

Jan. 14, 1930.

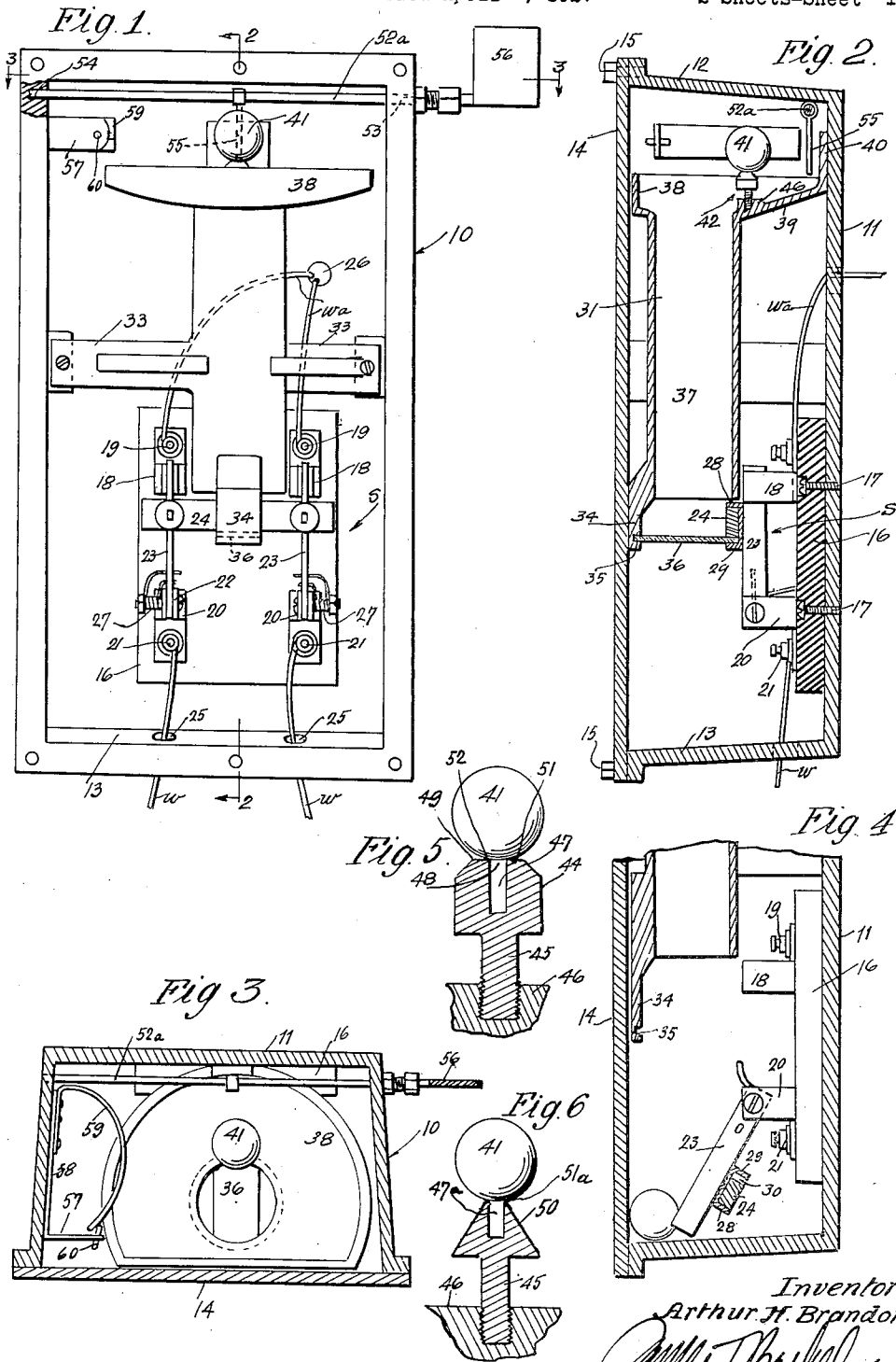
A. H. BRANDON

1,743,314

DEVICE FOR OPERATING ELECTRIC SWITCHES.

Filed April 5, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 7.

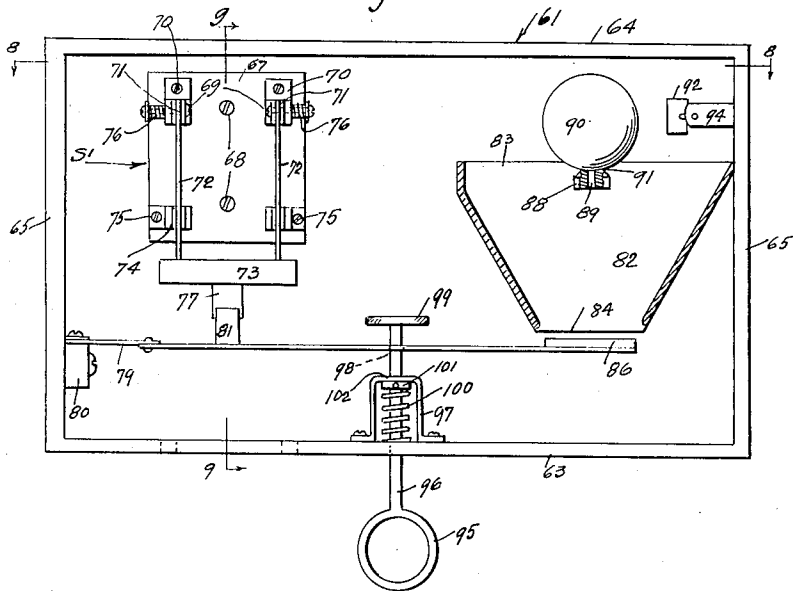


Fig. 8.

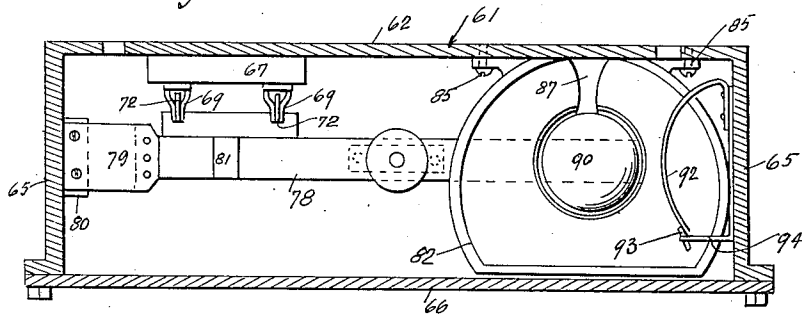
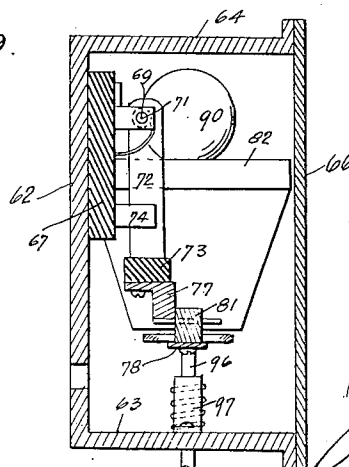


Fig. 9.



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DEVICE FOR OPERATING ELECTRIC SWITCHES

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This invention relates generally to devices for operating electric switches, and may be more particularly characterized as means for operating such switches through displacement of a weight. There have heretofore been provided devices wherein a weight, after predetermined extent of fall, itself closes a gap in a circuit, and thereby causes the actuation of electrically operated devices such as warning bells, etc. The present invention is broadly distinguished from the prior art by reason of the fact that the weight, in its displacement, does not itself provide the current bridge across the circuit gap, but rather actuates a switch element, which latter, in its actuation, is adapted to control a circuit. This actuation, under the influence of the displaced weight, may either be one which opens or one which closes a circuit, though in the illustrative embodiment here shown such actuation is a circuit-opening one.

It may therefore be considered as the general object of the invention to provide a switch element which is selectively movable to a plurality of positions, there being provided in association with said element a weight mounted for displacement, and means actuated by virtue of weight displacement to cause movement of the switch element from one position to another. Broadly, the causation may either be direct actuation by the weight, or it may be in the nature of a release for the element whereby other power means may be allowed to come into play in a manner causing such movement. It is the latter that is true in the illustrated embodiment of the invention, though it will be understood this is in no way limitative on my broader claims. Preferably, though not necessarily, the mounting of the weight and means associated with the weight are such that weight-displacement may be accomplished by any one of three agencies; namely, exertion of force directed manually thereagainst, thermal-controlled means, or disturbances such as shocks and vibrations incident to the occurrence of explosions or earthquakes. It is particularly in connection with the latter that my device has its greatest field of usefulness, and

therefore I will confine the major portion of the following descriptive matter to the functioning of the device in such situations.

In the event of earthquakes or other vibratory disturbances of a severe character it often occurs that fire results from broken electrical circuits. However, by installation of one of my devices in such circuits where they enter buildings, for instance, the vibrations set up cause displacement of the weight, thereby actuating a switch which serves either directly or indirectly to open the circuit at point of entry to the building, thereby avoiding the danger of fire by electrical discharge. It will thus be seen that my devices may be considered as a vibratory power shut-off.

In the preferred embodiment of the invention, though this is in no way limitative on my broader claims, the electric switch is automatically openable, there being provided a trigger or holding device normally restraining the switch from automatic actuation, the circuit thus being kept normally closed. The trigger is of a frangible nature and so located that the weight, in its fall, is adapted to break it, thereby releasing the switch for automatic actuation to open the circuit. However, the particular nature of the switch and its restraining device may be described to better advantage in the following detailed specification which also discloses variational structures for accomplishing the same end.

The manually controlled means for displacing the weight is of such form that it may be actuated by authorized persons, such as firemen, policemen or others in authority, in the event an emergency arises when quick and complete power shut-off is necessary and immediate access cannot be had to the usual switches. The attachment allowing such willful dislodgement or displacement of the weight may be operated by striking an exposed element by hand or with any suitable striking device, or, under certain circumstances, by impinging or projecting a stream of water thereagainst.

The thermal-controlled means for displacing the weight is such that if the temperature

about the device reaches a predetermined degree, fusing takes place and releases a striker adapted to dislodge the weight.

With the above general characteristics in mind, I will now proceed to a more detailed description of the invention, wherein other objects and novel features will be made apparent. Reference will be had to the accompanying drawings, in which:

Fig. 1 is a front elevation of a device embodying my invention, said device being housed within a box whose cover is here shown as being removed;

Fig. 2 is a section on line 2—2 of Fig. 1, but showing the cover in place;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view similar to the lower part of Fig. 2 but showing the parts in different positions;

Fig. 5 is a medial section through the weight stand, showing the weight disposed thereon;

Fig. 6 is a view similar to Fig. 5 but showing a variational form of stand;

Fig. 7 is a front elevation of a variational embodiment of my invention;

Fig. 8 is a section on line 8—8 of Fig. 7; and

Fig. 9 is a section on line 9—9 of Fig. 7.

In Figs. 1 to 4, inclusive, I have illustrated a housing 10 made up of back-wall 11, top 12, bottom 13, and a cover plate 14 detachably secured to top and bottom at 15. An insulating block 16 is secured to wall 11 at 17 and carries a pair of switch contacts 18 to which electrical connection is adapted to be made through binding posts 19. Block 16 also carries posts 20 having terminals 21, said posts pivotally supporting at 22 the switch blades or knives 23. The free ends of said blades are connected by insulating bar 24 so as to move as one about pivot points 22. Wires W enter the box through bottom openings 25, leading from the source of electrical energy to terminals 21, while wires W^a lead from posts 19 through apertures 26 in wall 11 to the building circuit.

It will be seen that blades 23 comprise switch elements which are movable selectively to the positions of Figs. 2 and 4, and that when they are in the position of Fig. 2, they are adapted to bridge the gap between posts 20 and contacts 18 to establish electrical connection between wires W and W^a, while, when they are in the position of Fig. 4, the circuit of which wires W, W^a may be a part, is open. The switch made up of the contacts, posts, terminals and blades hereinbefore specified, is generally designated at S, and may be considered in closed condition in Figs. 1 and 2 and in open condition in Fig. 4.

Coiled about pins 22, which pivotally connect blades 23 to posts 20, are springs 27, these springs being tensioned to exert a switch opening pressure on blades 23. Secured to bar 24 at a point substantially midway between

blades 23, is a channel-shaped bracket 28, the lower flange 29 thereof preferably being spaced slightly below the lower edge of the bar to provide an outwardly opening notch 30.

A vertically arranged, cylindrical tube 31 is detachably held to wall 11 by arms 33, the lower end of the tube extending between contacts 18. Depending from the end of the tube and at the side opposite bar 24 is a lug 34 having a notch 35 which is in horizontal alignment with notch 30 when the switch is closed. A restraining device or trigger 36, made of glass or other suitable frangible material, extends from lug 34 to bar 24, the ends of the trigger being disposed in notches 30, 35. The trigger is thus supported in vertical alignment with the bore 37 of tube 31, and is of a length to hold switch S against the tendency of springs 27 to open it. In other words, member 36 may be considered as a device normally holding the automatically opening switch against operation or as holding switch element 23 against movement from one position to another. Member 36 may be more broadly considered as a circuit controlling element since it normally acts through the switch to maintain the circuit in a given condition and if it be broken it acts through a switch to change the condition of the circuit.

At the upper end of tube 31 is a cup-like structure 38 whose bottom wall 39 inclines inwardly and downwardly toward bore 37. An upwardly extending tongue 40 on the cup is secured in any suitable manner to wall 12, it being noted that the axis of the cup portion is horizontally offset from the vertical axis of bore 37.

A weight 41, preferably in the form of a ball, is displaceably supported in such a manner that after displacement it is adapted to drop through tube 31. My invention broadly contemplates, and therefore certain of my claims are to be considered as broadly covering, any suitable means for displaceably mounting the ball in a manner whereby said ball, in its displacement, is adapted to actuate switch S or its equivalent, it being noted that this actuation is not of a character where the weight itself becomes a conducting element in an electrical circuit. However, I have here shown and will describe a preferred mounting for the ball, this mounting having characteristics which are individually novel and particularly effective. In the illustrated embodiment the support for the ball is offset from the bore of tube 31, but it will be readily appreciated that this is not an essential characteristic, considering the invention in its broader aspects.

A standing or supporting member, generally indicated at 42, is provided on cup bottom 39 for supporting ball 41 adjacent bore 37. This stand is shown, in Figs. 2 and 5, as including a cylindrical head 44, having a coaxial shank 45 threaded into the lug 46 which

projects upwardly from bottom 39. Head 44 provides the seat for ball 41, and for reasons that will be made apparent, it is desirable that the device be adapted to take seats of different characteristics, though, for a given installation, a seat of given characteristics once chosen will ordinarily remain in use. The threaded connection between the stand-shank and lug provide for this replaceability of supporting or seat-members.

It is desirable that the ball be displaced only when disturbances, as from explosions or earthquakes, are of a nature to do damage. In other words, when the disturbances are of a minor nature it is decidedly desirable that the ball remain seated. I have provided a type of support which is capable of being so constructed that the ball remains seated thereon under vibrations or shocks of a minor nature or predetermined characteristics, and yet insures that the ball will be unseated therefrom when the characteristic of the vibration is such that damage might be caused. The seat is of a nature which permits of accurate calculation to determine its ball-supporting characteristics under given conditions, and has a further feature in that it does not permit the accumulation of extraneous matter between the ball and seat. It will be readily appreciated that were the entrance of such matter to be permitted, the ball either would not seat with sufficient accuracy to respond properly under given conditions or that such matter might well tend to hold the ball by adhesion undesirably against displacement. The character of the seat is also such that there is practically no danger of the ball and seat rusting together, or of corrosion of the seat in a manner tending to prevent proper seating of the ball.

The construction shown in Fig. 5 is one which has the features enumerated above and permits of scientific calculation to determine accurately the critical degree of vibration which will cause unseating of the ball. Thus, head 44 has a coaxial vertically extending bore 47 which opens at 48 to the upper end 49 of the head. The side walls of the head or stand have portions inclining downwardly and outwardly from the horizontal face 51 of end 49, or, expressed otherwise, the upper end of the head has conical characteristics. Or, as shown in Fig. 6, the stand may be considered as a cone 50 arranged base down and having an upwardly opening axial bore 47^a, the ball 41 being seated on the annular edge 51^a presented at the upper end of the cone and internally defined by the upper end of bore 47^a.

In the form shown in Fig. 5, ball 41 is seated on the relatively sharp annular edge 52 presented by the intersection of the bore-defining wall and face 51. In either event, it will be seen that a relatively sharp annular edge is presented as a seat for the ball, there

thus being minimum contact between the ball and stand, and clearance being provided by the bore directly beneath the ball to prevent the accumulation of extraneous matter, to the advantageous ends mentioned above. The character of the head is such that if the ball be displaced from the annular seat, there is no likelihood of it moving back to seat, but rather that once the ball is dislodged from the seat it can do nothing but fall.

It is desirable to use balls of different diameters for actuating switches of different sizes or characteristics, and therefore it is necessary to use seats of different sizes if the ball is to be displaced under given conditions irrespective of its size. It has been found by experiment and calculation that the following relative sizes of balls and seats have the proper characteristics as regards ball-displacement under given conditions, though it will be understood that the sizes given are not limitative, since it may be desired that the ball respond under conditions other than those stated below. Assuming that it is desirable that the ball be dislodged and hence that switch S be actuated when earthquakes occur which have a magnitude of at least VIII on the Rossi-Forel scale and have an acceleration cm/sec² of 50, 60 or 80, if the ball is of 1 1/4 inch diameter the diameter of the bore in thousandths of an inch is calculated at 64, 76 and 102, respectively; for a 1 1/2 inch ball, 77, 92 and 122, for 2 inch ball 102, 122 and 163, respectively; for 2 3/4 inch ball 140, 168 and 224, respectively; for 3 3/4 inch ball 191, 230 and 305, respectively; for 4 3/4 inch ball 242, 290 and 387, respectively.

When the ball is dislodged from its seat, it drops either directly into tube 31 or is guided thereinto by the cup bottom, it being noted that the ball is mounted for displacement in any direction, and that irrespective of direction of fall it is directed into tube 31. The tube may be considered as means for guiding the ball in its fall, and it will be seen that the releasable restraining element or frangible trigger 36 is arranged in this path of fall. Consequently, when the ball drops, it strikes the frangible trigger, the extent of drop being such that the impact of the ball against said trigger breaks the glass, releasing the ball for further drop and allowing springs 27 to swing blades 23 out of contact with members 18 and thereby open the switch, as shown in Fig. 4 and to the ends stated above.

I have provided means whereby ball 41 may be displaced by willful effort on the part of firemen, policemen or other authorized persons should occasion arise for opening switch S during an emergency. For this purpose, I provide a rock-shaft 52^a which extends through bearing 53 on one side of the housing and is journaled at 54 in a socket at the other side of the housing. A finger or striker

55 is attached to shaft 52^a at a point within the box and is so positioned that rotation of shaft 52^a, in a clockwise direction, as viewed in Fig. 2, carries the striker into contact with the ball and thus dislodges it from seat 52, whereupon it drops through the tube and actuates the switch in the manner described. While any suitable means may be provided for rocking the shaft, I prefer to utilize a blade 56 on shaft 52^a at a point without the housing. This exposed blade may either be grasped by the hand of the operator to rotate the shaft, or it may be struck, in a manner to rotate the shaft, by a projectile, tool, or a projected stream of water from a fire hose.

I also provide means whereby the ball may be dislodged by reason of temperature changes. I have here shown such thermal-controlled means as including a stud 57 projecting from and secured to a side wall of the housing by angular base 58. A leaf-spring 59 is held under tension or in bowed condition by a fusible pin 60 mounted near the free extremity of stud 57. Pin 60 is of a nature to fuse at a predetermined temperature, and if a fire causes a raise in temperature to the critical degree, the pin fuses and thereby releases the spring 59 from its restraint. The spring is so located and of such proportionate length that as it flies to released position it acts as a striker against ball 41, the ball thus being dislodged from seat 52 and then dropping to break the frangible trigger and allow automatic opening of the switch.

In Figs. 7, 8 and 9 I have disclosed a variational embodiment of the invention, wherein the housing 61 is made up of a rear wall 62, adapted for attachment to a building or any other suitable supporting structure, bottom wall 63, top wall 64, and side walls 65, there preferably being provided a detachable cover 66. An insulating block 67 is secured at 68 to wall 61 and carries posts 69 which are in electrical connection with terminals 70. Posts 69 provide at 71 pivotal connections for switch blades 72 which are joined at their free ends by insulating bar 73. The switch blades are adapted to be swung into and out of engagement with contact members 74 which are carried by block 67 and are in connection with binding posts 75. Springs 76 are applied to blades 72 in a manner tending yieldably to swing blades 72 from the position of Figs. 7 and 9, that is, out of contact with members 74 to open the switch.

I then provide means for releasably holding the switch against operation from the position of Fig. 9, or against the action of springs 76. For this purpose, I utilize a lug or shoulder 77 depending from bar 73. A bar 78 is resiliently connected, as by leaf-spring 79, to a bracket 80, preferably of insulating material, supported from one of the end walls of the housing. Projecting upwardly from bar 78 is a trigger or shoulder

81, also preferably of insulating material, this shoulder 81 lying in the path of lug 77 and, when the bar is in the horizontal position shown, acting against the lug in a manner to hold blades 72 in contact with members 74 against the opening action of springs 76.

A cup or hollow cone structure 82, open both at top 83 and bottom 84, is secured to wall 62 at 85, end 84 being disposed directly over a circular plate 86 provided on the free extremity of bar 78, this bar being yieldably, normally held in the horizontal position illustrated by spring 79.

An arm or bridge 87 extends from the back of the cone structure and carries a seat or supporting member 88, which is preferably, though not necessarily, in vertical alinement with blade 86. Member 88 has a vertical bore 89 extending therethrough and ball 90 is adapted to seat on the annular edge 91 defining this bore at its upper end, the nature of the ball-taking seat of ring member 88 thus being generally similar to and having certain of the advantages of the seat or supporting structure described in connection with the other views.

In the event ball 90 is dislodged from its seat, it drops downwardly through cone 82, said cone serving to guide it to blade 86, the ball striking this blade with sufficient force to swing bar 78 downwardly about its resilient support. This downward movement clears trigger 81 from the path of lug 77, and springs 76 are then free to swing blades 72 in a counterclockwise direction, as viewed in Fig. 9, in a manner to disengage them from contacts 74 and thereby open the switch. It will be understood that the switch S', made up of the elements heretofore described, may be placed in circuit in the usual manner, the opening of the switch serving to open the associated circuit.

The dislodgment of the ball may be accomplished either by reason of earth disturbances of predetermined character or by reason of temperature changes, as described in connection with the other views. The thermal-controlled device for displacing ball 41 is here shown as a leaf-spring 92 held in bowed condition or under tension by fusible plug 93 which is supported from the housing by bracket 94. In the event the temperature rises to the fusing point of plug 93, said plug, in its fusing, releases spring 92 from restraint, the spring in its movement striking the ball and dislodging it from its seat, to the end described above.

When occasion arises for opening switch S' manually, this may be done by grasping or applying a hook to ring 95 provided on stem 96 and pulling down thereon. Ring 95 is exposed beneath the housing, while stem 96 is mounted for vertical sliding movement through housing bottom 63 and a frame 97 which extends upwardly from said wall with-

in the housing. Stem 96 continues upwardly through an aperture 98 in bar 78 and terminates in a head 99 which is preferably held slightly above the bar by means of a coiled spring 100 which encircles the stem between bottom 63 and a stem-carried collar 101. This collar engages the underside of the cross bar 102 of frame 97 to limit the upward movement of the head and stem under the influence of the spring.

It will be seen that by pulling down on ring 95, head 99 is brought into contact with bar 78, and the bar is thus swung downwardly about its resilient connection 79 in a manner to clear trigger 81 from lug 77 and thereby allow the switch to be opened automatically by springs 76.

While I have illustrated both switches S and S' as applied to a two-wire circuit, it will be readily understood that a three-wire or other type of switch may be employed with equal advantage, or that the switch may be utilized to open only one side of a circuit. Furthermore, my invention broadly contemplates operation of a switch by displacement of a weight whether this operation be a closing or opening one. In other words, the ball may be adapted, in its displacement, to close a normally open switch and thereby close an associated circuit which, in turn, may actuate alarm mechanism or valve-closing mechanism.

It will also be understood that a replaceable ball supporting stand such as those shown in Figs. 5 and 6 may be substituted for the ring type shown in Fig. 7 or vice-versa.

It will be understood the drawings and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

I claim:

1. In the art described, the combination of an electric switch element movable from a given position, means releasably holding said element in the given position, a weight seated for displacement by vibrations or shocks and free to fall after such displacement, said holding means having a member extending into the path of fall of the weight, and said weight being adapted, in its fall, to act on the member in a manner to release said element for movement from said given position.

2. In the art described, the combination of an electric switch element selectively movable to a plurality of positions, a weight mounted for displacement, means actuated by virtue of weight displacement to cause movement of the element from one position to another; and manually operated means to displace the weight.

3. In the art described, the combination

of an electric switch element selectively movable to a plurality of positions, means releasably holding the element in one position, a weight supported in association with the holding means and mounted for displacement, said weight being adapted to act on the holding means, by virtue of weight displacement, in a manner to release said element for movement from said one position; and manually operated means to displace the weight.

4. In the art described, the combination of an electric switch element selectively movable to a plurality of positions, means releasably holding the element in one position, a weight supported in association with the holding means and mounted for displacement, said weight being adapted to act on the holding means, by virtue of weight displacement, in a manner to release said element for movement from said one position, and thermal controlled means to displace the weight.

5. In the art described, the combination of an electric switch element selectively movable to a plurality of positions, a weight mounted for displacement, means actuated by virtue of weight displacement to cause movement of the element from one position to another, a spring associated with the weight, and a fusible device restraining the spring in tensioned condition, said spring being positioned to displace the weight when it is relieved from tension by virtue of the fusing of the restraining device.

6. In the art described, a seat, a weight mounted on the seat for displacement therefrom, a spring associated with the weight, and a fusible device restraining the spring in tensioned condition, said spring being positioned to displace the weight when it is relieved from tension by virtue of the fusing of the restraining device.

7. In the art described, the combination of an electric switch, means tending to operate the switch, a trigger device normally holding the switch against operation, and a weight mounted for displacement by vibrations or shocks, said weight being adapted, by virtue of its displacement, to actuate the trigger and thereby allow operation of the switch by said operating means.

8. In the art described, the combination of an electric switch, means tending to operate the switch, a trigger device normally holding the switch against operation, a weight mounted for displacement by vibrations or shocks, means for guiding the weight in its movement of displacement, said weight being adapted, by virtue of its displacement, to actuate the trigger and thereby allow operation of the switch by said operating means.

9. In combination, an automatically operable electric switch, a frangible member restraining said switch from operation, and a weight seated for displacement by vibrations

or shocks and free to fall after such displacement, said member being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible member and thereby release the switch for automatic operation.

10. In combination, an electric switch, a frangible member restraining said switch from operation, and a weight seated for displacement by vibrations or shocks and free to fall after such displacement, said member being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible member and thereby release the switch for operation.

11. In combination, an electric switch, a frangible member restraining said switch from operation, a weight seated for displacement and free to fall after such displacement, said member being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible member and thereby release the switch for operation, and manually operated means to displace the weight.

12. In combination, an electric switch, a frangible member restraining said switch from operation, a weight seated for displacement and free to fall after such displacement, said member being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible member and thereby release the switch for operation, and thermal controlled means for displacing the weight.

13. In combination, an electric switch, a frangible member restraining said switch from operation, and a weight seated for displacement by vibrations or shocks and free to fall after such displacement, means for guiding the weight in its fall, said member being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible member and thereby release the switch for operation.

14. A device of the character described embodying an electric switch, a housing, a weight seated within the housing for displacement to operate the switch, a movable element within the housing positioned to be moved to strike the ball and thereby displace it, and means outside the housing connected to the movable element for moving it.

15. A device of the character described embodying an electric switch, a housing, a weight seated within the housing for displacement to operate the switch, a movable element within the housing positioned to be moved to strike the ball and thereby displace it, and a blade outside the housing and connected to the movable element for moving it, said blade being actuatable to move the element by virtue of means projected thereagainst.

16. In a power shut off, a seat having a

weight mounted thereon, a manually operated device to unseat the weight, the weight being free to fall after it is unseated, and means controlled by the falling of the ball to actuate an electric switch.

17. In the art described, the combination of a frangible electric-circuit-controlling element, and a weight seated for displacement by vibrations or shocks and free to fall after such displacement, said element being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible element.

18. In the art described, the combination of a frangible electric-circuit-controlling element, a weight seated for displacement and free to fall after such displacement, said element being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible element, and manually operated means for displacing the weight.

19. In the art described, the combination of a frangible electric-circuit-controlling element, a weight seated for displacement and free to fall after such displacement, said element being disposed in the path of fall of the weight, said weight, in its fall, being adapted to break the frangible element, and thermal controlled means for displacing the weight.

In witness that I claim the foregoing I have hereunto subscribed my name this 22nd day of March, 1927.

ARTHUR H. BRANDON.

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