Aug. 22, 1950 W. A. GUSSOW ET AL 2,520,036

ELECTRIC SWITCH

Filed June 18, 1948 2 Sheets-Sheet 1

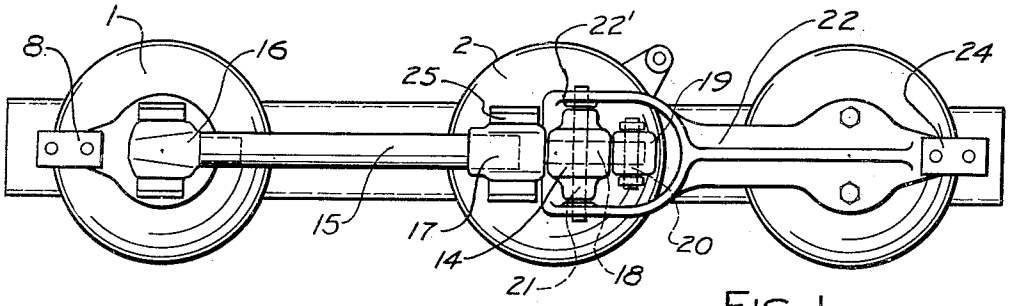


FIG. 1

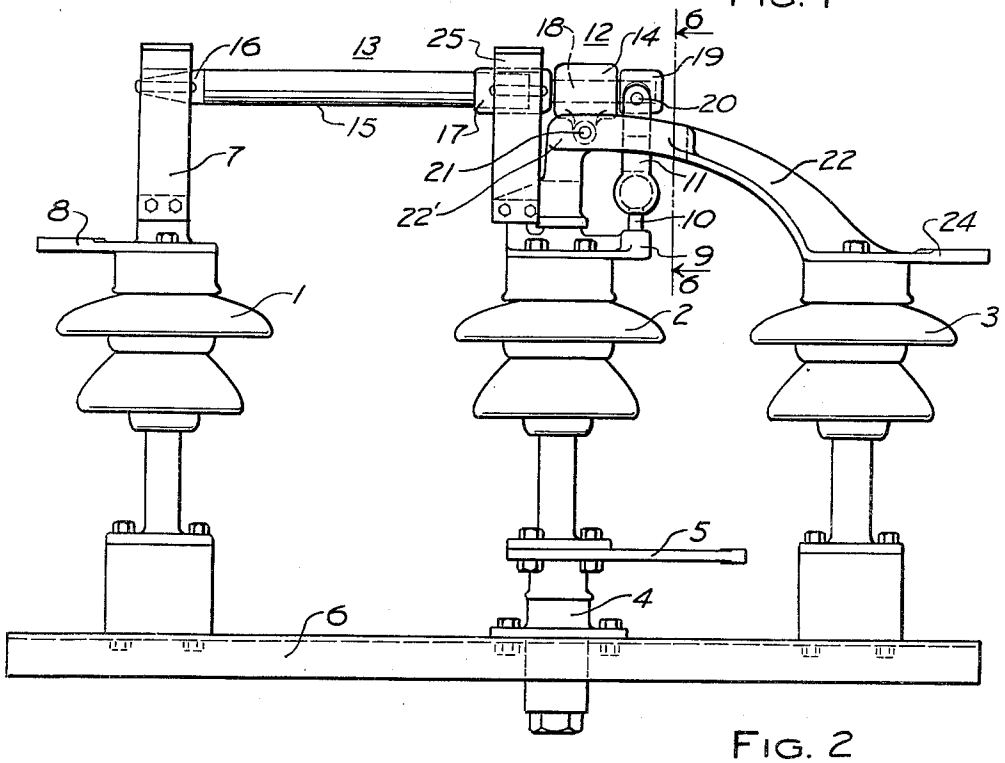


FIG. 2

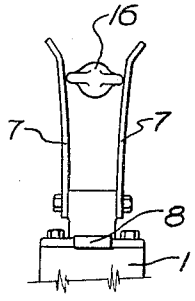


FIG. 3

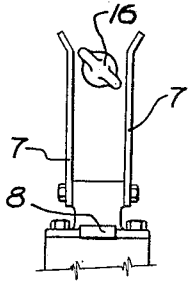


FIG. 4

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ELECTRIC SWITCH

Filed June 18, 1948 2 Sheets-Sheet 2

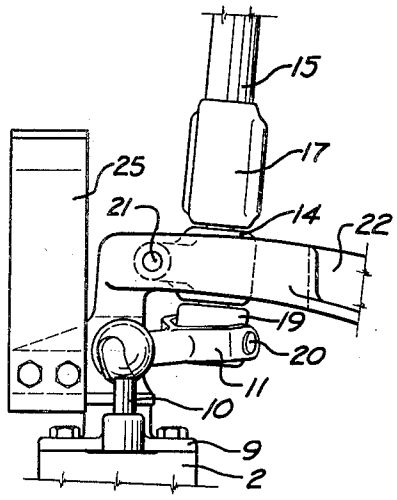


FIG. 5

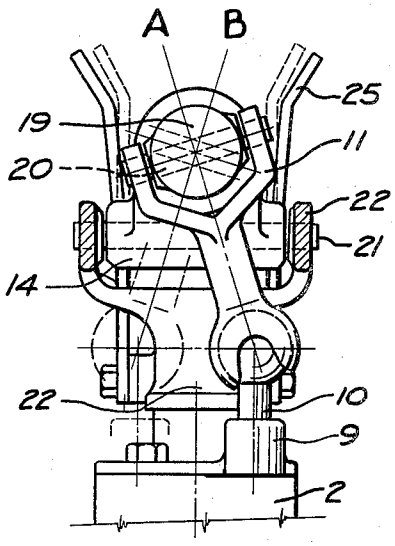


FIG. 6

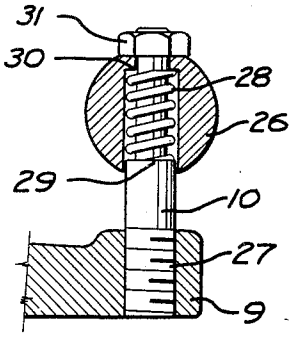


FIG. 7

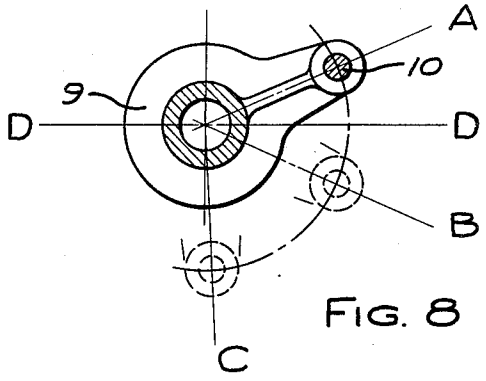


FIG. 8

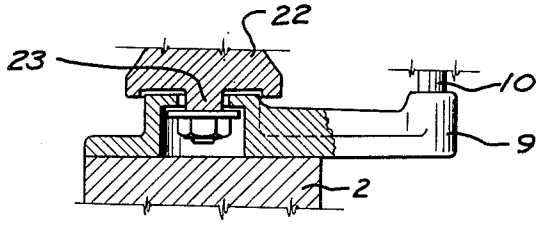


FIG. 9

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ELECTRIC SWITCH

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9 Claims. (Cl. 200—48)

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The invention relates to electric switches, and more particularly to the type having a blade rotatable about its longitudinal axis to bring oppositely disposed contact surfaces into high pressure engagement with cooperating stationary contacts.

One object of the invention is to provide an operating mechanism of the type in which the switch blade is first rotated about its longitudinal axis to disengage laterally disposed contact surfaces from cooperating stationary contacts, and then is moved with a swinging arcuate movement to increase the spacing between said blade and one of said stationary contacts until the switch is fully open; and wherein substantially all of the rotary motion of the switch blade is performed and the blade is disengaged from the stationary contacts prior to any arcuate circuit-opening movement of said blade, or subsequent to any arcuate circuit-closing movement thereof with respect to its cooperating stationary contacts.

Another object of the invention is to provide an operating mechanism for a switch of the above type wherein the arcuate circuit-opening and -closing and the rotary contact-engaging and -disengaging movements are performed in a novel, practical, and efficient manner.

Another object of the invention is to provide a switch-operating mechanism of the type described, wherein a minimum effort applied to the operating means imparts a powerful rotary movement to engage or disengage the contacts of the switch blade with respect to the cooperating stationary contacts.

A further object of the invention is to provide a switch-operating mechanism of the character described, wherein the motion of the switch blade is fully controlled throughout all portions of the circuit-opening or -closing and the contact-engaging or -disengaging movements.

A further object is to provide a switch-operating mechanism of the type described which is relatively simple in construction and which requires a minimum number of parts and which is free from latches, springs, and similar complications.

Other objects and advantages will be evident from the following description and claims.

Figure 1 is a plan view of a switch embodying the features of the invention.

Figure 2 is a side elevation of the switch shown in Figure 1.

Figure 3 is a partial end view of the switch shown in Figure 1 showing the blade in the closed position with the blade contacts fully engaged with the stationary contacts.

Figure 4 is similar to Figure 3 except that the switch is shown just prior to the final contact-engaging movement or just subsequent to the initial contact-disengaging movement.

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Figures 5, 6, 7, 8 and 9 show various details in larger scale.

Figure 5 is a partial side view of the switch operating mechanism with the switch blade in the fully open position.

Figure 6 is a partial section view on line 6—6 in Figure 2 showing the parts when the switch is fully closed.

Figure 7 is a partial section view showing one method of attaching one element of the ball-and-socket joint to the rotatable insulator.

Figure 8 is a partial section view showing in plan view the approximate proportions of the angular travel of the rotatable insulator required for the contact-engaging or -disengaging movements and for the arcuate circuit-opening or -closing movements.

Figure 9 is a partial section view showing one method of pivotally joining the frame to the rotatable insulator.

As shown in Figure 2, the insulators 1 and 3 are stationary and insulator 2 is mounted coaxially on a shaft supported by a bearing 4 and it is rotatable by means of arm 5. The entire switch is mounted on base 6. A stationary jaw contact 7 is attached to insulator 1 and is connected with a terminal pad 8 to which one electrical conductor may be attached. Crank 9 is rigidly attached on top of rotatable insulator 2 so that it forms an arm which rotates with its insulator support about the same axis. A ball-and-socket type joint connects crank pin 10 on crank 9 with link 11. The switch arm structure 12 consists of a switch blade 13 mounted on a hinge element 14 and also rotatable axially in its bearing in the said hinge element 14. The complete switch blade 13 consists of a tubular arm 15, a blade tip 16 having laterally disposed contact surfaces, a socket 17 firmly joined to the tubular arm 15 and having laterally disposed contact surfaces similar to those on the blade tip 16, a blade shaft 18 which is coaxial with the tubular arm 15 and with the socket 17 and which is an extension of the socket 17, said blade shaft 18 extending rearward through the hinge element 14, and a block 19 secured to the end of the blade shaft 18 by means of link pin 20 which passes through the block 19 and the blade shaft 18, the ends of said link pin 20 pivotally engaging the forked end of link 11. Thus the link 11 is an arm which is supported by the switch blade 13 and is swingable about the link pin 20 in an arc which is in a plane that also includes the longitudinal axis of the switch

blade, which arm also is rotatable with the blade about the longitudinal axis of the blade. The switch arm structure 12 is hinged about hinge pin 21. Hinge pin 21 is fixedly mounted on hinge mounting 22' which is part of frame 22.

One end of frame 22 is rigidly supported by insulator unit 3, and the other end is pivotally connected to the top of crank 9 which is secured to the rotatable insulator 2. The spindle 23 is integral with frame 22; it extends into the crank 9 and is held by a nut, as shown in Figure 9. A terminal pad 24 to which an electrical conductor may be attached is integral with frame 22. A resilient hinge contact 25 is attached to frame 22 so as to engage laterally disposed projections on the socket 17 when the switch is in the fully closed position.

When the switch is in the fully closed position, an electrical path is thereby formed as follows: from the terminal pad 24 through the frame 22 and hinge contact 25, hence through high pressure contact to the blade socket 17, thence to the tubular arm 15, thence to the blade tip 16, thence through high pressure contact to jaw contact 7, thence to terminal pad 8 and electrical conductor connected thereto.

The operation of the switch is as follows: With the switch in the fully closed and engaged position, pin 10 and link 11 are to one side of center as shown by Position A in Figures 6 and 8. An effort applied to arm 5 causes insulator 2 with attached crank 9 to rotate from Position A to Position B. In so doing the crank pin is moved at first in a direction substantially transverse to line DD which is the longitudinal axis of the switch, while the distance from the crank pin 10 to the axis of the switch blade 13 in the horizontal position remains approximately constant. This action of the link 11 causes the switch blade 13 to rotate through a considerable arc about its longitudinal axis without causing the switch arm structure 12 to move appreciably in an arcuate movement about hinge pin 21. The longitudinal rotation of the switch blade frees the laterally disposed contact projections on the socket 17 and the blade tip 16 from their respective cooperating stationary contacts 25 and 7, as indicated in Figure 4. As the rotation of insulator 2 is continued, the distance from the crank pin 10 to the initial position of link pin 20 is increased, and link 11, being pivotally joined by means of link pin 20 to switch blade 13, causes the switch blade 13 to swing with an arcuate movement about hinge pin 21. The rotation of insulator 2 is continued until the switch is fully opened, and crank 9 and crank pin 10 are as shown in Figure 5, which is Position C in Figure 8. The space relationships of the various parts of the mechanism may be chosen such that the total angular travel of insulator 2 required to disengage the contacts and to move the blade arcuately through an angle of more than 90° will be of the order of 100° to 110°.

In closing the switch the reverse action is followed. Rotation of the insulator 2 and the crank 9 from Position C in Figure 8 causes a compressive force on link 11, a component of which exerts a torque about hinge pin 21, moving the switch arm structure 12 arcuately toward the closed position. The axis of the switch blade 13 reaches a position parallel with the switch base 6 when the crank 9 reaches Position B in Figures 6 and 8. As the travel of crank 9 is continued from Position B to Position A, the crank pin 10 moves in a direction substantially parallel to the axis of hinge pin 21, and therefore produces no further arcuate movement about hinge pin 21. At the same time this movement of crank 9 causes the crank pin 10 to move substantially transversely to the longitudinal axis of the switch blade 13 and thereby causes axial rotation of the switch blade 13 by means of link 11 and link pin 20. As the switch blade 13 is rotated the laterally disposed contact surfaces on 16 and 17 engage the resilient stationary contacts 7 and 25 with a high pressure sufficient to insure an electrical contact free from dirt or oxide.

From Position A to Position B is a very substantial portion of the total movement of crank 9, and during this movement link 11 is substantially normal to the axis of blade 13. This combination gives unusually favorable leverages for rotating the blade 13 from the position shown in Figure 3 to that shown in Figure 4, so that there is ample power to overcome the heavy friction due to the high pressures between the blade and the contacts. Therefore a switch of this design is operated easily. These desirable features are made possible by having the crank 9 located directly below the hinge pin 21 and by having the link 11 connect with the switch blade to the rear of hinge pin 21, while the main part of the switch blade extends forward of pin 21 to cooperate with jaw contact 7.

As shown in Figure 6, the crank pin travels in a plane parallel to hinge pin 21, while the end of link 11 describes an arc about the axis of the switch blade 13. The slight discrepancy between these two paths may be taken up by the small amount of slack in the various joints of the mechanism, or it may be provided for by means such as shown in Figure 7. A ball 26, which is one element of a ball-and-socket type joint, is slidably supported by the crank pin 10, which is firmly and adjustably joined to the crank 9 by means of closely fitting threads 27. An initially-compressed spring 28 seats against a shoulder 29 on crank pin 10. The opposite end of spring 28 is restrained by an internal surface 30 inside the ball 26. The spring 28 is held with an initial compression by a stop 31 such as a nut or similar device attached to the extremity of crank pin 10 outside the ball 26. The ball 26 is slidably movable longitudinally along crank pin 10 in one direction by further compressing spring 28, and is restrained from movement in the other direction by the stop 31. The initial compression of spring 28 is such that spring 28 is not further compressed during the arcuate circuit-opening or -closing movements between Positions B and C in Figure 8, but is such that the spring will be further compressed a small amount during the final contact-engaging or initial contact-disengaging movements between Positions A and B, thus allowing ball 26 to move a small amount toward crank 9.

It is apparent that the switch can be mounted in an upright position as shown in Figure 2, or it can be mounted in a vertical or an underhung position. As an alternative to the construction described utilizing the resilient hinge contact 25, a shunt can be used made of suitable conductive, flexible material electrically connected to the frame 22 and the switch blade 13. Also suitable stops can be employed if desired at the stationary jaw contact 7 to limit the arcuate travel of the switch arm structure 12 or the rotary travel of the switch blade 13. Stops may also be used to limit the angular travel of the rotatable insulator unit 2. If desired, suitable springs

or counterweights can be attached to the switch arm structure 12 to balance the weight of said structure, thereby reducing the effort required for operation.

The foregoing description is intended to be illustrative rather than limitative, and a person skilled in the art can make further changes without departing from the purposes and spirit of this invention.

We claim:

1. In an electric switch, a jaw contact, a hinge element in spaced relation to said jaw, a blade supported on said hinge element and having a forward extension which is cooperable with said contact, said blade being rotatable about its longitudinal axis and also having a short axial extension rearward of said hinge element, a crank operable in fixed relation to said hinge element, and a link pivotally connected with the said rearward axial extension and with its other end connected to the swing end of said crank by a resilient universal joint, together with means to rotate the crank and thereby to operate the switch blade in combined axial and arcuate movements.

2. In an electric switch, a base having two stationary insulator columns mounted thereon and a rotatable insulator column between them, a stationary jaw contact mounted on one of said stationary insulator columns, a frame fixed to the other of said stationary columns and pivotally joined to said rotatable insulator column, a crank rigidly attached to said rotatable insulator column, a hinge pin supported by said frame, a hinge element pivotally supported on said hinge pin, a switch blade with its blade shaft pivotally mounted on the hinge element for axial rotation of the blade and extending through the hinge element to form a rear extension of the switch blade shaft, a link pivotally attached to said rear extension and with its other end movably connected to the said crank, together with means to rotate said rotatable insulator column and thereby to move said blade with a combined arcuate and axial movement into and out of engagement with said stationary contact.

3. An electric switch as described in claim 2, wherein said link is substantially normal to the axis of said blade during the contact-engaging or -disengaging phase of operation.

4. In an electric switch, a rotatable insulator column, a plurality of fixed insulator columns, a frame pivotally joined to said rotatable column and also supported by one of said fixed columns, a stationary jaw contact upon another of said fixed columns spaced away from said frame, a hinge element hingedly joined to said frame, a blade supported by said hinge element and rotatable axially to engage one or more stationary contacts including said jaw contact, said blade extending forwardly from said hinge element to said jaw contact, an axial extension of said blade extending rearwardly from said hinge element, a bifurcated link pivotally joined to said rearward extension of the blade by a link pin which is normal to the axis of the blade, said link being eccentrically connected at its other end to said rotatable insulator such that rotation of said insulator results in an arcuate movement of said blade and hinge element and a rotary movement of said blade member at the beginning of the opening movement and the end of the closing movement, respectively.

5. In an electric switch, a jaw contact, a hinge element in spaced relation to said jaw, a blade supported on said hinge element and having a forward extension which is cooperable with said contact, said blade being rotatable about its longitudinal axis and also having a short axial extension rearward of said hinge element, a crank operable in fixed relation to said hinge element, and a link pivotally connected to the said rearward axial extension and with its other end connected to the swing end of said crank, together with means to rotate the crank and thereby to operate the switch blade in combined axial and arcuate movements.

6. In an electric switch a fixed contact, a rotatable insulator in spaced relation to said contact, a crank fixed to said insulator and coaxial with it, a pivotally mounted hinge element adjacent to the said insulator, a switch blade movably supported by said hinge element for longitudinal rotation and also for arcuate motion, a long extension of said switch blade forward of said hinge element for engagement with said contact, a short extension of said switch blade through and rearward of said hinge element, a link connecting said rearward extension with the swing end of said crank, together with means to rotate the insulator and thereby to operate the switch.

7. An electric switch as in claim 2, wherein the said crank is fixedly attached to the rotatable insulator column and wherein the said frame is pivotally mounted on top of the said crank.

8. In an electric switch, a stationary contact, a rotatable insulator in spaced relation to said contact, a rigid crank fixed on top of the insulator and coaxial with it, a stationary insulator adjacent to the rotatable insulator, a frame secured to said stationary insulator and also connected with the said rotatable insulator by a pivotal support coaxial with the rotatable insulator, a hinge element pivotally supported on said frame above the crank, a switch blade movably mounted on said hinge element for arcuate and axial movements with a long forward extension for making engagement with said contact and a short rearward extension which passes through and beyond its bearing in the hinge element, a bifurcated link pivoted to said rearward extension for motion in an arc parallel to the longitudinal axis of the switch blade, the other end of the link being movably connected to the swing end of the said crank, the link being substantially normal to the longitudinal axis of the switch blade when the switch is fully closed, together with means to rotate the rotatable insulator and thereby operate the switch.

9. An electric switch as in claim 8 wherein the link is connected to the crank by a ball and socket joint with the ball slidable on its support.

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