

Nov. 28, 1950

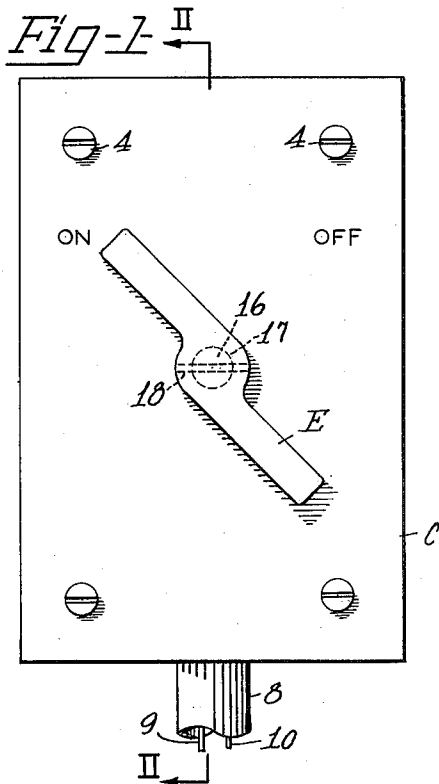
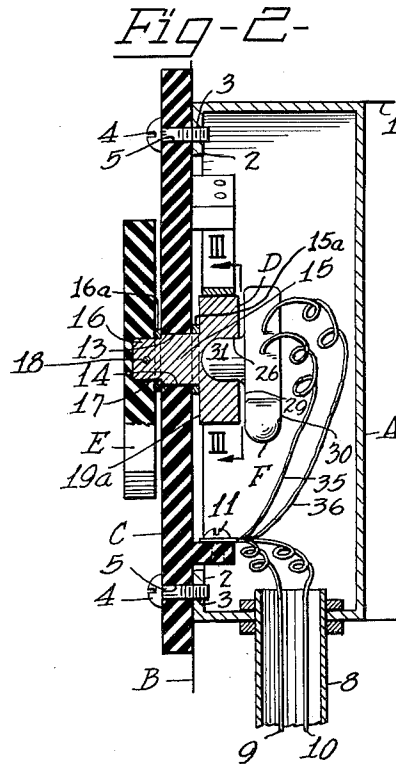
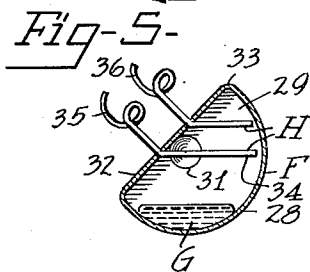
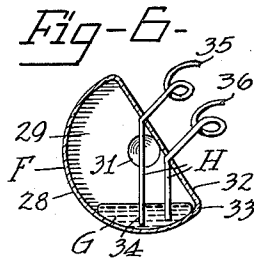
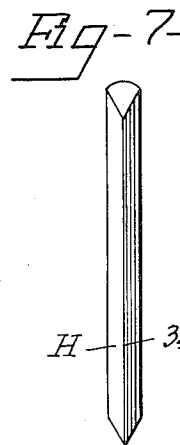
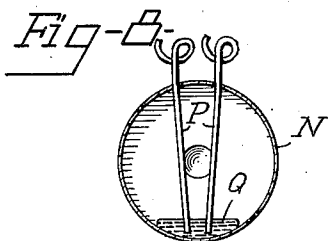
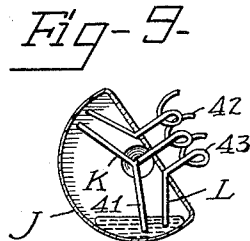
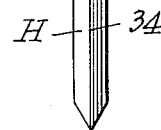
L. MANNON

2,531,452

SILENT ELECTRIC SWITCH

Filed Nov. 24, 1945

2 Sheets-Sheet 1



INVENTOR

LLOYD MANNON

BY *Munn, Riddy & Gleason*

ATTORNEYS

Nov. 28, 1950

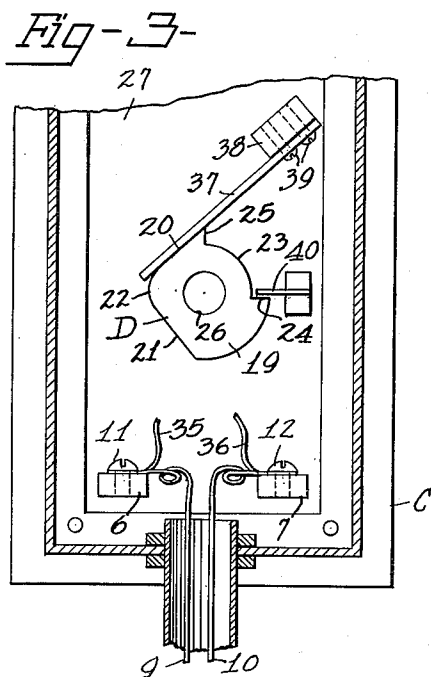
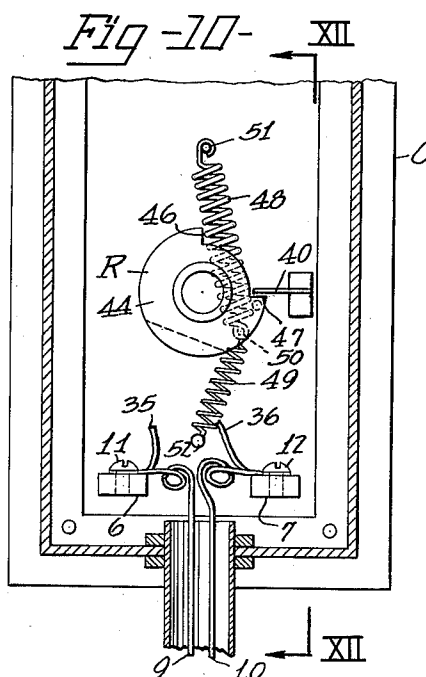
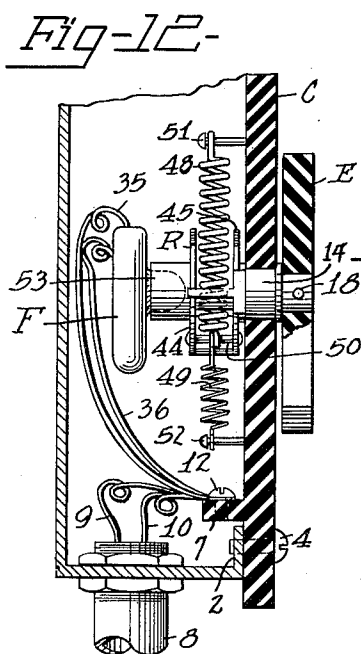
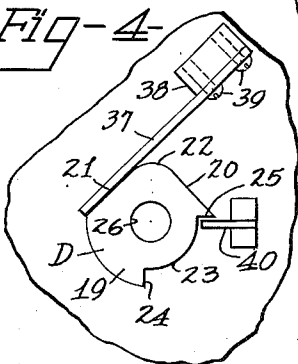
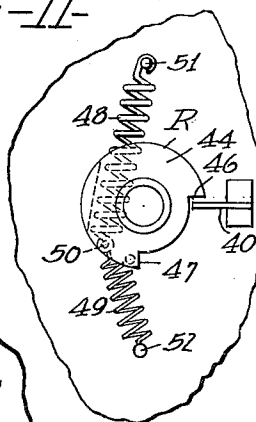
L. MANNON

2,531,452

SILENT ELECTRIC SWITCH

Filed Nov. 24, 1945

2 Sheets-Sheet 2



INVENTOR

LLOYD MANNON

BY

BY *Munn, Liddy & Gleason*
ATTORNEYS

ATTORNEYS

UNITED STATES PATENT OFFICE

2,531,452

SILENT ELECTRIC SWITCH

Lloyd Mannon, San Francisco, Calif.

Application November 24, 1945, Serial No. 630,578

4 Claims. (Cl. 200—152)

1

An object of my invention is to provide a silent electric switch which is silent in operation and which makes use of a quantity of mercury that is placed in an arcuate portion of a rotatable container, the container having electrodes extending into the interior thereof so that they will be electrically connected together by the mercury when the container is rotated into one position and will be freed from the mercury when the container is rotated into another position.

A further object of my invention is to provide a device of the type described which is extremely simple in construction and in which the electrodes are made wedge-shaped in cross section to aid them in entering the mercury when the switch is closed, and for leaving the mercury when the switch is opened. Novel means is provided for preventing the mercury from flowing beyond the electrodes when the switch is closed. Novel means is also provided for yieldingly holding the switch in open or closed position.

Still a further object of my invention is to provide a switch that will open or close a circuit with a minimum amount of movement and that is composed of a minimum number of wearable parts. The switch is so constructed that the shock and wear on its moving parts is eliminated.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming a part of this application, in which:

Figure 1 is a front elevation of the switch;

Figure 2 is a vertical section taken substantially along the line 2—2 of Figure 1, but showing the switch in open position;

Figure 3 is a transverse section taken substantially along the line 3—3 of Figure 2, and shows the switch in open position;

Figure 4 is a view similar to Figure 3, but shows the switch closed;

Figures 5 and 6 illustrate two views of the mercury container showing it in open and closed positions;

Figure 7 is a perspective view of one of the electrodes used with the switch;

Figure 8 illustrates a cylindrical form of mercury container;

2

Figure 9 illustrates a double-throw mercury switch;

Figure 10 is a view similar to Figure 3, but shows a modified form of the device;

Figure 11 shows the switch mechanism of Figure 10 in closed position; and

Figure 12 is a vertical section taken along the line 12—12 of Figure 10.

While I have shown only the preferred forms of my invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit and scope of the invention.

In carrying out my invention, I provide a switch box indicated generally at A and this box is placed in the usual wall recess 1 formed in a wall or other supporting surface, indicated generally at B. The box has an inwardly extending flange 2 that is provided with threaded bores 3 for receiving screws 4, these screws being passed through openings 5 in a face plate C made of insulating material or the like and entering the threaded bores 3 for securing the plate in position. The cover plate C is shown in Figures 1, 2, 3, 10 and 12, as being provided with inwardly extending insulating lugs 6 and 7. Figure 2 shows a conduit 8 entering the box A and wires 9 and 10 lead from the conduit and are secured to the lugs 6 and 7 by screws 11 and 12.

The face plate C has an opening 13 for receiving a bearing 14 and the bearing rotatably carries a rotatable stop D shown in detail in Figures 2 and 3. The stop has a cylindrical portion 15 that is rotatably received in the bearing and has a reduced shank 16 that enters a recess 17 provided in a switch handle E. A pin 18 secures the switch handle to the shank so that a swinging of the handle E from "off" to "on" position, as shown in Figure 1, will rock the stop D.

Again referring to Figure 3, it will be seen that the stop has a disc-like end 19 provided with two flat edges 20 and 21 that extend at right angles to each other and are interconnected by an arcuate portion 22. The end 19 has another arcuate portion 23 concentric with the axis of the stop and bounded by shoulders 24 and 25, which perform a function hereinafter described. The end 19 has a bore 26 in its outer face whose axis coincides with the axis of the stop D. The inner face 19a of the end 19 has a ring 15a mounted

on the cylindrical portion 15 and bearing against the inner surface 27 of the plate C, see Figure 2, and prevents the stop D from moving to the left in Figure 2. The mounting of a second ring 16a on the shank 16 causes this ring to contact with the outer face of the plate C and prevent longitudinal movement of the stop D to the right in Figure 2.

A container indicated at F in Figures 5 and 6 is made of an insulating material such as glass and has an arcuate portion 28 concentric with the container axis and side walls 29 and 30, see Figures 2 and 6. The side wall 29 carries a cylindrical projection that is received in the recess 26 of the rockable stop D and is secured in the recess by any suitable adhesive or cement. A rocking of the stop by the switch handle E will also rock the container.

The container has a flat edge wall 32 that is disposed opposite the curved wall, see Figure 5, and a quantity of mercury G is placed in the container. Electrodes H are disposed in the container and enter the container from the flat side 32. Figure 5 shows how the electrodes extend at an angle with respect to the side 32, so that the free ends of the electrodes will be placed near the corner 33 of the container. When the switch is in "on" position, the container will be in the position shown in Figure 6.

Reference to Figure 7 shows that each electrode H is wedge-shaped in cross section so as to provide a knife-like edge 34. The electrodes H are mounted in the container so that the knife edges 34 will face toward the ball of mercury and knife into the mercury as the container F is swung from the "off" position shown in Figure 5, into the "on" position shown in Figure 6. The electrodes will back out of the mercury G more readily when the switch is turned off due to their being wedge-shaped in cross section. Wires 35 and 36 lead from the electrodes H to the binding posts 11 and 12 mounted on the insulating lugs 6 and 7, see Figure 3. In this way the wires 35 and 36 are electrically connected to the wires 9 and 10.

Figures 3 and 4 show the rotatable stop D in two positions and illustrate how the stop is held in either of its two extreme positions by a leaf spring 37. The spring 37 is secured to a projection 38 which is integral with the face plate C and extends inwardly from the inner surface 27 of the plate. Screws 39, or other suitable fastening means, secure the leaf spring to the lug. When the switch is in "off" position, the shoulder 24 is spaced a slight distance from a stationary stop 40 mounted on the inner surface 27 of the face plate. The leaf spring 37 will contact with the flat edge 21 of the rotatable stop D and holds the shoulder 24 away from the stationary stop 40. The leaf spring will hold the container F in "off" position.

When now the switch arm E is swung from "off" to "on" position, the shoulder 25 will be moved near to the stop 40, see Figure 4, and the flat spring 37 will contact with the flat edge 21 of the rotatable stop. During the movement of the switch from "off" to "on" position, the spring 37 is flexed slightly when it is caused to ride up over the arcuate portion 22. There is no snapping sound caused by the spring as it rides over the arcuate portion 22. Furthermore, the flat spring 37 will bring the rotatable stop to a standstill before either of the shoulders 24 and 25 strike the fixed or stationary stop 40. The result is a silent operating switch. The shoulders and stationary stop are merely for the purpose of preventing the

switch handle E from being manually rotated in the wrong direction. The spring will have a tendency to hold the rotary stop in either "off" or "on" position, due to the fact that either one of the flat edges 20 and 21 is contacted by the spring and will be held against accidental rotation.

From the foregoing description of the various parts of the device, the operation thereof may be readily understood.

When the switch arm is rocked, the container F will also be rocked and the mercury G will remain at the lower part of the arcuate portion 28. When the container is brought to a stop in either closed or open position, the mercury will have no tendency to keep on moving because it will strike the flat side 32 of the container. This is especially true when the switch is in closed position and it is this arrangement that causes the switch to complete an electric circuit when the mercury electrically connects the electrodes H. There will be no tendency for the mercury to flow beyond the electrodes to momentarily break the circuit. The rotatable stop D also acts as a device for holding the switch in closed or open position.

In Figure 9 I show a slightly modified form of mercury switch. In this figure the container J is of the same shape as the container F, but the central electrode indicated at K is in the shape of a Y. One branch 41 of the electrode K cooperates with another electrode L for closing a circuit between wires 42 and 43 when the container J is in the position shown. The container J will be mounted on the rotary stop D and the device will operate in the same manner as that shown in Figure 1, except that it will act as a double-throw switch.

In Figure 10 I show a container N that is of the same shape as that disclosed in a joint application of Lloyd Mannon and Edward W. Coleman, Serial No. 592,582, filed May 8, 1945, now abandoned, on a Safety Control for Motion Picture Films. The container is cylindrical in shape and the electrodes P extend down into the mercury Q as illustrated. A rotation of the cylindrical container N will move the electrodes P out of the mercury to open the switch.

The switch casing may be cylindrical or semi-cylindrical and the principle involved is the same, namely: the raising of the electrodes out of the mercury to break an electric circuit and the moving of the electrodes into the mercury to close the circuit. Gravity maintains the quantity of mercury at the bottom of the casing at all times as the casing is revolved. Enough mercury is used to completely submerge the ends of the electrodes to a depth of about one-sixteenth of an inch when the switch is closed, and sufficient mercury is used to overcome the cohesion between the mercury and its supporting surface. The mercury will therefore not have any tendency to follow the container periphery as it is rotated.

The arc formed by the cylinder is great enough so that the portion adjacent the mercury will be at an angle which will permit it to readily slide under the mercury instead of tending to push against the body of mercury and carry it with it. The electrodes in entering the mercury, meet with resistance due to the density and surface tension of the mercury. The making of the electrodes wedge-shaped in cross-section and the causing of the knife-like edges of the electrodes to enter the mercury first, reduces this resistance and friction to a minimum. Low resistance metal is used for the electrodes and this permits them to

be made small in thickness and thus enter the mercury more readily.

A vacuum is preferably formed within the container housing the mercury. The container is provided with a nipple to permit the container to be evacuated of air more readily and after this is accomplished the nipple is sealed. The nipple also aids in securing the container in place.

I show another modified form of silent switch control in Figures 10, 11 and 12. In this form a hollow rotatable stop R is used and the shape of the stop is similar to the stop D. The stop is provided with two spaced disc plates 44 and 45 that have shoulders 46 and 47. These shoulders function in the same manner as the shoulders 24 and 25 on the stop D. Figure 10 illustrates the shoulder 47 spaced a slight distance away from the stationary stop 40, while Figure 11 shows the shoulder 46 spaced a slight distance away from the same stop 40.

A pair of coil springs 48 and 49 are connected to a common pin 50 which is carried by the stop R. The spring 48 has its other end connected to the face plate C by means of a pin 51, while the spring 49 has its free end connected to the same face plate by a pin 52. A line drawn through the two pins 51 and 52 also extends across the axis of the stop R.

The spring 48 is stronger than the spring 49 and the tension of the two springs is designed so that they will balance each other equally when the stop R is in the position shown in Figure 10 and also when the stop is in the position shown in Figure 11. In either position, the pin 50 will be disposed the same distance away from the straight line extending between the pins 51 and 52. In Figure 10 the pin will be disposed on one side of the line, while in Figure 11 it will be disposed on the other side of the line. A person rotating the switch handle E from "on" to "off" position, or vice versa, merely rotates the stop R until the two springs are in alignment with each other. Further movement of the handle E will permit the spring 48 to rotate the stop R past dead center position, and then the stop will assume the position shown in Figure 11. As already stated, the two springs will come into equal balance with each other before either the shoulder 46 or the shoulder 47 strikes its side of the stationary stop 40. The purpose of the stationary stop and the shoulders is to prevent the handle E from being rotated in the wrong direction when manually opening or closing the switch. The switch is silent in operation.

A good portion of the springs 48 and 49 are received within the hollow rotatable stop R. Figure 12 illustrates the disc plate 44 provided with a cylindrical hollow hub 53 that in turn receives the cylindrical portion 31 of the mercury container F. The mercury container will be rotated by the stop R into closed and open position for closing or opening the switch. In all other respects the form of the invention shown in Figures 10 to 12, inclusive, is the same as in the other form and will operate in the same manner.

The flat spring 37 creates sufficient force to complete the rotation of the stop D from "off" to "on" position or vice versa when the switch handle E has swung the stop to a position where the arcuate portion 22 starts to move beyond the dead center position. The spring 48 is strong enough to rotate the stop R to its "on" or "off" position after the switch handle has rotated the stop past dead center. In both the stops D and R, the action will be silent. The material com-

posing the face plate C is insulating material such as Lucite, Plexiglas, etc.

I claim:

1. In a silent electric switch, a rockable member, a shaft connected to the member, a pair of springs connected to a common point on the member which is disposed a predetermined distance from the center of the member, the outer ends of the spring extending substantially in opposite directions from said common point and being secured to fixed points that lie in a "dead center" line intersecting the center of the member, one of the springs being stronger than the other and continuing to rock the member beyond dead center when the shaft has been manually rotated to move the member slightly beyond dead center, the other spring acting as a silent stop for bringing the member to a predetermined stop on either side of dead center when the forces of the two springs are balanced.

2. In a silent electric switch, a rockable member, a shaft connected to the member, a pair of springs connected to a common point on the member which is disposed a predetermined distance from the center of the member, the outer ends of the spring extending substantially in opposite directions from said common point and being secured to fixed points that lie in a "dead center" line intersecting the center of the member, one of the springs being stronger than the other and continuing to rock the member beyond dead center when the shaft has been manually rocked to move the member slightly beyond dead center, the other spring acting as a silent stop for bringing the member to a predetermined stop on either side of dead center when the forces of the two springs are balanced, a stationary stop for the member, said member having shoulders angularly spaced from each other, either one of which is disposed close to the stop, but is spaced a slight distance therefrom when said member comes to rest in either one of its two predetermined stop positions, said stop lying in the path of the shoulders and preventing rocking of the member an appreciable distance beyond the two extreme positions determined by the balancing forces of the two springs on either side of the "dead center" line.

3. In a silent switch, a rotatable switch closing and opening member swingable past a dead center position for either of its movements, a stationary stop for said member, means for rocking the member including a spring for urging the member into its switch opening or closing position after the member has been moved past the dead center position, and spring means for balancing the force of the first spring when the member reaches either its switch closing or opening positions at a point spaced from said stop whereby the member will be brought to a silent stop in either of its positions.

4. In a silent electric switch, a plate, a shaft, a rotatable member connected to said shaft, a stationary stop secured to said plate and lying in the arcuate path of said member, a pair of springs connected to a common point on the member said point being offset from the axis of rotation of the member, the outer ends of the springs extending substantially in opposite directions from said common point and being secured to fixed points lying in a "dead center" line intersecting the center of said member, one of said springs being stronger than the other and causing continued movement of said member when the member has been rotated beyond

7

said line, the other spring being of such strength in comparison to the stronger spring to balance the force of said spring when the member reaches a predetermined point spaced from said stop.

LLOYD MANNON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
445,752	Hoffman	Feb. 3, 1891
529,578	Badt	Nov. 20, 1894

Number
843,070
919,535
1,569,965
1,658,619
1,902,926
1,982,717
2,314,714

5

10

15

8

Name	Date
Button	Feb. 5, 1907
Calhoun	Apr. 27, 1909
Chapin	Jan. 19, 1926
Walker	Feb. 7, 1928
West et al.	Mar. 28, 1933
Wilhelm	Dec. 4, 1934
Kouyoumjian	Mar. 23, 1943

FOREIGN PATENTS

Country	Date
Great Britain	Sept. 17, 1907
Great Britain	Oct. 7, 1903