June 5, 1951 A. W. JENSEN 2,556,091

CIRCUIT CONTROLLING APPARATUS

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Fig. 1.

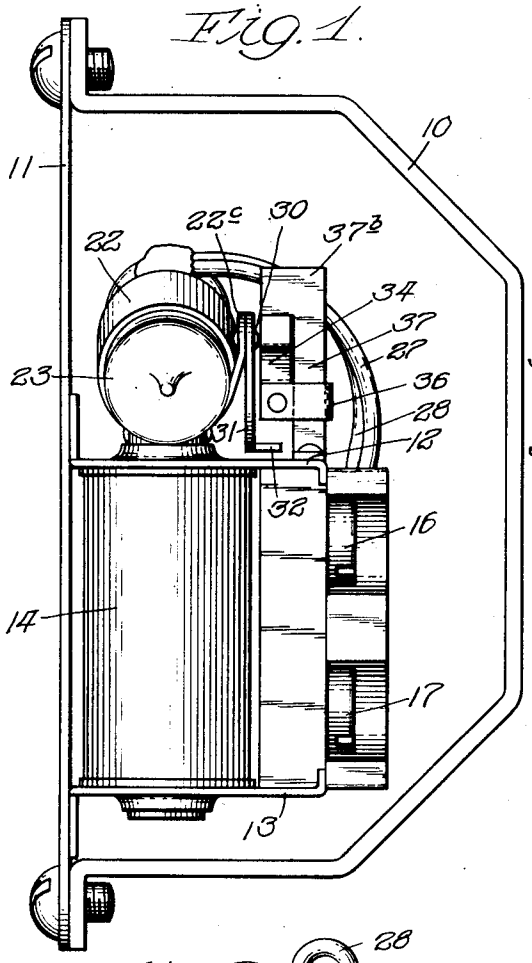


Fig. 2.

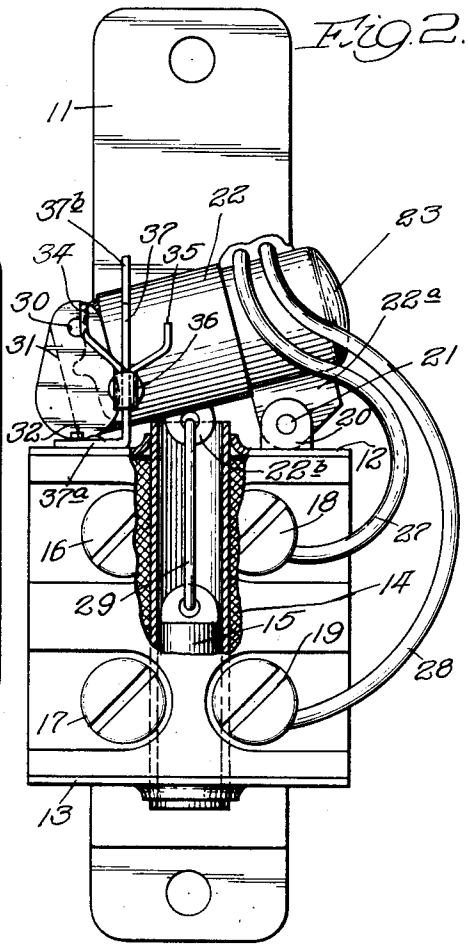


Fig. 3.

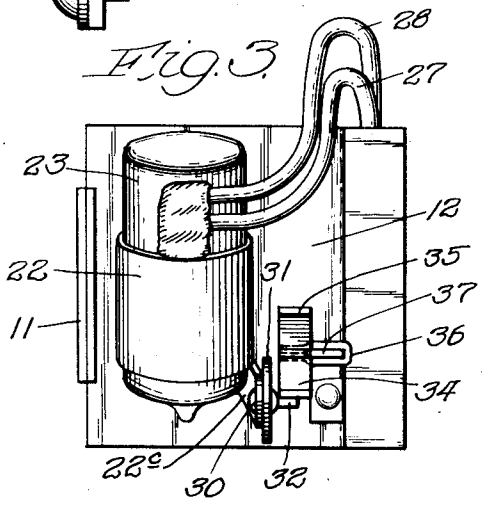
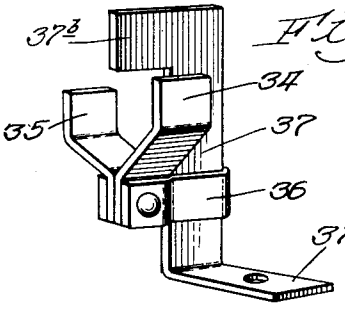


Fig. 7.



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Fig. 4.

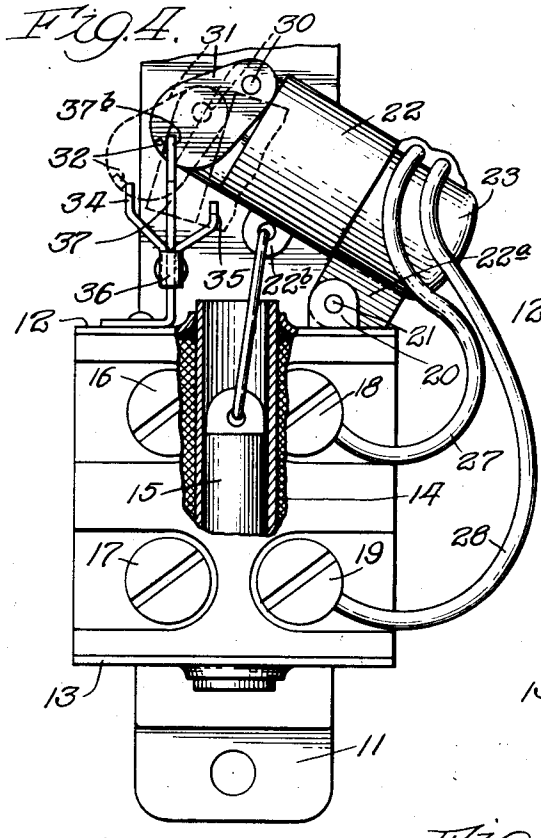


Fig. 5.

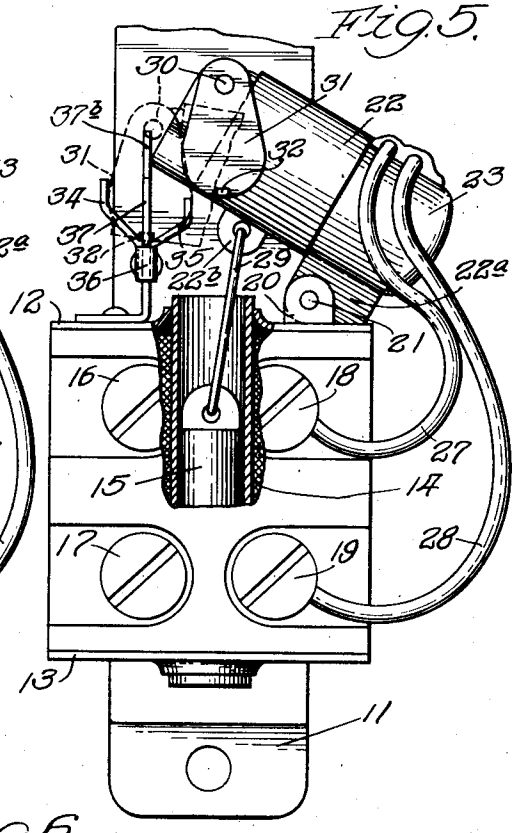
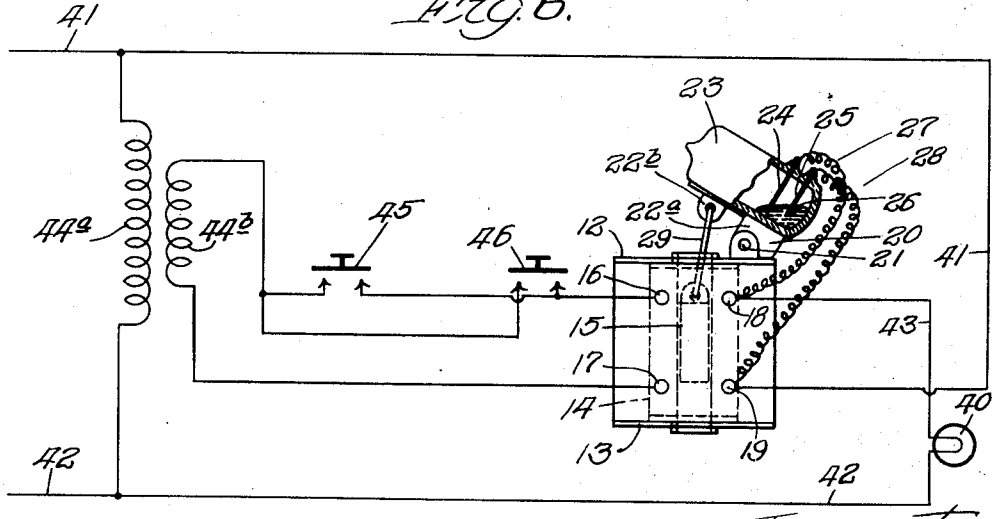


Fig. 6.



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CIRCUIT CONTROLLING APPARATUS

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5 Claims. (Cl. 200—112)

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This invention relates to circuit controlling apparatus, and more particularly to novel low voltage apparatus for controlling relatively high voltage circuits.

One feature of the invention is that it provides improved circuit controlling apparatus; another feature of the invention is that it provides a novel multiple switching arrangement; a further feature of the invention is that it provides switch operating means including a position holding device and a guide device adapted to be engaged by the position holding device to place the switch in a different one of two operating positions upon each successive energization of an electro-responsive member; yet another feature of the invention is that one of the above mentioned devices is mounted upon the actuating means for the switch and is movable relative thereto, and the other of said devices is stationary; and an additional feature of the invention is that it provides a solenoid-controlled switch which is gravity-biased to open position and a position holding device and guide device acting in cooperation to place said switch in a different operating position upon each successive energization of the solenoid.

Other features and advantages of the invention will be apparent from the following specification and drawings in which:

Fig. 1 is a side elevational view of the circuit controlling apparatus;

Fig. 2 is a front view, partly in section, looking from the right of Fig. 1 with a portion of the switch housing removed;

Fig. 3 is a plan view of the apparatus;

Figs. 4 and 5 are views similar to Fig. 2, but showing the apparatus in different positions;

Fig. 6 is a diagrammatic view showing a circuit arrangement which may be utilized with the invention and showing the switch partly in section; and

Fig. 7 is an enlarged perspective view of the guide device.

While the invention is susceptible of many different embodiments and uses, it is here illustrated and will be described as a part of a lighting system. Such a system utilizes important advantages of the invention, as will be hereafter apparent. In home lighting, for example, under conventional present practice, all parts of the lighting circuits are wired for relatively high voltage apparatus, as for example conventional commercial 110 volt current. Not only is high voltage wiring brought into the location of the lamp which is to be energized or the outlet which

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is to be utilized, but the high voltage circuits are carried in the walls of the house to the switch positions. Most municipal or other governmental codes require that all of this wiring be protected by metal tubing or that other protective arrangements be made, and these arrangements, while necessary for safety where high voltage is present, are expensive.

The present invention discloses improved means whereby the relatively high 110 volt circuit wiring need extend only to the lamp or other outlet, and the wall switches for operating the lamps or other devices may be wired in accordance with conventional low voltage practice, as for example, six or twenty-four volts. Such low voltage wiring does not present a fire hazard and most municipal codes do not require that such low voltage wiring be sheathed in metal or other fireproof material.

Another advantage of installations of this type is that they are much cheaper and the construction may include several switches in various locations for each lamp or other outlet, as for example, one switch adjacent each door to the room, without the necessity of utilizing complicated and expensive three wire circuits, as is now the case.

Referring now more particularly to the drawings the improved switch arrangement is shown in Figs. 1–5. The switch is illustrated as being mounted in a conventional wall box or switch receptacle 10 having a removable cover plate 11 for easy access. An upper bracket 12 and a lower bracket 13 secured to the cover plate and extending in spaced relation therefrom provide a mounting for a solenoid 14 having a core 15 of soft iron or other permeable material. As shown in Figs. 2 and 4–6 the core is movable in an opening extending through the solenoid, and when the solenoid is not energized the core drops by gravity to the position of Fig. 2. When the solenoid is energized the core is pulled into the solenoid (upwardly as the parts are illustrated) to the position of Fig. 4. The ends of the solenoid winding are connected to respective terminals 16 and 17 which provide low voltage terminals for connection to a source of operating voltage as shown in Fig. 6. Another pair of terminals 18 and 19 provide high voltage connector points for the lead wires from the switch, the high voltage circuit, and from the lamp or other high voltage device which is to be operated.

A pair of upstanding ears, as the ear 20, project from opposite sides of the bracket 12 and provide a bearing mounting for a rotatable shaft

21. A sleeve 22 is provided with extending portions 22a bent therefrom and mounted on the shaft 21. A conventional mercury switch tube 23 is carried in the sleeve 22 so that the switch is gravity-biased to the position of Fig. 2. While the switch tube 23 normally is referred to as a "switch," the actual switch elements comprise spaced terminals 24 and 25 within the tube near the mounted end thereof as shown in Fig. 6, which terminals cooperate with a pool of mercury 26. The holding sleeve arrangement 22 and the tube 23 merely comprise actuating means for the switch, since the position of these elements determine the operative position of the switch. Obviously when the switch is tilted about the horizontal axis of the shaft 21 to the position of Fig. 6 wherein the mercury bridges the contacts 24 and 25, the switch is in closed position while, when the switch is tilted to the position in which it is biased by gravity as shown in Fig. 2, the mercury runs to the left end of the tube and the switch is in open position. The switch terminals 24 and 25 are connected to the respective connector terminals 18 and 19 by leads 27 and 28 which are flexible enough to provide for tilting movement of the switch.

An ear 22b extending from the bottom of the sleeve 22 provides a pivotal mounting for a rod 29 which connects the actuating arrangement of the switch to the core 15 of the solenoid. When the solenoid is deenergized the weight of the core aids the switch in assuming the open position of Fig. 2. When the solenoid is energized the movement of the core into the solenoid moves the switch about the horizontal axis of the shaft 21 to the positions of Figs. 4, 5 and 6.

In accordance with the invention a position holding device is provided, and a guide device is adapted to be engaged by the position holding device to place the actuating means and switch in a different one of the two operative positions upon each successive energization of the solenoid. One of the two devices above mentioned is mounted upon the actuating means and is movable relative thereto. A flanged portion 22c upstanding from the sleeve 22 at one end thereof has pivotally mounted thereon by means of a rivet 30 a generally pear shaped elongated body member 31, so shaped that the bulk of its mass is near its free end. From the free end of said body member a positioning pin 32 projects. The construction of these parts is such that the action of gravity on the body member 31 causes the pin 32 to tend always to remain directly below the pivotal mounting point 30 of the body member, and upon tilting of the switch tube the body member 32 will pivot relative to the tube to retain this position.

The stationary guide device is shown in detail in Fig. 7 and has opposite side arms 34 and 35 mounted by a clamping sleeve 36 on a center arm 37 which extends through the sleeve and is bent at its lower end to form a bracket portion 37a which is mounted on the bracket 12. The arm 37 extends upwardly intermediate the opposite side arms 34 and 35 and terminates in a flag portion 37b which forms a stop. As may be seen in Fig. 7 the body portion of the arm 37 is offset from the arms 34 and 35 to permit passage of the pin 32 along the path provided by the guide means.

The operation of the device may be seen from Figs. 2, 4 and 5. Normally when the solenoid 14 is not energized the switch actuating means is gravity-biased so that the switch is open, this position being illustrated in Fig. 2. In Fig. 4 the parts are shown in the position they assume when the solenoid 14 is energized. The switch tube has been tilted to a position wherein the switch contacts are closed, and during this tilting operation the pin 32 on the position holding device moved upwardly into engagement with the side arm 34 of the guide device as shown in broken lines in Fig. 4. When the switch tilted sufficiently to move the position holding device beyond the position shown in broken lines, the body member of the position holding device pivoted to bring the pin 32 into engagement with the flag or stop portion 37b of the center arm of the guide means, and this stop portion acts to limit pivotal movement of the body member 31 beyond the position shown in full lines in Fig. 4. The parts remain in the solid line position of Fig. 4 until the solenoid is deenergized. Upon such deenergization the switch drops down toward its normal or biased position, the arm 35 insuring that the pin 32 engages in the trough formed above the sleeve 36 at the point of juncture of the guide arms 34 and 35, as shown in broken lines in Fig. 5. Consequently, after this first energization of the solenoid the switch remains closed, being held in this position by the cooperation of the position holding device and guide device.

The main function of the guide portion 35 is to prevent the pin 32 from swinging to its solid line position of Fig. 5 immediately after it leaves its solid line position of Fig. 4 and without resting in the trough as shown in broken lines in Fig. 5. In between the solid line position of Fig. 4 and the broken line position of Fig. 5, the switch tube 23 is moving downwardly, and when the positioning pin 32 leaves the flag 37b the body member 31 of the position holding device will act as a pendulum and tend to swing the pin 32 over to and even beyond the solid line position of Fig. 5. However, the guide arm 35 extends high enough to engage the pin and guide it into the trough as shown in broken lines in Fig. 5.

When the solenoid is again energized, the switch is pivoted upwardly to its solid line position of Fig. 5 and the positioning pin 32 is guided by the arm 35 of the guide means to the top thereof, at which point the freely swinging mass of the body member 31 carries the parts to a position beyond the guide device as shown in solid lines in Fig. 5. The center arm 37 of the guide device does not impede this movement because it is offset as shown in Fig. 7.

When the solenoid is deenergized after the parts have assumed the position shown in solid lines in Fig. 5, the apparatus returns to the position of Fig. 2, and upon each successive energization of the solenoid the switch is placed in a different operative position, being placed in closed position upon one energization and being placed in open position upon the next energization.

Fig. 6 shows a circuit wherein the switching arrangement is advantageously utilized, 40 representing a lamp which is connected in series with the mercury switch across line wires 41 and 42 which may comprise a conventional 110 volt source of voltage. The line wire 41 is connected to the terminal 19 and the series circuit is completed through the lead 28, the mercury switch contacts 24 and 25, the lead 27 and a lead 43 connected between the terminal 18 and one side of the lamp. The other side of the lamp is connected to the line wire 42 so that the lamp is energized only when the mercury switch con-

tacts **24** and **25** are bridged by the pool of mercury.

A transformer is provided having a primary **44***a* connected directly across the line and a secondary **44***b* connected in an operating circuit for the solenoid **14**. One side of the secondary is connected directly to the solenoid low voltage terminal **17**, and the other side of the secondary **44***b* is connected to the other low voltage terminal **16**, this last connection incorporating two normally open push button switches **45** and **46** connected in parallel. Of course, instead of the step down transformer **44** a battery or any other low voltage source may be provided. In Fig. 6 the lamp **40** is assumed to be energized, the switch being shown in the same position as fragmentarily illustrated in broken lines in Fig. 5. When it is desired to deenergize the lamp **40** either one of the push buttons **45** or **46** may be momentarily pressed. When either of these push button switches is momentarily closed, the solenoid **14** will be energized, and the switch structure will be pivoted to the solid line position of Fig. 5. When the push button is released the switch will move to the position of Fig. 2 breaking the circuit to the lamp. Obviously any number of push buttons connected in parallel may be utilized and each push button may be located at any convenient point. The connections of the circuit including the transformer secondary, the push buttons and the solenoid terminals **16** and **17** may be conventional low voltage connections and made without utilizing metal sheathing or other expensive protective arrangements.

While I have shown and described one embodiment of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. Circuit controlling apparatus of the character described, including: a mercury switch movable between open and closed positions; means for mounting said switch for pivotal movement about a horizontal axis and for biasing said switch to open position; a solenoid for moving said switch about said axis upon energization of said solenoid; a position holding device comprising a body member pivotally mounted near one of its ends on said switch mounting means and having a positioning pin projecting from near its other end; and a stationary guide device adapted to be engaged by said pin to place said switch in a different one of said positions upon each successive energization of said solenoid, said body member pivoting upon movement of said switch to carry said pin along a path defined by said guide device.

2. Apparatus of the character claimed in claim 1, wherein said switch has a spaced pair of terminals in one end and said switch is mounted adjacent said end for providing gravity bias to open position.

3. Circuit controlling apparatus of the character described, including: a mercury switch having a spaced pair of terminals adjacent one end; means for mounting said switch adjacent said end for pivotal movement about a horizontal axis for gravity-biasing said switch to open position; a solenoid having a core connected to said switch for moving said switch about said axis upon energization of said solenoid; a position holding device comprising a body member pivotally mounted near one of its ends on said switch mounting means adjacent the other end of said switch and having a positioning pin projecting from near the other end of said body member; and a stationary guide device having opposite side arms permitting free swinging movement of said holding device on opposite sides thereof, said arms guiding said pin during pivotal and vertical movement of said body member, a centrally disposed arm having a stop portion for limiting pivotal movement of said body member during every alternate energization of said solenoid, and a portion below said stop portion engaging said pin after said alternate energizations of said solenoid for supporting said switch away from said biased position.

4. Circuit controlling apparatus of the character described, including: a mercury switch having a spaced pair of terminals adjacent one end; means for mounting said switch adjacent said end for pivotal movement about a horizontal axis for gravity-biasing said switch to open position; a solenoid having a core connected to said switch for moving said switch about said axis upon energization of said solenoid; a position holding device comprising a body member pivotally mounted near one of its ends on said switch mounting means adjacent the other end of said switch and having a positioning pin projecting from near the other end of said body member; and a stationary guide device having opposite side arms for guiding said pin during pivotal and vertical movement of said body member, a centrally disposed arm having a stop portion for limiting pivotal movement of said body member during every alternate energization of said solenoid, and a portion below said stop portion engaging said pin after said alternate energizations of said solenoid for supporting said switch away from said biased position, said arms and supporting portion being spaced from each other a sufficient distance to permit free swinging movement of said position holding device between said arms and supporting portion.

5. Circuit controlling apparatus of the character described, including: a mercury switch having a pair of high voltage terminals adjacent one end; means for mounting said switch adjacent said end for pivotal movement about a horizontal axis for gravity-biasing said switch to open position; a solenoid having a core connected to said switch for moving said switch about said axis upon energization of said solenoid; a position holding device comprising a body member pivotally mounted near one of its ends on said switch mounting means adjacent the other end of said switch and having a positioning pin projecting from near the other end of said body member; and a stationary guide device having opposite side arms for guiding said pin during pivotal and vertical movement of said body member, a centrally disposed arm having a stop portion for limiting pivotal movement of said body member during every alternate energization of said solenoid, and a portion below said stop portion engaging said pin after said alternate energizations of said solenoid for supporting said switch away from said biased position, said arms and supporting portion being spaced from each other a distance equal to several times the width of the arms to permit free swinging movement of said position holding device between said arms and supporting portion and outside the side arms.

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