a view, on an enlarged scale, of the terminal prong member of the circuit breaker;

Fig. 9 is a fragmentary view, on an enlarged scale, of a pivot bearing recess defined in a body part of the circuit breaker casing;

Fig. 10 is a sectional view, on an enlarged scale, taken on the line 10—10 of Fig. 1;

Fig. 11 is a fragmentary view of a portion of Fig. 10 and illustrates the spring pivot in the circuit making condition thereof;

Fig. 12 is a top plan view of the circuit breaker;

Fig. 13 is a bottom plan view of the circuit breaker;

Fig. 14 is a side view of the circuit breaker; and

Figs. 15 and 16 are fragmentary sectional views taken on the lines 15—15 and 16—16, respectively, of Fig. 10.

Referring now to the drawings in detail, the circuit breaker 20, of the present invention, comprises a two-part insulation casing 22 having the complementary molded body and cover parts 24 and 26, respectively, which are secured together in housing defining relation, as best seen in Figs. 3, 4, 10, 12 and 13, as by the securing elements 28 (Fig. 14) which pass through the openings 30 in the casing parts, when the latter are in assembled relation. The casing parts define a chamber 31 in which the circuit breaker mechanism, generally indicated at 33, is mounted, an arcing chamber 32, an open recess 34 in which the wire terminal member 36 is disposed, and a chamber 38 in which the terminal prong member 40 is mounted, all substantially as illustrated and described in the U. S. application Ser. No. 127,433, filed November 15, 1949 by Thomas M. Cole, a joint inventor of the present invention, now Patent No. 2,647,186 dated July 28, 1953, and in U. S. Pat. No. 2,642,509 issued to the joint inventors hereof, both of which are assigned to the assignee of the present application. As here shown, the terminal member 40 (Fig. 8) is in the form of the plug-in or prong type terminal member, as generally described in the above mentioned U. S. Patent No. 2,647,186, and is specifically of the type illustrated and described in the copending application of Thomas M. Cole, a joint inventor hereof, Ser. No. 331,871, filed January 19, 1953 and assigned to the assignee hereof. As illustrated and described therein, and as shown herein, the stab contact 40 is formed from a strip of suitable conducting material which is bent upon itself as at 42 to form the companion prong or stab elements 44 and 46. Said elements are normally laterally offset from each other, so as to only partially overlap each other, so that when said prong elements are urged in opposite directions, respectively, for full mutual overlapping thereof, due to the inherent resiliency of the strip material, each prong will be biased for return to the normal position thereof, which is illustrated in Fig. 8. Each prong is notched in both side edges thereof, as at 48 and 50, for locking engagement in a terminal slot, as illustrated in said latter application, and the prongs are tapered to facilitate the entry thereof in said terminal slot. The prong member 46 is provided with the laterally extending ears 52 which engage in complementary recesses 54 of the chamber 38, to mount the prong terminal 40 in the body casing member 24, and in the plane thereof, as best illustrated in Figs. 1, 2 and 3. The companion terminal prong 44 is provided with the bent back portions 55 which secure one end of a flexible lead 57 there-

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to, the other end thereof being connected to the circuit breaker mechanism, as hereinafter described in detail. It will be understood that the specific type of prong member which is herein illustrated is not essential to the present invention but, on the contrary, a different type of prong terminal member may be provided in place thereof, for example, as illustrated and described in the copending application of Paul M. Christensen, a joint inventor hereof, Ser. No. 353,843, filed May 8, 1953, or, an entirely different type of terminal member may be provided in place of the plug-in type of terminal member herein.

The stationary contact 56 is carried by the previously mentioned terminal member 36 in a position within the arcing chamber 32 to be engaged by the movable contact 58 carried by the movable contact member 60. More specifically, the terminal member 36 is constituted by a single strip of conducting material which is shaped, as fully illustrated and described in the previously mentioned U. S. Patent No. 2,647,186, to provide the housing portion 62 for receiving a load line, and the laterally extending portion 64 which carries the stationary contact 56, said terminal member being mounted in the circuit breaker casing, in the same manner as illustrated and described in said latter application.

The movable contact member 60 is mounted for pivotal movement between the casing parts 24 and 26, and parallel to the confronting surfaces thereof, to and from its circuit closed condition, illustrated in Fig. 1, in which contact 58 engages the stationary contact 56, and to and from its circuit open position, illustrated in Fig. 2, in which the movable contact 58 is shown disengaged from the stationary contact 56. This movement may be accomplished manually by the pivoted handle 70 which is connected to a channel-shaped actuator 72 by a link 74. Said link is pivotally connected, at one end thereof, to a lug 76 provided on the handle 70 and at its opposite end is pivotally connected to said actuator, as at 78, as fully illustrated and described in said U. S. Patent No. 2,647,186. The actuator 72 is pivotally mounted on the movable contact member 60, as indicated at 80, and is operatively connected to the movable contact member for moving the latter under the control of the current responsive latch 82 which, as here shown, includes a flexible bimetallic strip 84 and an electro-magnetic device 86, by which said actuator is releasably latched to the movable contact member, as described in the above mentioned patent Re. No. 23,188.

It will be understood that, as illustrated in Fig. 1, when the handle 70 is in the "on" or circuit closed position thereof, and the actuator 72 is latched to the movable contact member 60 by engagement with the outer end of the bimetallic strip 84, as shown, relative pivotal movement between the actuator and the movable contact member is prevented and contact 58 is in engagement with contact 56. In this position of the parts, the circuit through the breaker is completed from the terminal member 36, through the engaged contacts, through the movable contact member 60, through the bimetallic strip 84, which is connected to one end of the previously mentioned flexible conductor 57, and through the latter to the terminal member 40. In this position of the parts, the link 74 and the actuator 72 are in overset toggle condition and, in order for the circuit breaker to open either automatically, i. e. pursuant to the flexing of the bimetallic strip 84, either upon heating thereof or by the attraction of the strip to the electromagnet armature 86, the toggle must be broken and this can take place either by movement of the handle 70 to its circuit open position (Fig. 2) manually or by release of the end 88 of the actuator 72 by the bimetallic strip 84, when the circuit breaker trips upon overload or upon other predetermined load conditions. The opening of the circuit breaker, when the latch member 84 releases the actuator 72, is effected by the spring 90, which is engaged at one end thereof with a lug 92 provided on the handle 70, and at its other end thereof is engaged with a lug 94 provided on the movable contact member 60. It will be understood that spring 90 biases both the movable contact member and the handle to the circuit open positions thereof so as to move both the handle and the movable contact member to said positions, as illustrated in Fig. 2, when the latch member 84 disengages the actuator 72. It will also be understood that even though the handle 70 is held in the "on" position, the spring 90 is effective to open the circuit breaker when the latter is tripped, i. e. when the latch 82 dis-

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engages the actuator 72, whereby to provide a "trip-free" breaker.

A feature of the present invention is the provision of a resilient pivot mounting for the movable contact member of the circuit breaker in order to permit both for a limited bodily movement of the movable contact member and for the biasing of the movable contact 58 toward the stationary contact 56 in the closed circuit position of the movable contact member, in order to provide the proper pressure between said contacts when they are engaged, or to compensate for wear or other inequalities in the various cooperating parts of the circuit breaker, said resilient pivot mounting providing, in addition, for "wiping" the companion contacts in order to remove any oxidized film which might have formed thereupon, which film would tend to offer resistance to the flow of current through said contacts. More specifically, the resilient pivot mounting of the present invention is constituted by a tightly coiled spiral spring 96 (Figs. 10 and 11) the opposite ends of which are mounted in bearing recesses 98 and 100 provided in the companion casing parts 24 and 26, respectively. It will be noted from Figs. 10 and 11 that the bearing recesses 98 and 100 are each provided with a lower surface portion 102 which is inclined downwardly from the top to the bottom of the casing, viewing Figs. 1, 2 and 10 to permit for the downward bowing or flexing of the spiral spring pivot 96, from the circuit interrupting disposition thereof, as illustrated in Fig. 11, to the circuit making disposition thereof, as illustrated in Fig. 10. It will be understood that when the circuit breaker toggle is in the overset condition thereof, there will be a component of force which tends to urge the portion 61 of the movable contact member 60, in which the spring pivot 96 is mounted, in a downward direction, as best illustrated in Fig. 10, whereby to downwardly flex or bow the pivot 96 from the condition thereof illustrated in Fig. 11, which represents the open or "off" condition of the circuit breaker, to the condition thereof illustrated in Fig. 10, which represents the closed or circuit making condition of the circuit breaker. The downwardly inclined portions 102 of the bearing recesses 98 and 100 permit said flexing of the pivot 96 whereby to bodily carry said portion 61 of the movable contact member 60, downwardly from the position thereof illustrated in Fig. 11 to the position thereof illustrated in Fig. 10. The flexed pivot 60, being tensioned, will resiliently urge the movable contact member 60 in a direction to move the portion 61 thereof upwardly toward the original position thereof, whereby to resiliently bias the movable contact 58 against the stationary contact 56 to provide the required contact pressure.

In addition to the previously described inclined bearing surfaces 102 which allow for the flexing of the spring pivot 96 in the direction of the arrow 104 in Figs. 1 and 2 to provide for the required contact pressure, provision is made for the bearing surface portions 106, as best illustrated in Figs. 7, 9 and 16, which are inclined in the direction of the arrows 108 in Figs. 1 and 2, transversely of the direction of inclination of the bearing surfaces 102, whereby to permit for limited bodily movement of the movable contact 60 in the direction of the arrows 108. More particularly, in moving the handle 70, from the position thereof illustrated in Fig. 2 to the full line position thereof illustrated in Fig. 1, in order to close the circuit breaker and to overset the toggle constituted by the link 74 and the actuator 72, the handle passes through an intermediate position thereof, which is illustrated in broken line in Fig. 1, at which intermediate position the toggle is at the point of being overset. At said intermediate position, the movable contact 58 makes its initial contact with the stationary contact 56, as illustrated in the broken line position thereof illustrated in Fig. 1. Continued movement of the handle 70 through said intermediate position to its full line position Fig. 1, to complete the oversetting of the toggle, creates a lateral component of force in the direction of the arrow 108, which results in limited bodily movement of the movable contact member 60 in the direction of said arrow to cause the movable contact 58 to slide along or "wipe" the abutting surface of the stationary contact 56 and to position said movable contact in the full line position thereof illustrated in Fig. 1. The bearing portions 106 which are inclined in the direction of the arrow 108, as best illustrated in Fig. 16, permit the spring pivot 96 to flex in the direction of the arrow 108 to allow for the limited bodily

movement of the movable contact member in said direction. Said wiping action, applied during the tensioning of the spring 96 as in Fig. 16, tends to remove any film formed on the abutting surfaces of the companion contacts. Upon tripping of the breaker there is a "wiping" action in the opposite direction.

As presently constructed, the circuit breaker 20 is substantially one-half inch wide, i. e. from the outer surface of casing part 24 to the outer surface of casing part 26. In order to provide for said overall widthwise dimension of the casing 22, the outer surfaces of the casing parts 24 and 26 are planar and devoid of outwardly projecting reinforcing portions, as best seen in Figs. 3, 4, 10, 12, 13 and 14. Therefore, in order to pivotally mount the handle 70, said casing parts are provided with the confronting bearing portions 110 and 112 which pivotally mount the handle 70, the latter being provided with a bearing aperture 113 in which the bearing portions are engaged, as best seen in Fig. 10. Consequently, the necessity for handle bearing recesses in the casing parts, as heretofore, which require outwardly projecting reinforcing portions on the outer surfaces of the casing parts, is obviated.

Pursuant to another feature of the present invention to provide for a circuit breaker of a minimum overall thickness the magnetic member 86 is made substantially of the same width as the bimetal 84 and, in order to secure the magnetic member to the bimetal, portions 114 of the material of the magnetic member, at the opposite edges thereof, are forced about the opposite side edges of the strip 84 and upset upon the latter, as best illustrated in Figs. 10 and 15. In this connection it will be understood that the magnetic member 86 is made of comparatively soft metal so that the portions 114 may be readily upset therefrom to secure the bimetal 84 thereto.

As previously indicated, the bearing apertures 98 and 100 are tapered in the direction of the arrow 108. However, it will be noted that said bearing apertures do not taper in the direction opposite to the arrow 108. Consequently, if for any reason, the handle 70 should fail to return to the position thereof illustrated in Fig. 2 upon the tripping of the circuit breaker, the breaker being "trip-free" as previously indicated, the actuator 72 will pivot in a clockwise direction from the position thereof illustrated in Fig. 1, and the latching tip 88 thereof will be engaged by the bimetal 84 inwardly of the free end of the latter upon the cooling of the bimetal. Thereafter, in order to reset the circuit breaker, it is necessary to manually move the handle substantially from the position thereof illustrated in Fig. 1, to the position thereof illustrated in Fig. 2, and this will result in the movement of the link 74 toward the stationary contact 56 as illustrated in Fig. 2. In this connection the untapered bearing portions 116-116 (Figs. 7 and 9) constitute detents, especially for a weak pivot spring which ordinarily may tend to flex in the direction opposite the arrow 108 to prevent the resetting operation, but which is prevented from flexing in said opposite direction by said detents whereby to permit for said resetting operation whether or not the pivot spring is relatively weak.

Pursuant to another feature of the present invention, provision is made to guide and retain the movable contact member 60 for pivotal movement thereof in a fixed path between and parallel to the laterally spaced casing walls 24 and 26, even though it is mounted on a resilient pivot mounting. In this connection the previously mentioned bearing recesses 98 and 100 are defined by the inwardly projecting and confronting portions 118 and 120 of the casing walls 24 and 26 which define a guideway 122 for the movable contact member 60, as best illustrated in Figs. 10 and 11.

While we have shown and described a preferred embodiment of our invention, it will be understood that various changes may be made in the 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. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel

to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts.

2. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said spiral spring pivot mounting being additionally flexible in a direction to provide limited bodily movement of said one contact member in a direction transversely of the plane of the engaged contact faces for providing resilient contact pressure between said contacts when the latter are engaged with each other.

3. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said spiral spring pivot mounting being additionally flexible in a direction to provide limited bodily movement of said one contact member in a direction transversely of the plane of the engaged contact faces for providing resilient contact pressure between said contacts when the latter are engaged with each other, said spiral spring being mounted between the opposite ends of said one contact member for supporting the latter for said pivotal movement thereof and for providing said resilient contact pressure.

4. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and a casing for said circuit breaker provided with bearings for the opposite ends, respectively, of said spring pivot, said bearings being inclined in a direction to facilitate said limited bodily movement of said one contact member.

5. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said spiral spring pivot mounting being additionally flexible in a direction to provide limited bodily movement of said one contact member in a direction transversely of the plane of the engaged contact faces for providing resilient contact pressure between said contacts when the latter are engaged with each other, said spiral spring being mounted between the opposite ends of said one contact member for supporting the latter for said pivotal movement thereof and for providing said resilient contact pressure, and a casing for said circuit breaker provided with bearings for the opposite ends, re-

spectively, of said spring pivot, said bearings being inclined in a first direction to facilitate said limited bodily movement of said one contact member in said parallel direction, and said bearings being additionally inclined in a direction to facilitate said limited bodily movement of said one contact member in said transverse direction.

6. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; a spiral spring pivot mounting for said one contact member which is flexible in a direction to provide for limited bodily movement of said one contact member in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and a casing for said circuit breaker provided with bearings for the opposite ends, respectively, of said spring pivot, said bearings being inclined in a direction to facilitate said limited bodily movement of said one contact member, and said bearings each having a detent portion to prevent flexing of said pivot at one side of its axis in said parallel direction.

7. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, spiral spring pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts.

8. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, spiral spring pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said pivot means being additionally flexible in a direction to provide limited bodily movement of movable contact member in a direction transversely of said sliding movement for providing resilient contact pressure between said contacts when the latter are engaged with each other.

9. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, spiral spring pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said pivot means being additionally flexible in a direction to provide limited bodily movement of movable contact member in a direction transversely of said sliding movement for providing resilient contact pressure between said contacts when the latter are engaged with each other, and means for moving said movable contact member to a substantially stationary position in which said companion contacts are in engagement, said moving means comprising a toggle mechanism operatively connected to said movable contact member and held in overset condition when said movable contact member is in said stationary contact-engaged condition thereof, and spring means for moving said mov-

able contact member to open-circuit position upon release of said operative connection of said actuator thereto.

10. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, spiral spring pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said pivot means being additionally flexible in a direction to provide limited bodily movement of movable contact member in a direction transversely of said sliding movement for providing resilient contact pressure between said contacts when the latter are engaged with each other, and means for moving said movable contact member to a substantially stationary position in which said companion contacts are in engagement, said moving means comprising a toggle mechanism operatively connected to said movable contact member and held in overset condition when said movable contact member is in said stationary contact-engaged condition thereof, and spring means for moving said movable contact member to open-circuit position upon release of said operative connection of said actuator thereto, said spiral spring pivot being intermediate the contact of said movable contact member and said operative connection thereto.

11. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, and means for actuating said movable member to engage and disengage said companion contacts, helical spring pivot mounting means for said movable member mounting the latter for said movement thereof and for limited bodily movement in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and said mounting means additionally mounting said movable member for limited bodily movement in a direction transversely of said parallel direction for providing resilient contact pressure between said contacts when the latter are engaged with each other.

12. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, and means for actuating said movable member to engage and disengage said companion contacts, helical spring pivot mounting means for said movable member mounting the latter for said movement thereof and for limited bodily movement in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and said mounting means additionally mounting said movable member for limited bodily movement in a direction transversely of said parallel direction for providing resilient contact pressure between said contacts when the latter are engaged with each other, said mounting means including a casing for said circuit breaker, said casing having laterally spaced walls provided with aligned bearing apertures for the opposite ends, respectively, of said helical spring pivot, and said apertures having provision to permit for the flexing of said pivot in said parallel and transverse directions.

13. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, and means for actuating said movable member to engage and disengage said companion contacts, helical spring pivot mounting means for said movable member mounting the latter for said movement thereof and for limited bodily movement in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and said mounting means

additionally mounting said movable member for limited bodily movement in a direction transversely of said parallel direction for providing resilient contact pressure between said contacts when the latter are engaged with each other, said mounting means including a casing for said circuit breaker, said casing having laterally spaced walls provided with aligned bearing apertures for the opposite ends, respectively, of said helical spring pivot, and said apertures having provision to permit for the flexing of said pivot in said parallel and transverse directions, said bearing apertures extending inwardly from the outer surfaces, respectively, of said casing walls, and each being inclined in intersecting directions to facilitate the flexing of said pivot in said parallel and transverse directions, respectively.

14. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, and means for actuating said movable member to engage and disengage said companion contacts, helical spring pivot mounting means for said movable member mounting the latter for said movement thereof and for limited bodily movement in a direction parallel to the plane of the engaged contact faces to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, and said mounting means additionally mounting said movable member for limited bodily movement in a direction transversely of said parallel direction for providing resilient contact pressure between said contacts when the latter are engaged with each other, said mounting means including a casing for said circuit breaker, said casing having laterally spaced walls provided with aligned bearing apertures for the opposite ends respectively, of said helical spring pivot, and said apertures having provision to permit for the flexing of said pivot in said parallel and transverse directions, said bearing apertures extending inwardly from the outer surfaces, respectively, of said casing walls, and each being inclined in intersecting directions to facilitate the flexing of said pivot in said parallel and transverse directions, respectively, and said bearing apertures each having a detent portion to prevent flexing of said pivot at one side of its axis in said parallel direction.

15. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto, under the control of said latch, for closing the circuit breaker, said latch comprising a thermally responsive member and a companion magnetic member, said thermally responsive member being releasably connected to said actuator and said magnetic member having a portion thereof which is upset over said thermally responsive member to secure said latch members together.

16. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto, under the control of said latch, for closing the circuit breaker, said latch comprising a thermally responsive member and a companion magnetic member, said latch members having abutting portions and mutually spaced portions, said abutting portions being secured together by upset portions of said magnetic member.

17. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto, under the control of said latch, for closing the circuit breaker, said latch comprising a thermally responsive member and a companion magnetic member, said latch members having abutting portions and mutually spaced portions, said abutting portions being secured together by upset portions of said magnetic member, and said latch members being substantially of the same widthwise dimension.

18. In a circuit breaker, a casing having laterally spaced walls, a stationary contact mounted in said casing, a contact member mounted for pivotal movement

between said walls and having a contact engageable with and disengageable from said stationary contact, and mechanism in said casing for operating said contact member to engage and disengage said contacts, said mechanism having a manually operable member, and aligned confronting bearings provided on said casing walls, respectively, and mounting said manually operable member for pivotal movement in said casing.

19. In a circuit breaker, a casing having laterally spaced walls, a stationary contact mounted in said casing, a contact member mounted for pivotal movement between said walls and having a contact engageable with and disengageable from said stationary contact, and mechanism in said casing for operating said contact member to engage and disengage said contacts, said mechanism having a manually operable member, and aligned confronting bearings provided on said casing walls, respectively, and mounting said manually operable member for pivotal movement in said casing, and means mounting said contact member for said pivotal movement comprising pivot means for said movable contact member and aligned confronting bearing apertures provided in said casing walls for said pivot means, said casing walls having planar outer surfaces, respectively, and said bearings and bearing apertures extending inwardly of the outer surface of the associated casing wall, whereby to obviate reinforcing portions on said outer surfaces, respectively.

20. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, resilient pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said pivot means being additionally flexible in a direction to provide limited bodily movement of movable contact member in a direction transversely of said sliding movement for providing resilient contact pressure between said contacts when the latter are engaged with each other, and a casing for said circuit breaker, said casing having laterally spaced walls provided with aligned bearing recesses for the opposite ends, respectively, of said pivot, said bearing recesses having inclined portions to facilitate flexing of said pivot in both of said directions, said walls having aligned confronting bearing portions, and means for moving said movable contact member to engage and disengage said contacts, said moving means including a handle mounted for pivotal movement on said bearing portions.

21. In a circuit breaker having a stationary contact, a pivotally movable contact member having a contact engageable with and disengageable from said stationary contact, a current responsive latch carried by said movable contact member, and an actuator pivotally mounted on said contact member and operatively connected thereto under the control of said latch, for closing the circuit breaker, resilient pivot means for said movable contact member, said pivot means being flexible in a direction to provide for limited bodily movement of said movable contact member in the engaged condition of said contacts to provide for a limited sliding movement of the movable contact along the face of the stationary contact upon engagement and disengagement of said contacts, said pivot means being additionally flexible in a direction to provide limited bodily movement of movable contact member in a direction transversely of said sliding movement for providing resilient contact pressure between said contacts when the latter are engaged with each other, said latch comprising a thermally responsive member and a companion magnetic member, said latch members having abutting portions secured together by upset portions of said magnetic member, and said latch members being substantially of the same widthwise dimension.

22. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of

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said contact members being substantially rigid and pivotally movable in a substantially fixed path; means for providing resilient contact pressure between said contacts when the latter are engaged with each other, said means comprising a resiliently movable mounting for said pivotally movable contact member for supporting the latter for said pivotal movement thereof and resiliently biasing said movable contact member in a direction to provide said contact pressure, and means guiding said pivotally movable contact member for pivotal movement thereof in said fixed path.

23. In a circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; means for providing resilient contact pressure between said contacts when the latter are engaged with each other, said means comprising a resiliently movable mounting for said pivotally movable contact member for supporting the latter for said pivotal movement thereof and resiliently biasing said movable contact member in a direction to provide said contact pressure, and means guiding said pivotally movable contact member for pivotal movement thereof in said fixed path, a casing in which said contact members are mounted, said casing having parts providing a pivotal support for said movable contact member and constituting said guide means.

24. In an automatic circuit breaker having a casing, a movable contact member mounted for pivotal movement in said casing and provided with a contact engageable with a companion contact in abutting face-to-face relation therewith in the closed condition of the circuit breaker, and means for pivotally moving said movable contact member to engage said contact thereof with and to disengage it from said companion contact; means in said casing providing said pivotal mounting for said

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movable contact member, comprising pivotal bearing parts and spring biased means supporting said movable contact member in said bearing parts, said spring biased means acting on said movable contact member to press its contact yieldably against said companion contact in abutting face-to-face relation therewith when said movable contact member is pivotally moved to close the circuit breaker, said pivotal bearing parts defining a guideway for said movable contact member to guide the latter for pivotal movement thereof in a substantially fixed path.

25. In an automatic circuit breaker having companion relatively movable contact members provided with contacts, respectively, engageable with and disengageable from each other for closing and opening the breaker, at least one of said contact members being substantially rigid and pivotally movable in a substantially fixed path; means for providing resilient contact pressure between said contacts when the latter are engaged with each other, said means comprising a resiliently movable mounting between the opposite ends of said movable contact member for supporting the latter for said pivotal movement thereof and for providing resilient contact pressure between said contacts when the latter are engaged, a casing having laterally spaced walls between which said movable contact member is disposed for said movement thereof said resiliently movable mounting including pivotal bearing portions provided on said casing walls, respectively, said bearing portions defining a guideway for said movable contact member to guide the latter for pivotal movement thereof in a substantially fixed path parallel to said walls.

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