June 5, 1934. J. R. HARRINGTON 1,961,146

SWITCH

Original Filed Nov. 12, 1931

Fig. 1

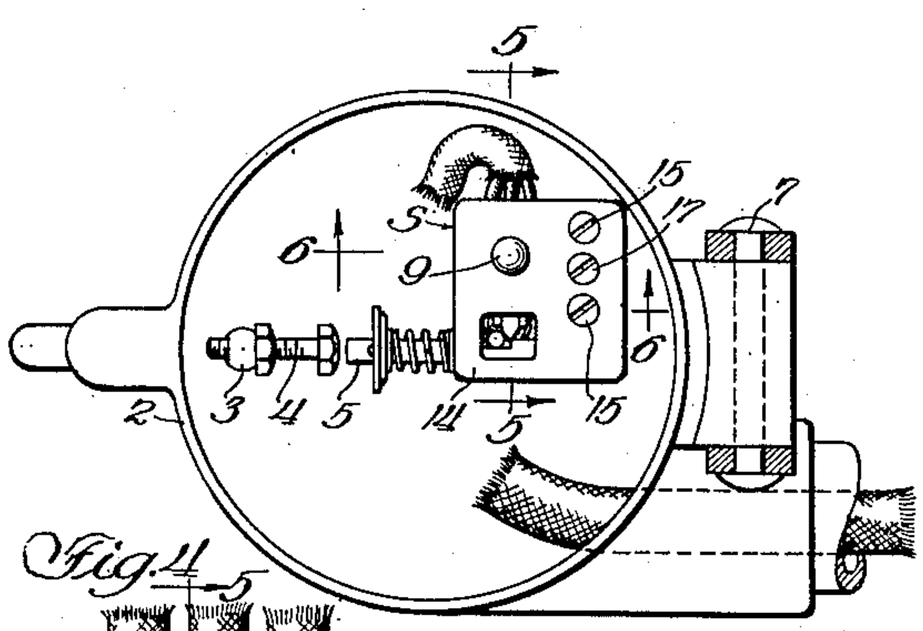



Fig. 2

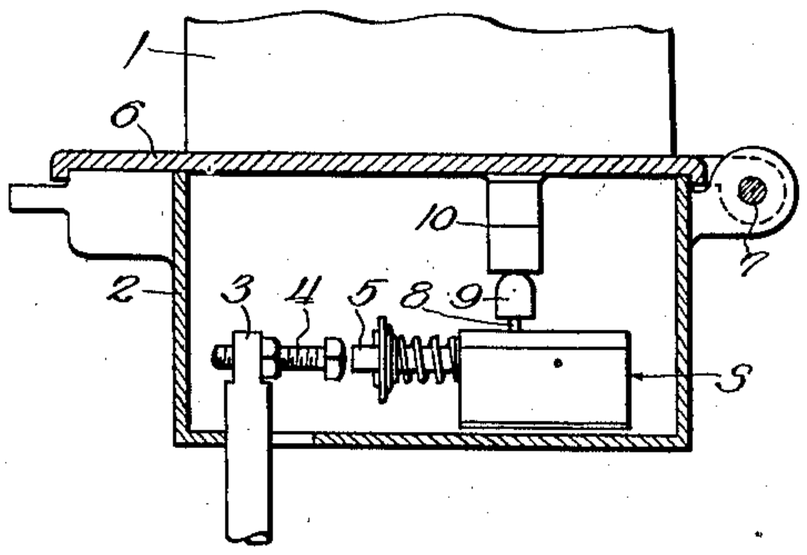



Fig. 4

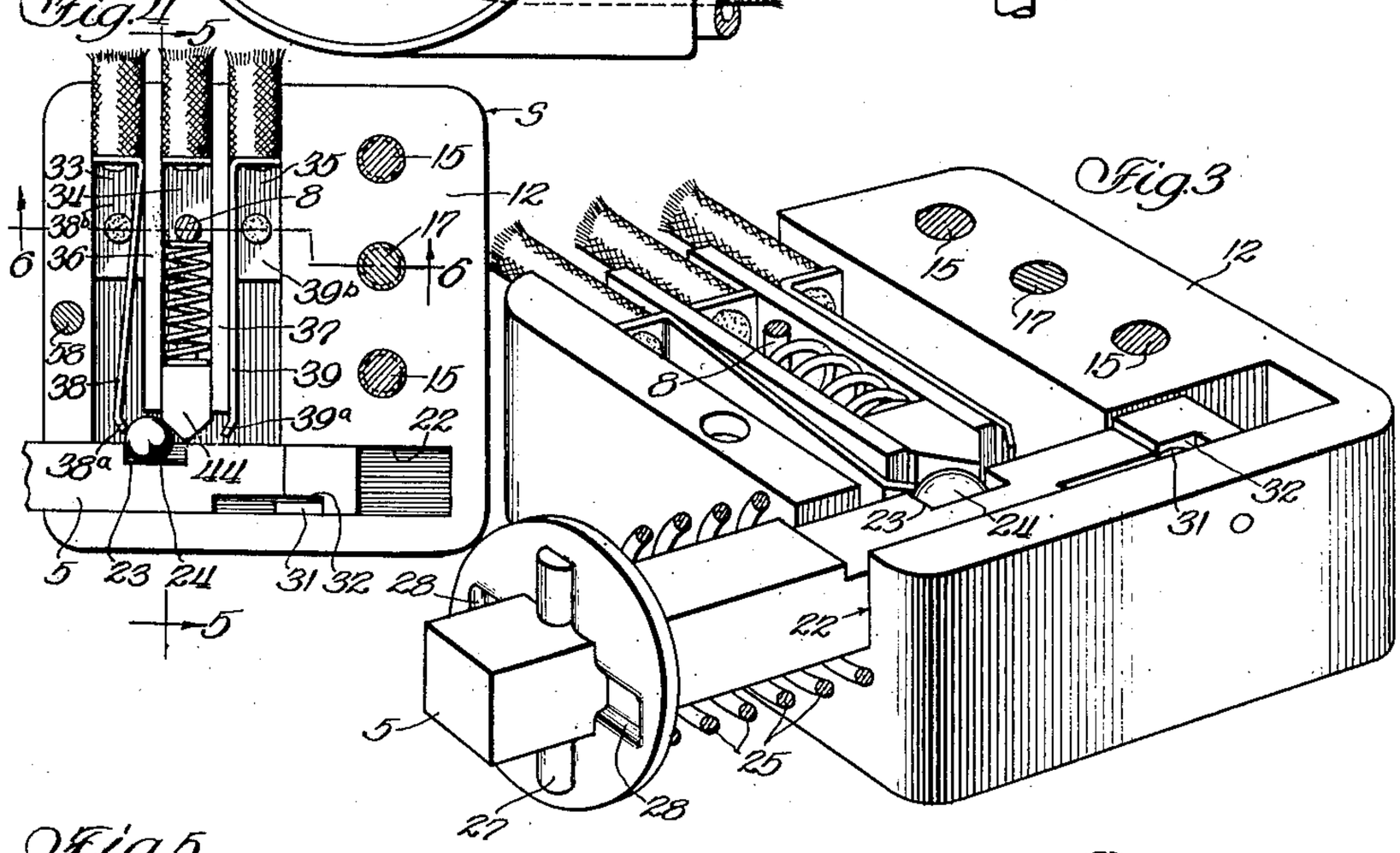



Fig. 3




Fig. 5

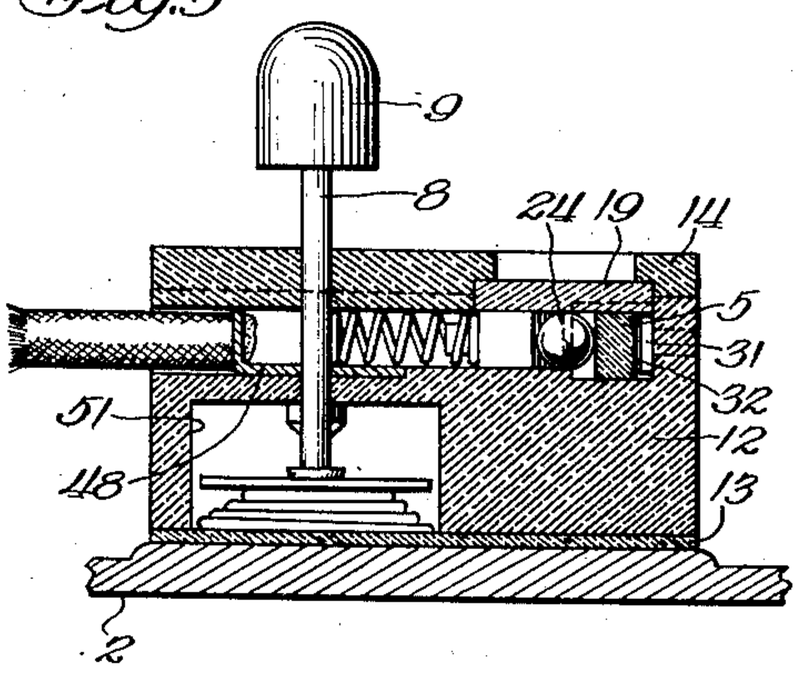
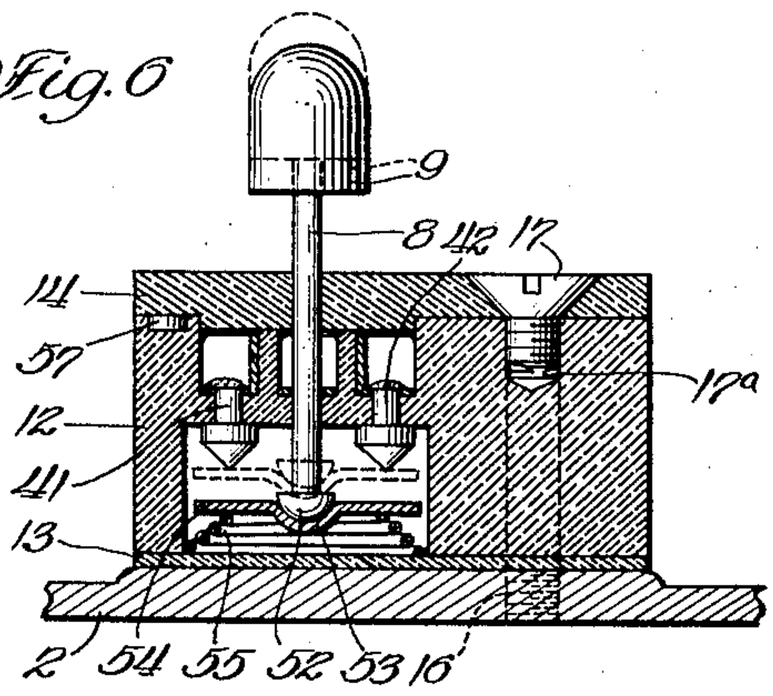



Fig. 6

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# UNITED STATES PATENT OFFICE

1,961,146

## SWITCH

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Application November 12, 1931, Serial No. 574,503
Renewed October 21, 1933

27 Claims. (Cl. 200—5)

The present invention relates to switches and has as its general object to provide a construction which can be embodied in small, compact form and which is reliable, yet very inexpensive in manufacturing and assembly costs.

Another object is to provide an improved three-point switch in which the making and breaking of the circuit connections is effected by a shifting ball.

Another object is to provide a switch characterized by this shiftable ball contact, wherein improved means is provided for giving the ball a snap motion.

Another object is to provide an improved three-point switch wherein the opening of a circuit between two switch contacts and the closing of the circuit between two contacts is performed by a simple reciprocatory motion of a switch actuating member.

Another object is to provide a switch combination in which a main switch structure has cooperating with it a secondary, tamper switch which performs a certain circuit controlling operation in the event of any one tampering with apparatus associated with the main switch.

Another object of the invention is to provide a switch construction of the above general type in which the switch contacts are enclosed but are nevertheless visible at all times for inspection.

Other objects and advantages of the invention will appear in the following detail description of a preferred embodiment thereof. In the drawing accompanying this description:

Figs. 1 and 2 are views illustrating a typical use of my improved switch, being plan and vertical sectional views, respectively, of the lower portion of a signal transmitter housing;

Fig. 3 is a perspective view of the present switch with the cover plate removed;

Fig. 4 is a fragmentary plan view, with the cover removed, showing the relation of the contacts;

Fig. 5 is a longitudinal vertical section taken approximately on the plane of the line 5—5 of Fig. 4, and

Fig. 6 is a transverse sectional view taken approximately on the plane of the line 6—6 of Fig. 4.

In Figs. 1 and 2 I have illustrated my improved switch structure serving in the capacity of controlling a signalling transmitter of the type disclosed in my copending applications Serial No. 550,739 and No. 563,237. Such is one of the preferred uses of the improved switch, although it will be understood that it is adapted to other fields of utility as well. In this typical adaptation the transmitter is enclosed in a casing 1 which is mounted on a base housing 2. The present switch, indicated generally at S, is disposed in this base housing. The switch is to respond to the motion of a movable member 3 which extends up through an opening in the bottom of the housing 2. Said movable member is adapted to respond to any condition or operation to which it is desired that the signalling transmitter be made responsive: for example, the member 3 may be actuated by the opening and closing of a valve in order that the transmitter shall then signal the position of the valve; it may be actuated by a float so that the transmitter will signal conditions of high or low water level; or it may be actuated by a fire condition or any alarm condition or may be manually actuated whereby the transmitter will transmit signals corresponding thereto. An adjustable screw 4 mounted in the upper end of the actuating member 3 is adapted to impart end thrust to the switch actuating member 5 of the switch S. The transmitter 1 is secured to a plate 6 which serves as a cover for the housing 2. This cover is hinged to the base portion of the housing at 7 so that the cover can be swung up to provide access to the housing for inspection, etc. When the cover is swung up from its normal position it is desirable that the transmitter indicate that fact, so as to safeguard the device against tampering, also to prevent the possibility of an inspector swinging the cover back and forgetting to replace it. The tamper switch feature of my construction provides for this condition, the latter comprising a switch rod 8 projecting upwardly from the switch structure S and carrying an insulating button 9 on its upper end which is adapted to be engaged and depressed by any suitable projection 10 on the under side of the cover when the cover is in its normal position. When the cover is raised the tamper switch rod 8 is permitted to move upwardly and close certain contacts, as will hereinafter appear.

Referring now to the details of the switch structure S as illustrated in Figs. 3, 4, 5, and 6, it will be noted that it comprises a casing built up of a main body portion 12, a base plate 13 and a cover 14, all composed of hard rubber, bakelite or any other suitable insulating material. These three parts are secured together by screws 15 passing therethrough, said screws having their heads countersunk in the cover 14 and having their lower ends screwing into tapped holes 16 provided in the bottom of the main enclosing

casing 2. A third screw 17 also extends through the cover portion 14 and taps into a threaded hole 17*a* in the body portion 12 for holding the cover 14 to said body portion when the screws 15 are not in place. The cover 14 has a window opening therein adjacent to one corner, and recessed into the cover from the under side thereof is a pane of glass 19 closing this opening. This sight opening permits ready inspection of the switch contacts to make sure of proper operation after assembly and to check for any faulty operation during service.

The switch actuating member 5 is in the form of a slide bar projecting from the side of the main casing portion 12. Preferably, this slide bar is composed of insulating material and is of square or rectangular cross section for sliding in a square or rectangular guideway 22 formed in the molding of the casing portion 12. A notch 23 formed in the vertical side of said actuating bar receives a ball contact 24 which, in the reciprocation of said bar, is shifted into and out of engagement with the cooperating contacts which I shall presently describe. A compression spring 25 confined between the side of the casing and a washer 26 on the end of the actuating bar normally tends to project said bar outwardly. The washer bears against a pin 27 set in a hole formed in the end of the actuating bar. Preferably, the washer has a square hole setting over the square form of the actuating bar, and its outer face is punched with oppositely disposed pairs of depressions 28 for receiving the projecting ends of the stop pin 27, one of the two pairs of depressions receiving the stop pin 27 irrespective of how the washer is assembled over the actuating bar. The depressions 28 do not extend out to the periphery of the washer but have closed ends which engage the ends of the stop pin 27 and prevent the same from accidentally working out of its hole in the actuating bar 5. The inward and outward movements of said actuating bar are limited by the enlarged head portion of a stop pin 31 which is molded in the upper part of the casing portion 12. The opposite ends of a slot 32 formed in the upper vertical edge of the actuating bar 5 engage the stop pin 31 and limit both ends of the movement of the actuating bar.

Extending at right angles to the guide channel 22 are three parallel channels 33, 34 and 35 molded in the casing portion 12 and separated from each other by the partitions 36 and 37. Two leaf spring contacts 38 and 39 are set edgewise in the outer channels 33 and 35, being secured therein by angularly bent attaching portions 38*b* and 39*b* which engage in the bottoms of said channel recesses and which are rigidly fastened in place by pins 41 and 42 passing downwardly through said attaching portions 38*b* and 39*b*. The upper end portions of the contact springs 38 and 39 are free to flex toward and away from the partitions 36 and 37, normally tending to occupy a position in contact with or closely adjacent to these partitions. The upper ends of said springs are bent inwardly across the tops of the partitions to form "edge" contacts 38*a* and 39*a* for engaging alternately with the sides of the ball contact 24 when the latter is reciprocated by the slide bar.

Reciprocally mounted in the central channel or guideway 34 is a spring pressed plunger contact 44. This constitutes the third contact for cooperating with the two leaf spring contacts 38 and 39 and comprises a metallic block of rectangular cross section for sliding in said guideway, the lower end of said block having a short cylindrical extension over which is centered a compression spring 46. The lower end of said spring bears against the tamper switch rod 8 which passes down through the insulating body portion 12 of the switch casing. A connector clip 48 is seated in this central guideway, having a hole therethrough through which said rod 8 passes, the engagement between the spring, the rod and the connector clip, with the spring constantly pressing against the rod and base portion of the clip, establishing electrical connection between these parts.

The upper end of the plunger contact 44 is of wedge shape, having oppositely sloping surfaces which alternately bear against the ball contact 24. When the slide bar 5 is actuated in either direction the ball contact is snapped across the wedge shaped upper end of the contact 24. When the actuating member 5 has been moved either inwardly or outwardly and is maintained in that position the spring pressure of the wedge contact 44 exerts a continuous camming pressure for holding the ball 24 resiliently pressed against the edge contact of the adjacent leaf spring. Thus, with the slide bar 5 in either of its positions the ball contact is continuously maintained in resiliently wedged engagement between the contact 44 and one or the other of the leaf spring contacts 38, 39.

Referring now to the tamper switch parts, it will be seen from Figs. 5 and 6 that the tamper switch rod 8 extends from the connector clip 48 down into a cavity 51 formed in the underside of the main casing portion 12. Here this rod is formed with a semi-spherical head 52 which seats in the semi-spherical socket 53 of a disc contacting element 54. A spiral compression spring 55 is disposed under the disc 54, tending to move said disc and rod 8 up to the circuit closing position indicated in dotted lines in Fig. 6. The spiral form of spring 55 is preferable since it can be compressed into a smaller space, but other forms of springs might be used. The pins 41 and 42, which have their upper ends soldered or otherwise suitably secured to the angularly bent attaching portions 38*b* and 39*b* of the contact springs, have their lower ends formed or provided with conical heads which serve as contact points for cooperating with the contact disc 54. When said disc is allowed to move upwardly to its dotted line position, under the action of the spring 55, said disc engages both contact pins 41 and 42 and establishes an electrical connection between said pins and also between said pins and the tamper switch rod 8. The circular disc formation of the contact element 54 insures that this contact element will always engage with the contact pins 41 and 42 even if said contact element 54 should be rotated to different positions; and the rockable bearing established between the semi-spherical head 52 and socket 53 insures that the spring 55 will press the contact element 54 against the contact pins 41 and 42 with equalized spring pressure even if such contact pins should not project downwardly uniform distances. It will be seen from the foregoing that when the cover 6 of the transmitter installation is swung upwardly the tamper switch is permitted to move to closed position for establishing certain circuit relations between the contacts 38, 39 and 44 of the main switch and thereby effect a signal transmission.

As illustrated in Fig. 1, the glass sight window 19 is disposed directly over the main contacts

38, 39, 44 and the ball contact 24, so that the relation of these parts is instantly visible for inspection, with the switch actuating bar 5 in either of its positions. If desired, a short dowel pin 57 may be secured to the under side of the housing cover 14 for engaging in a recess 58 in the main housing portion 12, to insure proper assembly of the cover 14 on the main housing portion.

Attention is directed to the fact that the present switch structure does not require extreme accuracy in predetermining the limits of the reciprocating motion of the switch actuating bar 5, and that the actual motion imparted to this bar may vary appreciably from any exact predetermined motion without disturbing the proper operation of the switch. For example, the leaf spring contacts 38 and 39 can flex laterally to a considerable degree in paths substantially parallel to the path of movement of the switch actuating bar 5, and the ball 24 can have end play in its notch 23. The spring pressed plunger contact 44, in its ability to assume different projected positions along its line of movement substantially at right angles to the path of motion of the switch actuating bar 5, insures firm pressure being had against the ball and firm pressure of the ball against the adjacent leaf spring contact 38 or 39, even with inaccurately adjusted limits of movement of the bar 5 or variations occurring in the motion of said bar.

While the construction above described constitutes what I regard to be the preferred embodiment of my invention, nevertheless it will be understood that such is merely exemplary and that modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, and a switch actuating member adapted to move said ball from one position to the other.

2. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, and a switch actuating member reciprocating substantially at right angles to said spring plunger and adapted to move said ball from one position to the other.

3. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts and having a wedge shaped end, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, and a switch actuating member adapted to move said ball across the wedge shaped end of said spring plunger and alternately into and out of engagement with said spring contacts.

4. A switch comprising two laterally spaced leaf spring contacts, a spring plunger reciprocably mounted between said contacts, said contacts having spring ends capable of flexing toward and away from said spring plunger, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said spring contacts, and a switch actuating member adapted to move said ball from one position to the other.

5. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, said contacts having end portions turned inwardly towards each other, a ball adapted in one position to close a circuit between said spring plunger and the inturned end portion of one of said contacts and in another position to close a circuit between said spring plunger and the inturned end portion of the other of said contacts, and a switch actuating member adapted to move said ball from one position to the other.

6. A switch comprising two laterally spaced leaf spring contacts, a spring plunger reciprocably mounted between said contacts, said leaf spring contacts having end portions turned inwardly towards each other adjacent to said spring plunger, said plunger having a wedge shaped end adjacent to the inturned end portions of said contacts, a ball adapted in one position to close a circuit between said spring plunger and the inturned end portion of one of said contacts and in another position to close a circuit between said spring plunger and the inturned end portion of the other of said contacts, and a switch actuating member reciprocating substantially at right angles to said spring plunger and adapted to move said ball across the wedge shaped end of said spring plunger from one of the aforesaid positions to the other.

7. A switch comprising a mounting member having two spaced guides, a spring pressed plunger reciprocably mounted between said guides, two spring contacts disposed on the outer sides of said guides, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, and a switch actuating member adapted to move said ball from one of said positions to the other.

8. A switch comprising two spring contacts, a spring plunger reciprocably mounted between said contacts, a ball adapted to be moved across the end of said spring plunger from a position in engagement with one of said contacts to a position in engagement with the other of said contacts, and a switch actuating member adapted to move said ball from one of said positions to the other.

9. A switch comprising two laterally spaced contacts, a yieldable member mounted between said contacts, a switch actuating member, said yieldable member having movement both parallel to and normal to the axis of movement of said switch actuating member, and a device moved by said switch actuating member into and out of engagement with said contacts on opposite sides of said yieldable member.

10. A switch comprising a reciprocating switch actuating member, a bridging contact movable thereby substantially along the path of movement of said switch actuating member, two contacts movably mounted for motion substantially parallel to the path of movement of said switch actuating member and adapted to be engaged by said bridging contact, and a cooperating movable member arranged for movement in a path sub-

stantially at right angles to the path of movement of said switch actuating member.

11. A switch comprising a block having a guideway formed therein, a switch actuating member reciprocating in said guideway, three substantially parallel depressions in said block extending substantially at right angles to said guideway, spring contacts mounted in the two outermost depressions, a spring plunger reciprocably mounted in the intermediate depression, and a ball engaged by shoulders on said switch actuating member and adapted to be moved across the end of said plunger and into and out of engagement with said contacts.

12. In a switch of the class described, the combination of two laterally movable contacts, a spring plunger contact reciprocably mounted between said laterally movable contacts, a bridging contact adapted to establish engagement alternately between said plunger contact and one of said laterally movable contacts, and said plunger contact and the other laterally movable contact, a main switch actuating member adapted to move said bridging contact, and tamper switch contacts adapted to establish circuit connections between certain of said above named contacts.

13. In a switch of the class described, the combination of a main switch structure comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, a switch actuating member adapted to move said ball from one of the aforesaid positions to the other, and a secondary tamper switch structure adapted to establish a circuit connection between said two laterally spaced spring contacts.

14. In combination, a housing comprising a movable wall adapted to afford access to the interior of said housing, a switch structure in said housing, an operating member extending into said housing, said switch structure comprising main switch contacts adapted to make and break circuit connections upon the operation of said operating member, and secondary, tamper switch contacts adapted to modify circuit connections between said main switch contacts when said wall is moved to afford access to the interior of said housing.

15. In a device of the class described, the combination of a main switch structure comprising a pair of main contacts, a spring plunger and a ball cooperating therewith and adapted to engage said main contacts; and a tamper switch structure comprising contact extensions on said main contacts, and a bridging contact adapted to engage with said contact extensions.

16. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a ball adapted in one position to close a circuit between said spring plunger and one of said contacts and in another position to close a circuit between said spring plunger and the other of said contacts, a switch actuating member adapted to move said ball from one of said positions to the other, said laterally spaced spring contacts comprising contact extensions, a bridging contact adapted to engage with said contact extensions, a spring tending to force said bridging contact into engagement with said contact extensions, a rod for moving said bridging contact out of such engagement, and a rocking connection between said rod and said bridging contact permitting said bridging contact to rock relatively to said rod.

17. A switch comprising two main contacts, a movable member movable into and out of engagement with said main contacts, said main contacts comprising contact extensions, a disc contact adapted to engage with said contact extensions, spring means normally tending to force said disc contact into engagement with said contact extensions, a rod for moving said disc contact out of said engagement, and a ball and socket joint between said rod and said disc contact permitting rocking movement of said disc contact relatively to said rod.

18. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a reciprocable switch actuating member, a ball moved by said switch actuating member across said spring plunger and into and out of engagement with said laterally spaced spring contacts, a spring encircling said switch actuating member for normally tending to thrust the latter in one direction, a washer on said switch actuating member against which said spring bears, a pin extending through said switch actuating member, and depressions in said washer receiving the projecting ends of said pin and comprising end stops adapted to be engaged by the ends of said pin for preventing endwise displacement of said pin from said switch actuating member.

19. A switch comprising two laterally spaced spring contacts, a spring plunger reciprocably mounted between said contacts, a switch actuating member movable normal to the axis of said plunger, and a ball carried by said member and having lost motion connection therewith adapted in one position to close a circuit between said spring plunger and one of said contacts, and in another position to close a circuit between said spring plunger and the other of said contacts.

20. A switch comprising two laterally spaced contacts, a yieldable plunger mounted between and insulated from said contacts, a switch actuating member, means carried by and having lost motion connection with said actuating member and moved thereby into and out of engagement with said contacts on opposite sides of said yieldable member, resilient means associated with said contacts for providing engagement therebetween, and means normally spacing said last named means out of engagement.

21. In a device of the class described, a switch housing having a plurality of channels therein, laterally spaced spring contacts in two of said channels, a yieldable plunger in a third channel between and parallel to said first two channels, a switch actuating member including ball contact means reciprocable in a fourth channel normal to said first named channels, and means in said last named channel for limiting the reciprocatory movement of said member.

22. In a device of the class described, the combination of a main switch structure comprising a pair of main contacts, a spring plunger and ball cooperating therewith to engage said contacts, and a tamper switch structure comprising contact extensions on said main contacts, and resilient means adapted to provide a connection between said contact extensions.

23. In combination, a pair of spring contacts, a spring plunger therebetween, and a reciprocatory switch-actuating member having means for se-

lectively connecting either of said contacts with said plunger.

24. In combination, a pair of spring contacts, a spring plunger, switch means for selectively connecting said plunger to each of said contacts, extensions on said contacts, and resilient means normally tending to establish connection between said extensions.

25. A switch housing having a main channel receiving a switch actuating member, a plurality of normally extending channels having switch contacts disposed therein, means carried by said actuating member for selectively engaging said contacts, and a cover member for said housing having a sight opening therein at the junction of said channel.

26. A switch housing having a main channel receiving a switch actuating member, a plurality of normally extending channels having switch contacts disposed therein, means carried by said actuating member for selectively engaging said contacts, a cover member for said housing having a sight opening therein at the junction of said channel, and a recessed portion in said housing beneath said normally extending channels providing for connection between said switch contacts.

27. In combination, a switch housing having a projecting switch actuating member, a tamper switch structure having an operating member projecting from said housing, an enclosure for said housing, operating means entering said enclosure and adapted to engage said switch actuating member, a pivoted cover member for said enclosure having means for holding said tamper switch operating member in inoperative position, and spring means normally tending to move said operating member to operative position.

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