

Jan. 7, 1964

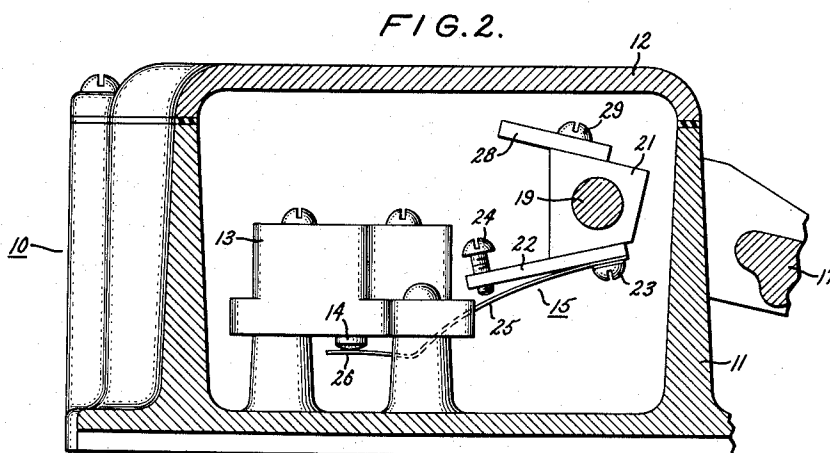
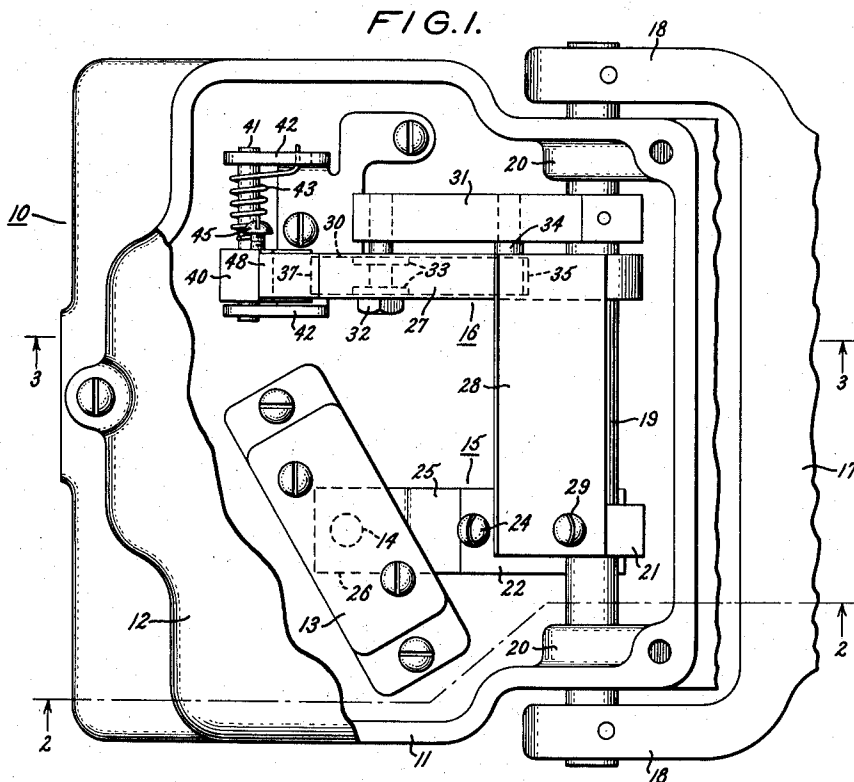
E. R. WOLFF

3,117,200

SWITCH DEVICE HAVING MAINTAINED OPERATION

Filed Dec. 29, 1961

3 Sheets-Sheet 1



INVENTOR:
ERNST R. WOLFF,
BY *David M. Schiller*
ATTORNEY.

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E. R. WOLFF

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3 Sheets-Sheet 2

FIG. 3.

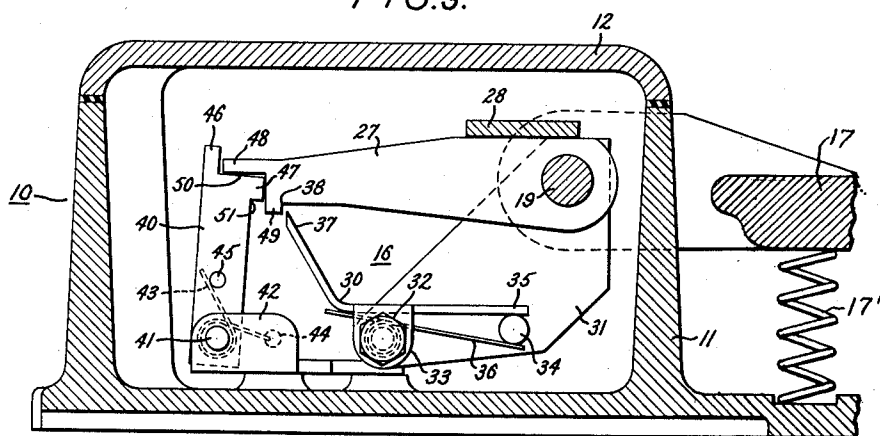
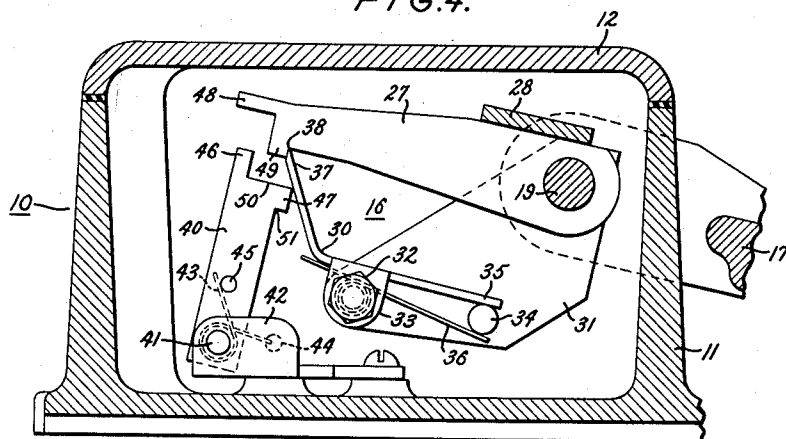


FIG. 4.



INVENTOR:
ERNST R. WOLFF,
BY *David M. Schiller*
ATTORNEY.

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E. R. WOLFF

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3 Sheets-Sheet 3

FIG. 5

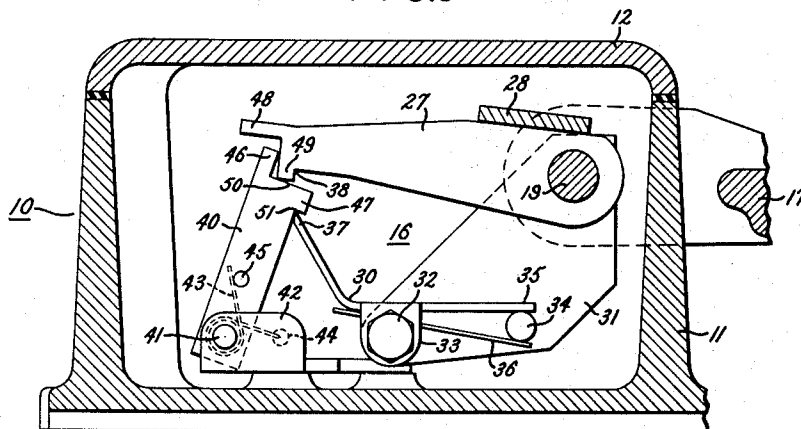
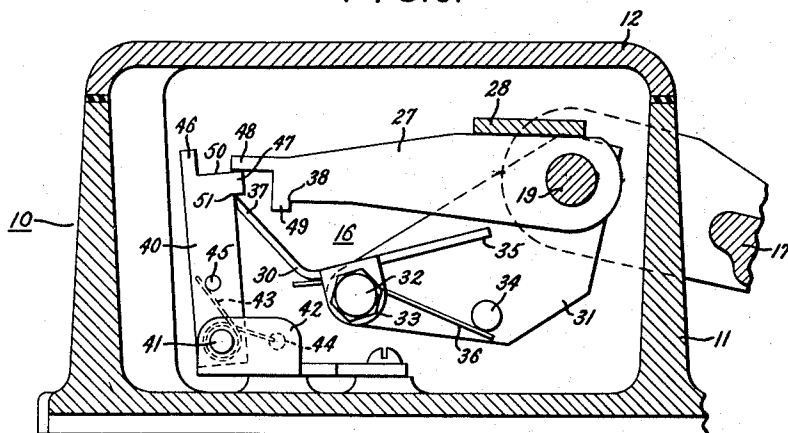


FIG. 6.



INVENTOR:
ERNST R. WOLFF,
BY *David M. Schiller*
ATTORNEY.

1

3,117,200

SWITCH DEVICE HAVING MAINTAINED OPERATION

Ernst R. Wolff, Bloomington, Ill., assignor to General Electric Company, a corporation of New York
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9 Claims. (Cl. 200—86.5)

This invention relates to switches and has particular relation to operating mechanisms for use in a foot operated switch.

Switch devices have heretofore been constructed which include a switch with an actuating mechanism for the switch which is operated in response to movement of an actuator in a given direction for establishing a certain condition of the switch. In many applications it is desirable to provide a switch having a so-called maintained switch operation wherein the switch will be alternately opened and closed by movement of the actuator in a given direction so that during a first direction of actuator movement the switch will be actuated to an open or closed condition, will be maintained in the actuated condition when the actuator is moved in the opposite direction, and will be actuated to the other condition when the actuator is again moved in the first direction. Previous switch designs incorporating maintained switch mechanism have generally incorporated a large number of expensive parts contributing to a high cost and a bulky construction.

It is accordingly a primary object of the present invention to provide a switch mechanism of novel and improved construction for providing a maintained operation of the switch.

It is another object of the invention to provide a novel and improved switch mechanism effective to provide a maintained operation of the switch and including a minimum number of inexpensive parts which are compactly arranged.

It is a further object of the invention to provide a switch including an operating mechanism arranged to control a switch actuating mechanism for providing maintained operation of the switch in response to oscillation of a shaft about its axis which shaft mounts parts of the actuating and operating mechanisms.

In carrying out the invention in one preferred form a switch is provided including a spring-biased, manually movable actuator secured to an oscillatable shaft which oscillates about its axis in response to actuation and release of the actuator. A switch actuating mechanism is loosely mounted on the shaft for rotation with respect thereto and is moved to a first position to displace a switch operating member in one direction in response to actuation of the actuator, is maintained substantially in the first position during release of the actuator, and is moved to a second position to displace the switch operating member in the opposite direction in response to the next actuation of the actuator. To this end a pawl is fixed to the shaft for rotation therewith to effect movement of the actuating mechanism to the first position and actuation of the switch in response to initial actuation of the actuator. A spring-biased, pivotally mounted ratchet cooperates with the actuating mechanism and with the pawl in a manner to hold the actuating mechanism substantially in the first position to maintain the switch

2

in one condition when the actuator is released following initial actuation thereof, and to effect movement of the actuating mechanism to the second position and actuation of the switch to its other condition in response to subsequent actuation of the actuator.

Other objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view in top plan with parts broken away of a switch constructed in accordance with the invention;

FIG. 2 is a view in section taken along the line 2—2 of FIG. 1 showing the switch and the actuating mechanism therefor; and

FIGS. 3—6 are sectional views taken along the line 3—3 of FIG. 1 and showing parts of the operating mechanism and a part of the actuating mechanism in various positions for conditions wherein the actuator is respectively elevated, depressed, elevated again, and depressed again.

Referring now to the drawings and particularly FIGS. 1 and 2 there is shown a switch device including a housing represented generally by the numeral 10 and consisting of a base 11 and a cover 12 shown in FIGS. 3—6 adapted to be detachably secured to the base 11 for enclosing the switch and the operating and actuating mechanisms. Mounted on the base 11 and spaced therefrom is a switch 13 of any suitable construction including a reciprocable operating member 14 adapted to be engaged by switch actuating mechanism represented generally by the numeral 15 to provide open and closed operating conditions of the switch 13. Movement of the actuating mechanism 15 is controlled by operating mechanism represented generally by the numeral 16 which is operated in response to depression and release of an actuator 17 which may comprise a foot operated pedal. The pedal 17 has a generally U-shaped terminal part with spaced legs 18 fixed to opposite ends of a shaft 19 which is journaled for oscillatory movement about its axis by spaced side walls 20 of the base 11. The pedal 17 is biased in a counterclockwise direction as viewed in FIG. 3 to its normal elevated position shown in FIG. 3 by means of a suitable spring 17'.

The switch actuating mechanism 15 is loosely supported by the shaft 19 for pivotal movement with respect thereto in response to movement of parts of the operating mechanism 16. For this purpose a hub 21 is loosely mounted on the shaft 19, and a rigid arm 22 is secured to the lower portion of the hub 21 as shown in FIG. 2 by means of a screw 23 passing through an opening of the arm 22 at its right hand end into a threaded opening of the hub 21. The left hand end of arm 22 as shown in FIG. 2 rotatably carries an adjusting screw 24 which cooperates with a leaf spring 25 secured to the arm 22 by the screw 23. The spring 25 includes a terminal part 26 engageable with the operating member 14 of switch 13 to reciprocate the member 14 in response to operation of the mechanism 16 as will presently appear. The screw 24 may be adjusted to contact spring 25 and vary the position of terminal 26 relative to operating member 14 to permit adjustment of the pretravel and overtravel of foot pedal 17.

As shown in FIGS. 1 and 3 a rocker arm 27, forming part of the switch actuating mechanism, is loosely mounted on shaft 19 and is spaced axially of hub 21 for

pivotal movement with respect to the shaft. The arm 27 carries at its upper surface an axially extending bar 28 which is rigidly fixed to the upper surface of the hub 21 and which serves to directly connect together the arm 27 and the hub 21 so that the hub 21 moves in accordance with movement of the arm 27.

Movement of arm 27 is controlled by means of an operating mechanism including a control member or pawl 30 operatively connected to the shaft 19 for movement in response to oscillation of the shaft 19. For this purpose, a bracket 31 is fixed to the shaft 19 for rotation therewith, and the pawl 30 is secured to the bracket 31 by means of a threaded bolt 32 which extends through spaced flanges 33 on the pawl 30 and into a threaded opening of the bracket 31. A pin 34 is mounted on the bracket 31 and extends laterally therefrom beneath the right hand end 35 of pawl 30 as shown in FIGS. 1 and 3. A spring 36 is coiled about the bolt 32, and its right hand end engages the undersurface of the pin 34 whereas the left hand end of spring 36 engages the undersurface of the pawl 30 so as to bias the pawl 30 upwardly as viewed in FIG. 3 and to permit pivoting of the pawl relative to bracket 31 in the counterclockwise direction for a purpose appearing hereinafter. The pawl 30 includes an upwardly and outwardly extending tip 37 adapted to engage a shoulder 38 formed on the undersurface of the rocker arm 27 adjacent the left hand end thereof as viewed in FIG. 3 to elevate the arm 27 from the position shown in FIG. 3 in response to depression of the pedal 17 as will presently appear.

Movement of the arm 27 is also controlled by means of a spring biased pivotally mounted control member or ratchet 40 into the lower end of which a pin 41 frictionally extends and is journaled by means of spaced brackets 42 carried by the base 11. The ratchet 40 is thus pivotally mounted and is biased toward the right or in a clockwise direction as viewed in FIG. 3 by means of a spring 43 coiled about the pin 41 and having one of its ends extending through an opening 44 of the uppermost bracket 42 as viewed in FIG. 1, and having the other of its ends passing beneath and engaging a screw 45 threadably carried by the ratchet 40. Under normal at rest conditions of the switch device when the pedal 17 is elevated as shown in FIG. 3, the ratchet 40 is urged in a clockwise direction toward the arm 27 so that right angled projections 46 and 47 of ratchet 40 engage respectively right angled projections 48 and 49 formed on the left hand end of arm 27. For this condition the lower surface of projection 48 of arm 27 engages the upper surface 50 of projection 47 of ratchet 40. The arm 27 is thus held in its lower position so that spring 25 is also in its lower position and operating member 14 of switch 13 either is slightly spaced from or rests lightly on end 26 of spring 25 and is in its fully extended position to provide either a switch "off" or a switch "on" condition. It will be assumed that the switch 13 is "off" when the parts are as shown in FIG. 3.

In the present invention the switch mechanism is designed so as to provide a maintained condition of the switch 13 so that when the pedal 17 is first depressed, the switch 13 will be actuated to an "on" condition, and will remain in such condition when the pedal 17 is thereafter elevated. When the pedal 17 is again depressed, the switch 13 will be actuated to the "off" condition. In operation, initial depression of pedal 17 is effective to pivot pawl 30 in a clockwise direction as viewed in FIG. 3 through the agency of the bracket 31 from the position shown in FIG. 3 to that shown in FIG. 4. During such movement pawl 30 engages the shoulder 38 of arm 27 to elevate arm 27 from the position shown in FIG. 3 to that shown in FIG. 4 wherein the projection 48 of arm 27 is disengaged from the ratchet 40. Such movement of arm 27 is transmitted through the bar 25 to the hub 21 which rotates in a corresponding manner to effect elevation of the end

26 of spring 25 and therefore elevation of operating member 14 of switch 13 to the position shown in FIG. 2 to actuate the switch to the "on" position.

When the pedal 17 is released, the pawl 30 is pivoted in a counterclockwise direction from the position shown in FIG. 4 to that illustrated in FIG. 5. During such movement of pawl 30 the arm 27 is also moved in a counterclockwise direction until projection 49 of arm 27 engages the upper surface 50 of projection 47 of ratchet 40 which terminates such movement of arm 27. As pawl 30 is so pivoted tip 37 thereof passes over projection 47 of ratchet 40 whereupon ratchet 40 is snapped in a clockwise direction to the position illustrated in FIG. 5 wherein ratchet 40 and arm 27 engage to positively retain arm 27 against further counterclockwise movement. Although arm 27 is lowered slightly during release of the pedal 17, such movement is insufficient to cause sufficient lowering of spring 25 and member 14 to actuate the switch 13 "off." Therefore, the switch 13 remains in the "on" condition during release of the pedal 17. Note that tip 37 of pawl 30 is adjacent a shoulder 51 of ratchet 40 after the pedal has been elevated.

When the pedal 17 is again depressed from its position in FIG. 5 to that in FIG. 6, bracket 31 is pivoted in a clockwise direction to move the pawl 30 therewith to pivot ratchet 40 in a counterclockwise direction and move surface 50 thereof out of engagement with projection 49 of arm 27 and into engagement with projection 48 of arm 27. It is noted that during this action pawl 30 pivots about the bolt 32 in a counterclockwise direction against the bias of spring 36. This action results in counterclockwise movement of arm 27 to the position shown in FIG. 6 which effects corresponding movement of spring 15 to actuate switch 13 to the "off" condition. When the pedal 17 is again released the various parts will move from the positions shown in FIG. 6 to positions illustrated in FIG. 3.

It is thus seen that a very simple, inexpensive and efficient operating mechanism has been provided for effecting a maintained operation of the switch 13. Also, a single shaft 19 mounts all parts of the mechanisms except the ratchet 40. Although the invention has been described in connection with a switch of the foot operated type, the invention is applicable to switches having actuators of other types and is not to be limited to foot operated switches.

While I have shown and described a particular embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made without departing from my invention in its broader aspects and I, therefore, intend in the appended claims to cover all such changes and 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. In a switch device, a switch, a shaft mounted for oscillation about its axis, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to establish a different switch operating condition for each direction of and a certain amount of such pivotal movement, first means connected to the shaft for oscillation therewith to pivot said switch actuating means by said certain amount in one direction in response to shaft oscillation in one direction, and second means mounted for movement relative to said switch actuating means to a first position in response to pivoting of the switch actuating means in said one direction to prevent pivoting of the switch actuating means by said certain amount in the other direction during the succeeding shaft oscillation in the other direction, said first means being mounted to move said second means to a second position permitting pivoting of the actuating means in said other direction by said certain amount in response to the next succeeding shaft oscillation in said one direction.

2. A device as defined in claim 1 wherein said switch

5

actuating means includes a rocker arm loose on the shaft for engagement with said first and second means, and third means loose on the shaft and connected to the rocker arm for actuating said switch.

3. In a switch device, a switch, a shaft mounted for oscillation about its axis, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to establish a different switch operating condition for each direction of and a certain amount of such pivotal movement, a first member connected to said shaft for oscillation therewith to pivot said actuating means by said certain amount in one direction during shaft oscillation in one direction, and a second spring biased member mounted independently of the shaft for pivotal movement relative to said switch actuating means and relative to said shaft, said second member being biased to engage said actuating means to prevent pivoting of said actuating means by said certain amount in the other direction in response to the succeeding shaft oscillation in the other direction, said first member being mounted to pivot said second member against its bias to a second position permitting pivoting of the actuating means by said certain amount in said other direction during the next succeeding shaft oscillation in said one direction.

4. A device as defined in claim 3 wherein said switch actuating means includes a rocker arm loose on the shaft for engagement by said first and second members, and means loose on the shaft and connected to the rocker arm for actuating said switch.

5. In a foot operated switch device, a switch, a shaft mounted for oscillation about its axis, a spring-biased foot operated pedal connected to the shaft, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to establish a different switch operating condition for each direction of and a certain amount of such pivotal movement, a first member connected to said shaft for oscillation therewith to pivot said actuating means by said certain amount in one direction in response to first depression of said foot pedal, a second member mounted for movement to a first position in response to pivoting of the switch actuating means in said one direction to prevent pivoting of the actuating means by said certain amount in the other direction during elevation of said foot pedal following first depression thereof, said first member being mounted to move said second member to a second position permitting pivoting of the actuating means by said certain amount in said other direction in response to a second depression of said foot pedal following elevation thereof.

6. In a foot operated switch device, a switch, a shaft mounted for oscillation about its axis, a spring-biased foot operated pedal connected to the shaft, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to establish a different switch operating condition for each direction of and a certain amount of such pivotal movement, a first member connected to said shaft for oscillation therewith to engage and pivot said actuating means by said certain amount in one direction during first depression of said foot pedal and to disengage said actuating means during elevation of said foot pedal following said first depression thereof, and a second pivotally mounted member movable by a biasing force into a first position wherein it engages said actuating means in response to disengagement of said first member and said actuating means during elevation of said foot pedal following the first depression thereof to prevent pivoting of said actuating means by said certain amount in the other direction, said first member being mounted to pivot said second member against its bias out of said first position into a second position in response to a second depression of said foot pedal following elevation thereof to permit pivoting of said actuating means by said certain amount in said other direction.

6

7. In a switch device, a switch having a reciprocable operating member, a shaft mounted for oscillation about its axis, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to reciprocate said switch operating member in a different direction for each direction of and a certain amount of such pivotal movement, said actuating means including a leaf spring engageable with said operating member to effect reciprocation thereof, a first member connected to said shaft for oscillation therewith to pivot said actuating means by said certain amount in one direction during shaft oscillation in one direction, and a second spring-biased member mounted for pivotal movement relative to said actuating means and relative to said shaft, said second member being mounted for pivotal movement about an axis spaced from and generally parallel to the axis of said shaft, said second member being biased to engage said actuating means to prevent pivoting thereof by said certain amount in the other direction in response to the succeeding shaft oscillation in the other direction, said first member being mounted to pivot said second member against its bias to a second position permitting pivoting of the actuating means by said certain amount in said other direction during the next succeeding shaft oscillation in said one direction.

8. In a switch device, a switch, a shaft mounted for oscillation about its axis, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to establish a different switch operating condition for each direction of and a certain amount of such pivotal movement, said switch actuating means including an arm extending transversely of the shaft and having a pair of right angled projections, a first member connected to said shaft for oscillation therewith to engage one of the projections of said arm to pivot said actuating means by said certain amount in one direction during shaft oscillation in one direction, and a second spring biased member mounted for pivotal movement relative to said actuating means and relative to said shaft, said second member being mounted for pivotal movement about an axis spaced from and generally parallel to said shaft, said second member also having two right angled projections and being biased for pivotal movement towards said shaft so that one of its projections engages one of the projections of said arm to prevent pivoting of said arm by said certain amount in the other direction in response to the succeeding shaft oscillation in the other direction, said first member being mounted to engage said one of the projections of the second member to pivot said second member against its bias to a second position wherein said one of the projections of the second member is moved clear of said one projection of the arm to permit pivoting of the arm by said certain amount in said other direction during the next succeeding shaft oscillation in said one direction.

9. In a switch device, a switch having a reciprocable operating member, a shaft mounted for oscillation about its axis, switch actuating means mounted loose on the shaft for pivotal movement relative to the shaft and effective to reciprocate said switch operating member in a different direction for each direction of and a certain amount of such pivotal movement, said actuating means including a leaf spring engageable with said operating member to effect reciprocation thereof, said switch actuating means including an arm extending transversely of the shaft and having a pair of right angled projections, a first member connected to said shaft for oscillation therewith to engage one of the projections of said arm to pivot said actuating means by said certain amount in one direction during shaft oscillation in one direction, and a second spring biased member mounted for pivotal movement relative to said actuating means and relative to said shaft, said second member being mounted for pivotal movement about an axis spaced from and generally parallel to said shaft, said second member also having two right angled

7
projections and being biased for pivotal movement to-
wards said shaft so that one of its projections engages
one of the projections of said arm to prevent pivoting of
said arm by said certain amount in the other direction in
response to the succeeding shaft oscillation in the other di-
rection, said first member being mounted to engage said
one of the projections of the second member to pivot said
second member against its bias to a second position
wherein said one of the projections of the second member
is moved clear of said one projection of the arm to permit
10

8
pivoting of the arm by said certain amount in said other
direction during the next succeeding shaft oscillation in
said one direction.

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