July 18, 1939. B. E. GETCHELL 2,166,545

ELECTRIC SWITCH

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Fig. 1.

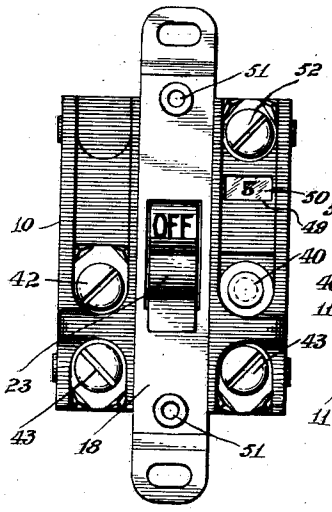


Fig. 2.

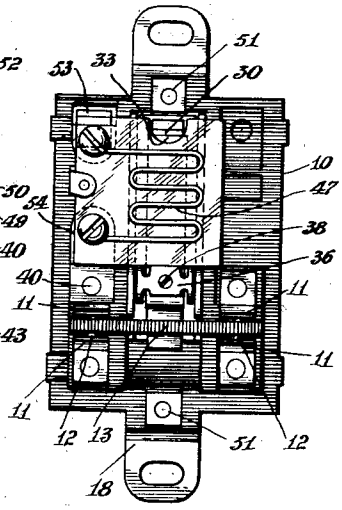


Fig. 3.

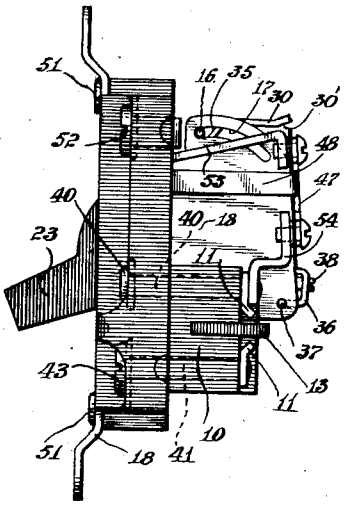


Fig. 4.

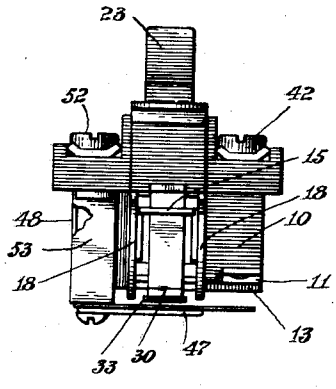


Fig. 5.

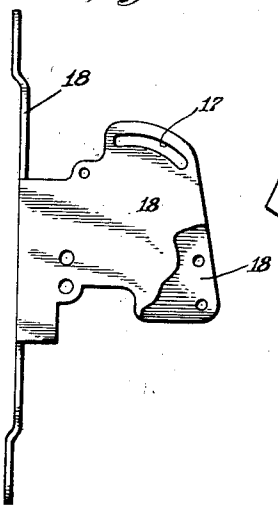
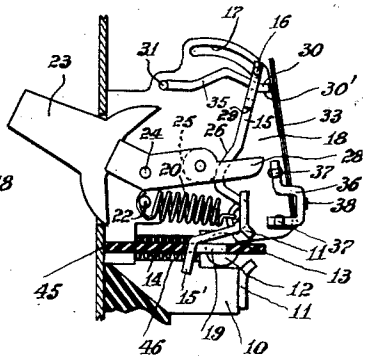


Fig. 6.



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Fig. 7.

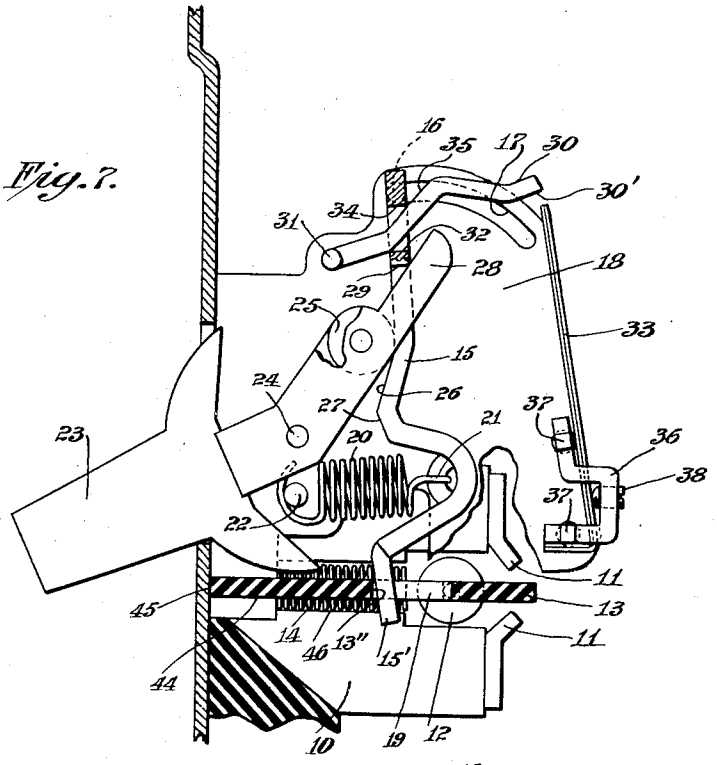
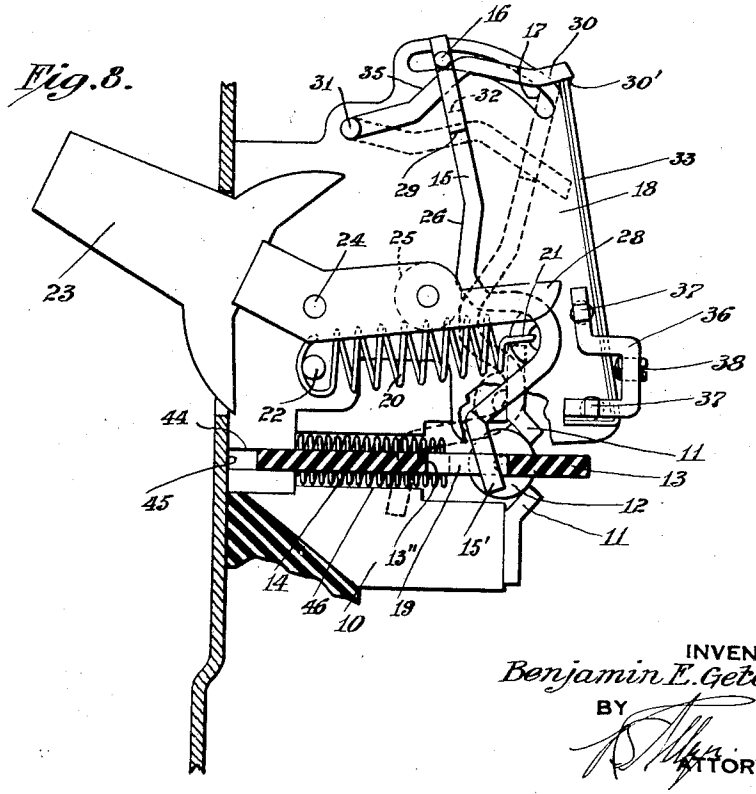


Fig. 8.



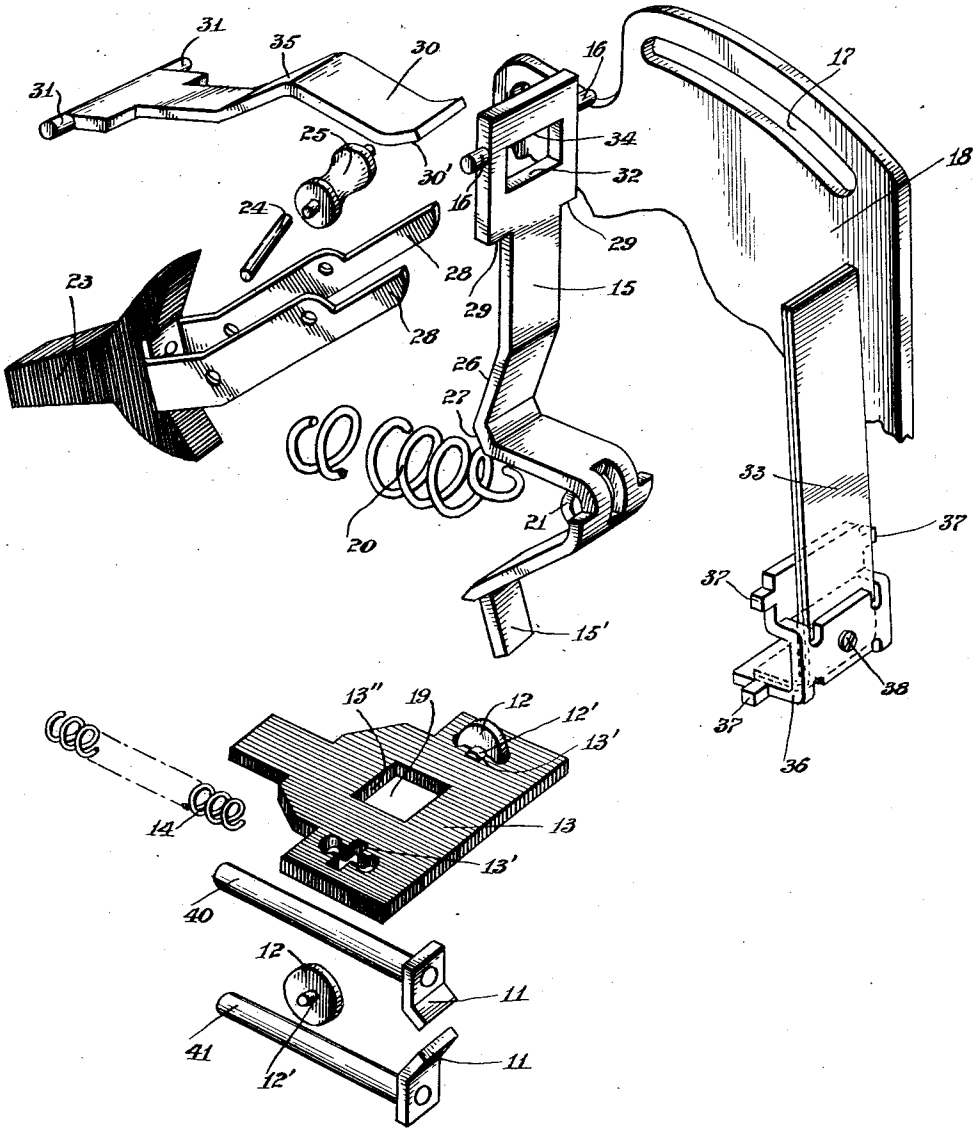
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Fig. 9.



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Fig. 10.

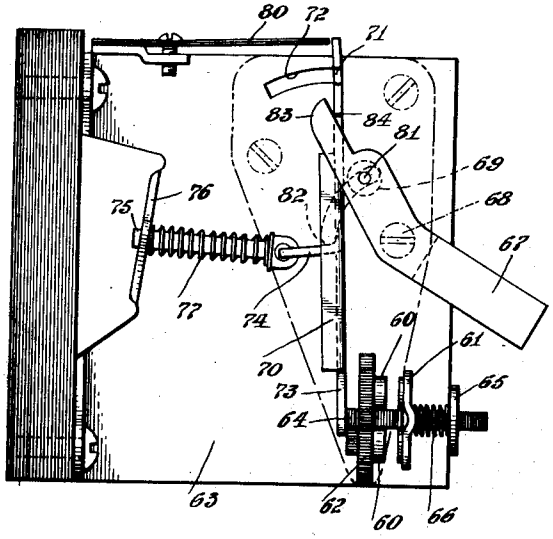


Fig. 12.

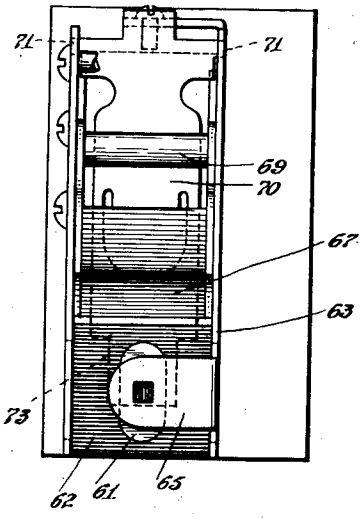


Fig. 11.

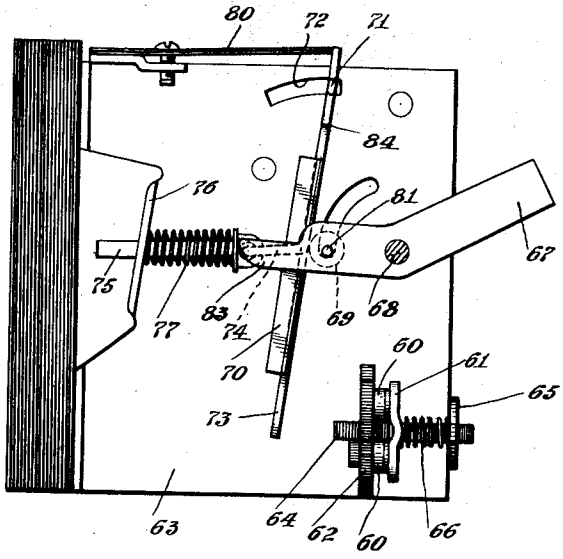
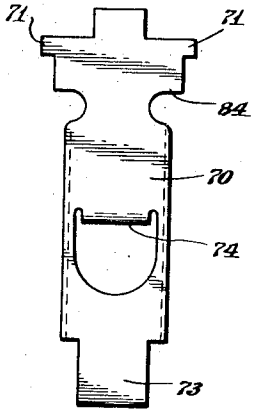


Fig. 13.



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Patented July 18, 1939 2,166,545

UNITED STATES PATENT OFFICE

2,166,545

ELECTRIC SWITCH

Benjamin E. Getchell, Plainville, Conn., assignor to The Trumbull Electric Manufacturing Company, Plainville, Conn., a corporation of Connecticut

Application May 17, 1938, Serial No. 208,428

28 Claims. (Cl. 200—116)

My invention relates especially to devices which provide not only for convenient manual operation but for automatic opening of the circuit when it is overloaded.

One object is to provide a switch of this character which is compact and reliable and which can be made economically and according to practical commercial standards.

Among the features of the preferred form of my invention are the following:

1. I provide a single lever for opening and closing the circuit by hand.

2. In case of an overload the circuit is broken automatically by the releasing action of a current responsive device preferably in the form of a bimetallic thermostatic device.

3. The automatic overload circuit breaker mechanism is entirely out of control of the operator at all times.

4. The floating lever has a novel supporting means, sometimes it is rockably supported at one of its ends, and sometimes at the other end and sometimes it tilts about an intermediate point.

5. The floating lever is moved automatically to the fully "off" position when the overload device trips the switch to open the circuit.

6. If the operating or handle lever is allowed freedom of movement it is moved automatically to full "off" position when the overload device trips the switch to open the circuit.

7. If the operating or handle lever is held manually in the closed circuit position when the switch is tripped and the circuit is opened automatically, the handle will automatically be moved to the fully "off" position when released.

8. The circuit cannot be re-closed after automatic tripping until the thermostatic circuit breaking element cools and returns to its normal position.

9. The latch of the automatic tripping device is retracted from any direct connection with the thermostatic element when tripped so as to permit free unhampered return of the thermostatic member to its normal latching position.

10. The handle lever when released to the "off" position automatically retracts the latch from the thermostatic arm but reengages the latch before closing the circuit.

11. The circuit may be jogged or closed momentarily without latching the parts in the "on" position.

12. I provide separate operating springs biased in opposite directions.

13. Whenever the circuit has been closed, whether momentarily or finally, one of the springs acts to exert full contact pressure so that the switch is never closed under partial contact pressure.

Fig. 1 is a front view of one form of switch embodying my invention.

Fig. 2 is a rear view of the same.

Fig. 3 is a side view of the same form.

Fig. 4 is an end view.

Fig. 5 is a side view of the mechanism frame.

Fig. 6 is a side and sectional view showing switch parts in an intermediate "tripped" position.

Fig. 7 is a side sectional view showing the switch parts in the open circuit or "off" position.

Fig. 8 is a side sectional view showing the switch parts in the closed circuit or "on" position.

Fig. 9 is an exploded perspective view of the principal parts of the mechanism.

Fig. 10 is a side view of a modified form of the invention, the parts being in the "off" position.

Fig. 11 is a similar view with the parts in the "on" position.

Fig. 12 is a front view.

Fig. 13 is a detail view of the floating lever of Figs. 10 to 12.

In the preferred form, the insulating body 10 has one or more pairs of stationary contacts 11, 11 each pair having a roller switch member or disc 12 preferably of silver, carried by a slide 13 under pressure of one or more springs 14 tending to close the circuit.

A floating lever 15 has projecting guide pins 16 at its upper end positioned and guided in a curved slot 17 in a metal frame 18 supported in the body. The lower end 15' of this lever 15 extends through an opening 19 in the slide 13. The main spring 20 is connected at 21 to the lever 15 and at its other end to a stationary anchor or abutment pin 22 in the frame so as to bias the parts toward the open circuit position.

The operating lever or handle 23 is pivoted on a pin 24 in the frame, and has a projection preferably in the form of a curved surface or a roller 25 which engages the lever 15 and is adapted to travel along the incline 26 and over the shoulder 27.

The lever 23 also has an extension 28 adapted to engage a shoulder 29 on the lever 15 in certain positions of the handle, for a purpose described further on.

The trigger or latch member 30 is hinged at 31 and passes between shoulder 32 and cross piece or shoulder 34 in the floating lever 15. When the switch is in the normal "off" or the full trip position, the latch is held in the position shown

in Fig. 7 by the action of the main spring 20 which biases the lever 15 around its end 15' with a fulcrum on the edge 13'' in hole 19. Shoulder 32 of the lever 15 will then engage the slanting underside of the trigger 30 and hold the trigger away from the end of arm 33.

The upper end of the lever 15 has a cross-piece or shoulder 34 for engaging the incline 35 on the latch when the lever 23 is moved to the closed circuit of "on" position of Fig. 8 where the tip 30' of the latch or trigger member engages the end of the thermostatic arm 33.

The thermostatic arm 33 is carried by a saddle 36 which has studs 37 which may be riveted into the frame 18. An adjusting screw 38 is also carried by this saddle for the purpose of calibration by varying the release and latching action of the arm 33.

The stationary switch contacts 11 are held in place on the insulating body 10 by means of extensions 40, 41 which pass through the body and may be spun or riveted over at their outer ends. Terminal plates and screws 42, 43 are fastened to the ends of extensions 40, 41 when the extensions are used as a part of the circuit through the switch, as shown in the left-hand side of Fig. 1.

The slide 13 is guided in slot 44 in the body of the switch and has a stop 45 to limit its outward movement. Each switch roller 12 has a shaft 12' located in a slot 13' in the slide, this slot being sufficiently large to permit free movement of the roller so that it can be sure to seat against the inclined edges of the stationary contacts. Each spring 14 is housed in a recess 46 in the body.

The resistance heater 47 may be of any suitable type supported in any suitable manner for instance as shown in Reissue Patent 20,649 of February 8, 1938.

The capacity or rating indicator 48 may be carried by the heater unit and made visible in any suitable manner as for instance through an opening 49 behind a transparent window 50.

The frame 18 may be secured in a recess or slot of the body 10 for instance by means of tapped tubular rivets 51—51. The tapped rivets may be used in securing a back cover and front cover to the switch assembly by means of screws in a conventional manner.

The circuit through the side of the switch which does not have a heater may be traced through terminal plate and screw 42, extension 40, a contact 11, switch member 12, a second contact 11, extension 41, and terminal plate and screw 43. A heater may be used on either one leg of the circuit, as shown in Reissue 20,649, or on both the legs of the circuit as shown in Patent 2,051,943. When a heater is used, the circuit through that side of the switch goes through terminal plate and screw 52, heater supporting post 53, heater 47, heater supporting post 54, a contact 11, switch member 12, a second contact 11, extension 41, and terminal plate and screw 43. It will be noted that in the side where a heater is used, the circuit does not include extension 40. In this case, the outer end of extension 40 is simply spun over a washer to secure it to the insulating body, and no terminal plate or screw is provided.

The operation of the device is as follows:

In the "off" position, the spring 20 holds the end 15' of floating lever 15 against the edge 13'' of slot 19 in contact slide 13 and holds the slide 13 in "off" position against the bias of springs 14. The tension of spring 20 pulls on floating lever 15 with point 15' as a fulcrum and holds guide pin 16 in the left end of slot 17 as viewed in Fig. 7 and holds shoulder 32 against the latch 30 to hold the latter away from the thermostat 33. The incline 26 of floating lever 15 engages roller 25 and holds the lever 23 in "off" position.

The closing operation.—The handle end of lever 23 is moved upwardly, which moves the inner end downwardly by rotation on pivot pin 24. Roller 25 moves along floating lever 15 and presses it against the pull of spring 20 causing the cross bar 34 of the floating lever to engage incline 35 of latch 30 and press its tip 30' against the end of the thermostat 33. This engagement of the latch and thermostat prevents further movement of the guide pin 16 of floating lever 15 in slot 17. Continued "on" movement of roller 25 upon floating lever 15 causes the floating lever to pivot about shoulder 34 and swing against the pull of spring 20.

The roller 25 then rolls over the incline 26 of floating lever 15 on to the shoulder 27. This shoulder 27 is at such an angle that the pull of spring 20 biases the roller 25 further toward the "on" position until the handle lever engages the stop of the frame. This retains the handle lever in "on" position. Expressed in another way, the incline 26 and the shoulder 27 are arranged at an angle with each other so as to bias the handle respectively to "off" and to "on" positions through the action of spring 20 on the floating lever 15. This is so because the lines of force applied by the surfaces 26 and 27 to the handle are on opposite sides of the pivot 24 of the handle.

Projecting end 15' of floating lever 15 moves to the right as viewed in Fig. 7 and permits spring or springs 14 to press contact slide 13 toward the closed circuit position. Slide 13 carries the switch member 12 into engagement with the stationary contacts 11, 11 thus closing the circuit.

Manual opening.—To manually open the switch, pressure is applied in the "off" direction to handle lever 23. This moves roller 25 from shoulder 27 to incline 26 of the floating lever 15. Roller 25 is now biased to the "off" position by the angle of incline 26 through the pull of spring 20, and floating lever 15 will be pulled to the "off" position by spring 20 thus forcing the lever 23 and contact slide 13 to "off" position, as shown in Fig. 7. A slight movement of the latch 30 also takes place at the same time as described above, so that it no longer bears on the end of the thermostatic arm 33.

Jogging.—When the switch handle is being thrown "on", the switch contacts are pressed entirely closed by full pressure of springs 14 before the roller 25 passes over the shoulder 27. End 15' of the floating lever continues to move away from the edge 13'' of the hole 19 upon further movement of the handle toward "on" position, until finally the roller 25 passes from incline 26 on to shoulder 27, when the handle becomes latched "on" by stress of the spring 20. If the handle is released before the roller passes over the shoulder 27, the handle will not stay in this position but will go back to "off" position because of the pull of spring 20 and slant of incline 26.

Because of the lost-motion connection which permits this full closing of the contacts before the handle is latched "on", this switch can be safely used in "jogging" or "inching" a motor. When jogging, the operator simply presses the handle part way toward "on" position and holds it there momentarily. To stop the motor he re-

leases the handle which is not latched and the spring 20 will return both handle and contacts to "off" position. This sequence of momentary contact and release can be accomplished very rapidly because the handle is not latched at first when the contacts close.

Automatic overload trip.—In the closed circuit position, lever 23 holds floating lever 15 against the bias of spring 20. The spring or springs 14 hold the slide 13 and the contacts 12 in the closed circuit position. The floating lever 15 is biased by spring 20 to move pin 16 in slot 17. This bias of pin 16 is restrained by the action of incline 35 on latch 30 engaging cross piece 34. The pressure of cross piece 34 of floating lever 15 on incline 35 of latch 30 biases the latch 30 to swing on its pivot 31 out of line with slot 17, but latch 30 is restrained from such movement by the thermostatic arm 33 which engages latch 30 at point 30'.

Upon occurrence of a predetermined overload enduring a predetermined time the thermostatic heater unit 47 heats the thermostatic arm 33 and causes its end to move out of engagement with latch 30. Upon such release, the pressure of cross piece 34 on incline 35 causes latch 30 to swing inward and such release permits spring 20 to swing floating lever 15 on roller 25 as a fulcrum. The projecting end 15' moves outward and carries slide 13 to open circuit position thus disengaging switch member 12 from contacts 11, 11. Movement of slide 13 is limited by engagement with the frame 18 at a suitable point such as 45. This, in turn, limits the movement of end 15' of the floating lever 15 which rests against the edge 13'' of the slot 19 in slide 13. Guide pin 16 of floating lever 15 has now travelled to the inner end of slot 17. The direction of slot 17 is such that it not only permits movement of guide pin 16 of floating lever 15 but it also causes an appreciable longitudinal movement of floating lever 15 through the slide 13. This movement accomplishes two purposes. First, it shifts spring anchorage point 21 further out of line with the fulcrum on roller 25 and permits the spring 20 to exert greater pressure on slide 13. Second, it shifts the fulcrum point of 25 from shoulder 27 to incline 26, thus transferring the biasing action on roller 25 from "on" position to "off" position. The members are now in "intermediate trip" position of Fig. 6. Spring 20 is still biasing the end 15' of floating lever 15 to move outward. End 15' is restrained from further outward movement by slide 13. Roller 25 resting now on incline 26 offers no restraint. Therefore floating lever 15 now swings on end 15' as a pivot and guide pin 16 moves outward in slot 17. The shoulder 32 of floating lever 15 contacts latch 30 and swings it outward so that point 30' is beyond the end of thermostat 33. Simultaneous with this outward movement of lever 15, roller 25 is pushed across incline 26 and returns the lever 23 to "off" position. When the thermostat 33 cools, the end returns to normal position in the path of movement of point 30'.

In case the lever 23 is manually or automatically held in "on" position after automatic trip, until the thermostat 33 cools and resumes its normal position, point 30' of the latch 30 will engage the inner surface of thermostat 33 as it swings into normal position under pull of spring 20. If the friction between these two parts is too great for spring 20 to overcome and latch 30 does not automatically resume its normal position for latching, pressure toward the "off" position manually applied to lever 23 will cause extension 28 of the lever 23 to engage shoulder 29 of the floating lever 15 and force shoulder 32 against the latch 30. This forces latch 30 into position for latching.

Light tripping pressure on the thermostat.—When roller 25 is pressing on shoulder 27 with the switch in "on" position, the line of pull of spring 20 passes very close to this fulcrum point 25—27 of lever 15. This results in comparatively light pressure of shoulder 34 of lever 15 on latch 30, and consequently light pressure of latch 30 against thermostat 33.

Increase of effective spring pressure in "trip" position.—When the floating lever 15 swings on fulcrum 25, spring anchor point 21 swings on an arc centered at 25 toward slide 13 moving the line of force exerted by spring 20 farther away from fulcrum 25 which increases the pressure exerted by spring 20 upon slide 13. Thus point 21 is influenced to move toward slide 13 by two causes—the normal arc of movement by turning on fulcrum 25 and by actual shift of lever 15 caused by the incline of slot 17.

This construction is not only considerably cheaper to make than devices heretofore made for similar purposes but it is rugged and durable as well. The automatic resetting of the finger lever or actuator to the "off" position after automatic tripping is of considerable advantage since the position of the lever of an ordinary switch is quite generally regarded as indicative of the condition of the circuit and it is consequently misleading to find the actuating lever of a switch of this character in the "on"—or nearly "on" position when the circuit is really open. Expressed in another way the operator of this switch can always tell by looking at the finger lever whether the switch is "on" or "off". This form of device is dependable for one reason because of the fact that the pressure on the thermostatic member is very light and there is little danger of the parts getting struck and inoperative. The construction is such that the circuit breaking action is very effective, in fact a small sized switch will safely rate for one horsepower on a 110 or 220 volt circuit with either alternating or direct current.

In the form of switch shown in Figs. 10 to 13, the general principles and advantages are the same as those previously described but there are a number of modifications in details.

The circuit making and breaking contacts may be of any suitable type. I have shown two stationary contacts 60, 60 and a movable switch member 61 for connecting them. Suitable circuit connections, not shown, are provided for the contacts. The stationary contacts are mounted on an insulating support 62 which in turn is mounted on the frame 63 which supports all the parts of the switch. The member 61 is carried by an insulating slide 64 which is guided by the support 62 and by a lug 65 on the frame 63 and pressed toward the "on" position by a spring 66.

The operating member 67 is in the form of a lever pivoted at 68 and carries a cross piece 69 in the form of a roller which engages an intermediate floating lever 70. This lever has a guiding pin 71 at one end confined by and movable in a slot 72 in the frame and at its other end 73 engages the slide 64 and the support 62 when the circuit is open. This lever 70 has a lug 74 to which is pivotally attached a spring guiding rod 75 whose free end slides in a lug 76 attached to the main frame 63. A spring 77 normally

biases the rod and lever toward the roller 69 and toward the switch slide 64 and toward the outer end of the bimetallic latch 80, these three elements at various times constituting the support or fulcrum for the lever 70.

The bimetallic strip 80 constitutes a part of an overload device and is heated in a suitable manner when the circuit is closed and an overload occurs. One end of this strip is fixed and the other end normally stands in the path of movement of the lever 70 but does not actually touch the lever 70 when the circuit is open and the finger piece or lever 67 is in the normal "off" position.

The lever 67 has a projection 81 adapted when the lever is moved to the "on" position to engage a shoulder 82 mounted on the frame. This lever also has an extension 83 adapted to engage the back of the shoulder 84 on the lever 70 for manual return of lever 70 to a full normal "off" position in case the spring 77 fails to complete the action after an overload trip.

To close the circuit the lever 67 is raised and the roller 69 engages and moves the lever 70 and rod 75 inwardly and compresses spring 77. The upper end of lever 70 engages the tip of the thermostatic arm 80. The continued upward movement of the lever 69 then causes the lever 70 to swing about its upper end as a pivot thus retracting the lower end 73 away from the switch slide 64 and allowing the spring 66 to move the switch member 61 into engagement with the stationary contacts 60, 60 and close the circuit. When the lever 67 is raised to its fullest extent the projection 81 strikes against the abutment shoulder 82 at which time the pressure of the spring 77 holds the lever 67 because of the changed slant of floating lever 70.

To open the circuit the lever 67 is pulled down and the action reversed, the spring 77 being strong enough to overcome the spring 66 and open the circuit when the lower end 73 of the floating lever 70 engages and moves the carrier slide 64.

In case of an overload, the arm 80 moves out of the path of the upper end of the lever 70 thus permitting the spring 77 to tilt the lever about the roller 69 as a pivot so that the lower end 73 strikes the switch slide 64 and opens the circuit. As the lever 70 tilts around the roller 69, it changes the direction of pressure sufficiently to press upwardly against the inner end of the lever 67 and throws said lever to the "off" position. If the lever 67 is held by hand in the "on" position, the lever 70 will nevertheless be tilted sufficiently by the spring 77 to engage the switch slide 64 and move it to the "off" position and open the circuit. When the lever 67 is released the spring 77 will move the lever 70 and the operating lever 67 to the "off" position.

As the closing of the circuit is dependent upon holding the upper end of lever 70 by the arm 80, the arm must cool off and return to its normal position before the circuit can be closed.

It will be understood that, in this modified form, a suitable form of heater element may be provided and positioned adjacent the thermostatic strip 80, that suitable wire attaching means may be provided for the stationary contacts 60, 60 and that various modifications may be made in the details of construction of the supporting frame for this form of operating mechanism.

I claim:

1. In a switch, a frame, a stationary switch contact, a spring pressed slide, a switch member carried by said slide, a floating lever having one end coacting with said slide and a pivotal connection for its other end, a guiding pin and slot connection between the frame and the floating lever, a finger lever having a rolling engagement with said floating lever and a spring for pivoting said floating lever at its point of engagement with the finger lever for moving said slide to open circuit position and permitting said slide to move to the closed circuit position.

2. In a switch, a frame having a slot, a stationary switch contact, a slide, a switch member carried by said slide, a floating lever guided in said slot and having one end coacting with said slide and the other end pivotally supported, spring means normally biasing said slide to closed circuit position, and a spring normally urging the floating lever to open circuit position and a finger lever in rolling engagement with said floating lever for moving the latter to closed circuit position.

3. In a switch, a stationary switch contact, a spring pressed switch member, a spring actuated floating lever at times opposing said spring pressed switch member, a finger lever having a roller for engaging said floating lever to move it away from the switch member and serving as a pivot for the floating lever in case of an overload, an overload actuated member at times coacting with said floating lever to provide a pivot for the tilting of said lever, said spring actuated floating lever being adapted to throw said finger lever to the "off" position when released by the movement of the overload actuated member.

4. In a switch, a frame having a slot, a spring actuated floating switch lever guided in said slot to tilt and to move longitudinally, a manually operable operating lever coacting with said lever to hold it in either the "off" circuit position or in the "on" circuit position, an overload tripping device, a trigger device normally held by the floating lever in one position when the parts are in the "off" circuit position, said trigger supporting one end of the floating lever when the parts are in the "on" circuit position.

5. In a switch, an insulating base, a stationary contact, a member slidable in the base, a contact carried by said slide adapted to engage said stationary contact, spring means urging the sliding contact into engagement with the stationary contact, a floating lever having one end adapted to engage said slide to move its contact away from the stationary contact, a spring urging said lever end toward engagement with the slide, a manually operable lever adapted to move said floating lever out of engagement with the slide, a latch member adapted to engage the opposite end of said floating lever to hold said lever out of engagement with the slide, thermostatic means for tripping said latch, said last named spring being adapted to move said floating lever into engagement with the slide whereby its contact is moved out of engagement with the stationary contact upon tripping of the latch.

6. In a switch, a floating lever having two bearing surfaces inclined relatively to each other and to the general direction of the lever, means for supporting said lever so as to permit it to tilt and also to move longitudinally, means biasing said lever to tilt and to move longitudinally, said means including an actuating lever having means engaging the inclined surfaces of said lever, contact making means associated with one part of

said lever and current responsive means coacting with another part of said lever.

7. In a switch, a stationary contact, a movable contact, a spring for moving said movable contact into engagement with the stationary contact to close the circuit, a floating lever sometimes hinged at one end, a spring pressed member for normally forcing the opposite end of said floating lever into contact disengaging position, a manually operable lever for moving said floating lever out of contact disengaging position against the action of said spring and for shifting the line of force of said spring pressed member on said floating lever, and common means for holding the shifted line of pressure and for permitting return of said spring pressed member to normal position for forcing the end of the floating lever to contact disengaging position, said means including a projection on said floating lever and a thermostatically controlled arm, said arm being positioned in the path of movement of said projection and being adapted to be moved away from said path of movement upon an overload.

8. In a switch, a frame having a slot, a stationary contact, a slidable member, a switch member carried by said slide for engagement with said stationary contact, a spring biasing said slide to closed circuit position, a floating lever having a projecting end adapted to engage said slide to move and hold it in open circuit position and having projecting pins movable in said slot to guide the movement of the lever, a spring for automatically moving the end of said lever into engagement with the slide to cause its movement and for holding said end to prevent movement of the slide, a manually operable lever for moving the projecting end of said floating lever away from the slide, and mechanism for preventing the movement of said floating lever to slide actuating position including a shouder on the floating lever, a latch member coacting with said shoulder and a movable arm positioned in the path of movement of said latch, said arm being adapted to be moved out of the path of movement of the latch to permit further movement of the floating lever.

9. In an electric switch, a spring actuated floating lever guided at one end, a spring pressed switch actuating slide having a lost motion connection with the other end of said lever, an actuating lever having a roller for engaging the floating lever, and overload-actuated means limiting the movement of the guided end of said floating lever when the actuating lever is moved to close the circuit.

10. In an electric switch, a spring biased floating lever guided at one end, a spring pressed switch actuating member having a lost motion connection with the other end of said lever, said floating lever having a cam-like shoulder between its ends, an actuating lever having a part for engaging the floating lever and coacting with said shoulder in the closed circuit position and overload-actuated means limiting the movement of the guided end of said floating lever when the actuating lever is moved to close the circuit.

11. In a switch, a spring pressed slide, a contact disc loosely carried by said slide, spaced contacts having inclined surfaces adapted to be connected by said disc, a floating lever having at one end a lost motion connection with said slide, means for guiding said lever to permit it to move transversely and to move longitudinally, a manually operable lever having means coacting with said floating lever to close the circuit, overload-actuated means for controlling the end of said floating lever remote from the slide and a spring coacting with said floating lever to move it and the manually operable lever to the open circuit position when it is released by said overload actuated means.

12. In an electric switch, a floating lever guided in its floating movement, a spring pressed switch member having a lost motion connection with one end of said lever, an actuating lever having a part for engaging the floating lever to move it to the closed circuit position, overload-actuated means limiting the movement of the other end of said floating lever when the actuating lever is moved to close the circuit, and a spring acting upon said floating lever between the part where it is engaged by a part of said actuating lever and the connection with said switch member to bias said floating lever toward and to move the actuating lever to the open circuit position when said floating lever has been released by the action of the overload-actuated means.

13. In a switch an insulating body having a guide groove, a slide movable therein, two roller switch members loosely supported therein, two pairs of stationary contacts carried by the body in position to be connected by the respective roller members, spring means biasing said slide toward a closed circuit position, a floating lever having at one end a lost motion connection with said slide, a finger lever for actuating said floating lever to a position allowing said bias to close the contacts, a spring for moving said floating lever to open the circuit, and an overload release device for controlling the movement of the end of the floating lever remote from the slide.

14. In a switch, a stationary contact, a cooperating movable contact, a floating lever for operating said movable contact between closed and open circuit positions, a load responsive means for normally holding a point of said floating lever in a predetermined position, an operating handle having a curved surface engaging said floating lever, said operating handle being movable to move said floating lever about said point and thereby operate said movable contact between its closed and open circuit positions, a spring biasing said floating lever against said handle and for movement about said handle when said floating lever is released by said load responsive means and means for controlling the position of said floating lever so as to cause said handle to move to its open circuit position when said floating lever is released by said load responsive means.

15. In a switch, a stationary contact, a cooperating movable contact, a floating lever for operating said movable contact between closed and open circuit positions, a load responsive means for normally holding one end of said floating lever in a predetermined position, a pivoted operating member having a curved surface engaging said floating lever, said operating member being movable to move said lever about said end as a pivot and thereby operate said movable contact between its closed and open circuit positions, a spring biasing said floating lever against said operating member and for movement about said operating member as a pivot when said floating lever is released by said load responsive means and guide means for controlling the longitudinal position of said floating lever so as to cause said floating lever to throw said operating member to its open circuit position when said

floating lever is released by said load responsive means.

16. In a switch, a stationary contact, a cooperating movable contact, a floating lever for operating said movable contact between closed and open circuit positions, a load responsive means for normally holding a point of said floating lever in a predetermined position, an operating handle engaging said floating lever, said handle being movable to move said floating lever about said point and thereby operate said movable contact between its closed and open circuit positions, a spring biasing said floating lever against said handle, said floating lever being provided with inclined surfaces for selectively engaging said handle to hold said handle in either its open or closed circuit positions, said spring biasing said floating lever for movement about said handle as a pivot when said floating lever is released by said load responsive means and guide means for said floating lever for moving said floating lever when released by said load responsive means so as to bring the other of said surfaces into engagement with said handle to throw said handle to its open circuit position.

17. In a switch, a stationary contact, a movable contact, a floating lever provided with bearing surfaces arranged at a predetermined angle with each other, a load responsive means for normally holding one end of said floating lever in a predetermined position, a handle selectively engaging said surfaces so as to operate said lever about said end, said handle being held in selected positions by said surfaces, circuit controlling means operated by said floating lever, a spring biasing said floating lever against said handle and biasing said floating lever about said handle as a pivot when said floating lever is released by said load responsive means and guide means for said floating lever for moving said floating lever longitudinally when released by said load responsive means so as to bring another of said surfaces into engagement with said handle and thereby throw said handle to another position.

18. A switch including an operating member movable between "on" and "off" positions, a switching member movable between "on" and "off" positions, a contact adapted to be engaged by said switching member when in "on" position, a spring acting between a stationary point and a portion of said switching member to bias said switching member always toward "on" position, a lost-motion connection between the operating member and the switching member such that an initial movement of the operating member toward "on" position will allow the spring to move the switching member to full "on" position under full spring tension, and further movement of the operating member toward "on" position is possible, free of connection with the switching member, and a second spring always urging said operating member toward "off" position, strong enough to overcome the bias of the first spring to move said switch member to "off" position when said operating member is in "off" position.

19. A switch including a handle movable between "on" and "off" positions, a switching member movable between "on" and "off" positions, a contact adapted to be engaged by said switching member when in "on" position, a spring acting between a stationary point and a portion of said switching member to bias said member always toward "on" position, a lost-motion connection between the handle and the switching member such that an initial movement of the handle toward "on" position will allow the spring to move the switching member to full "on" position under full spring tension, and further movement of the handle toward "on" position is possible, free of connection with the switching member, means for latching said handle in the end of its movement to "on" position, and a second spring always urging said handle toward "off" position, strong enough to overcome the bias of the first spring to move said switch member to "off" position when said handle is out of latch position, said latching means, when operative, rendering said second spring inoperative to throw the handle and switch member toward "off" position.

20. In a switch, a stationary contact, a movable switch member spring pressed to engage the stationary contact, a spring pressed lever engageable with the movable switch member, the spring power of the lever being sufficient to overcome the spring power of the switch member, an actuating lever engaging said spring pressed lever to move the same against the power of the spring of said lever so as to permit the circuit to be momentarily closed through the switch member by a partial movement of the actuating lever toward the "on" position, the construction and arrangement of the spring pressed lever and the actuating lever being such that the spring pressed lever is resiliently held with the switch member in a closed circuit position when the actuating lever is moved to the fully "on" position.

21. A circuit breaker comprising a fixed contact, a movable contact always biased toward engagement with said fixed contact, a manually movable member for controlling movement of said contacts into and out of engagement, a floating actuating lever between said manual member and said movable contact and having a pivotal connection with said manual member, spring means always biasing said floating lever towards said manual member and said movable contact, a member movable in response to the effect of an overload current to release said floating lever, said release member acting as a support for said floating lever whereby said floating lever pivots about its point of engagement with said releasable member during manual engagement and disengagement of said contacts, said floating lever rotating about said point of pivotal engagement with said manually operable member upon overload release of said release member and means for guiding said floating lever in its movements.

22. A circuit breaker comprising a fixed contact, a movable contact always biased toward engagement with said fixed contact, a manually movable member for controlling movement of said contacts into and out of engagement, a floating actuating lever between said manual member and said movable contact and having a pivotal connection with said manual member, spring means always biasing said floating lever towards said manual member and said movable contact, a member movable in response to the effect of an overload current to release said floating lever and pivotally supporting said floating lever for movement about one end during manual operation of the switch or releasing said floating member on overload for pivoting about an axis spaced from said end, and means for guiding said floating lever in its movements.

23. A circuit breaker comprising fixed and movable contacts, a manually movable member for moving said contacts out of engagement, biasing means for moving said contacts into engage-

ment, a floating actuating lever between said manual member and said movable contact, means providing a pivotal support for pivotal movement of said floating lever during manual opening of said contacts, said means including a member movable in response to the effect of an overload current to cause said contacts to separate on overload, means providing a pivotal support for pivotal movement of said floating lever during overload operation of said contacts, spring means urging said floating lever into engagement with said pivotal supporting means, said spring means acting on said floating lever outside of the space between said pivotal supporting means.

24. A circuit breaker comprising fixed and movable contacts, a manually movable member for moving said contacts out of engagement, biasing means for moving said contacts into engagement, a floating actuating lever between said manual member and said movable contact, means providing a pivotal support for pivotal movement of said floating lever during manual opening of said contacts, means providing a pivotal support for pivotal movement of said floating lever during overload operation of said contacts, said first named means including a member movable in response to overload current to release said lever for pivoting about said overload operation pivot, spring means urging said lever into engagement with both said pivotal supporting means, said spring means acting on said lever outside of the space between said pivotally supporting means, and said manually movable member being actuable to return said lever into engagement with said manual operation pivotal supporting means prior to return of said contacts into engagement after their release by action of overload current.

25. A circuit breaker comprising fixed and movable contacts, a manually movable member for causing movement of said contacts out of engagement, biasing means for causing movement of said contacts into engagement, a floating actuating lever between said manual member and said movable contact, two points about which said lever may pivot, said lever pivoting about one point during manual operation and about the other point during overload operation of said movable contact, spring means outside of the space between said pivot points urging said lever against said points, a member movable in response to overload currents to remove the support of one of said pivot points and permit pivoting of said lever about said other point.

26. A circuit breaker comprising a fixed contact, a movable contact always biased toward engagement with said fixed contact, a manually movable member for controlling movement of said contacts into and out of engagement, a floating actuating lever between said manual member and said movable contact, a member movable in response to overload currents for causing said movable contact to disengage said fixed contact, said overload responsive member affording a pivotal bearing for said floating lever during manual operation of said contacts, said manually movable member affording a pivotal bearing for said lever during operation of said contacts on overload, and spring means, outside of the space between the bearing points for said overload responsive member and said manually movable member, urging said floating lever against said bearing points.

27. In a circuit breaker a pair of contacts, one of said contacts being movable to open and close the circuit, biasing means always urging said contacts towards closed circuit position, a floating arm for controlling the movement of said movable contact, a spring applying a biasing force tending to move said floating arm and said movable contact toward open circuit position, a temperature responsive member normally engaging and latching one end of said floating arm against movement by said spring, said temperature responsive member providing a pivot point for said floating arm at its point of engagement therewith about which said floating arm is rotatable to normally control circuit opening and closing movement of said movable contact, a manually operable member upon movement of which the force exerted thereby is applied to said floating arm at a point to rotate it against the bias of said spring about its end engaging said temperature responsive member, and said temperature responsive member being movable upon the occurrence of an abnormal condition to release the end of said floating arm and cause it to rotate under the bias of said spring about the point at which the force exerted by said manually operable member is normally applied thereto and thereby moves said movable contact to open circuit position against its biasing means.

28. A circuit breaker comprising fixed and movable contacts, a manually movable member for moving said contacts out of engagement, biasing means for moving said contacts into engagement, a floating actuating lever between said manual member and said movable contact, means providing a first pivotal support for pivotal movement of said floating lever during manual opening of said contacts, said means including a member movable in response to the effect of an overload current to cause said contacts to separate on overload, means providing a second pivotal support for pivotal movement of said floating lever during overload operation of said contacts, and means providing a third pivotal support for pivotal movement of said floating lever during automatic resetting operation of the floating lever, spring means urging said floating lever into engagement successively with said pivotal supporting means, said spring means acting on said floating lever in the space between the second and third mentioned pivotal supporting means.

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