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2,824,932

THERMAL OVERLOAD CIRCUIT BREAKER

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Fig. 1

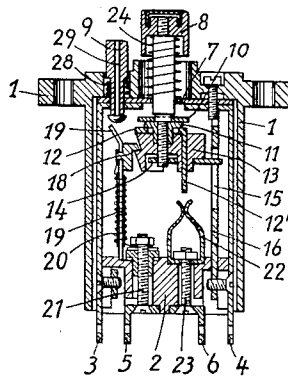


Fig. 2

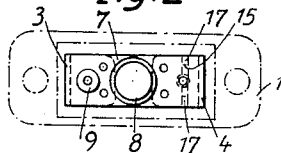


Fig. 4

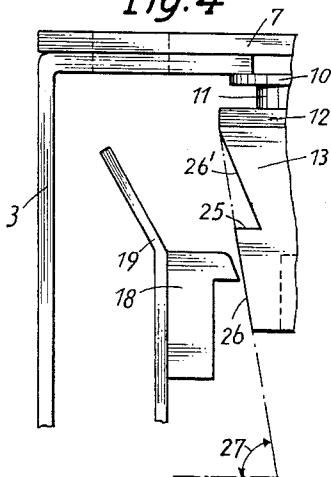
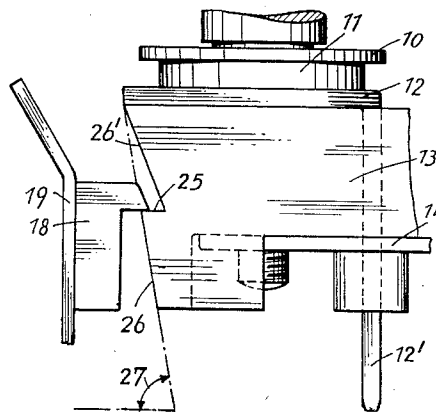


Fig. 3



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## THERMAL OVERLOAD CIRCUIT BREAKER

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9 Claims. (Cl. 200—116)

The present invention relates to a thermal overload circuit breaker, and more particularly to further improvements in the thermal overload circuit breaker as described and illustrated in my prior copending application Serial No. 222,473, now Patent No. 2,767,281.

That prior application describes and shows a thermal overload or excess current circuit breaker which is provided with a contact bridge having a push button which when depressed against the force of a disconnecting or release spring places the contact bridge into its operative or contact-making position in which it is held by means of a projecting contact which is mounted on the free end of a bimetallic strip which is heated by the current which the circuit breaker is intended to control. In this operative position, the contact bridge also forms the connection to a second contact. If a current passes through the bimetallic strip, the projecting contact disengages from and releases the contact bridge which can then be moved by the disconnecting spring into the circuit-breaking position in which the electrical connection will be interrupted both between the contact bridge and the bimetallic strip, as well as between the contact bridge and the second contact.

It is an object of the present invention to provide an overload circuit breaker of the type as described which, considering its high circuit-breaking efficiency, is of very simple construction and small dimensions, and which is further provided with means for controlling an auxiliary electric circuit so that the latter will be closed when the circuit breaker is in its disengaged or released position, such auxiliary circuit serving to indicate or record such released position of the circuit breaker at a point remote from the place of installation of the circuit breaker.

Another object of the present invention is to provide a circuit breaker of the type as described which substantially retains the same small dimensions and mechanical simplicity as if such additional mechanism were not provided therein.

A feature of the invention for attaining the latter object consists in loosely mounting on the movable element which also forms the support of the contact bridge and is operated by a push button, a contact disk so as to be insulated from the contact bridge by a suitable insulating disk or the like. Such contact disk then forms a secondary contact bridge for an auxiliary electric circuit which is closed under the pressure of the disconnecting or release spring of the circuit breaker when the latter is in its current-breaking position.

According to the invention, the stationary contacts for the auxiliary circuit are formed by two stationary L-shaped contact strips, the longer arms of which form the longitudinal sides of the circuit breaker proper and carry soldering terminals at their lower ends which are to be connected to the auxiliary circuit, while their short, substantially horizontal arms which face each other form the counter-contacts which are to be bridged by the contact disk so as to close the auxiliary circuit when the circuit breaker is in its released position. For increasing the stability of these contact strips, as well as of the entire

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circuit breaker, they may also be interconnected by means of an insulating member which connects the short arms of the contact strips with each other so that the contact strips with the insulating member form a framelike unit.

5 This insulating member also forms a guiding element for supporting and guiding a switch-on button, which is connected to the contact bridge, as well as a release button which acts upon an inclined surface on the movable end of the bimetallic strip.

10 It is a further object of the present invention to provide the circuit breaker with a measuring contact which, although safely hidden to prevent accidental injury to the operator, is easily accessible from the outside of the circuit breaker, such measuring contact permitting the resistance of the heating coil on the bimetallic strip or the contact resistance of the switch contacts on the contact bridge to be measured even though the circuit breaker has been installed in a wall or machine and its inner parts are thus not accessible from the outside.

20 Another object of the present invention is to provide the circuit breaker with suitable means for holding the contact bridge in a position intermediate the contact-making and contact-breaking position, in which intermediate position both electric circuits, that is, the main circuit as well as the auxiliary circuit are interrupted.

25 A feature for attaining this latter object of the invention consists in providing a block of insulating material to support the main contact bridge and to provide such insulating block with a suitable angular notch or tooth which is adapted to cooperate with the locking projection on the movable end of the bimetallic strip. This angular notch or tooth is preferably provided on the insulating block at a point intermediate the fully engaged and fully released positions of the contact bridge so that, when the switch-on button is partly depressed, the locking projection on the bimetallic strip will engage with such intermediate notch and hold the circuit breaker in a position in which neither the main contact bridge closes the main circuit nor the auxiliary contact bridge closes the auxiliary circuit.

40 Still another object of the invention is to provide means for preventing an accidental locking of the circuit breaker in such intermediate position. This object may be attained by tapering-down the outer faces of the notch or tooth on the insulating block both above and below the locking surface thereof, so that when the projection on the bimetallic strip bends away from and releases the contact bridge, it will not accidentally engage the intermediate notch but slide past the same and release the insulating block entirely to assure the closing of the auxiliary current.

Additional features and advantages of the present invention will become apparent from the following detailed description thereof particularly when read in connection with the accompanying drawings, in which:

Fig. 1 shows a longitudinal section through the circuit breaker according to the invention;

Fig. 2 is a plan view thereof, with the housing of the circuit breaker, however, only being indicated in dot-and-dash lines;

Fig. 3 is an enlarged detail view, showing the contact bridge arrested in the intermediate position; while

Fig. 4 shows the contact bridge in the fully released position so as to close the auxiliary electric circuit.

Referring to the drawings, the housing 1 of insulating material which is open at its lower end contains an insulating member 2 preferably of ceramic material on which the two contact terminals 3 and 4 are secured to which an auxiliary electric circuit is to be connected, as well as the two inner terminals 5 and 6 leading to the main circuit. Each of the two connecting strips 3 and 4 forms a substantially L-shaped supporting member on

the shorter upper arms of which a plate 7 of insulating material is secured which is provided with a central aperture within which the switch-on button 8 is slideably guided which a coil spring 24 tends to hold in an elevated position. The contact member 3 and the insulating plate 7 are further provided with coaxial bores for additionally supporting and guiding a release button 9 which is slideably mounted in a suitable aperture in the cover plate which preferably forms an integral part of the housing 1. The button 9 is provided with a narrow central bore extending entirely therethrough, and in said bore a metallic pin 29 is firmly secured which has at its lower end a smoothly rounded contact head. As shown in Fig. 1, the pin 29 does, however, not extend entirely through the bore in the button 9 but terminates at a point below the upper surface thereof which is spaced a sufficient distance from such upper surface so that the finger of the operator when depressing the release button 9 cannot possibly come into contact with the pin 29 and receive an electric shock. A coil spring 23 around the button 9 tends to maintain the button in a raised position in which it is normally held by the projecting contact head of the metallic pin 29 abutting against the lower surface of the short arm of the contact member 3.

The central switch-on button 8 is provided at its lower end with a pin-shaped threaded portion of reduced diameter which is screwed into an insulating block 13 which carries on its upper surface an annular contact member 12 with a downwardly extending prong 12' which is adapted to be firmly engaged by two contact springs 22 when the switch-on button 8 is in its fully depressed position. On its lower surface, the insulating block 13 also carries a guide member 14 which is likewise screwed to the threaded extension of the button 8 and laterally guided within a vertical slot 15 of an elongated rail 16 which has a pair of prongs at its upper end inserted into a pair of notches 17 in the upper horizontal portion of the contact member 4. Likewise screwed on the threaded stem of the button 8 and so as to overlie the annular contact member 12 is an insulating disk or sleeve 11. Intermediate the stem portion and the main cylindrical portion of the button member 8 is a neck portion on which a round contact disk 10 is loosely mounted and resting on the insulating disk 11, so that, when the button 8 is in its fully released upward position, such contact disk 10 connects the two L-shaped contacts 3 and 4, the lower ends of which are connected to the auxiliary current circuit.

On the left side, as shown in the drawings, the main terminal 5 is rigidly secured by a screw 21 to one end of a bimetallic spring strip 19, which carries adjacent its outwardly bent upper end a contact 18 which has an inwardly projecting finger thereon which, when the push button 8 is fully depressed against the action of the spring 24, engages the upper surface of the annular contact member 12, thus closing the main circuit with the current then flowing from the terminal 5 through the screw 21, the bimetallic strip 19, the annular contact member 12, its prong 12', the two contact springs 22, and the screw 23 to the other main terminal 6. As shown in Fig. 1, the bimetallic strip 19 is also provided with a heating coil 20 which is electrically insulated therefrom along its length and the ends of which are connected thereto either in parallel or in series.

Approximately half-way intermediate the upper surface of the annular contact member 12 and the lower end of the insulating block 26, the latter is provided on the left side thereof, as seen in the drawings, with a notch 25 into which the inwardly projecting finger of the contact 18 is first adapted to engage when the push button 8 is being depressed. If, at such time, the push button 8 is no further depressed, contact 18 arrests the insulating block 13, as well as the annular contact member 12, and the contact disk 10 in an intermediate position, wherein the contact member 12 is disconnected from the con-

tacts 18 and 22, and the contact disk 10 is disconnected from the contact members 4 and 5 so that both the main current circuit, as well as the auxiliary current circuit, are interrupted.

To assure a smooth operation of the circuit breaker and a gradual and secure locking action of the contact 18 with both the notch 25 and the upper surface of the contact member 12, respectively, the left outer face of the insulating block is tapered off so as to form a surface which is inclined at a suitable angle 27 relative to the perpendicular. Thus, when push button 8 is being depressed, the inclined surface 26 slides along the inclined face of the contact 18, thereby bending back the bimetallic strip 19 against its spring force until the horizontal surface of notch 25 reaches the level of the lower surface of the projecting finger of contact 18 and the latter can snap into notch 25 and hold the insulating block 13 in the intermediate position in which both contact members 12 and 10 are disconnected from their respective counter-contacts so that neither the main nor auxiliary currents are able to flow through the circuit breaker.

When the push button 8 is then further depressed, the inclined face 26' of notch 26 slides along the face or tip of contact finger 18, thereby again bending back the bimetallic strip 19 against its own spring action until the upper surface of contact member 12 reaches the level of the lower surface of contact finger 18 and the latter is able to snap into full engagement with contact member 12. Since at the same time, the contact prong 12' of contact member 12 has been engaged by the two contact springs 22 the main current circuit is closed as previously described.

The release of the circuit breaker is effected either automatically by the tendency of the bimetallic strip 19 to bend when heated, or manually when the release button 9 is being depressed. If the current passing through the bimetallic strip 19 and/or the heating coil 20 should become excessive and the bimetallic strip thus be heated either directly or indirectly, it will bend outwardly so that the contact finger 18 will disengage from contact member 12. Simultaneously, therewith, the strong spring 24 will pull the insulating block 13 quickly upwardly and thereby withdraw the contact prong 12' from the contact springs 22, thus suddenly interrupting the main circuit.

By the provision of the release button 9, the circuit breaker may also function as a manually operated switch. When the button 9 is being depressed, its smoothly rounded head will engage with the outwardly bent upper end of the bimetallic strip 19 and thereby bend the strip outwardly, thereby disengaging the contact finger 18 from the contact member 12 so that the flow of current will be interrupted and the spring 24 can pull the insulating block with the contact member 12 in an upward direction. By tapering the left face of the insulating block 13 inwardly, an accidental engagement of the contact finger 18 with the notch 25 during the release movement will be prevented regardless of whether the bimetallic spring strip 19 bends of its own accord, that is, through being heated by an excess current, or by being manually disengaged from contact member 12 by the release button 9 since the outer tip of the notch 25 is located further inward from the tip of the contact finger 18 than the outer edge of the contact member 12. Thus, in either event, the contact member 12 when released will move fully upwardly so that the contact disk 10 will always interconnect the two contact members 3 and 4 and close the auxiliary circuit which may lead to a suitable indicating recording or alarm device which may be located at any suitable point remote from the circuit breaker. It is thus possible to indicate at such remote point whenever the main current is interrupted by the circuit breaker either by the occurrence of an excess current, or by manual release of the circuit breaker.

By the provision of the central aperture in the release

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button 9, it is also possible, even though the circuit breaker is installed in a closed apparatus or machine to measure the resistance of the heating coil 20 or the contact resistance, respectively, by inserting a thin measuring pin into such central aperture of the depressed button 9 and into contact with the metallic pin 29, and by connecting the other terminal of the measuring instrument either to the terminal 5 or to the terminal 6, respectively. The first measuring circuit extends through the pin 29, the contact 18, and the heating coil 20 to the terminal 5, while the second measuring circuit extends through the pin 29, contacts 18, 12, 12', and 22 to the terminal 6.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof I wish to have it understood that it is in no way limited to the details of such embodiments or to the specific examples described, but is capable of numerous modifications within the scope of the appended claims.

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

1. A thermal overload circuit breaker comprising a contact member in the form of a contact bridge, a resilient bimetallic strip, one end of said strip being fixedly mounted and adapted to be connected to one line of an electric operating circuit, the other end of said strip being freely movable and having a contact finger thereon, said contact finger being adapted to engage with said contact member, said bimetallic strip when heated being adapted to bend and thereby disengage said contact finger from said contact member, a stationary contact element adapted to be connected with said contact member when said contact finger is engaged with said contact member, said contact finger being electrically connected solely with the contact member if the contact member is electrically connected with the said stationary contact element, said contact element adapted to be connected to the other line of said operating circuit, means for mounting said contact member and for moving the same from a first position in which an auxiliary circuit is closed into a second position wherein said contact member engages with and forms an electrical connection to said contact finger and said contact element so as to close said operating circuit, the said contact member being rigidly connected with the said mounting means, resilient means engaging against said mounting means and tending to maintain said contact member in said first position and to return the same to said first position when said contact member is disengaged from said contact finger, a second contact member rigidly mounted on said mounting means and electrically insulated from said first contact member, and a pair of contacts adapted to be connected to the auxiliary current circuit, said second contact member being adapted to interconnect said pair of contacts when said mounting means are in said first position.

2. A thermal overload circuit breaker comprising a housing having a cover, an operating element having a push button at least partly projecting outwardly from said cover and a lower portion extending into said housing, said element being mounted in said cover so as to be slidable in an axial direction, a spring tending to maintain said element in a raised position relative to said housing and cover, a first contact member mounted on said lower portion, a stationary contact on said housing and adapted to be connected to one line of an electric operating current, a resilient bimetallic strip having a lower end fixedly mounted on said housing and adapted to be connected to the second line of said operating circuit, and an upper end being freely movable and having a contact finger thereon, said contact member when depressed by said push button and said operating element being electrically connected with said stationary contact, and adapted to engage with said contact finger on said bimetallic strip and to be locked thereby in such depressed

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position, said bimetallic strip when heated being adapted to bend and thereby disengage said contact finger from said contact member to release the same to be returned by the action of said spring to said raised position and disengage from said stationary contact, a second contact member mounted on said lower portion of said operating element and electrically insulated from said first contact member, and a pair of contacts adapted to be connected to an auxiliary current circuit, said second contact member being adapted to interconnect said pair of contacts when said operating element is in its raised position.

3. A thermal overload circuit breaker as defined in claim 2, wherein said second contact member comprises a disk, said disk being loosely mounted on said lower portion of said element, said pair of contacts comprising two stationary L-shaped contact arms having soldering terminals at their lower ends, the upper shorter parts of said contact strips facing and being separated from each other and being adapted to be electrically connected by said contact disk when said operating circuit is interrupted by said circuit breaker and said operating element is in its fully raised position.

4. A thermal overload circuit breaker as defined in claim 2, further comprising a release button slidably mounted in said cover, a spring tending to maintain said release button in a raised position, said bimetallic strip having an inclined upper end, said release button when being depressed adapted to engage said inclined end so as to bend said bimetallic strip and thereby disengage said contact finger from said first contact member when said operating element is in its depressed position so as to release the same to return to its raised position.

5. A thermal overload circuit breaker as defined in claim 2, wherein said release button has a small central bore extending therethrough, a contact pin secured within said bore and having a contact head at its lower end, the length of said contact pin within said bore being shorter than the length of said bore so as to leave a free opening in the upper end of said release button, said free opening being adapted to permit access of a measuring instrument to the upper end of said contact pin, said bimetallic strip having an upper inclined end, said contact head, when depressed together with said release button being adapted to engage said inclined end so as to bend said bimetallic strip and thereby disengage said contact finger from said first contact member when said operating element is in its depressed position so as to release the same to return to its raised position.

6. A thermal overload circuit breaker as defined in claim 3, wherein the upper shorter parts of said L-shaped contact arms are secured to and interconnected by a plate of insulating material so that said contact arms with said insulating plate form a framelike structure, said insulating plate having an aperture therein, said operating element being slidably guided within and supported by the wall of said aperture.

7. A thermal overload circuit breaker comprising a contact member, a resilient bimetallic strip, one end of said strip being fixedly mounted and adapted to be connected to one line of an electric operating circuit, the other end of said strip being freely movable and having a contact finger thereon, said contact finger being adapted to engage with said contact member, said bimetallic strip when heated being adapted to bend and thereby disengage said contact finger from said contact member, a stationary contact element adapted to be connected with said contact member when said contact finger is engaged with said contact member, said contact element adapted to be connected to the other line of said operating circuit, means for mounting said contact member and for moving the same from a first position into a second position wherein said contact member engages with and forms an electrical connection to said contact finger and said contact element so as to close said operating circuit, resilient means tending to maintain said contact member

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in said first position and to return the same to said first position when said contact member is disengaged from said contact finger, a second contact member mounted on said mounting means and electrically insulated from said first contact member, and a pair of contacts adapted to be connected to the auxiliary current circuit, said second contact member being adapted to interconnect said pair of contacts when said mounting means are in said first position, an insulating member mounted on said mounting means, said insulating member having a notch therein, said contact finger being adapted to engage into said notch of said insulating member when said mounting means are being moved from said first position toward said second position to arrest said insulating member, said mounting means, and said first and second contact members in a position intermediate said first and second positions wherein said first and second contact members are spaced from said contact finger, said contact element and said pair of contacts.

8: A thermal overload circuit breaker as defined in claim 2, further comprising an insulating member mounted on said lower portion of said operating element below said first and second contact members, said insulating member having a side wall facing said contact finger, said side wall being inwardly inclined from the upper to the lower end thereof and having a tooth-shaped notch in said inclined side wall, said contact finger on said bi-metallic strip being adapted to engage into said notch in said insulating member when said push button and operating element are depressed to an intermediate position between said raised and fully depressed positions,

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and to arrest said insulating member, said operating element, and said first and second contact members in a position wherein said first and second contact members are spaced from said contact finger, said stationary contact, and said pair of contacts.

9. A thermal overload circuit breaker as defined in claim 8, wherein said insulating member supports said first contact member, said first contact member comprising an L-shaped member, the shorter substantially horizontal arm of said last member forming the contact which is adapted to be engaged with said contact finger on said bi-metallic strip, the longer arm extending through said insulating member and the free lower end thereof forming a prong, said stationary contact having a pair of co-operating contact springs at its upper end and a soldering terminal at its lower end, said prong being adapted to engage between said contact springs when said first contact member is in its fully depressed position.

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