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R. W. GOFF

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SWITCH AND OPERATING MECHANISM THEREFOR

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Fig. 1.

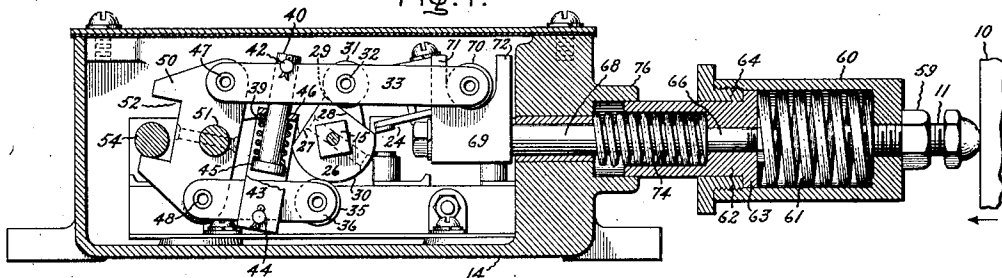


Fig. 2.

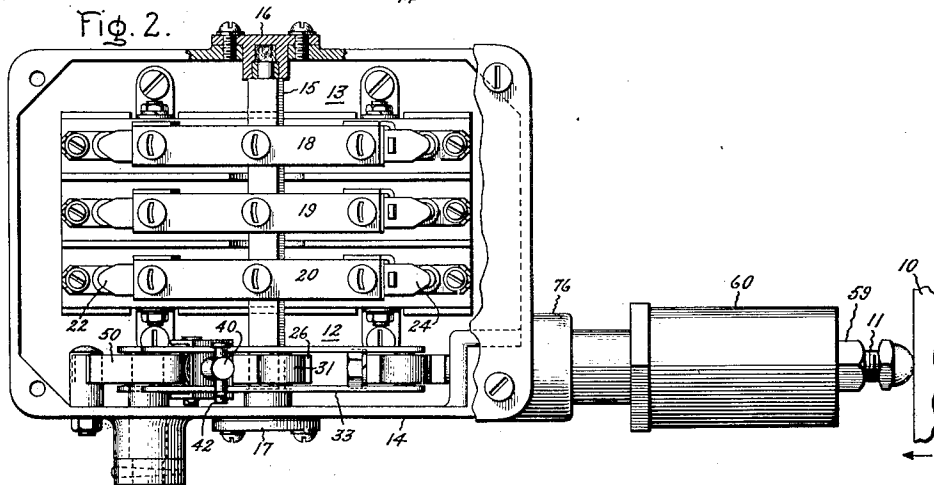


Fig. 3.

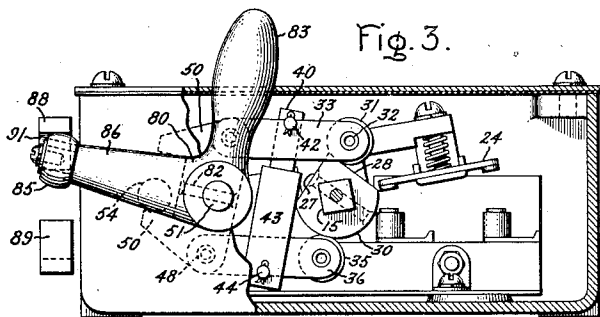
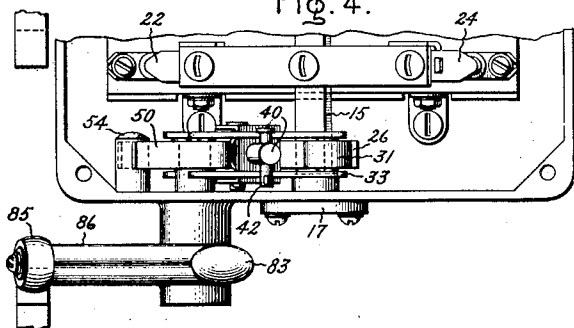


Fig. 4.



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SWITCH AND OPERATING MECHANISM THEREFOR

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7 Claims. (Cl. 200—47)

My invention relates to electric switches of the type used for alternately opening and closing electric circuits, and has for an object the provision of a simple, inexpensive, and durable, quick acting circuit controller.

While it is suitable for a variety of applications, my invention may be used to advantage to control the forward and reverse motions of electrically operated planers. In machines of this type the work is driven alternately to and fro under a cutting tool and the driving motors are consequently continuously energized for rotation first in one direction and then in the other. My invention may also be successfully applied to control the driving motor of lift bridges and the like. In such applications it is desirable to provide a quick acting circuit controller which is operated at exactly the same time for successive operations so that great accuracy in the stopping of the controlled device may be secured.

Consequently it is essential that the switch shall remain in one position until the instant preceding its operation to another position. Accordingly it is a further object of my invention to provide a switch operating mechanism without a dead center and which operates the switch at exactly the same time for successive operations.

In carrying out my invention in one form thereof, I provide a switch with a double acting cam against which an operating link and a restraining link are urged by a compression spring. By means of a rocking lever the operating link is forced over the crest of the cam against the bias of the spring while the restraining link acts to increase the force applied to the closed contacts of the switch until the operating link has moved beyond the crest of the cam. The movement of the operating link beyond the crest causes the stored energy of the spring to be applied to the switch to operate it to a different position. The restraining link and the operating link in cooperation with the cam prevents dead centers on the switch and insures a positive action of the switch irrespective of the speed of movement of the links.

For a more complete understanding of my invention reference should now be had to the drawing in which Fig. 1 is a side elevation of my invention applied to a drawbridge; Fig. 2 is a top view, partly in section, of Fig. 1; Fig. 3 is a sectional elevation, partly in section, of my invention applied to a planer, while Fig. 4 is a plan view of Fig. 2, partly in perspective.

Referring now to Figs. 1 and 2, I have shown my invention in one form as applied to a bridge

(not shown) having an operating member 10 arranged to move a threaded rod 11 to the left. The rod 11 through a mechanism 12 operates the switch 13 mounted within an enclosing casing 14. A contact operating shaft 15 of rectangular cross section is pivotally supported in the bearings 16 and 17 located on the respective sides of the enclosing casing 14. A plurality of contact carrying arms 18, 19 and 20 are secured to the shaft 15. The arm 20 has attached to its respective ends contacts 22 and 24. In order to show the construction of the operating mechanism more clearly only the contacts 24 are shown in Fig. 1. Adjacent one end of the shaft 15 there is mounted a double acting cam 26. This cam is provided with angularly related faces 27 and 28 meeting in an abrupt crest 29. The angularly related faces are formed from one half of the cam and the remaining half of the cam is provided with a curved or rounded surface 30. As shown, an operating roller 31, rotatably mounted by a pin 32 in a link 33, is in engagement with the face 28 of the cam. Directly opposite the roller 31 a restraining roller 35, supported in a link 36, bears against the curved surface 30. These rollers 31 and 35 are normally biased against the double acting cam by means of a compression spring 39. The compression spring biases the rollers against the cam by means of a pin 40 which is pivotally secured to the link 33 by a pin 42, and a tubular member 43 pivotally secured to the link 36 by the pin 44. Preferably, the compression spring 39 is normally placed under tension to exert a thrust on the headed portion 45 of the pin 40 and against the closed end 46 of the tubular member 43.

The operating link 33 and the restraining link 36 are respectively pivoted at 47 and 48 to a connecting and rocking member 50. The member 50 is secured at its mid-portion to a shaft 51. A notch 52 provided in the rocking member 50 cooperates with a stationary pin 54 secured to the casing 11 to limit the motion of the links 33 and 36.

To operate the switch, pressure is exerted upon the rod 11. As shown, this may be accomplished by operating the member 10 from a moving part of the bridge so that whenever the bridge is operated to a predetermined position the push rod 11 is moved in the direction indicated by the arrow. The rod 11 is rigidly secured by screw threads and a locking nut 59 to an enclosing casing 60 within which there is mounted a compression spring 61. A plunger 62 extends within the enclosing casing 60 and has an outwardly extending flange 63

which is normally maintained against the bushing 64 which is held in place by screw threads provided in the end of the casing 60. A rod 66 is secured to the plunger 62 by means of screw threads and is slidably mounted at 68 within the casing 14. A U-shaped member 69 is supported within the casing by the rod 66. A roller 70 carried by the link 33 normally rests between the two ends 71 and 72 of the member 69. A compression spring 74 encircles the rod 66 and normally maintains the plunger 62 and the enclosing casing 60 in spaced relation with the casing 14. It will be observed that the plunger 62 is arranged in telescopic relation with an outwardly extending guiding flange 76 formed on the end of the casing 14.

Assuming now that the operating member 10 has been moved to the left or in the direction indicated by the arrow, the rod 11, compression spring 61, and push rod 66 cooperate to move the U-shaped member 69 to the left so that a similar movement is imparted to the link 33. As this movement occurs, the roller 31 is forced up the inclined face 28 of the cam 26. At the same time the restraining roller 35 is rotated in a counterclockwise direction over the rounded or curved cam surface 30. A resultant force is frictionally produced by this rotation of the roller 35 in a direction to maintain the contacts 22 closed. As the operating roller 31 is forced upwardly along the inclined cam surface 28 the compression spring 39 is placed under increasing compression and the rollers 31 and 35 are thereby forced against the cam with an increasing effort. When the operating roller 31 is moving over the crest 29 no component of force tending to rotate the cam is produced. However, the force frictionally produced by the restraining roller 35 maintains the contacts 22 closed until the operating roller 31 passes just beyond the crest. When this occurs the compression spring 39 quickly forces the operating cam into engagement with the inclined cam surface 27. The resultant force on the cam causes the switch 13 to be operated with a snap action to close its contacts 24 and to open its contacts 22.

If the restraining link 36 had not been provided to bear against the rounded surface 30 a dead center would have resulted as the roller 31 reached the peak of the crest, that is to say as soon as the links are moved to a position on the cam so that the rotative forces exerted on the cam disappear, the switch might be operated so as to open both contacts 22 and 24. By the provision of the restraining link 36, however, this is not possible.

Continuing the operation of my invention, it will be seen that the stop formed by the notch 52 and the pin 54 limits the movement of the operating roller 31 so that it is brought to a standstill relatively near the crest of the cam.

The plunger 62, at the moment the switch 13 was operated, has been forced by the spring 61 against the casing 14. Any further movement of the operating lever 10 is rendered possible without damage to the switch by the lost motion arrangement provided by the casing 60 and the compression spring 61. For example, a further movement of the operating member 10 results in the compression of the spring 61, the casing 60 moving to take care of the additional movements of the operating member 10.

As soon as the operating member moves to the right the compression spring 61 returns the casing 60 to its original position. The compression spring 74 thereupon returns the plunger 62 and

the rod 66 to their original position. The rod 66 now operates the U-shaped member 69 to the right causing the operating roller 31 to rise along the inclined cam surface 27. The restraining roller at the same time is rotated in a clockwise direction about the rounded cam surface 30 to produce a force on the switch in a direction to maintain the contacts 24 closed. The switch is returned to the position shown as soon as the roller 31 passes beyond the crest 29.

In the form of my invention shown in Figs. 3 and 4, the links 33 and 36 are operated by means of a member 80 secured to the shaft 51 by a pin 82. A handle 83 is provided on the member 80 by means of which the links 33 and 36 may be manually rotated for the selective operation of the switch. A roller 85 secured to an extension 86 of the member 80 is arranged in cooperative relation with a pair of beveled cams 88 and 89. These cams 88 and 89 are slidably mounted on a planer or the like. As shown in the drawing, the movement of the cams is vertical to the plane of the drawing. The inclined face 91 of the cam 88 as it moves outwardly causes the member 80 to be rotated in a counterclockwise direction. As shown, this movement is relatively small and is only sufficient to cause the links 33 and 36 to be rotated an amount sufficient to move the operating roller 31 slightly beyond the crest of the cam. The contacts 24 are therefore quickly closed to reverse the direction of the planer driving motor (not shown). Subsequently the inclined cam 89 engages the roller 85 and rotates the links 33 and 36 until the roller 31 again operates the circuit controller to reverse the direction of the driving motor. Since a relatively small movement of the member 80 is sufficient to operate the contacts 22 and 24, it will be seen that the stroke of the planer may be very small. In fact, I have mounted the cam members 88 and 89 so close together as to operate the planer in the forward and in the reverse direction within limits of substantially one half inch. The operation of the switch is accomplished in the same manner by manually operating the handle 83.

By providing a plurality of contacts on the switch (as shown in Fig. 2) a number of movements of the planer may be simultaneously accomplished. For example, the cutting tool may be advanced after each cutting stroke. The planer driving motor may be energized for high speed operation during the return stroke and for low speed operation during the cutting stroke.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A snap switch comprising a cam having angularly related faces meeting in a substantially abrupt crest, an operating link biased into engagement with said cam and movable over said crest from one to the other of said faces whereby said cam is snapped from one position to another, means actuated with said link for biasing said cam in one of its positions until said link passes over said crest and switching means actuated by said cam.

2. Means for operating a switch from a circuit closing position to a circuit interrupting position comprising a cam operatively associated with

said switch the said cam having a pair of angularly related faces meeting in an abrupt crest and opposite said faces a rounded surface, an operating link movable from one to the other of said faces, a restraining link movable over said rounded surface, biasing means normally biasing said links against said cam, and means for moving said operating link from one to the other of said faces to operate said switch, and for moving said restraining link over said rounded surface in a direction to bias said switch to one of its positions until said operating link has passed beyond said crest of said cam.

3. A switch comprising stationary contacts, movable contacts operable from a circuit closing position to a circuit interrupting position, a cam operatively associated with said movable contacts the said cam having a pair of angularly related faces meeting in an abrupt crest, and opposite said faces a rounded surface, an operating link, and a restraining link, a compression spring connected to said links normally to bias said operating link against one of said faces and to bias said restraining link against said rounded surface, rocking means connecting said links for rotating said operating link from one of said faces to the other of said faces thereby to operate said switch with a snap action from one to the other of said positions, and for rotating said restraining link along said rounded surface to bias said switch to one of said positions during the time said operating link moves over said crest.

4. In combination, a circuit controller operable from one circuit controlling position to a second circuit controlling position, a cam operatively associated with said controller the said cam having a pair of oppositely inclined faces meeting to form a crest and opposite said faces a curved surface, an operating link movable from one to the other of said faces, a restraining link movable over said curved surface, a compression spring connected to said links to bias them against said cam, rocking means pivotally con-

nected to said links for rotating said operating link from one to the other of said faces to operate said controller from one to the other of its positions with a snap action and for rotating said restraining link against said curved surface to maintain said controller in one of said positions until said operating link passes beyond said crest. 80

5. In combination, a movable switch member, an over center snap action operating mechanism therefor, and movable friction means associated with the operating mechanism for biasing the switch member against movement until the operating mechanism passes over center. 85

6. In combination, a switch having a contact movable from a circuit closing position to a circuit interrupting position, a double acting cam operatively associated with said switch, an operating link movable between predetermined limits for rotating said cam from one position to a second position thereby to operate said switch from one to the other of its positions, a compression spring normally biasing said link to one of its limits, means for operating said link including a second compression spring arranged between said first spring and an operating member, said second compression spring providing for movement of said member in addition to the movement required to operate said switch. 90 95 100

7. In combination a switch operable from a circuit closing position to a circuit interrupting position, a double acting cam operably associated with said switch, an operating link movable between predetermined limits for operating said switch with a snap action, means for actuating said link comprising a push rod, a coil spring normally biasing said rod to one position, a plunger connected to said rod, a second coil spring of greater strength than said first spring, and an enclosing casing therefor having an abutment cooperating with said plunger, said second coil spring providing a lost motion connection between said rod and said casing. 105 110 115

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