June 7, 1955 J. ELLENBERGER 2,710,321

PROTECTIVE SWITCH

Filed April 16, 1954

FIG. 1

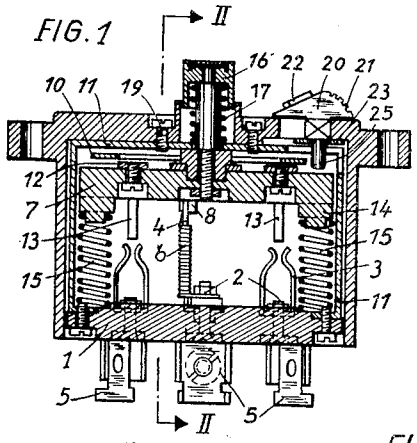


FIG. 2

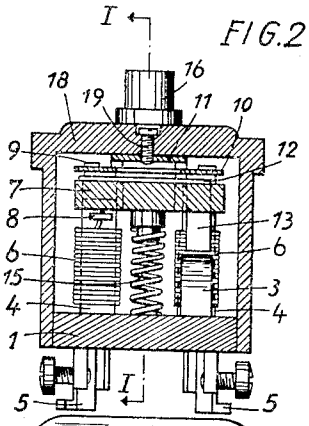


FIG. 3

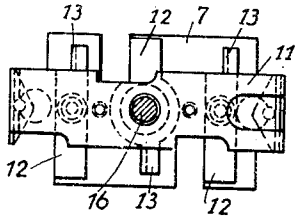


FIG. 5

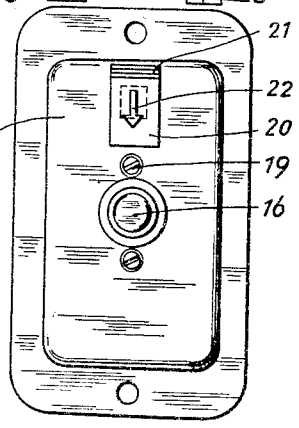


FIG. 4

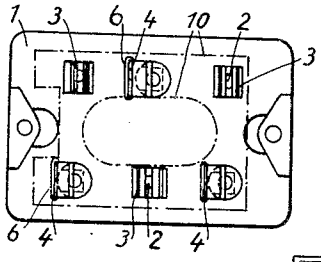


FIG. 6

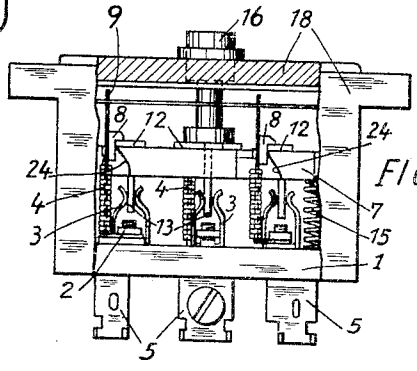


FIG. 7

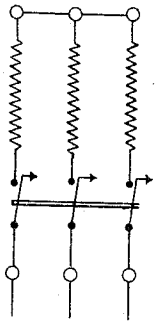
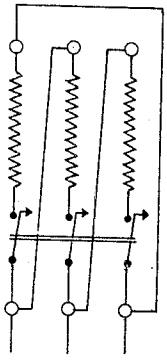


FIG. 8



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PROTECTIVE SWITCH

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9 Claims. (Cl. 200—114)

The present invention relates to improvements in protective switches, and more particularly to multiple-pole switches for electric motors and other electric apparatus.

It is the object of the invention to design a new multiple-pole thermal cut-out switch for a maximum load and of minimum size which will safely protect an electric motor or other electrical apparatus or appliance from overcurrents, which may be caused, for example, by overheated bearings or any other occurrences.

A feature of the invention consists in providing a multiple-pole protective switch of novel design and very small dimensions, in which a movable contact bridge is provided for each circuit, which is safely retained in the on-position by a catch or detent on the movable end of a bimetal strip, and which is quickly released under spring pressure to interrupt the current if an overload occurs and the bimetal strips are bent by the resulting heat, or if the temperature in or around the switch should exceed a certain value for any other reasons.

Another feature of the invention consists in providing the movable contact bridges and the opposed stationary contacts each on a common supporting element parallel to each other, and in mounting each switch element so as to be turned 180° relative to the adjacent elements.

Further features of the invention consist in mounting the individual switch elements, and especially the contact bridges, adjacent each other on a common contact plate, and in providing all of the elements which effect the movement of such contact plate within the area of the switch base on which the stationary contacts are mounted.

Another feature of the invention consists in mounting the contact plate so as to be freely movable and without any special guiding means, and to prevent it from tilting under the pressure of the release spring by holding it at several points which are symmetrically arranged relative to the point of application of the release spring by detents mounted on the free or movable ends of bimetal strips. Such freely movable mounting of the contact plate results in an extremely simple and compact design of the entire switch, and an easy, reliable operation thereof at all times.

An additional feature of the invention resulting from such compact design of the novel switch and the fact that it is made of heat resistant material consists in its application not merely for protecting an electrical machine or apparatus from overcurrents, but also from excessive heat, caused, for example, by overheated bearings or other reasons, in which event the circuit breaker may be mounted in the immediate vicinity of the respective machine part to be controlled, for example, within the housing of the electric motor. Naturally, the application of the new switch is not restricted to electric motors but it may also be used in any other place or be built into any other machine or apparatus, especially if a protective switch of very small dimensions is desired.

Further objects, features, and advantages of the present invention will appear from the following detailed description thereof and the accompanying drawings, in which—

Fig. 1 shows a longitudinal section through a protective switch according to the invention, taken along line I—I of Fig. 2;

Fig. 2 shows a section through the switch taken along line II—II of Fig. 1;

Fig. 3 is a top view upon the mounting strap and the contact plate;

Fig. 4 is a top view upon the base plate and the contact clips thereon;

Fig. 5 is a top view of the entire switch in closed position;

Fig. 6 is a side view of the switch with the front wall of the cover removed for better illustration;

Fig. 7 is a diagrammatic illustration of the use of the switch as applied to a three-phase A. C. motor in star connection; while

Fig. 8 is an illustration similar to Fig. 7 for a delta connection.

Referring to the drawings, the base plate 1, preferably consisting of ceramic material, carries on its upper surface the spring contact clips 3 and the bimetal strips 4, and on its lower surface the terminals 5. As shown especially in Fig. 2, each of the bimetal strips 4 has coiled thereon a resistance wire 6 which terminates below the contact plate 7. Spring clips 3, the lower end of the resistance coils 6, and the terminals 5 are electrically connected, as well as secured to base plate 1, by bolts 2 which also support the bimetal strips 4 which, however, are electrically insulated therefrom. The upper end of each resistance coil 6 is connected to a lug 8 with a detent thereon and mounted on the bimetal strip 4 which extends upwardly and beyond such lug or detent 8 with its free end 9 passing through an aperture in an insulating plate 10. Plate 10 is arranged so as to be freely movable and is prevented from sliding off the free ends 9 of the bimetal strips 4 by a mounting strap 11 which, in turn, is secured to the base plate 1 and the upper part of which extends closely above the insulating plate 10. The contact plate 7 has bolted thereon the contact bridges 12 with downwardly projecting contact fingers 13 which are adapted to fit into, and engage with, the free ends of the spring clips 3. The lateral studs 14 extending downwardly from the contact plate 7 act as centering means for securing the coil springs 15. The contact plate 7 has further rigidly and centrally mounted thereon a control button 16 which is forced upwardly by a coil spring 17 which rests on the upper surface of the retaining strap 11. The cover 18 is removably secured to the strap 11 by two screws 19 and has a central aperture for the control button 16, as well as a slide button 20 with knurls 21 on one side and the symbol of an arrow on the other side, i. e. the side facing the control button 16. The slide button 20 is preferably made of a single piece of material and secured to the cover 18 by means of a spring ring 23 so as to be laterally slidable thereon.

If in the operation of the switch the button 16 is depressed from the position shown in Fig. 1 to that shown in Fig. 6 to switch on the current by engaging the contacts 13 and 3, the cam surfaces 24 on the contact plate 7 will bend the elements 8 toward the left until the upper surface of the contact bridge 12 engages with the detents thereon, permiting them to spring back to their original position, thereby retaining the contact plate 7 against the action of the springs 15 and 17 in the position shown in Fig. 6. If the bimetal strip 4 is then heated beyond a certain temperature either by the resistance coil 6 or for any other cause, the upper, free ends 9 thereof will bend toward the left until the detents of the elements 8 release the contact bridge 7. The same result may also be obtained by pushing the slide button 20 in the direction shown by the arrow 22, i. e. toward the control

button 16. The lower, fingerlike projection 25 of the slide button 20 thereby engages the edge of the insulating plate 10 and bends the free ends 9 of the bimetal strips 4, which are guided by the plate 10, toward the left in the same manner as if such bending were caused by heating the bimetal strips 4. If, however, contrary to the manual operation of the switch by the slide button 20, the bimetal strips 4 are bent by being heated by the resistance coils 6 to disengage the detents 8 from the contact bridge 12 to release the plate 7 and disconnect the contacts 13 and 3, the current may not again be switched on until the temperature in or around the switch has returned to normal and the bimetal strips 4 have regained their normal position.

For confining the adjacent contact elements within the smallest possible space, they preferably are turned 180° relative to each other. Also, it is advisable to make both the base plate 1 as well as the contact plate 7 of ceramic material, and the insulating plate 10, used for manually disconnecting the switch, likewise of heat resistant material.

While the foregoing description sets forth in detail what I regard as the preferred embodiment of my invention, it is to be understood that numerous changes may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new is:

1. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts mounted on said base, a bimetal strip for each circuit having one end mounted on said base, means for heating said bimetal strips, a detent carried on each of said bimetal strips near the free end thereof, a movable bridge element, contacts mounted on said element to cooperate with said stationary contacts, said movable and corresponding stationary contacts being turned 180° relative to the adjacent contacts, a spring tending to force said bridge and the contacts thereon to the off-position, resilient means for maintaining said bridge always substantially parallel with said base, means for depressing said bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said heating means, each of said detents adapted to release said bridge when said bimetal strips are heated beyond a certain temperature and are thereby bent so as to disconnect said corresponding contacts under the pressure of said spring.

2. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts on said base, a bimetal strip for each circuit mounted on said base, means for heating said bimetal strip, a detent on each of said bimetal strips near the free end thereof, a movable bridge element, contacts mounted on said element to cooperate with said stationary contacts, said movable and stationary contacts being turned 180° relative to the adjacent contacts, a central button for depressing said movable bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said heating means, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, a central spring tending to force said bridge and the contacts thereon to the off-position, and a plurality of springs for maintaining said bridge always substantially parallel with said base.

3. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts mounted on said base, a bimetal strip for each circuit mounted on said base, means mounted on said bimetal strips for heating the same, a detent on each of said bimetal strips, said strips having a free end extending upwardly and beyond said heating means and detents, a movable contact bridge element, contacts mounted on said element to cooperate with said stationary contacts, resilient means tending to force said bridge and contacts thereon to the off-position and for maintaining said bridge always substantially parallel with said base, a central button for depressing said movable bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said heating means, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate having apertures, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, and means for shifting said insulating plate to bend said strips to disengage said detents, release said bridge, and disconnect said contacts independently of said heating means.

4. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts mounted on said base, a bimetal strip for each circuit mounted on said base, means mounted on said bimetal strips for heating the same, a detent on each of said bimetal strips, said strips having a free end extending upwardly and beyond said heating means and detents, a movable bridge element, contacts mounted on said bridge to cooperate with said stationary contacts, a central button for depressing said bridge to engage the contacts thereon with said corresponding stationary contacts and simultaneously for engaging said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said heating means, a central spring tending to force said bridge and the contacts thereon to the off-position, a plurality of springs for maintaining said bridge always substantially parallel with said base, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate having apertures therein disposed above said bridge, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, and means for manually shifting said insulating plate to bend said strips to disengage said detents, release said bridge, and disconnect said contacts independently of said heating means.

5. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts mounted on said base, a bimetal strip for each circuit mounted on said base, means mounted on said bimetal strips for heating the same, a detent on each of said bimetal strips, said strips having a free end extending upwardly and beyond said heating means and detents, a movable bridge element, contacts mounted on said bridge to cooperate with said stationary contacts, a cover, a push button centrally mounted in said cover for depressing said bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said heating means, a central spring mounted within said cover tending to force said bridge and the contacts thereon to the off-position, a plurality of springs intermediate said base and said bridge for maintaining said bridge always substantially parallel with said base and also tending to force said bridge to the off-position, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate have apertures therein disposed intermediate said bridge and said cover, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, and a slide button on said cover movably mounted therein toward and away from said central button, said slide button having a knob thereon extending inwardly of said cover and, when moved toward said central button, engaging said insulating plate to move the same laterally

to bend said strips to disengage said detents and release said bridge for manually disengaging all of said contacts independently of said heating means.

6. A multiple-pole protective switch comprising, in combination, a stationary base, stationary contacts mounted on said base, a bimetal strip for each circuit mounted on said base, means mounted on said bimetal strips for heating the same, a detent on each of said bimetal strips, said strips having a free and extending upwardly and beyond said heating means and detents, a movable bridge element, contacts mounted on said bridge to cooperate with said stationary contacts, a cover, a push button centrally mounted in said cover for depressing said movable bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said heating means, a central spring mounted within said cover tending to force said bridge and the contacts thereon to the off-position, a plurality of springs intermediate said base and said bridge for maintaining said bridge always substantially parallel with said base and also tending to force said bridge to the off-position, said detent adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate having apertures therein disposed intermediate said bridge and said cover, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, and a slide button on said cover and movably mounted therein toward and away from said central button, said slide button having a knob thereon extending inwardly of said cover and, when moved toward said central button, engaging said insulating plate to move the same laterally to bend said strips to disengage said detents and release said bridge for manually disengaging all of said contacts independently of said heating means, the free ends of said bimetal strips automatically returning said insulating plate and said slide button to their neutral position when said slide button is released.

7. A multiple-pole protective switch comprising, in combination, a stationary base of ceramic material having apertures therein, stationary contacts mounted on said base and within said apertures, connecting terminals below said base and connected to said contacts, a bimetal strip for each circuit mounted on said base, a resistance coil, around each of said strips, one end of said coils being connected to said stationary contacts, a detent on each of said bimetal strips and connected to the other end of said resistance coil, said strips having a free end extending upwardly and beyond said resistance coils and detents, a cover for said switch mounted on said base, a bridge element of ceramic material within said cover and movable relative to said base, contacts mounted on said bridge to cooperate with said stationary contacts, a push button centrally mounted in said cover for depressing said movable bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said other end of said resistance coils to said movable contacts, a central spring mounted within said cover tending to force said bridge and the contacts thereon to the off-position, a plurality of springs intermediate said base and said bridge for maintaining said bridge always substantially parallel with said base and also tending to force said bridge to the off-position, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate having apertures therein disposed intermediate said bridge and said cover, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, said cover preventing said insulating plate from sliding off the free ends of said strips, and a slide button on said cover and movably mounted therein toward and away from said central button, said slide button having a knob extending inwardly of said cover and, when moved toward said central button engaging said insulating plate to move the same laterally to bend said strips to disengage said detents and release said bridge for manually disengaging all of said contacts independently of said heating means, the free ends of said bimetal strips automatically returning said insulating plate and said slide button to their neutral position when said slide button is released.

8. A multiple-pole protective switch comprising, in combination, a stationary base of ceramic material having apertures therein, stationary contacts mounted on said base and within said apertures, connecting terminals below said base and connected to said contacts, a bimetal strip for each circuit mounted on said base, a resistance coil around each of said strips, one end of said coils being connected to said stationary contacts, a detent on each of said bimetal strips and connected to the other end of said resistance coil, said strips having a free end extending upwardly and beyond said resistance coils and detents, a cover for said switch mounted on said base, a bridge element of ceramic material having glazed cam surfaces for leading detents within said cover and movable relative to said base, contacts mounted on said bridge to cooperate with said stationary contacts, a push button centrally mounted in said cover for depressing said movable bridge to engage the contacts thereon with the corresponding stationary contacts and simultaneously to engage said detents with said bridge to retain the same in the on-position, and for simultaneously connecting said other end of said resistance coils to said movable contacts, a central spring mounted within said cover tending to force said bridge and the contacts thereon to the off-position, a plurality of springs intermediate said base and said bridge for maintaining said bridge always substantially parallel with said base and also tending to force said bridge to the off-position, said detents adapted to release said bridge when said bimetal strips are being heated beyond a certain temperature, an insulating plate having apertures therein disposed intermediate said bridge and said cover, the free ends of said bimetal strips extending through said apertures so as to move freely in one direction when said strips are bent by being heated, said cover preventing said insulating plate from sliding off the free ends of said strips, and a slide button on said cover and movably mounted therein toward and away from said central button, said slide button having a knob extending inwardly of said cover and, when moved toward said central button engaging said insulating plate to move the same laterally to bend said strips to disengage said detents and release said bridge for manually disengaging all of said contacts independently of said heating means, the free ends of said bimetal strips automatically returning said insulating plate and said slide button to their neutral position when said slide button is released.

9. In combination with an electric motor having a housing, a multiple-pole protective switch mounted within said housing and connected to said motor, comprising a stationary base, stationary contacts mounted on said base, at least one bimetal strip mounted on said base, a detent on said bimetal strip near the free end thereof, means on said bimetal strip for electrically heating the same when said switch is in the on-position, a bridge element movable relative to said base, other contacts mounted on said bridge to cooperate with said stationary contacts, resilient means tending to force said bridge and the contacts thereon to the off-position, means for depressing said bridge so that the contacts thereon engage with the corresponding stationary contacts and simultaneously to engage said detent with said bridge to retain the same in the on-position, said detent being adapted to release said bridge when said bimetal strip

is heated beyond a certain temperature either by said electric heating means or the surrounding temperature, and is thereby bent to disconnect said corresponding contacts, and independent manual means for mechanically bending said bimetal strip to release said detent from said bridge to release said bridge and disconnect said contacts.

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