

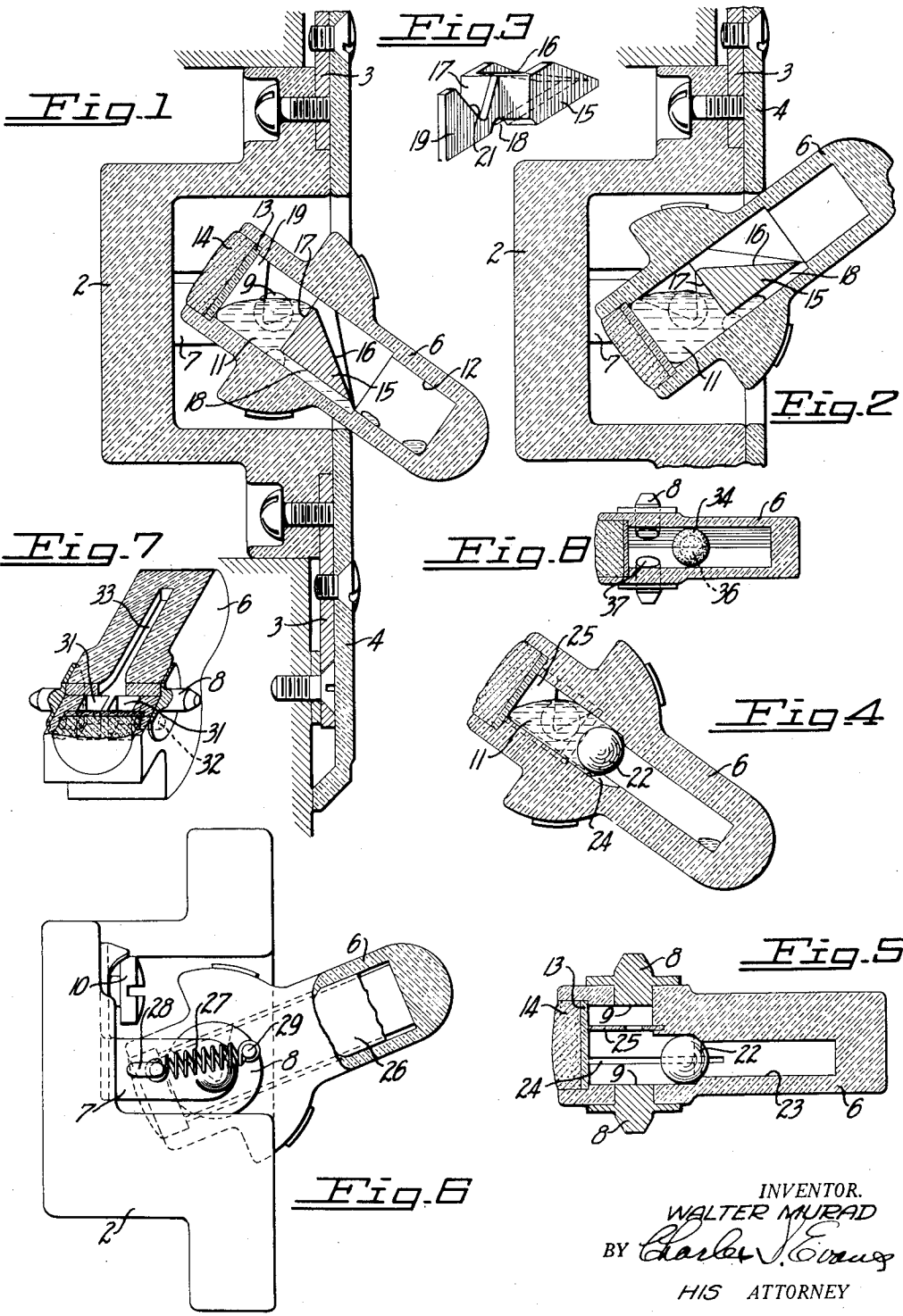
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SWITCH

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SWITCH

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My invention relates to a switch, and more particularly to an electric switch.

It is among the objects of my invention to improve the operation and simplify the construction of electric switches.

Another object of my invention is to provide an improved mercury switch.

A more specific object of my invention is to provide a mercury switch having a time delay action.

Still another object of my invention is to provide a mercury switch embodying quick-acting means for actuating the flow of mercury.

Further objects of my invention include the provision, in a mercury switch of the character described, of an improved construction and arrangement of the mercury tumbler and its cooperating elements.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of my invention. It is to be understood that I do not limit myself to this disclosure of species of my invention, as I may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawing:

Figure 1 is a vertical sectional view of a switch embodying the improvements of my invention; and

Figure 2 is a similar view showing the tumbler in another position.

Figure 3 is a detail perspective view of the barrier insert employed in the tumbler shown in Figures 1 and 2.

Figure 4 is a longitudinal vertical sectional view taken through a tumbler embodying a modified form of construction; and

Figure 5 is a longitudinal horizontal sectional view of the same.

Figure 6 is a side view, partly in section and partly in elevation, showing other improvements of my invention.

Figure 7 is a perspective view, partly in section and partly in elevation, showing further improvements of my invention.

Figure 8 is a horizontal sectional view through a tumbler embodying still further improvements of my invention.

In terms of broad inclusion, the switch embodying my invention comprises a container or tumbler mounted for movement between open and closed switch positions. Contacts are provided in the container, and a conducting body movable in the container is provided for bridging the contacts in the closed switch position. In

one form of my invention I provide a solid conducting body, and in another form I provide a fluid body such as mercury. Quick-acting means are also preferably provided for shifting the container from one to another of its switch positions to effect rapid movement or flow of the conducting body.

In the mercury type of switch I provide means for dividing the mercury between the contacts, and in a special construction I also provide means for retarding the mercury flow to give a time delay action. In order to provide a compact construction for the flush type of wall switch I pivotally mount the tumbler behind the wall plate with the trunnions also providing the contacts for the tumbler, and with portions of the tumbler projecting through the plate to provide a chambered handle for receiving the conducting or mercury body. I also provide a fusible plug in the rear end of the tumbler as a safety measure to prevent accidental breaking of the tumbler in the hand of an operator. The switch of my invention also embodies other improvements in the construction and arrangement of the mercury tumbler and its cooperating elements.

In greater detail, and referring particularly to Figures 1 and 2, a form of switch embodying the improvements of my invention comprises a recessed base or frame 2 having straps 3 provided for mounting the base in the wall of a building. The base 2 may be of any suitable material, such as porcelain. The straps 3 of the frame also provide a mounting for the wall plate 4 of the switch. This plate is preferably flush with the wall in which the switch is mounted, and may be of any suitable material, such as metal or a molded composition product; it being understood that the particular form or composition of the plate 4, like that of the frame 2, may be varied within wide limits.

A hollow tumbler or container 6 is mounted on the base 2 for movement between open and closed switch positions. The tumbler is positioned with its rear end behind the wall plate and with its front end projecting through the plate to provide a handle for operating the switch. The mounting for the tumbler preferably comprises a pair of resilient brackets 7 projecting from the base 2 and terminating in sockets for receiving suitable studs or trunnions 8 projecting from the sides of the tumbler. Note Figures 5 and 6 in conjunction with Figures 1 and 2 for details of this construction. The brackets 7 are of an electrical conducting material, such as metal, as are the studs 8, and the latter extend through the walls

of the tumbler to provide contacts 9. Note Figure 5. Each bracket, as best shown in Figure 6, is provided with a binding screw 10 for attaching a circuit wire.

It will be understood that in addition to providing a releasable pivot mounting for the tumbler, the brackets and studs cooperate to form an electrical connection between the external binding screws 10 and contacts 9 located within the tumbler. This construction provides a simple and compact mounting for the tumbler which is right both electrically and mechanically, and by which the tumbler may be removed by simply pulling the same out from between the brackets, or inserted by pressing the same into position. While I have shown studs 8 having bevelled ends for seating in sockets formed in the ends of the brackets 7, it is understood that this is merely for illustration and may equally as well be substituted by a construction in which nipples on the brackets engage recesses or sockets formed in the ends of the studs.

Referring again to Figures 1 and 2, I provide a conducting body 11, such as mercury, within the tumbler 6 for bridging the contacts 9 in the closed switch position of the tumbler. This body of mercury is adapted to flow along the bore 12 of the tumbler when the latter moves back and forth between the upwardly extending or closed switch position, as shown in Figure 2, and the downwardly extending or open switch position, as shown in Figure 1. The body of mercury is confined in the tumbler by a closure comprising a plate or disk 13, preferably of mica, seated in an enlarged end of the bore 12 to provide a cup in which a filling of sealing wax is provided to form a fusible plug 14.

In assembling the tumbler unit of my switch both the mercury and tumbler are preferably heated to dry out the moisture before the tumbler is sealed. After the mercury has been poured into the tumbler the disk 13 is inserted and the cup provided thereby filled with molten sealing wax. This method of assembling the tumbler of my invention not only precludes the presence of moisture within the tumbler, but also creates a partial vacuum within the tumbler when the elements have cooled.

In addition to providing a simple and effective means for sealing the mercury within the tumbler, the closure comprising the sealing wax plug 14 provides an important safety feature. If the switch should be accidentally overloaded the heat and pressure developed within the tumbler will soften the fusible plug 14 and blow the closure as well as the mercury out through the rear end of the tumbler. This eliminates any possibility of a pressure developing and breaking the forward or handle end of the tumbler and blowing the hot mercury into the hand of an operator.

The recess of the porcelain base 2 covered by the wall plate 4 provides a safe receptacle for receiving the blown elements of the switch. Another important feature of my switch construction is that the circuit through the switch is opened immediately upon the blowing out of the mercury. All the fire hazards of a faulty connection through the switch are therefore entirely eliminated. The switch is either in a condition to be safely operated or it is rendered inoperable and absolutely harmless.

Another important feature of my invention, clearly illustrated in Figures 1 and 2, is that the container which holds the mercury provides the handle for operating the switch. The compact,

economical and workable construction of the switch is due largely to the fact that the mercury chamber projects through the wall plate and into the handle portion of the tumbler. The chambered handle provides a reservoir for receiving the mercury in the open switch position, and it is this maximum utilization of available space in the tumbler that makes my toggle type of mercury switch possible.

From all outward appearances the switch of my invention cannot be distinguished from the ordinary mechanical type of toggle wall switch, yet it is of simpler construction and has all the advantages offered by a mercury switch, such as silence of operation and absence of a naked arc. The tumbler 6 is preferably of a moldable material, such as glass or urea-resin. I have used the latter composition with particularly good results. It presents a good appearance, and possesses the necessary dielectric characteristics.

Figures 1 and 2 further illustrate the inclusion of means for retarding the flow of mercury from the closed switch position. This means is preferably in the nature of a stationary barrier comprising a block-like insert which may be slipped into the tumbler. The barrier is shown in detail in Figure 3 and preferably comprises a moldable insulating material, such as urea-resin, having a sloping forward wall 16 providing an inclined channel for the mercury flow from the open to the closed switch position, and a vertical back wall 17 to block the mercury flow from the closed to the open switch position.

A groove 18 is formed along the bottom of the barrier to provide a duct through which the mercury may flow slowly back to the open switch position. In other words, the barrier or insert 15 provides a substantially free passage for the mercury flow in one direction and a restricted passage for flow in the opposite direction. When the tumbler is thrown to the upwardly extending position the mercury will wash freely over the incline plane 16 and into the rear end of the tumbler to substantially instantaneously bridge the contacts 9 and close the circuit through the switch. When the tumbler is moved to the downwardly extending position however the flow of mercury is blocked by the barrier, and will flow to the forward or handle end of the tumbler only as it is permitted to bleed out through the passage 18.

By means of this time delay action a lamp in circuit with the switch will stay lit for a predetermined interval after the switch has been snapped off. The amount of time required for the mercury to bleed through the restricted passage 18 determines the interval before the circuit is opened and the light extinguished. For ordinary purposes in a home the time required to cross a room, or retire into bed, will determine the delay action. This delay, depending upon the rate of bleeding through the passage 18, may of course be varied within wide limits. It is understood of course that the delay may be effected from the "on" instead of from the "off" position. Such a time delay switch is useful in photographic work.

Means are also provided for dividing the mercury between the contacts before it has left either contact. This is done in order to effect the make and break of the circuit in the mercury itself. The means to accomplish this result preferably comprises a partition 19 positioned between the contacts 9 and preferably having a V-shaped opening 21. As the mercury recedes from the

contacts it is gradually split and finally severed by the partition before the mercury has left either contact. Any arcing present in the switch therefore takes place in the mercury rather than between the mercury and the contacts.

The partition 19 is preferably formed integrally with the insert or barrier 15. Note Figure 3. As best shown in Figures 1 and 2 the barrier 15 is insertably positioned in a rectangularly cored portion of the tumbler and is locked securely in position by the plate 13 bearing against the rear edge of the partition portion 19.

A modified form of time delay switch embodying the improvements of my invention is shown in Figures 4 and 5. In this construction a movable barrier in the nature of a ball 22 is provided. The ball may be of any suitable material, such as glass, and is adapted to seat against a shoulder provided by the reduced forward portions of the bore 23. The ball operates as a check valve and provides a substantially free passage for the flow of mercury to the rear end of the tumbler, but blocks the passage of mercury in the opposite direction. A bleeding action past the ball 22 is provided by a groove 24 cored in the bottom of the tumbler. The partition between the contacts in this case preferably comprises a notched panel 25 insertably mounted in suitable grooves cored in the tumbler, and is locked in place by the plate 13 behind the wax plug 14.

Figure 6 illustrates another form of my invention. This switch does not contemplate a time delay action, and the means for dividing the mercury between the contacts preferably comprises a notched partition insertably mounted in and extending longitudinally of the tumbler. Of course it is understood that the partition may be formed integrally with the tumbler, as shown in my copending application Serial No. 511,537, filed January 27, 1931.

An important feature illustrated in Figure 6 is the quick-acting means for shifting the tumbler from one to the other of its switch positions. A tensioned spring 27 is preferably connected between a lip 28 knocked out from the bracket 7 and a pin 29 formed on the flange of the stud 8. The spring is positioned so that it passes over the pivot axis of the tumbler when the latter moves from one to another of its positions. The spring therefore operates to hold the tumbler in a given position, and to snap the tumbler into a new position whenever the unbalanced spring passes over center. Preferably a spring is provided on each side of the tumbler.

This quick-acting means for the tumbler is of particular importance in a mercury type of switch, since it initiates a rapid flow of the mercury body into and out of the closed switch position. This causes a rapid make and break and reduces the period of arcing. Another important function of the springs 27 is that of providing additional paths for carrying current from the binding screws 10 to the contacts 9. The brackets 7 and studs 8 have adequate current carrying capacities per se. It is the bearing connection between these elements that forms the weakest link. The springs 27 bridge this link and provide an additional path for carrying current. A good conducting spring metal, such as phosphor-bronze, is preferably used in these springs.

Other improvements embodying my invention are shown in Figure 7. In this case a pair of cups or recesses 31 are provided in the base end of the tumbler for retaining pools of the mercury. A pin 32 on the flange of each of the studs 8 provides a contact with the mercury in the pool. A

passage 33 communicating with the upper edges of the pools and extending forwardly into the handle portion of the tumbler provides a chamber for receiving a portion of the mercury in the open switch position.

When the tumbler is moved upwardly this mercury flows back along the passage 33 and washes over the cups or pockets 31 to bridge the mercury contained therein. By this arrangement the circuit is made and broken in the mercury, as in the previous cases. The present construction however has the disadvantage of contacts permanently immersed in the mercury, so that there is always the possibility of a leak completing itself across the partition between the pockets 31 to short the switch. In my other forms there is no possibility of a short being created across the contacts when the tumbler is in the open switch position, since the mercury at that time is entirely out of engagement with the contacts.

Another modified form of switch embodying the improvements of my invention is shown in Figure 6. In this case a solid conducting body or ball 34 is employed instead of a fluid body. This ball may be of any suitable material, such as carbon, and is preferably weighted with a lead core 36. The conducting body moves into the handle portion of the tumbler as in the previous cases. In the present instance the bottom portion of the bore is V-shaped, so that the studs 8 present sloping contacts 37 upon which the ball 34 may ride. In the closed switch position the weighted ball rests upon the contacts 37 to complete the circuit through the switch.

In conclusion it is pointed out that the noiseless action of my switch makes it particularly desirable for use in hospitals. The externally arcless feature eliminates fire hazard and improves the switch for all uses, and particularly in the presence of inflammable gases such as in service stations. The fuse action in my switch makes it possible to safely use portions of the mercury container itself as the handle for operating the switch. The chambered handle projecting through the wall plate for receiving the conducting body in one of the switch positions is a feature of construction which permits the making of a mercury switch in simulation of that toggle type flush wall switch, without exceeding the overall dimensions now standardized in such switches.

I claim:

1. A switch comprising a tumbler having a bore therein, a body of mercury in the tumbler, a plate across the bore adjacent its opening to provide a cup, and a body of fusible material in the cup for closing the bore.

2. A switch comprising a wall plate, a hollow tumbler having a base portion positioned behind the wall plate and having an elongated portion projecting through the plate to provide a handle, electrical conducting brackets terminating in bearings and mounted behind the wall plate, electrical conducting trunnions on the tumbler mounted on the base portion behind the wall plate and journaled in said bracket bearings for mounting the tumbler for pivotal movement between open and closed switch positions and extending into the tumbler to provide contacts, a body of conducting fluid in the tumbler for closing the circuit through the contacts, and electrical conducting springs connected between the brackets and trunnions for snapping the tumbler from one to the other of said switch positions.

3. A switch comprising a wall plate, a tumbler

mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, a cover plate across the bore behind the contacts, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

4. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, means for dividing the fluid between the contacts and behind the wall plate, a cover plate across the bore behind the contacts, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

5. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, means for dividing the fluid between the contacts and behind the wall plate, said bore being enlarged behind the contacts to provide a shoulder, a cover plate across the bore and seated against said shoulder, and a body of fusible material in the enlarged portion of the bore behind the cover plate to seal the tumbler.

6. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, a partition insertably mounted in the tumbler and extending longitudinally of the bore for dividing the fluid between the contacts, a cover plate across the bore behind the partition to hold the latter in place, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

7. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate

mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, a barrier insertably mounted in the bore between the contacts and the handle end of the tumbler for restricting the flow of said fluid, a partition insertably mounted in the bore and extending rearwardly of the barrier for dividing the fluid between the contacts, a cover plate across the bore behind the partition for holding the latter and the barrier in place, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

8. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, said bore being enlarged rearwardly of its intermediate portions to provide a shoulder forwardly of the contacts, a barrier in the bore and seated against said shoulder for restricting the flow of said fluid, a partition in the bore behind the barrier for dividing the fluid between the contacts, a cover plate across the bore behind the partition, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

9. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate to provide a handle, said tumbler having a longitudinal bore extending from the rear end of the tumbler and projecting into the elongated portion to provide a chambered handle outside the wall plate, contacts in the tumbler behind the wall plate, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position and flowable along the bore and into the chambered handle in the open switch position, said bore being enlarged rearwardly of its intermediate portions to provide a shoulder forwardly of the contacts, a barrier insertably mounted in the bore and seated against said shoulder for restricting the flow of said fluid, a partition formed integrally with the barrier and extending rearwardly therefrom for dividing the fluid between the contacts, a cover plate across the bore behind the partition for holding the latter and the barrier in place, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

10. A switch comprising a wall plate, a tumbler mounted back of the plate for movement between open and closed switch positions and having an elongated portion projecting through the plate

to provide a handle, contacts in the rear end of the tumbler behind the wall plate, said tumbler having a bore extending from the rear end of the tumbler between the contacts, a body of conducting fluid in the tumbler for bridging the contacts in the closed switch position, a partition in the bore for dividing the fluid between the contacts and behind the wall plate, a cover plate across the bore behind the partition, and a body of fusible material in the bore behind the cover plate to seal the tumbler.

11. A switch comprising a chambered tumbler mounted for movement between open and closed switch positions, contacts in the chamber, a body of mercury flowable in the chamber for bridging the contacts in the closed switch position, means extending transversely across the chamber for restricting the flow of mercury from the closed to the open switch positions, and a partition extending longitudinally of the chamber for dividing the mercury to open the circuit.

12. A switch comprising a wall plate, a hollow tumbler mounted behind the wall plate and hav-

ing an elongated portion projecting through the plate to provide a handle, contacts in the tumbler, a body of mercury flowable in the tumbler for bridging the contacts, means for restricting the flow of mercury away from the contacts, and means behind the restricting means for dividing the mercury between the contacts to open the circuit before all the mercury has bled past the restricting means.

13. A mercury switch comprising a hollow tumbler, oppositely disposed journals adjacent one end of the tumbler for mounting the latter for pivotal movement and extending into the tumbler to provide contacts, a body of mercury in the tumbler for bridging the contacts and flowable away from the latter to open the circuit, means positioned across the tumbler ahead of the contacts for restricting the flow of mercury away from the contacts, and a mercury severing partition behind the restricting means and arranged between the contacts for dividing the mercury to open the circuit while the mercury is bleeding past the restricting means.

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