March 3, 1931. A. HORST 1,795,211

ELECTRIC SWITCH

Filed May 2, 1930

Fig. 1.

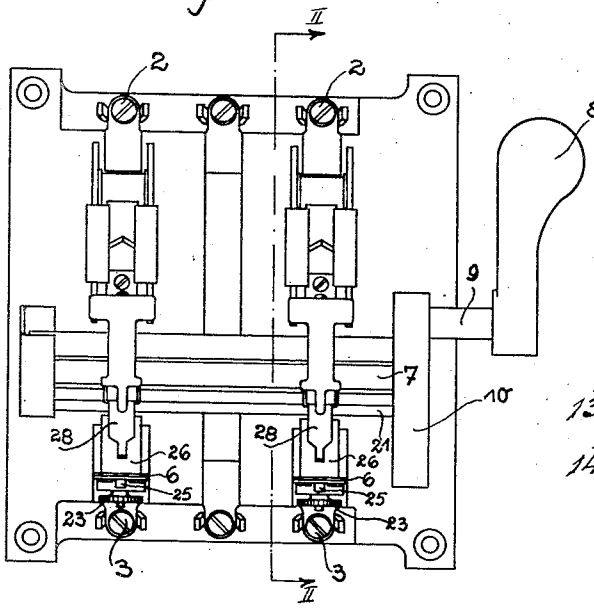


Fig. 2.

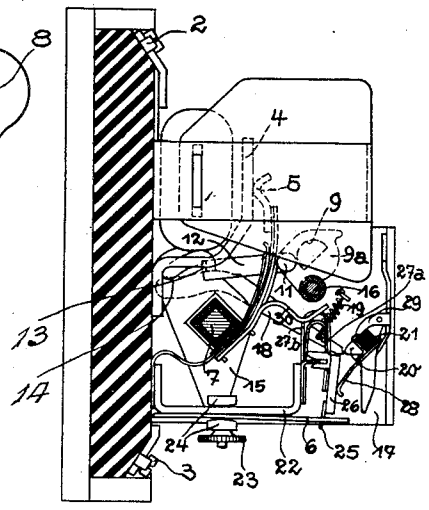


Fig. 3.

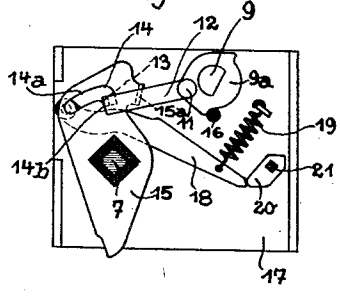


Fig. 4.

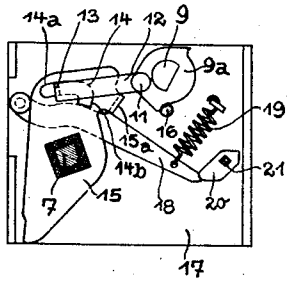
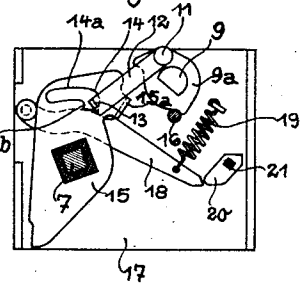


Fig. 5.



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH.

Application filed May 2, 1930, Serial No. 449,269, and in Germany November 25, 1927.

This invention relates to an operating and release mechanism for electric switches intended to break the circuit automatically upon the occurrence of excessive currents, which enables the automatic release to take place at all times, even with the operating handle held in the "on" position. The invention is distinguished from known apparatus of this kind by its simplicity and accuracy of operation.

According to the invention one link of a toggle is guided in an angle slot in a member moving in conjunction with the moving switch contact, while the other link of the toggle can be turned by means of a handle until the toggle has passed slightly beyond a dead centre. Further movement is then prevented by a stop. The first toggle link can be so moved in the guide slot by one or more release members, that the member in which the slot is formed and the moving switch member can move into the "off" position.

The accompanying drawing illustrates an example embodying the invention.

Figure 1 is an elevation of a switch provided with the operating and release mechanism.

Figure 2 is a section on the line II—II of Figure 1 looking in the direction of the arrows, and

Figures 3, 4 and 5 illustrate the toggle and the member with the guide slot with the immediately adjacent parts in three different positions.

On the upper part of the switch are two terminals 2 and on the lower part two further terminals 3. The current flows from the terminals 2 over the fixed switch contacts 4, the moving switch contacts 5 and thence over bimetallic strips 6 serving to release the switch on the occurrence of excessive current, to the terminals 3. The moving contacts 5 are under the action of a force exerted say by a spring tending to move them and to turn the shaft 7 upon which they are secured, to the "off" position. Further description of the construction and action of the switch itself is unnecessary since this is well known and is not part of the invention which resides in the operating and releasing devices.

Of the operating mechanism, only the handle 8, the turning of which rotates the shaft 9, is visible in Figure 1. The rectangle 10 in Figure 1 indicates the operating mechanism shown in detail in Figures 2–5. On the shaft 9 is a plate 9*a*. At the point 11 in the plate 9*a* is pivoted a link 12. A projection 13 on the link 12 works in an angle guide slot 14 in a member 15 fast on the rectangular section shaft 7 and thus always moves together with the moving switch contacts 5. The angle slot 14 consists of a curved part 14*a* and a straight part 14*b*, which forms an extension tangential to the end of the curved part. The plate 9*a* and the link 12 together form a toggle, which in the "on" position has slightly passed its dead centre, as can be seen in Figures 2 and 3. Further rotation of the handle 8, shaft 9 and plate 9*a*, that is further displacement of the toggle from its dead centre is not possible as the rotation of the plate is limited by a stop 16. To the plate 17 carrying the shaft 7 is pivoted an arm 18 under the influence of a spring 19 tending to turn it upwards and cause it to strike against the projection 13 of the link 12. The arm 18 bears against a cam disc 20 fast on the release shaft 21. Accordingly the arm 18 can only move the toggle link 12 when the release shaft 21 rotates. On the member 15 is a projection 15*a* which during the switching off movement of this member, that is during its rotation in clockwise direction, moves the arm 18 back so that the spring 19 is again tensioned. The release shaft 21 is set in rotation when one of the two bimetallic strips 6 has bent downwards a predetermined amount. Adjacent each bimetallic strip is a guide rail 22 upon which is a slider 24 which can be adjusted along the rail and can be secured in any position by a nut 23, as can be seen from Figure 2. By adjusting the slider 24 the length of the free end of the bimetallic strip 6 can be changed and thus the bending which this free end undergoes with a given current after a given time also can be varied. By adjusting the slider 24 the current strength at which release takes place can be accurately regulated. The bimetallic strips are as usual slotted

down the centre so that they are of U form. The current flows into one limb and out of the other. The bolt for securing the slide 24 passes between the limbs of the strip 6. Two fingers 25 on plates 26 engage respectively in the slots of the strips 6. A plate 26 is provided for each strip, and each plate 26 is secured to two U form leaf springs 27*a*, 27*b* carried by the guide rails 22 of the strips 6. The springs 27*a* and 27*b* tend to spring open but cannot do so as long as the fingers are held by the strips 6. When a current of excessive strength and duration causes one of the strips to bend down far enough to release the respective finger 25, the springs 27*a* and 27*b* drive the plate 26 outward and the later moves a projection 28 fast on the release shaft 21. The shaft 21, previously held still by a pivoted member 29 is therefore rotated. During the release action the springs 27*a* and 27*b* are again loaded by a bow 30 connected to the switch shaft 7.

The two characteristic actions of the switch of the invention, namely switching on and off by hand, and automatic switching off with the handle loose or held in position, are described below.

With the switch on, when the shaft 9 is rotated by means of the handle 8, all the parts move from the position shown in Figures 2 and 3 to the position shown in Figure 5. By the turning of the shaft 9, the toggle formed by the link 12 and the plate 9*a* is bent upwardly, so that the member 15 and the shaft 7 can rotate. Accordingly the moving switch contact 5 moves away from the fixed contact 4, and the circuit through the switch is broken.

Upon rotation of the handle 8 in the opposite direction, the projection 13 of the link 12 engages in the straight part 14*b* of the slot 14 so that the member 15 is moved. Its motion is shared by the shaft 7 and the switch contact 5. When all the parts have moved from the position shown in Figure 5 to that shown in Figures 2 and 3, the member 15 can no longer rotate even when the handle is released since the toggle 9*a*, 12 has slightly passed its dead centre.

If with the handle 8 free a current of excessive strength and duration flows, the following action occurs. The bimetallic strips 6 bend downwards owing to their heating up, to such an extent that one or both fingers 26 are released. The springs 27*a*, 27*b* drive the plate against the projection 28 and the latter rotates the release shaft 21, the pawl 29 being lifted. With the shaft 21 turns the disc 20 thus releasing the arm 18 which is drawn upwards by the spring 19. The upwardly moving arm 18 strikes the projection 13 of the link 12 upwards so that it loses its bearing against the straight part of the curve 14. Accordingly the member 15 and with it the shaft 7 and the switch contact 5 can move into the "off" position. The projection 15*a* on the member 15 during the movement of the latter to the "off" position engages the arm 18 and returns it downwards against the action of the spring 19. The release movement of the shaft 7 drives the bow 30 downwards which tensions the springs 27*a*, 27*b* and moves the plate 26 inwards so that the finger can be caught by the strip 6 which cools during the "off" period. The inward movement of the plate 26 allows the release shaft and disc 20 to rotate into their original position under spring or weight action. After automatic release the parts take the position shown in Figure 4. In order to put the switch "on" again it is merely necessary to move the handle 8 to the "off" position and then return it to the "on" position. When it has been moved to the "off" position, the projection 13 of the link 12 engages the straight part 14*a* of the slot 14 and on its being pressed into the "on" position the member 15, the shaft 7 and the contact 5 are moved by the handle 8.

From the above description it will be understood that the switch reacts to an excess current even if the handle is held in the "on" position by an operator and that the switch is automatically reset in position for release after it has released so that it immediately reacts again if put "on" and the cause of the overload is still in existence.

What I claim is:—

1. In operating and release mechanism for electric switches having means urging the switch to open, the combination of an operating handle, a plate having an angle slot therein moving in conjunction with the moving switch contact, a pair of members forming a toggle having one end normally engaged in one end of said angle slot and the other end operatively connected with said handle, said toggle normally holding said slotted plate in the "on" position when said toggle is near dead centre, a stop limiting the movement of said toggle a short distance beyond dead centre, and a release member adapted when actuated to move the end of said toggle out of engagement with the end of said angle slot so that the switch opens independently of said handle and toggle.

2. In operating and release mechanism for electric switches having means urging the switch to open, the combination of a plate on the shaft of the moving contact of the switch, a slot being formed in said plate comprising a curved part and a straight part tangential to the end of the curved part, a pair of members forming a toggle pivoted at one end on a shaft and having its other end normally in engagement with the straight part of said slot, said toggle normally holding said plate in the "on" position when near its dead centre, a handle adapted to rotate said shaft, a stop limiting the rotation of said shaft when

said toggle has just passed its dead centre, and a release member adapted when actuated to move the respective end of said toggle out of engagement with the straight part of said slot into the curved part of said slot.

3. In operating and release mechanism for electric switches having means urging the switch to open, the combination of an operating handle, a pivoted release lever, spring means acting on said release lever, a plate moving in conjunction with the moving contact of the switch having an angle slot therein, a pair of members forming a toggle having one end operatively connected with said handle and the other end in the path of said release lever and normally in engagement with one end of said angle slot, said toggle normally holding said plate in the "on" position when near its dead centre, a stop limiting the movement of said toggle a short distance beyond its dead centre, a release shaft, a cam disc on said release shaft normally holding said release lever out of action, means actuated by excess currents for rotating said release shaft and cam to free said release lever, and means on said slotted member for returning said release lever to its normal position during release movement of said slotted member.

4. In operating and release mechanism for electric switches having means urging the switch to open, the combination of an operating handle, a pivoted release lever, spring means acting on said release lever, a plate moving in conjunction with the moving contact of the switch having an angle slot therein, a pair of members forming a toggle having one end operatively connected with said handle and the other end in the path of said release lever and normally in engagement with one end of said angle slot, said toggle normally holding said slotted plate in the "on" position when near its dead centre, a stop li iting the movement of said toggle a short distance past its dead centre, a release shaft, a cam disc on said release shaft normally holding said release lever out of action, a support rail, a slider on said rail, a bimetallic strip traversed by the current secured to said rail by said slider, means for actuating said release shaft normally held out of action by said bimetallic strip but freed by bending thereof under temperature rise, and means on said slotted member for returning said release lever to its normal position during release movement of said slotted member.

5. In operating and release mechanism for electric switches having means urging the switch to open, the combination of an operating handle, a pivoted release lever, spring means acting on said release lever, a plate moving in conjunction with the moving contact of the switch having an angle slot therein, a pair of members forming a toggle having one end operatively connected with said handle and the other end in the path of said release lever and normally in engagement with one end of said angle slot, said toggle normally holding said slotted plate in the "on" position when near its dead centre, a stop limiting the movement of said toggle a short distance past its dead centre, a release shaft, a cam disc on said release shaft normally holding said release lever out of action, a support rail, a bimetallic strip traversed by the current secured to said rail, U shaped springs secured to said rail normally held out of action by said bimetallic strip but freed by bending thereof under temperature rise, and means for actuating said release shaft in the path of said springs.

In testimony whereof I have signed my name to this specification.

ADAM HORST.