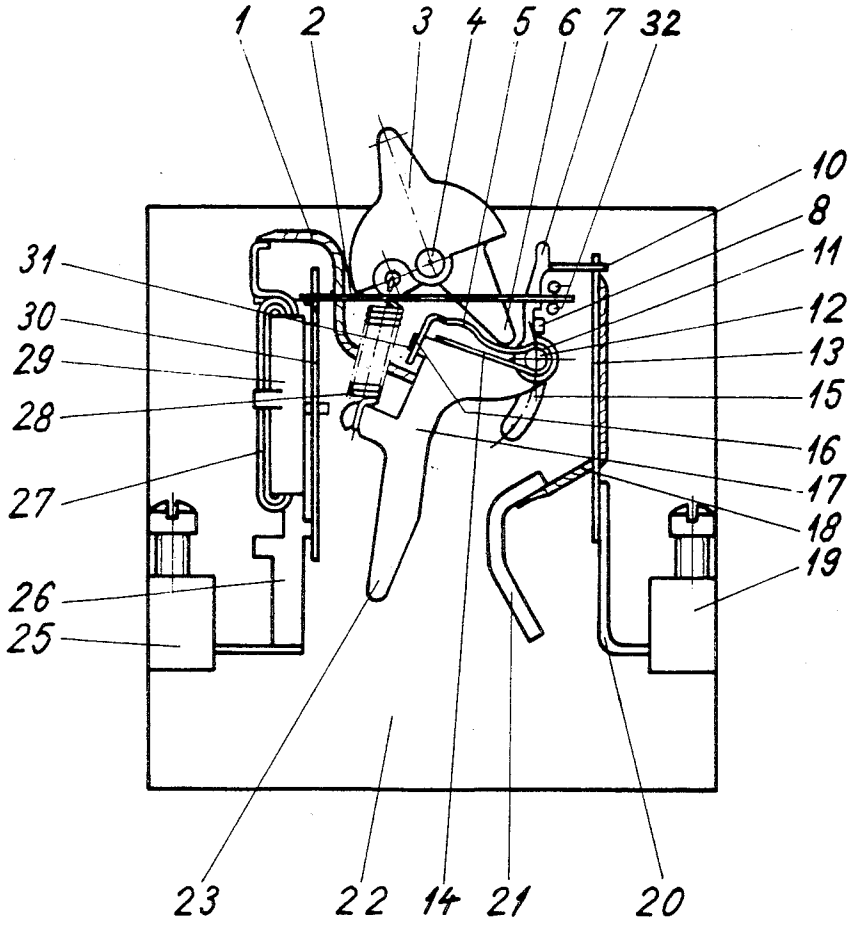
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SWITCH AND CIRCUIT BREAKER COMBINATION

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SWITCH AND CIRCUIT BREAKER COMBINATION

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ABSTRACT OF THE DISCLOSURE

The housing of a toggle switch has guide slots formed therein, approximately transverse to the movement of the switching element, and the shaft, about which a switching element pivots, is slidable in the guide slots. The shaft is retained in a first position by a latch lever which, upon sensing of overcurrent conditions is moved to unlatch the shaft so that it can slide in the guide slots to interrupt the connection of the movable contact with the fixed contact of the toggle switch. Springs, which provide for switch contact pressure can be so arranged that they at the same time provide for power release of the movable contact as the shaft slides in the guide slots, when unlatched.

The present invention relates to switch-circuit breaker combinations, and more particularly to such combinations which may be used instead of fuses and which, therefore, must be inexpensive.

Circuit breakers which are to replace fuses, in order to be manufactured inexpensively, must have as few parts as possible. In known constructions, the breaking mechanism to interrupt current is still the one part which is relatively expensive to manufacture. This breaking mechanism must be so arranged that the contact will open when a short circuit occurs in the network connected to the circuit breaker even if the toggle lever for closing the circuit breaker is held manually in closed position. In the past, an interlock has been placed between the operating lever and the contact which was arranged to interrupt direct connection between the fixed contact and the operating switching element if the short circuit trigger was in the position indicating presence of a short circuit.

It is an object of the present invention to provide a switch-circuit breaker combination which utilizes a minimum of parts and is inexpensive to manufacture.

Subject matter of the present invention.—Briefly, a toggle switch is provided in which a spring acts on the pivot shaft over which the movable switch element can pivot and against a fixed point, to retain the switch member in the position commanded by the manual toggle control. The pivot shaft for the switching member is arranged in a guide track, formed in the housing, and held in normal operating position by a latch member. Upon sensing of a current overload, or short circuit, the latch member is moved to unlatch, so that the pivot shaft can slide, under force of the spring in the guide track and break the contact between the fixed member and the contact member. The guide track is arranged substantially perpendicular to the normal path of travel of the switching member, to provide for rapid change in distance between the fixed and movable contact member upon sensing of a current overload.

The contact pressure, for normal operation, can thus be substantial, the same force being available to shift the position of the pivot shaft upon sensing of an overload. The switch-circuit breaker combination of the present invention thus does not require a separate interlock.

The invention will now be described by way of example with reference to the accompanying drawing, wherein the single sheet illustrates, partly in schematic

form, the switch mechanism, in plan view (with the top part of the housing removed), with the switch indicated in switched-off position.

A manual operating lever 3 is pivoted about a shaft 4. Lever 3 is formed with a projection 6 which slides over a leg 5 of a generally U-shaped leaf spring 11. Spring 11 partly surrounds a pivot shaft 12 of the movable contact 17. The other leg 14 of spring 11 engages contact member 17. Shaft 12 further has latch 7 mounted thereon, which has a notch, seating against a projection 8 secured to the housing wall 22 of the switch-circuit breaker combination. The lower end 23 of the contact member 17 is arranged to contact a fixed contact 21. When operated, end 23 engages the fixed contact. Contact pressure is transmitted from manual lever 3 over leaf spring 11 to contact 17.

Pivot shaft 12 of contact 17 is guided in guide tracks 15 formed in the housing wall 22. The guide tracks 15 are arranged essentially perpendicular to the movement of the contact 17; since the lower end 23 of contact 17 will turn over a restricted arc, the guide track 15 is substantially perpendicular thereto. As best seen in the drawing, it may be slightly curved.

The switch is connected to a network over contact terminal 25 then by means of connection 26 to a winding 27 of a short circuit release mechanism 29, which is essentially a fast acting relay, and then by means of a flexible stranded pigtail 1 to the movable contact 17; from fixed contact 21, the current path passes over a flexible stranded lead 18 to a bimetal strip 13 of a delayed overcurrent release mechanism, then to a support carrier 20 and to the second terminal connection 19.

A tension spring 28 interconnects movable contact member 17 and manual operating lever 3. Leg 5 of the U-shaped spring 11 is extended beyond the length of the other leg 14, bent over, and hooked, with play, into a projection 31 of contact 17.

To normally connect the circuit, that is for the switch-on operation, the top of lever 3 is moved to the right; projection 6 will ride over the top of leg 5 of U-shaped spring 11 and force the lower end 23 of contact member 17 to engage fixed contact 21. The force of the spring 11 is chosen to be greater than the strength of the spring 28, when spring 28 is stretched in connected position. The leg 5 of spring 11 is shaped to have a slight depression near its outer end to provide for positive seating of the operating lever 3.

To interrupt manually, lever 3 is moved towards the position shown in the figure; upon partial movement, spring 28 will override the strength of spring 11 and snap movable contact member 17, as well as manual operating lever 3 into the switched-off position as shown in the figure. The extended leg 5, and the bent-over lug over projection 31 on the movable contact lever prevent excess friction between the manual toggle 3 and the spring 11. Additionally, as the contacts gradually deteriorate and burn off, contact pressure will fall abruptly upon further burning, after the contact pressure has reached a predetermined minimum value, thus giving an abrupt indication that the unit should be replaced.

If a gradual overcurrent condition is sensed, that is if the current rating for which the circuit breaker is designed is exceeded for a period of time, but only by a small value, bimetal strip 13 will heat and bend towards the left; operating bar 10 will engage latch 7, moving latch 7 to the left to release the latch from engagement with projection 8 in the housing, so that pivot shaft 12 will then, together with latch 7, be free to slide in guide tracks 15. The tension of spring 28 will cause contact 17 to turn about projection 6 of manual operating lever 3, and cause movement of the

pivot shaft **12** in the guide slots **15**. The guide tracks **15**, are curved about projection **6** of the toggle lever **3** when in switch-on position. If manually operating member **3** is not deliberately held in the switched-on position, it will, likewise, slip to the switched-off position due to the tension of spring **28**. Spring **28** will, simultaneously, pull the contact member **17** upwardly, causing latch member **7** to again slip over projection **8** so that the latch will again be engaged.

The notch in latch member **7**, against which projection **8** engages, may be slightly elongated (as seen in the figure) so that in the normal closed condition, a slight play, that is, movement of pivot shaft **12** in guide tracks **15**, is possible.

In case of a short circuit, armature **30** of the magnetic short circuit relay **29** will be attracted that is, in the figure, moved towards the left. Operating bar **2**, engaging latch member **7**, again moves latch member **7** towards the left, thus releasing the notch from the projection **8** and again permitting sliding of pivot shaft **12** in guide tracks **15** to break the contact. The travel, upon short circuit, of the armature **30** of magnetic short circuit relay **29** is much less than the distance of movement of bimetal strip **13**. The engagement points of the two operating bars **2** and **10** with the latch member **7** are therefore chosen to be a different distances from shaft **12**. Both operating bars **2** and **10** are guided in suitable grooves, or guide projections, of which only two are shown at **32** in the figure.

It may occur that, due to excessive overcurrent, a weld has formed between contact extension **23** of movable contact member **17** and fixed contact member **21**. If, after an overcurrent has been sensed, contact **17** should not immediately separate from contact **21**, then leaf spring **11** will further cause a strong pushing force acting on the contact point which assists in breaking such welds.

It is of course not necessary to provide the switch-circuit breaker combination with both a short circuit and overcurrent sensing arrangement, as shown; only one or the other may be used in accordance with design, or network requirements.

The invention has been illustrated and described in connection with a toggle switch having a U-shaped leaf spring surrounding a movable pivoting shaft, in which the shaft not only serves to pivotally retain a contact member but also is capable of sliding in a guide track, substantially perpendicular to operating movement, powered by spring pressure, and if permitted to do so under control of overcurrent sensing mechanisms, releasing a latch. Other switch, and toggle mechanisms may be used within the scope of the inventive concept.

What is claimed is:

1. Switch-circuit breaker combination having a housing (**22**); a fixed contact (**21**) located in said housing;

a pivoted contact member (**17**) having a movable pivot shaft (**12**), said contact member being movable between a switched-off position free from said fixed contact member and a switched-on position engaging said fixed contact member;

a manually operable toggle lever (**3**) engaging and operating said movable contact member to pivot between said switched-on and switched-off positions;

a guide track (**15**) formed in a wall (**22**) of said housing extending essentially perpendicularly to the direction of switching movement of said movable contact member, said pivot shaft (**1**) being located for sliding movement in said guide track;

and overcurrent-responsive means (**7, 13, 29, 30**) permitting movement of said shaft in said guide track upon sensing of overcurrent conditions whereby, to produce the contact pressure, the manually operable toggle lever will act on the pivotable movable contact member (**17**).

2. Combination according to claim **1**, wherein said overcurrent-responsive means includes a latch member (**7, 8**) mounted on said pivot shaft (**12**) of said movable contact member (**17**);

and overcurrent-sensing means (**13, 29, 30**) releasing said latch member upon sensing of overcurrent conditions.

3. Combination according to claim **1**, including a U-shaped leaf spring (**11**) interposed between said toggle lever (**3**) and said movable contact member (**17**), said leaf spring being located with one leg of the "U" (**14**) bearing against the contact member and the other leg of the "U" (**5**) engaging said toggle lever.

4. Combination according to claim **3**, wherein said "U"-shaped leaf spring (**11**) surrounds said pivot shaft (**12**) in the region of the bend of the "U";

the leg of the "U" (**5**) engaged by said toggle lever (**3**) extends beyond the length of the other leg of the "U" (**14**);

and interengaging means (**31**) are formed on said contact member and said extended leg of the "U" to limit the spread of the legs of the "U."

5. Combination according to claim **1**, including a tension spring (**28**) interconnecting said toggle lever (**3**) and said movable contact (**17**) and located to bias both contact and toggle levers into switched-off condition.

6. Combination according to claim **3**, including a toggle spring (**28**) interconnecting said toggle lever and said movable contact (**17**) and located to bias both contact and toggle levers into switched-off condition, the force of said tension spring tending to bias said contact member to switched-off condition being less than the force of the U-shaped spring when in switched-on condition so that, upon movement of said shaft as controlled by said overcurrent-responsive means, excess force of said U-shaped spring will tend to push said movable contact member in a direction perpendicular to switching direction, as determined by said guide track guiding the shaft of said contact member.

7. Combination according to claim **2**, wherein at least one of said overcurrent-sensing means (**13, 29, 30**) includes an operating bar (**2, 10**) engaging said latch means (**7**); and the wall of said housing (**22**) is formed with guide means (**32**) guiding said operating bar for movement therein.

8. Combination according to claim **2**, wherein said overcurrent-sensing means (**13, 29, 30**) includes a short circuit sensor (**29, 30**) and a delay-overcurrent sensor; and

including a pair of operating bars (**2, 10**), one bar interconnecting each said sensor and said latch member (**7**), the point of engagement of the operating bar (**10**) of the delayed overcurrent sensor (**13**) being located further from said pivot shaft (**12**) on which said latch member is mounted than the point of engagement of the operating bar (**2**) of said short circuit sensor (**29, 30**).

9. Switch-circuit breaker combination comprising a housing;

a movable switch member (**17**) pivotable about a movable pivot shaft (**12**) over a restricted arc, located within said housing;

a fixed contact member (**21**) in the path of movement of said movable switch member located in said housing;

manually operable means engaging said movable contact member (**17**) to move said member between switched-on and switched-off positions;

spring means (**11, 28**) in said combination acting on said pivot shaft and said movable switch member, respectively, to retain said switch member in switched-on or switched-off condition;

a guide track (**15**) formed in said housing extending substantially perpendicularly to the chord of said arc described by an end (**23**) of said movable switch member, said pivot shaft being located in said guide track to slide therein;

and overcurrent operated latch means (**7, 13, 29, 30**)

holding said shaft in said guide track against the force of said spring means under normal operating conditions, said latch means being moved, under overcurrent conditions, to release said shaft and permit said shaft to slide in said guide track under force of said spring means and thus change the position of said movable switch member (**17**) relative to said fixed contact to interrupt electrical contact therewith.

10. Combination according to claim **9**, wherein said latch means includes a lever (**7**) mounted on said pivot shaft;

cooperating holding means (**8**) on said lever and said housing normally securing said lever in position to hold said shaft against sliding in said guide track (**15**);

and means (**13**, **29**, **30**) responsive to overcurrent conditions and engaging said lever to release said lever from said cooperating holding means.

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