Dec. 4, 1956 T. D. G. WINTLE 2,773,150

ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 1

FIG. 1.

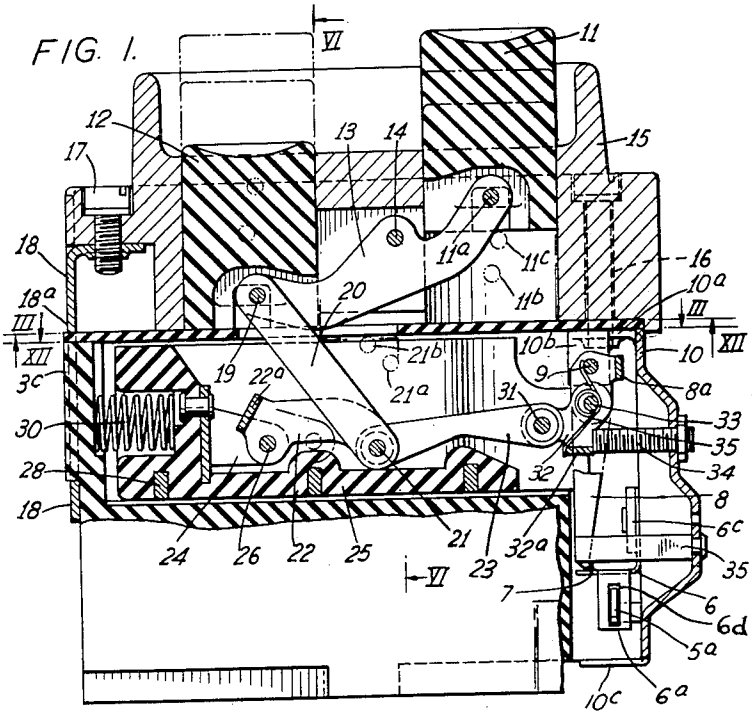
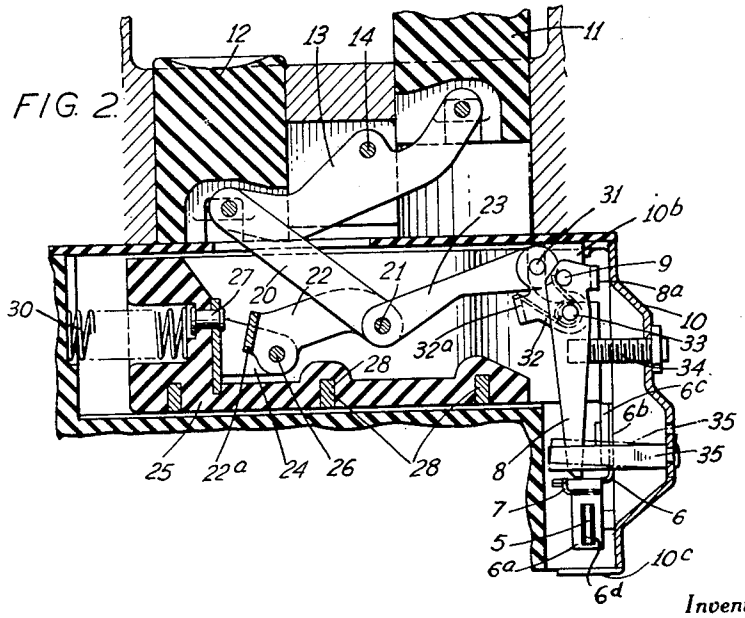


FIG. 2.



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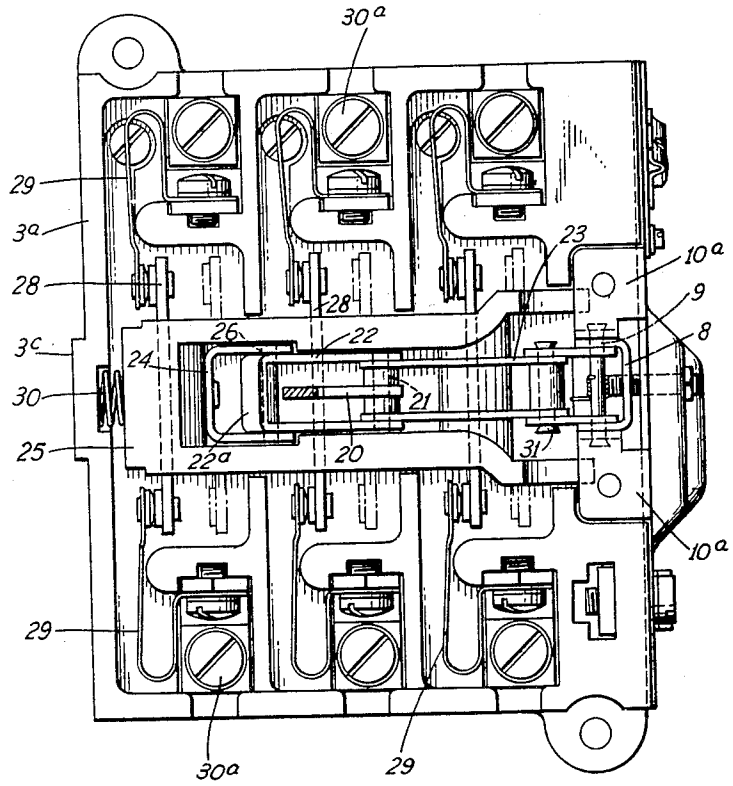
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ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 2

FIG. 3.



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ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 3

FIG. 4.

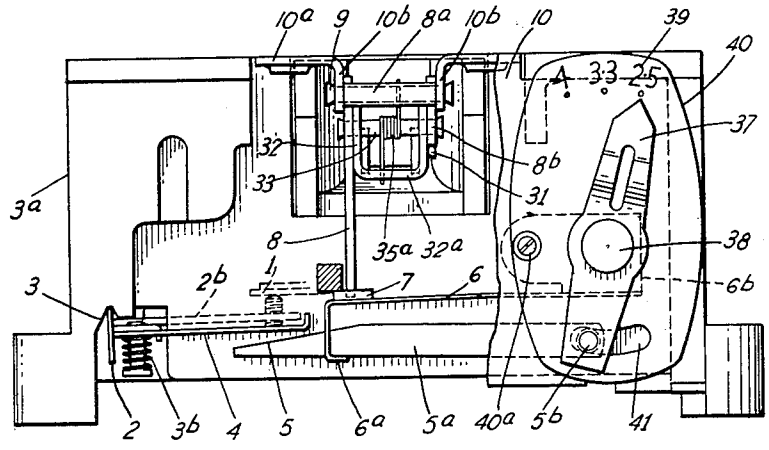
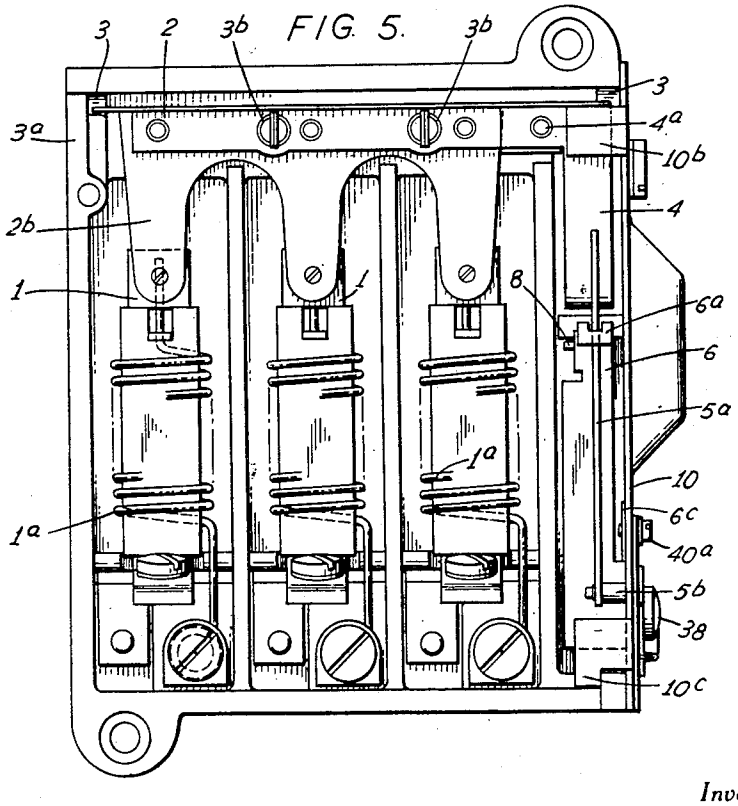


FIG. 5.



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Dec. 4, 1956 T. D. G. WINTLE 2,773,150

ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 4

FIG. 6.

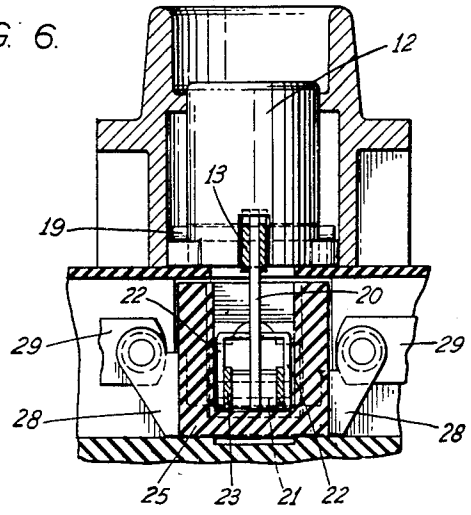
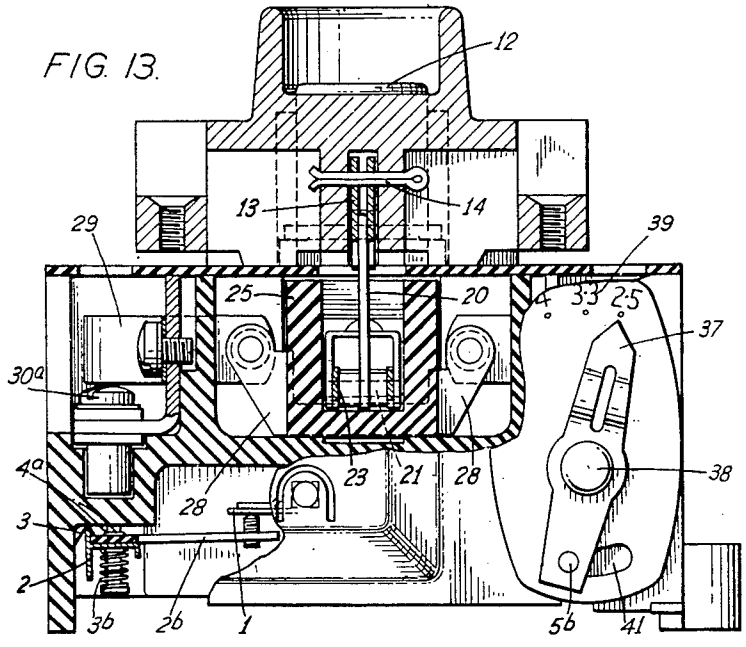


FIG. 13.



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Dec. 4, 1956 T. D. G. WINTLE 2,773,150

ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 5

FIG. 7.

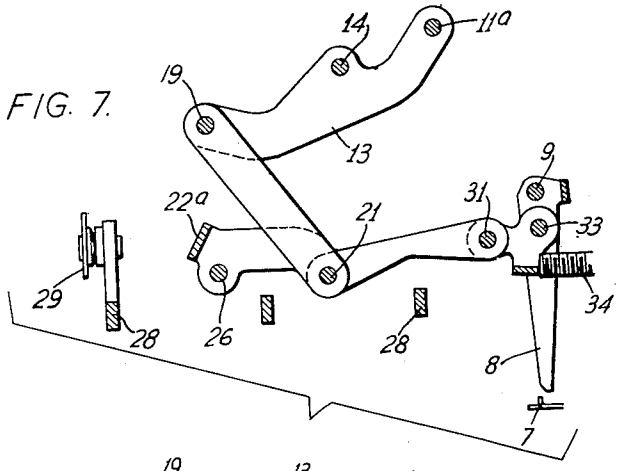


FIG. 8.

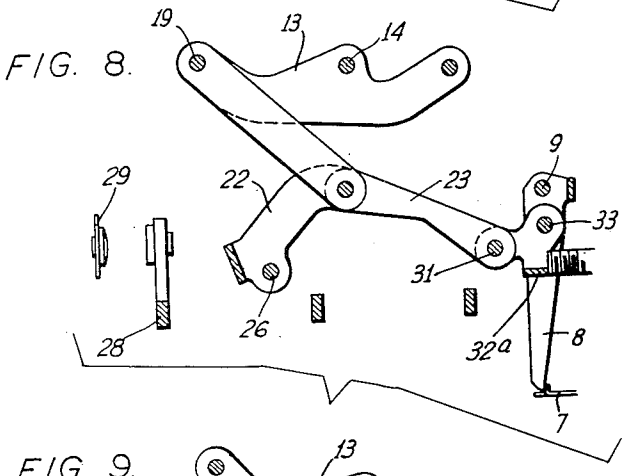
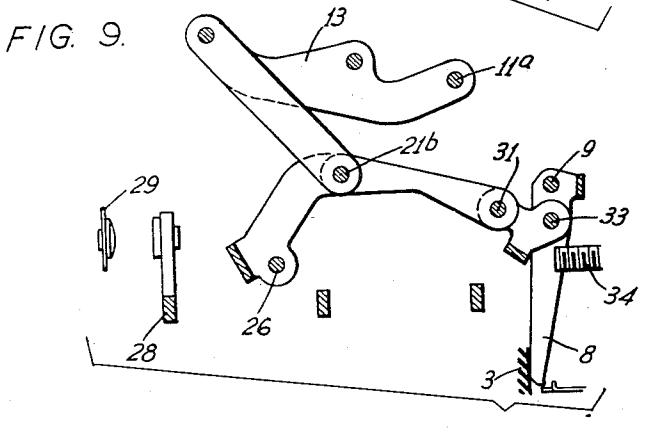


FIG. 9.



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Dec. 4, 1956 T. D. G. WINTLE 2,773,150

ELECTRIC SWITCHES AND CIRCUIT BREAKERS

Filed Feb. 19, 1954 6 Sheets-Sheet 6

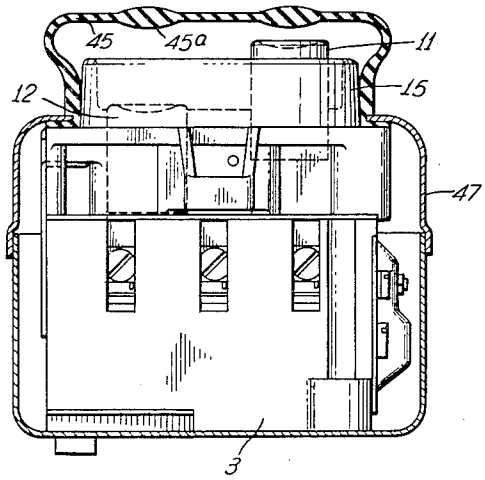


FIG. 10.

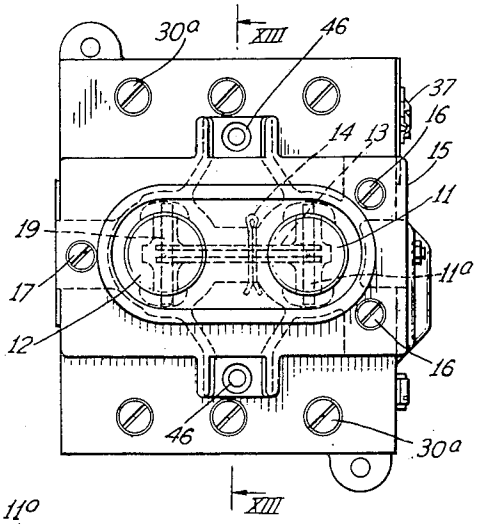


FIG. 11.

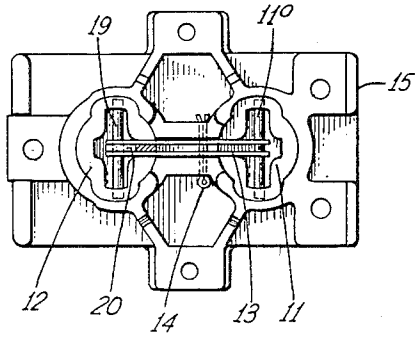


FIG. 12.

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ELECTRIC SWITCHES AND CIRCUIT BREAKERS

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Application February 19, 1954, Serial No. 411,494

Claims priority, application Great Britain February 26, 1953

14 Claims. (Cl. 200—116)

This invention relates to improvements in electric switches or circuit breakers and is particularly concerned with arrangements provided with overload devices adapted for tripping the switch or circuit breaker on the occurrence of overload conditions. With such switches or circuit breakers it is necessary for tripping to be effective on overload, even if the switch be held in the "on" position, and to ensure that it is impossible to engage the contacts if the switch be actuated to the "on" position while an overload exists. Such a "trip free" arrangement is particularly advantageous with thermal overload devices if the bimetal has not returned to the normal position, after deflection, due to an overload.

The principal object of the present invention is to provide an improved construction in which adequate contact pressure is ensured while minimising the pressure and wear on the releasable catch actuated by the trip mechanism, a further object being to provide adequately strong forces for switching with a desirably compact construction.

According to this invention a toggle actuated by the switch is pivotally supported at one end on a swinging bracket carried on a lever actuated by the trip mechanism. The other end of the toggle may be subjected to spring pressure imparted to a moving contact carrier. The toggle may be actuated by a pair of plunger-like buttons operable on a see-saw lever connected by a link with the centre joint of the toggle. The bracket may be of triangular shape, one corner being pivotal on an end of the toggle and another corner being pivotally supported on a long lever the other end of which is adapted for engagement with a trip bar. The third corner of the bracket has abutting engagement with a fixed screw.

In order to enable the invention to be readily understood reference will now be made to the accompanying drawings illustrating by way of example means for carrying the invention into effect, in which drawings:

Figure 1 is a central vertical section with the switch in the "on" position, the chain lines representing the position of the buttons in the "off" position.

Figure 2 is a view similar to Figure 1, with parts broken away and showing the switch in the tripped position.

Figure 3 is a plan section on the line III—III of Figure 1 the chain lines representing the "off" position of the moving contacts.

Figure 4 is an end elevation of Figure 1 with the button casing removed, and with a portion of the end plate broken away in order to disclose the parts more clearly.

Figure 5 is an inverted plan view of Figure 1 with the bottom closure plate removed, in order to disclose the overload units and other parts.

Figure 6 is a section on the line VI—VI of Figure 1.

Figure 7 is a diagrammatic view of the linkage and associated parts in their position immediately after a tripping operation.

Figure 8 is a view similar to Figure 7 of the parts in the normal "off" position.

Figure 9 is a view similar to Figure 7 of the parts in a prepared position ready for operation to the "on" position, after tripping.

Figure 10 is an elevation with parts in section, and to a reduced scale, of the construction shown in Figure 1 mounted in a casing embodying a waterproof shrouding for the push buttons.

Figure 11 is a plan of the switch, Figure 10, removed from its casing.

Figure 12 is an inverted plan view of the button casing of Figure 10, and

Figure 13 is a section on the line XIII—XIII of Figure 12.

Referring to the drawings and more particularly to Figures 1–6, overload units, of the construction described and claimed in our United States Patent No. 2,674,672, and each comprising a bimetal strip 1 and a heater coil 1a, are adapted to be deflected downwardly on overload, into engagement with lateral extensions 2b of a trip arm 2, supported at each end in notches 3 in the casing 3a. When the arm is turned, in the direction of the arrow Figure 4, against the action of the springs 3b, it causes an ambient bimetal strip 4, riveted at 4a to the trip bar 2, to engage a ramp 5, on an insulating plate 5a to cause the latter to be turned about its pivotal support 5b, to be hereinafter described, thereby depressing a member 6a, forming part of a spring blade 6. The spring blade 6 is formed with a bent portion 6b at one end to enable it to be secured by a washer 6c to a metal end plate 10. The other end of the blade has a short lateral bent-up flange 7 which constitutes an abutment for engagement with the lower end of an elongated plate or lever 8. The latter depends from a pivotal support 9 carried on the vertical arms 10b on L-shaped lugs bent inwards from the end plate 10. The upper end of the lever 8 is connected by a cross piece 8a to a shorter arm 8b parallel with the longer arm and pivotal also with the latter on the pin 9. The horizontal arms 10a of these lugs are provided with tapped openings as hereinafter described.

In the top of the casing are mounted plunger-like push buttons, one 11 being a "stop" button and the other 12 a "start" button. These buttons are carried on the respective ends of a see-saw like lever 13 pivotally mounted on a cotter pin 14 supported in a metal casting 15, which is secured at one end to the arms 10a by a pair of screws 16, and at the other end by a screw 17 to a metal plate 18. This plate is formed with a rectangular opening 18a engaging a spigoted formation 3c on the moulded base. The plate 10 is secured by the engagement of a short inturned lug 10c on one corner of its lower end with the base 3. The other corner of the plate is formed with a lug 10b for the retention of an insulating cover plate for the overload units.

One end of the lever 13, which is in the form of a pair of plates, is connected by a pin 19, mounted within the start button 12, to a link 20 the other end of which is connected by a pin 21 to the knee or centre joint of a toggle constituted by the arms 22, 23 each of which also consists of a pair of plates. The button 11 is connected by a pin 11a with the other end of the lever 13. The plates constituting the arm 22 are united at their outer ends at 22a and the member is pivotal about a pin 26 mounted on a bracket 24 secured to an insulated traverse 25 by a rivet 27.

On the traverse 25 are removably carried transversely disposed moving contact strips 28 engageable at each end with fixed contacts 29, as described in our United States application aforesaid. A helical compression spring 30 is operative between one end of the traverse 25 and the base for urging the former to the right for dis-

engaging the contacts, as shown in chain lines in Figure 3.

The arm 23 of the toggle is connected at its outer end by a pin 31 to one corner of a triangular shaped bracket 32 which comprises a pair of side plates united by a cross strip 32^a which constitutes a second corner of the triangular formation. The third corner is pivotally connected by a pin 33 to the lever 8 and its short parallel arm 8^b. The cross member 32^a is adapted for abutting engagement with the end of a screw 34 on the plate 10. Turning of the screw 34 causes adjustment of the pivot 31 and this results in variation in the pressure between the catch 7 and the lever 8.

The amount of engagement between the abutment 7 and the lever 8 can be varied by adjustment of a square pillar 35 riveted to the plate 10. The portion of the latter to which the pillar is riveted is weakened by the provision of a horseshoe slot to enable the pillar to be moved vertically, one position of adjustment being shown in chain lines in Figure 2. The flexibility of the blade 6 ensures that the flange 7 thereon normally bears against the pillar. The adjustment of the pillar causes the position of the slot 6^d in the blade through which the insulating plate 5^a passes to be moved vertically so that the amount of engagement between the flange 7 and the tail of the lever 8 can be varied so that a greater or lesser amount of movement of the plate 5^a is required for producing disengagement or tripping.

The plate 10 also serves for carrying adjustable means for varying the gap between the ramp 5 and the ambient strip 4. This means comprises a scale lever 37 pivotally mounted between its ends at 38 on the plate 10. The pointed end of this lever co-operates with a scale marking 39 on a plate 40 secured to the plate 10, while the other end which carries the pivot pin 5^b for the lever 5^a moves in an arcuate shaped slot 41 formed in the plates 10 and 40. The plate 40 can be factory-adjusted by turning it about the axis 38 and then securing it in position by the screw 40^a.

In the "on" position, Figure 1, the centre point 21 of the toggle is disposed below the line 26, 31. For operation to the "off" position the point 21 is moved upwards above this imaginary line as seen in Figure 8, by depression of the button 11, so that the spring 30 is enabled to move the traverse 25 rightwards for disengaging the contacts. The abutment 7 holds the lever 8 in the position shown in Figures 1 and 8 for permitting normal operation to the "on" and "off" positions by the buttons 11, 12 and from which it will be seen that the triangular shaped bracket 32 is maintained stationary so that the pivot point 31 of the toggle is fixed. Thus the see-saw lever 13 is enabled to raise and lower the centre point 21 of the toggle with the result that the end 26 of the toggle is moved into the respective positions.

In the event of failure of the spring 30 the arrangement ensures a positive drive of the traverse to the "off" position by the continued movement of the centre point 21 of the toggle, to the position 21^b (Figure 1). The centre point of the toggle is displaced upwards from 21^a to 21^b causing the toggle arm 23 and the triangular bracket to positively move the lever 8 to the reset position. As a result the pin 31 is raised so that the points 31, 23 and 32 are disposed in line, and the point 26 is constrained to be moved rightwards.

On the occurrence of an overload the catch abutment 7 is released by operation of the bimetals through the trip bar 2, and the ambient blade 4 as previously described. Hence the lever 8 is moved, due to the action of the spring 30, about its pivot 9 and it carries with it the pin 33. Thus the pivot 31 rises until it is disposed, as seen in Figure 7, above the line between 21, 33. The further action of the spring 30 then urges the parts into the position shown in Figure 2. The triangular bracket or lever turns above 33 due to the pressure exerted by the spring 30 which has caused rightwards movement of

the traverse for disengaging the contacts. While the overload persists the contacts cannot be made, even if the start button 12 is held depressed because the toggle 22, 33 (with its end 31 in the position shown in Figure 2) can be extended only to the amount shown in that figure, and this is insufficient for moving the traverse to the left to engage the contacts.

In order to reset after an overload, the stop button 11, is pressed inwards to bring the parts into the position shown in Figure 9, after which the button 12 is depressed for returning the switch to the "on" position, Figure 1. This causes the centre point 21 of the toggle to be moved from 21^b to 21^a and continues moving downwardly. The arm 22 tends to be moved leftwards against the action of the spring 30 carrying the parts, including the traverse into the position shown in Figure 1.

In the event of the overload persisting the continued movement downward of the toggle point 21 causes the triangular lever 32 to turn about its point of abutment with the screw 34. This is rendered possible because the lever 8 has been disengaged from the catch 7 and is therefore free to turn about its pivot 9. Consequently the pin 31 rises in position above a line between 21, 31 33 and point of abutment of 32 with 34 and is caused to fly upwards to position Figure 2. The lever 8 moves rightwards to permit the pin 33 to move into the position shown in this figure. Thereby the contacts are prevented from re-engaging.

If the stop button be fully depressed while the overload persists the centre point 21 of the toggle moves to 21^b and the position of 31 and 8 is restored by a spring 35 coiled around the pin 33 and having its respective ends extended outwards for stressed engagement with the pin 9 and with the abutment 32^a on the triangular lever. The improvements ensure that only a relatively light pressure engagement exists between the catch parts 7, 8, thereby minimising wear. The pressure is in effect taken up mainly by the screw 34 because the actuating force on the button 12 occurs with the point of abutment of 32^a, 34 in line with the pin 31 and the pin 21 (in the position 21^a) when switching-on. In the "on" position the forces due to spring pressure are largely taken up by this screw thereby resulting in a reduction in the pressure at the point 33. The arm represented by the distance between the points 9 and 7 is greater than that of the arm 9, 33 and therefore the pressure on the catch 7, 8 is still further reduced. Thus although the improved arrangement provides for a desirably strong contact pressure, the catch is nevertheless readily releasable and wear thereon is reduced to a minimum. This is achieved with a desirably compact arrangement, as the elongated lever 8 can still be relatively short.

According to the modified construction shown in Figure 10 the buttons 11, 12 are shrouded by a protective flexible cover 45 made of rubber for example, and formed with bulges 45^a adapted to be depressed for actuating the buttons secured in waterproof manner to a box or enclosure 47.

The button casing is formed with laterally disposed tapped ears for the entry of securing screws on a machine or mounting.

Having thus described my invention, I claim:

1. In an electric switch or circuit breaker provided with devices for tripping the switch or circuit breaker on overload, a lever actuated by such tripping mechanism, a swinging bracket of triangular shape carried on said lever, a toggle pivotally supported at one end on one corner of said swinging bracket, a second lever pivotally connected at one end to a second corner of said bracket, a trip bar pivotally connected at the other end of said second lever, a screw with which the third corner of said bracket has abutting engagement, and a spring coiled around one corner of said swinging bracket, the respective ends of said spring engaging an abutment on said bracket and the pivotal support of said second lever.

2. In an electric switch or circuit breaker provided with devices for tripping the switch or circuit breaker on overload, a lever, a swinging bracket of triangular shape carried on said lever, a toggle pivotally supported at one end on one corner of said swinging bracket, a second lever pivotally connected at one end to a second corner of said bracket, a trip bar pivotally connected at the other end of said second lever, a screw with which the third corner of said bracket has abutting engagement, spring blades adapted to make a catch engagement with said first-named lever and to be actuated by the tripping devices of the switch or circuit breaker, and an end plate removably secured to the switch base for adjusting said blades.

3. In an electric switch or circuit breaker provided with devices for tripping the switch or circuit breaker on overload, a lever actuated by such tripping mechanism, a swinging bracket of triangular shape carried on said lever, a toggle pivotally supported at one end on one corner of said swinging bracket, a second lever pivotally connected at one end to a second corner of said bracket and at the other end with a trip bar, a screw with which the third corner of said bracket has abutting engagement, a spring blade for releasably engaging said first-named lever, said blade having a slot therein formed with an inclined ramp, and a trip mechanism for actuating said first-named lever, said mechanism including an insulating plate having one end adapted to enter the slot in said blade for engagement therewith.

4. An electric switch or circuit breaker mechanism according to claim 3 wherein an end plate having an arcuate slot therein is fixed on the switch base, a scale plate is fixed on said end plate, a pin is carried on the end of said insulating plate remote from the ramp thereon projecting through such arcuate slot, and a scale lever pivoted upon said scale plate and connected to said pin serves to adjust the position of said insulating plate.

5. In an electric switch or circuit breaker with devices for tripping the switch or circuit breaker on overload, a lever actuated by such tripping mechanism, a swinging bracket of triangular shape carried on said lever, a toggle pivotally supported at one end on one corner of said swinging bracket, a second lever pivotally connected at one end to a second corner of said bracket, a trip bar pivotally connected at the other end of said second lever, an end plate on the switch base, and a screw threaded into said end plate adjustable for varying the position of said swinging bracket in relation to said toggle.

6. A multi-pole motor starting switch consisting of manual means for operating the switch, in combination with thermal overload devices, said devices comprising: a bimetal element; a trip bar operable by said devices upon overload; a movable carrier; a plurality of contacts on said movable carrier; complementary fixed contacts; a tripping lever actuated by said trip bar; a swinging bracket carried on said lever, a toggle connected at one end to said carrier and at the other end to said swinging bracket; and linkage connecting said manual operating means with said toggle.

7. A multi-pole motor starting switch comprising a pair of plunger-like buttons, a see-saw like lever connected at each end to one of said buttons, thermal overload devices each incorporating a bimetal element and a trip mechanism operable thereby, a moveable carrier, moving contacts on said movable carrier, a spring resiliently holding said carrier in the "off" position, fixed contacts complementary to said moving contacts, a tripping lever operable by said trip mechanism, a swinging bracket carried on said tripping lever, a toggle connected at one end to said carrier and at the other end to said swinging bracket, and a link connected at one end to one end of said see-saw lever and at its opposite end to the center joint of said toggle.

8. A multi-pole motor starting switch comprising an insulating base, a casing removably mounted on said base, plunger-like buttons guidingly mounted in said casing, a see-saw like lever pivotally mounted in said casing having each end pivotally connected to one of said buttons, thermal overload devices, trip mechanism including a trip lever operable by said devices, a toggle, a linkage connecting said see-saw like lever and said toggle, a moving contact carrier connected to one end of said toggle and operable thereby, and a swinging bracket pivotally mounted on said trip lever and connected to an end of said toggle.

9. A manually operated motor starting switch having thermally operated overload devices, said switch comprising a switch base, a trip mechanism including a trip lever, a movable contact carrier, a toggle disposed between the manually operated means and said contact carrier, a spring for resiliently holding said carrier in the "off" position and a swinging bracket of triangular shape, one corner of said bracket being pivotally connected to one end of said toggle, a second corner of said bracket being pivotally supported on said trip lever, and the third corner of said bracket engaging an abutment on the switch base.

10. A manually operated motor starting switch consisting of thermally operated overload devices; and a trip mechanism comprising a trip lever, a pair of plungers, a see-saw lever connected at each end to one of said plungers, a toggle, a link connecting said see-saw lever with the center joint of said toggle, a movable contact carrier connected to one end of said toggle and a swinging bracket pivotally mounted on said trip lever and connected to the other end of said toggle.

11. A manually operated motor starting switch consisting of trip mechanism including a trip lever operated by overload devices, said devices comprising a switch base, a movable contact carrier, an end plate for said base, an abutment on said plate, a toggle connected at one end of said carrier, a triangular plate carried on said trip lever having one corner thereof pivoted to the other end of said toggle, a second corner pivotally supported on said trip lever and the third corner in engagement with said abutment.

12. A manually operated motor starting switch consisting of trip mechanism including a trip lever operated by overload devices, said devices comprising a switch base, a casing removably mounted on said base, a see-saw lever pivotally mounted in said casing, plunger-like buttons guidingly mounted in said casing one connected at each end of said lever for alternately moving said lever in opposite directions, a toggle in said casing, a link connecting said see-saw lever to said toggle, a movable contact carrier connected to one end of said toggle, and a swinging bracket pivotally mounted on said trip lever and connected to the other end of said toggle.

13. A multipole manual motor starting switch comprising a common trip bar, thermal overload devices operable on said trip bar, a trip lever actuated by said trip bar a movable insulating carrier, a plurality of contacts mounted on said carrier, and manually depressible buttons for operating the switch, in combination with a toggle connecting said buttons to said carrier, and a swinging bracket connected to said toggle and said trip lever.

14. A multipole manual motor starting switch comprising an insulating motor switch base, a casing removably mounted on said base, a lever pivotally mounted in said casing, plunger-like buttons guidingly mounted in said casing one connected at each end of said lever for alternately moving said lever in opposite directions, a toggle in said casing, a link connected between one end of said lever and the center joint of said toggle, and a trip mechanism, said mechanism comprising a trip lever, a movable contact carrier connected to one end of said toggle, and a swinging bracket pivotally mounted on said trip lever and connected to the other end of said toggle.

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