March 4, 1969 J. ELLENBERGER 3,431,517

TERMINAL BOARD WITH PLUG-IN TYPE PUSHBUTTON-CONTROLLED CIRCUIT BREAKERS

Original Filed Aug. 18, 1964 Sheet 1 of 4

Fig.1

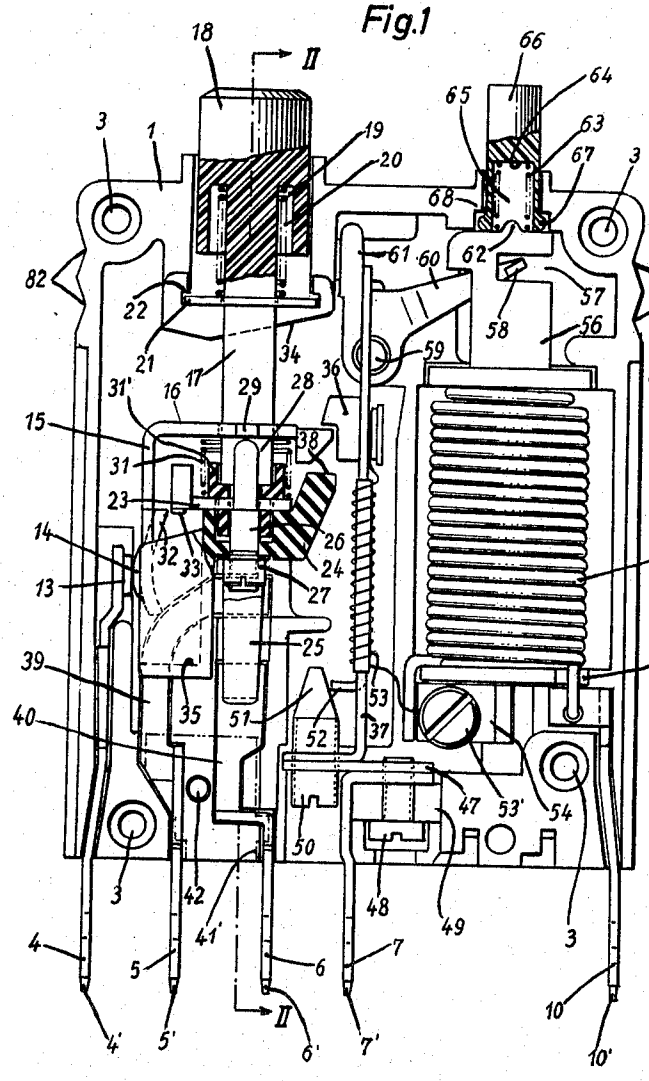
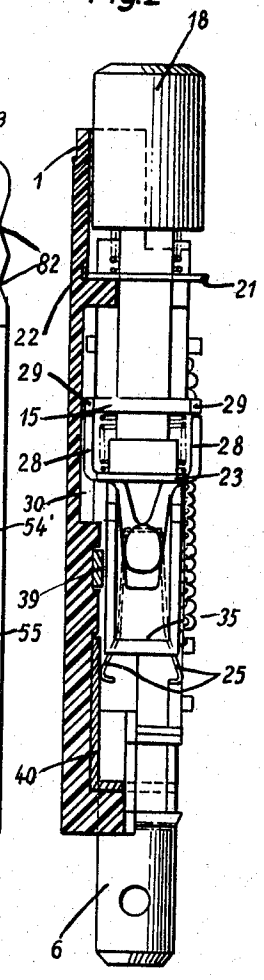


Fig.2



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TERMINAL BOARD WITH PLUG-IN TYPE PUSHBUTTON-CONTROLLED CIRCUIT BREAKERS

Original Filed Aug. 18, 1964 Sheet 2 of 4

Fig.4

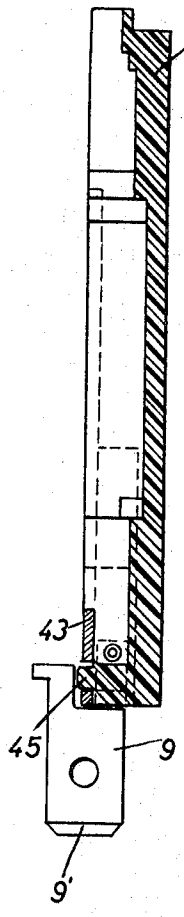
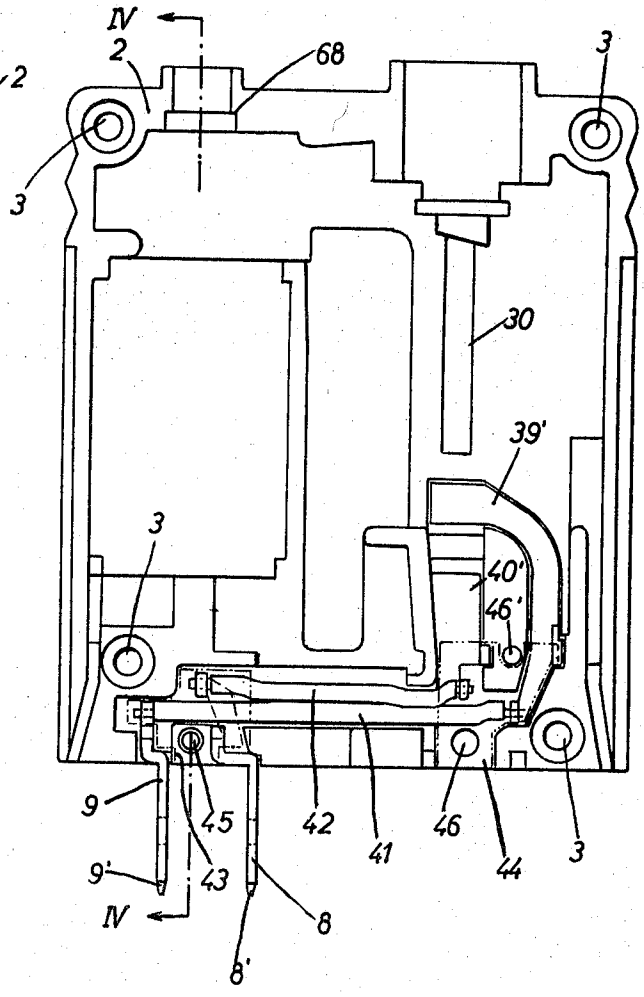


Fig.3



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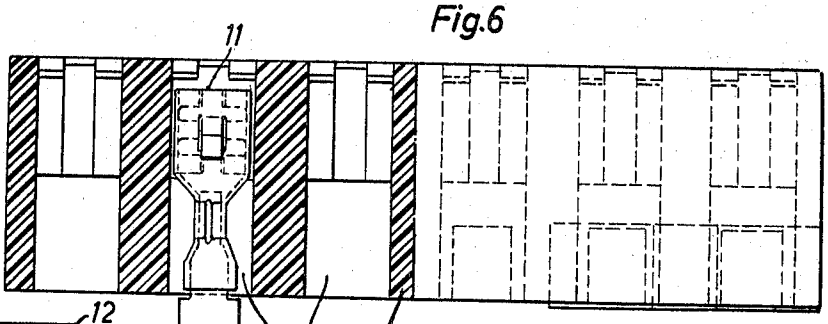
TERMINAL BOARD WITH PLUG-IN TYPE PUSHBUTTON-CONTROLLED CIRCUIT BREAKERS

Original Filed Aug. 18, 1964 Sheet 3 of 4

Fig.6



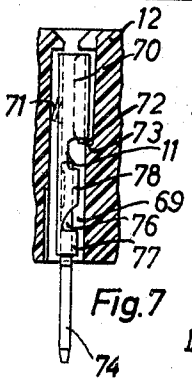


Fig.7

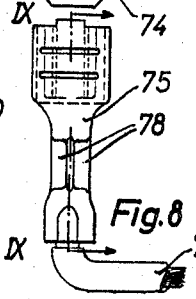


Fig.8

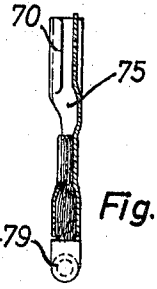


Fig.9

Fig.5

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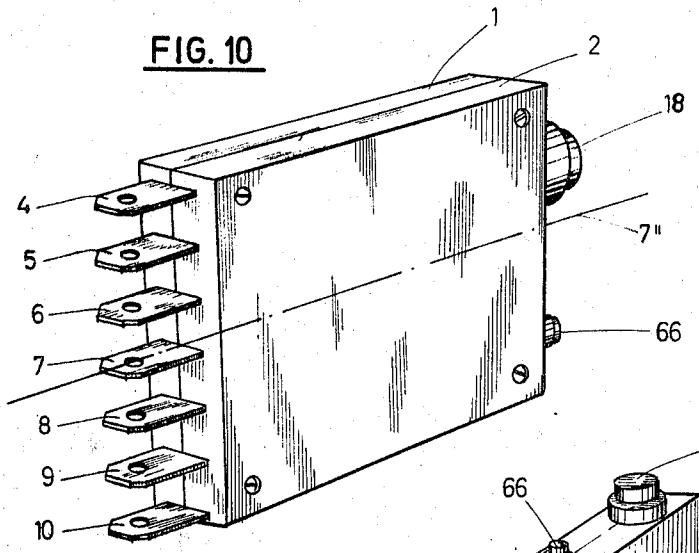
FIG. 10



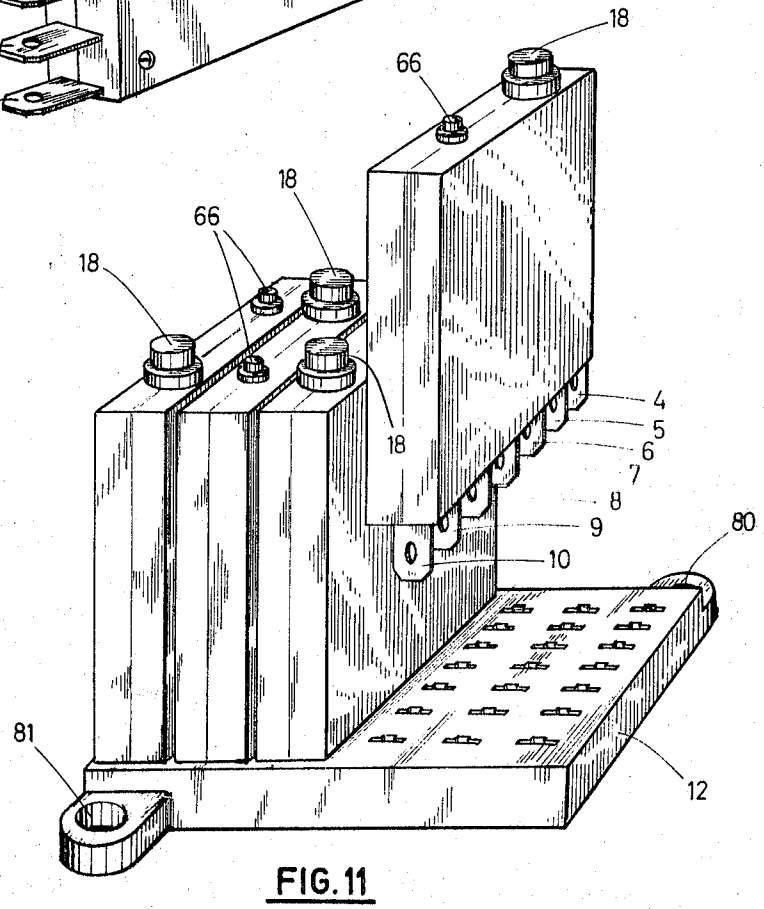


FIG. 11

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United States Patent Office

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TERMINAL BOARD WITH PLUG-IN TYPE PUSH-BUTTON-CONTROLLED CIRCUIT BREAKERS

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Continuation of application Ser. No. 390,322, Aug. 18, 1964. This application Dec. 2, 1966, Ser. No. 598,878
Claims priority, application Germany, Nov 27, 1963, E 25,922
U.S. Cl. 335—35 8 Claims
Int. Cl. H01h 71/16, 73/30, 77/02

ABSTRACT OF THE DISCLOSURE

A terminal board with pushbutton controlled circuit breakers mounted thereon. The circuit breaker has prongs extending from one end of the breaker and the pushbutton extending from the opposite end of the breaker. The prongs of the circuit breaker are so arranged that the breaker may be plugged into the terminal board in either one of two orientations, which are reversed by 180°, without any effect on the circuit connections.

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of application Ser. No. 390,322, filed Aug. 18, 1964, now abandoned for "Push-Button Controlled Overload Circuit Breaker."

The present invention relates to a pushbutton-controlled overload circuit breaker of the type which is provided with thermally responsive releasing means and a contact bridge in the form of an angular lever which is freely pivotable on projections on a control bridge which is rigidly connected by a control rod to the spring-loaded pushbutton. This contact bridge is also movable in the axial direction of the control rod and it is pressed by these projections against an inclined stop when the circuit breaker is switched off. When the circuit breaker is switched on, a detent on this contact bridge engages with the control bridge and the contact bridge is then taken along by the control bridge until it is moved behind a holding detent on the thermally responsive releasing means. A circuit breaker of this type is also provided with signal contacts which are adapted to be bridged by a contact spring or the like which is secured to and movable with the control bridge and it is further provided with a plurality of terminal strips corresponding in number to the main and secondary contacts and the releasing means terminals. These strips are electrically connected with the main contacts and the signal or secondary contacts of the circuit breaker, as well as to the releasing means.

There is a circuit breaker of the above-mentioned type already known, for example from U.S. Pat. No. 2,895,-028, the terminal strips of which are connected to the terminals of an associated terminal board by being soldered thereto. When these connections are being made, there is the danger that one or several terminal strips of the circuit breaker might not be connected to the proper terminals on the terminal board but with other terminals so that the circuit breaker may operate improperly or its operation might result in wrong connections. Furthermore, several circuit breakers of the mentioned kind are arranged on the terminal board side-by-side in such a manner that the starting pushbuttons of the different circuit breakers and, if provided, their release pushbuttons as well are disposed within one row. If these circuit breakers are located closely adjacent to each other, it is relatively difficult to manipulate the individual push-

buttons and to depress those and only those which should be depressed.

It is an object of the present invention to improve the construction of an overload circuit breaker of the type as above described and to design the same in a manner so as to permit several of these circuit breakers to be mounted closely adjacent to each other in such an arrangement that the pushbutton or buttons of each of them may be easily operated individually without danger that accidentally the pushbuttons of adjacent circuit breakers might also be depressed. A further object of the invention is to design the overload circuit breaker in such a manner that its terminal strips will always be properly connected to the associated contacts on a terminal board and any erroneous connections will be absolutely prevented. These objects are attained according to the invention by providing the terminal strips of each circuit breaker in the form of connecting plugs, by arranging these plugs in uniformly longitudinally spaced relation and symmetrically to a plane extending through the circuit breaker in the direction in which it is to be plugged into the sockets on the terminal board, and by connecting the terminal strips to the main and signal or secondary contacts in a manner so as to permit the connecting plugs of each circuit breaker to be inserted into the associated sockets on the terminal board. The sockets are arranged in spaced rows each comprising a number of sockets equal to the number of plugs on a circuit breaker, and the sockets have the same spacing and symmetrical arrangement as the plugs. Thereby one circuit breaker may be rotated 180° about its longitudinal axis of symmetry relative to an adjacent circuit breaker. Due to its particular inventive design and construction, the new overload circuit breaker has therefore the advantage that it may be very easily connected and that erroneous connections will be impossible. It is merely necessary to insert its plug-shaped terminal strips into the corresponding plug sockets in the associated terminal board in order to attain a proper and noninterchangeable electric connection of the circuit breaker and also to secure it mechanically in a fixed position to the terminal board. If several circuit breakers are to be mounted on and connected to the same terminal board, every circuit breaker may be so rotated through an angle of 180° relative to the one adjacent thereto. The pushbuttons of the different circuit breakers will therefore be staggered relative to each other and may thus be easily operated.

For releasing it in the event of a short circuit, the known overload circuit breaker of this type is provided with electromagnetic releasing means, the field coil of which is connected in series with the heating coil of the bimetal strip of the thermal releasing means. The fixed contact, the bimetal strip, and the free end of the field coil of this circuit breaker are each connected to a separate terminal strip. According to the present invention, however, the terminal strip which is connected to the bimetal strip lies within the plane of symmetry of the circuit breaker, the terminal strips which are connected to the fixed contact and to the free end of the field coil lie at the outer sides, and the terminal strips which are connected to the signal contacts are located between these three terminal strips. The terminal strips of the signal contacts for a signal circuit are then arranged symmetrically at both sides of the central terminal strip of the bimetal strip.

The electromagnetic releasing means and thus the field coil may also be omitted from the overload circuit breaker according to the invention in the same manner as this is possible in the known overload circuit breaker. The main current is then conducted directly through the central terminal strip and the bimetal strip.

In order to permit the circuit breaker according to the invention to be easily employed either with or without a field coil, the heating coil of the bimetal strip is connected to the field coil so as to be easily disconnected therefrom, for example, by means of a terminal screw.

For protecting the signal contacts from arcing over, the control bridge carries a block of insulating material which is provided within the area in which the contact on the contact bridge and the associated fixed contact are located within a chamberlike recess which serves as a quenching chamber for these contacts and prevents any arcing toward the signal contacts. The insulating block is further provided at the side facing the holding detent of the bimetal strip with a projection which engages upon the holding detent when the contact bridge is in a neutral position in which the contact bridge is not in engagement either with the fixed contact or with the holding detent of the bimetal strip but entirely separated therefrom. When the contact bridge is in this neutral position, the contact spring which is secured to the control bridge also does not engage with the signal contacts but is fully insulated therefrom. This projection on the insulating block has the advantage that it cannot damage the holding detent of the bimetal strip and that therefore this holding detent will last for a long time and will always insure a proper release of the circuit breaker.

In order to be highly reliable in operation and to prevent the occurrence of resonance phenomena, especially within the excess current range, the pushbutton for the manual release of the circuit breaker is provided, at the side facing toward the inside of the housing, with a socket bore in which a tensioned compression spring is mounted.

The opposite narrow sides of the housing of the circuit breaker are preferably provided with transverse grooves to permit the circuit breaker to be held with a firm grip when it is to be inserted into or pulled out from the plug sockets in the associated terminal board. Each of these sockets is loosely inserted into an aperture in the terminal board so as to have a considerable play therein. This facilitates considerably the insertion of the connecting plugs on the outer ends of the terminal strips of the circuit breaker into the plug sockets and it insures that each of these plugs will make proper contact with the associated socket and will remain in such contact even though the circuit breaker and the terminal board are subjected to considerable jarring or vibrations. In order to permit the connecting lines leading to the plug sockets of the terminal board also to be easily and removably connected to these sockets, the latter are provided on their rear ends with connecting plugs upon which plug sockets which are secured to the ends of the connecting lines may be plugged. Several overload circuit breakers according to the invention therefore form a structural unit together with the terminal board into which they are plugged, and the connecting lines may be connected to this unit in a very simple manner by making the rear ends of the plug sockets of the terminal board in the form of connecting plugs and by providing the ends of the connecting lines with corresponding plug sockets.

By providing the opposite sides of the terminal board with mounting lugs which are laterally offset relative to each other, it is possible to mount several of these terminal boards closely adjacent to each other since two adjacent terminal boards will then be separated only by a distance which is equal to the width of one mounting lug.

For simplifying the manufacture of the circuit breakers and the associated terminal boards, the invention further provides that the terminal strips forming the connecting plugs and the associated plug sockets on the terminal board are spaced at equal distances from each other.

Still another feature of the invention consists in connecting the signal contacts of the circuit breaker to their associated terminal strips from which they are spaced by means of insulated conductors.

The various features and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which—

FIGURE 1 shows an elevation of an overload circuit breaker, according to the invention, from which the upper part of the housing has been removed;

FIGURE 2 shows a cross section which is taken along the line II—II of FIGURE 1;

FIGURE 3 shows a view of the inside of the upper part of the housing which serves as a cover for the circuit breaker according to FIGURE 1;

FIGURE 4 shows a cross section which is taken along the line IV—IV of FIGURE 3;

FIGURE 5 shows a top view of a terminal board for several overload circuit breakers according to FIGURES 1 to 4;

FIGURE 6 shows a cross section which is taken along the line VI—VI of FIGURE 5;

FIGURE 7 shows a cross section which is taken along the line VII—VII of FIGURE 5;

FIGURE 8 shows an elevation of a plug socket on the end of a conecting line;

FIGURE 9 shows a cross section which is taken along the line IX—IX of FIGURE 8;

FIG. 10 is a perspective view of a circuit breaker embodying the invention; and

FIG. 11 is a perspective view of the circuit breaker and the terminal board, illustrating three circuit breakers mounted on the terminal board and one circuit breaker just before being plugged into the terminal board.

As illustrated in the drawings, the overload circuit breaker according to the invention is installed in a housing which is divided into two halves **1** and **2** which may be connected to each other by tubular rivets which are inserted into bores **3**. As shown particularly in FIGURES 1, 3, 10 and 11, the circuit breaker is provided with seven terminal strips **4** to **10**, the ends **4'** to **10'** of which are tapered (FIGS. 1–4) so as to serve as connecting plugs which may be inserted into corresponding sockets **11** on a terminal board **12**. All of the terminal strips **4** to **10** are inserted into corresponding slot-shaped recesses in both housing parts **1** and **2** and are held in a fixed position by these housing parts.

The terminal strip **4** is provided at its upper end, according to FIGURE 1, with a contact **13** which is operatively associated with a contact **14** on a contact bridge **15**. The horizontal arm **16** of contact bridge **15** is provided with a bore through which a control rod **17** extends with considerable play, which permits the contact bridge **15** to be shifted along the control rod **17** in the axial direction thereof and also to be pivoted relative thereto. The upper end of control rod **17** carries a push-button **18** and rod **17** and push button may be integral with each other and should be made of an insulating material. In its lower side, pushbutton **18** has an annular recess which extend coaxially thereto and contains the upper part of a release spring **20**, the lower end of which is supported on an insulating plate **21** which is inserted into a slot-shaped recess **22** in the housing part **1**.

The lower end of control rod **17** carries a control bridge **23**, which is stamped of sheet metal, a block of insulating material **24**, and a substantially U-shaped contact spring **25**. These parts are rigidly secured to the control rod **17** by means of a screw **26** and a nut **27**. The control bridge **23** is provided on each side with a projection **28** on which the contact bridge **15** is pivotable. Contact bridge **15** is for this purpose provided on both sides with tablike projections **29** which, together with the projections **28** of the control bridge **23**, are slidably guided in longitudinal grooves **30** in both housing parts **1** and **2**. Between the horizontal arm **16** of contact bridge **15** and the control bridge **23**, a coil spring **31** is interposed which serves for the trip-free release of the circuit breaker and is weaker than the release spring

20. This spring 31 is guided by a sleeve 31' which is secured to the control rod 17.

Contact bridge 15 is further provided with a detent 32 which is pressed out of the vertical arm of this bridge and is adapted to engage with the left end 33 of the control bridge 23 when the contact bridge 15 is in its disconecting or off position in which it engages with the inclined surfaces 34 on the two housing parts 1 and 2.

The insulating block 24 is provided at the side facing the contacts 13 and 14 with a relatively large recess 35 which serves as a chamber for quenching an arc which might occur between the two contacts 13 and 14.

The overload circuit breaker according to the invention is illustrated in FIGURE 1 in its on position in which the right end of contact bridge 15 engages, under the action of the release spring 20 and the weaker coil spring 31, with a holding detent 36 on a bimetal strip 37. The right end of the insulating block 24, which forms a detent 38, is adapted to engage with the holding detent 36 on the bimetal strip 37 when the control bridge 23 and the pushbutton 18 are in a neutral intermediate position.

Both housing parts 1 and 2 are further provided with suitable recesses into which contact members 39, 39', 40 and 40' are inserted. Contact member 39 is electrically connected to the terminal strip 5 and contact member 40 to the terminal strip 6, while contact member 39' is connected by an insulated conductor 41 to the terminal strip 9, as shown in FIGURE 3, and contact member 40' by an insulated conductor 42 to the terminal strip 8.

When the circuit breaker is in the on position as shown in FIGURE 1, the contact-forming ends of the arms of contact spring 25 engage upon the contact members 40 and 40' so that the latter are electrically connected to each other by the contact spring 25. In the off position, however, in which the contact bridge 15 engages upon the inclined surfaces of the two housing parts 1 and 2, the ends of the arms of contact spring 25 engage upon the contact members 39 and 39' so that these two contact members are electrically connected to each other by the contact spring 25.

If the right end 38 of the insulating block 24 is in engagement with the holding detent 36 of the bimetal strip 37, the contact-forming ends of the arms of contact spring 25 engage upon the walls of the two housing parts 1 and 2. These contact-forming ends are then located intermediate the contact members 39, 40 and 39', 40'. Therefore, when the contact spring 25 is in this position, it has no electric conection either with the contact members 39 and 39' or the contact members 40 and 40'. Contact bridge 15 is then also located in an intermediate position in which its detent 32 is held arrested by the left end 33 of the control bridge 23 and in which it is not connected either with the fixed contact 13 or with the holding detent 36 of the bimetal strip 37 but separated entirely from both of them.

The terminal strips 5 and 6 are held in a fixed position in the housing part 1 by an insulating plate 41', as shown in FIGURE 1 in dot-and-dash lines, and they are partly covered thereby. By means of a hole in the insulating plate 41', this plate is fitted tightly over a stud 42' which is integral with the housing part 1.

For the same purpose, the other housing part is also provided with two insulating plates 43 and 44, as shown in dot-and-dash lines in FIGURE 3, which cover the points of connection of the terminal strips 8 and 9 and the conductors 41 and 42 with the contact members 39' and 40'. These insulating plates 43 and 44 are likewise tightly fitted by means of bores and a slot over the studs 45, 46, and 46' which are integral with the housing part 2.

The lower end of the bimetal strip 37 is bent over at a right angle and secured to a metal plate 47 which, in turn, is secured together with the terminal strip 7 to a projection 49 on the housing part 1 by means of a screw 48. Terminal strip 7 extends along the center line 7'' (FIG. 10) of the circuit breaker. The bent end of the bimetal strip 37 and the left end of the metal plate 47, as shown in FIGURE 1, are provided with a setscrew 50 the tapered end 51 of which engages laterally upon a tab 52 which is stamped out of the bimetal strip 37. The setscrew 50 serves for adjusting the circuit breaker to the particular current intensity at which it should be switched off.

Underneath the holding detent 36 the bimetal strip 37 carries a heating coil 53 the lower end of which, as shown in FIGURE 1, is clamped by a screw 53' to a metal plate 54 which is inserted into a suitable recess in the housing part 1 and to which the end of a winding of a fixed coil 54' is soldered, this coil being mounted on a spool 55 which is inserted into suitable apertures in both housing parts 1 and 2. The other end of the field coil winding 54' is soldered to the upper end of the terminal strip 10. Spool 55 contains an armature 56 which has a slot-shaped recess 57 into which the bent end 58 of a lever 60 which is pivotably mounted on a stud 59 which is integral with the housing part 1.

If the field coil winding 54' is energized and the armature 56 is thereby drawn into the spool 55, lever 60 is pivoted in the clockwise direction, as seen in FIGURE 1, whereby the arm 61 of lever 60 takes along the upper end of the bimetal strip 37 and pivots the same in the clockwise direction so that the holding detent 36 releases the contact bridge 15.

The armature 56 has a projection 62 for guiding a tensioned coil spring 63 which acts with its lower end upon the upper side of the armature 56 and with its upper end upon the bottom of a recess 65 in a pushbutton 66 for manually releasing the circuit breaker. This release button 66 has on its lower end an annular flange 67 which, under the action of spring 63, engages upon an annular shoulder 68 conjointly formed by both housing parts 1 and 2. Pushbutton 66 is adapted to press the armature 56 into the spool 55 and thereby to cause the circuit breaker to be switched off.

The signal circuits may be provided, for example, with colored lamps so that, when the circuit breaker is in the on position, a lamp of one color, for example, a red lamp, will light up, while when the circuit breaker is in the off position, a lamp of another color, for example, a green lamp, will light up. If the insulating block 24 which is secured to the control rod 17 is arrested when its detent 38 is held by the holding detent 36 of the bimetal strip 37, the contact forming ends of the arms of the contact spring 25 will be located in a neutral position between the signal contacts 39, 39' and 40, 40' so that neither the red nor the green lamp will light up.

If the circuit breaker has been released either by electromagnetic or thermal action, the green lamp will be lit to indicate to the operator of the apparatus that the circuit breaker has been switched off. As an indication that he has recognized the actuation of the circuit breaker, the operator will then depress the pushbutton 18 so far into the housing that the detent 38 of the insulating block 24 snaps behind the holding detent of the bimetal strip 37. This will extinguish the green lamp. The supervisor of the section containing the apparatus when noting that no lamp is burning but that the pushbutton 18 projects considerably from the housing will thereby know that the circuit breaker has been switched off and also that this fact has already been noted by the operator of the apparatus. Since in this neutral intermediate position of the contact bridge 15 the circuit within the overload circuit breaker is opened, there is no possibility that the bimetal strip 37 might be pivoted by a magnetic or thermal action. A release of the contact bridge 15 is then possible only by an actuation of the manual release button 66. Of course, it is also possible to depress the main pushbutton 18 still further into the housing from this neutral position until the right end of the contact bridge 15 has snapped behind the holding detent 36 of the bimetal strip and the circuit breaker is thereby switched on.

As may be seen particularly in FIGURE 6, the terminal board **12** is provided with a separate aperture **69** for each plug socket **11**. The sockets are arranged in parallel rows each including seven uniformly spaced sockets. Each of these sockets consists of two arms **70** which are rolled inwardly toward each other. On its rear side, each socket **11** has a resilient projection **71** which is pressed out of the material of the socket. When the socket **11** is being inserted into one of the apertures **69** this projection **71** is pressed resiliently toward the notch from which it has been cut out, and it is not released until the lowest edge **72** of the arms **70** has passed beyond the shoulder **73**. This shoulder therefore locks the socket **11** in the aperture **69** in the position as illustrated in FIGURE 7, even though within the aperture **69** the socket **11** has a considerable play which facilitates the insertion of one of the terminal strips **4** to **10** and insures that the circuit breaker will be securely held. The plug sockets **11** then adjust themselves automatically in accordance with small deviations of the inserted terminal strips. On its lower end, each socket **11** is further provided with a flat plug pin **74**, as shown in FIGURES 6 and 7, upon which a corresponding plug socket **75**, as shown in FIGURES 8 and 9 may be plugged. The flat plug pin **74** has a reduced pin-shaped extension **76** which is gripped by two lateral arms **77** and two lateral tabs **78**. The tabs **78** may also be pinched together so as to insure a perfect mechanical and electrical connection between the socket **11** and the flat plug pin **74**.

The plug socket **75** is of the same construction as the plug socket **11**. As shown in FIGURES 8 and 9, the lower end of the socket **75** is connected to a conductor **79** which is gripped by the lateral arms **77** and the lateral tabs **78**.

The terminal board **12** is provided on its opposite sides with a pair of mounting lugs **80** and **81** which are laterally offset relative to each other. This permits several terminal boards **12** to be mounted adjacent to each other in such a manner that only two mounting lugs **80**, **81** will be located between two adjacent terminal boards. In this manner space will be saved since each pair of terminal boards **12** has to be separated only by a distance which is equal to the width of one mounting lug **80**, **81**.

As illustrated in FIGURE 5, the terminal board **12** contains several rows of sockets **11** adjacent to each other, and each comprising seven sockets, so that several overload circuit breakers may be plugged into this board, as shown in FIG. 11. Because of the particular construction and arrangement of the terminal strips **4** to **10** it is possible to arrange the circuit breakers so as oriented about their longitudinal axes of symmetry by an angle of 180° relative to each other, also as shown in FIG. 11. The pushbuttons **18** and **66** of the different circuit breakers are then more easily accessible and may therefore be more easily manipulated. The apertures **69** and thus also the sockets **11** are equally spaced from each other at the same distance as the terminal strips **4** to **10**.

In order to improve the grip on the circuit breaker to permit it to be more easily pulled out of the terminal board **12**, both housing parts **1** and **2** are provided on each of their opposite narrow outer sides with a pair of transverse grooves **82** above each other, as shown in FIGS. 1 and 3. For the sake of simplicity, grooves **82** have not been shown in FIGS. 10 and 11.

Having thus fully disclosed my invention, what I claim is:

1. In combination, a terminal board having plural sockets arranged in openings therein, and at least two identically constructed overload circuit breakers arranged for mounting on said terminal board; each overload circuit breaker comprising a narrow casing having a pair of narrow ends, a pair of narrow side walls interconnecting said narrow ends, and a pair of relatively wide side walls interconnecting said narrow ends; each casing having a longitudinal center line extending parallel to the plugging direction; each casing having, at one narrow end thereof, at least one pushbutton arranged off-center with respect to said center line and, at the opposite narrow end thereof, at least one pair of plug contacts for the electrical connection of the overload circuit breaker; the plug contacts of each circuit breaker being arranged in a main circuit to be interrupted by the overload circuit breaker and being arranged at opposite sides of said center line and extending in the direction of plugging, and being arranged at equal distances from said center line which intersects a line connecting the two plug contacts; said two overload circuit breakers being plugged into said terminal board in parallel relation with each other with their relatively wide side walls facing each other, and being opposite each other with their plug contacts being inserted into corresponding sockets of the terminal board; one of the overload circuit breakers being rotated by 180° about its longitudinal center line relative to the other overload circuit breaker; the pushbuttons of the two overload circuit breakers being displaced relative to each other in a direction perpendicular to a line interconnecting the longitudinal center lines of the two overload circuit breakers.

2. The combination claimed in claim **1**, wherein each circuit breaker has a main switch means including, for thermal operation, a bimetallic strip provided with a heating coil thereon and, for electromagnetic operation, a solenoid winding; each circuit breaker including two fixed load contacts in spaced relation to each other, one of said contacts being mounted on said bimetallic strip, and including a first contact bridge interconnecting said load contacts in the closed position of the circuit breaker; each circuit breaker further having secondary switch means including four fixed signal contacts arranged in two spaced pairs, and a second contact bridge selectively interconnecting one pair of signal contacts or the other pair of signal contacts in accordance with the circuit breaker position; there being seven plug contacts on each circuit breaker arranged in three pairs, with the seventh plug contact extending from said opposite narrow end of said casing on said longitudinal center line; one of the outermost plug contacts of each circuit breaker mounting the other fixed load contact and the outermost plug contact being connected to one end of said solenoid winding, the other end of said solenoid winding being connected in series to said heating coil; said seventh plug contact of each circuit breaker being connected to said bimetallic strip; the plug contacts of one of the remaining pair, on each circuit breaker, being connected to respective signal contacts of one pair, and the plug contacts of the other remaining pair being connected to respective contacts of the other pair of signal contacts.

3. The combination claimed in claim **2**, including a relatively elongated switching rod displaceable longitudinally in a direction parallel to said center line, and connected to said one pushbutton for operation therewith; spring means biasing said pushbutton outwardly; a switching bridge rigidly secured on said switching rod and having a pair of shoulder forming means disposed on respective opposite sides of said switching rod and projecting longitudinally of the latter; said first contact bridge comprising a bell crank lever having a transverse arm formed with an aperture through which said switching rod extends and pivotal on the ends of said shoulders; said one fixed load contact on said bimetallic strip having a retaining nose latching said first contact bridge against movement toward said one pushbutton; said casing being formed with means providing an abutment extending obliquely and transversely of said switching rod adjacent said one end of said casing, said abutment being engaged by said transverse arm of said first contact bridge, upon release of said contact bridge by said other load contact, to pivot said first contact bridge in a direction to disengage the latter from said one load contact; the other arm of said first contact bridge being formed with an abutment engageable by said switching bridge upon inward movement of said one pushbutton to reclose the circuit breaker whereby said first contact bridge

is carried along by said switching bridge to slip past said one load contact and be latched therebehind; a dielectric block fixed with respect to said switching bridge and defining a chamber facing toward said other fixed load contact and serving as an arc-quenching chamber protecting against arcing and, in the neutral position of the circuit breaker, being disposed between the two pairs of signal contacts; said switching bridge being formed with a projection which, in the neutral position of the circuit breaker, engages behind the retaining nose of said one load contact.

4. The combination claimed in claim 2, the relatively narrow side walls adjacent said one end of each casing being formed with gripping surfaces facilitating plugging-in of the circuit breaker into said terminal board.

5. The combination claimed in claim 2, in which each of said sockets is a jack loosely inserted in its associated opening in said terminal board.

6. The combination claimed in claim 5, in which the opposite ends of said jacks project from the rear surface of said terminal board and are formed as plug terminals.

7. The combination claimed in claim 1, in which said terminal board is substantially rectangular and has mounting lugs projecting from a pair of opposite sides thereof, each mounting lug being adjacent a respective other side of said terminal board.

8. The combination claimed in claim 1, in which said plug contacts are uniformly spaced and aligned in a row extending across said opposite narrow end of said casing and intersecting said longitudinal center line; said terminal board openings being arranged in a rectilinear row at uniform spacings equal to the spacings of said plug contacts.

References Cited

UNITED STATES PATENTS

2,924,807	2/1960	Field.	
2,929,966	3/1960	Bangert	317—119
3,141,717	7/1964	Olsson et al.	

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