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J. R. THORP ET AL

**2,338,365**

SWITCH ASSEMBLAGE

Filed June 19, 1943

2 Sheets-Sheet 1

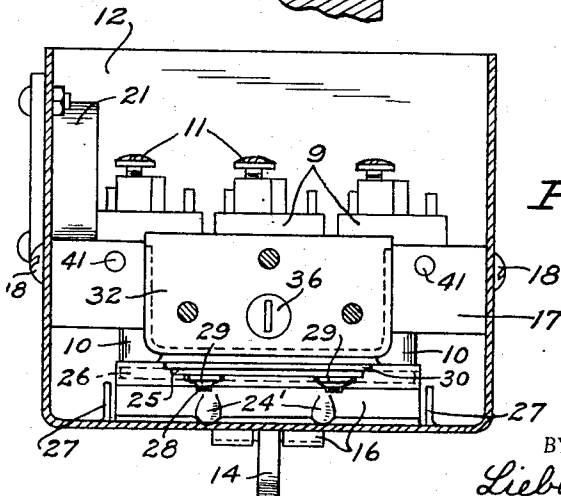
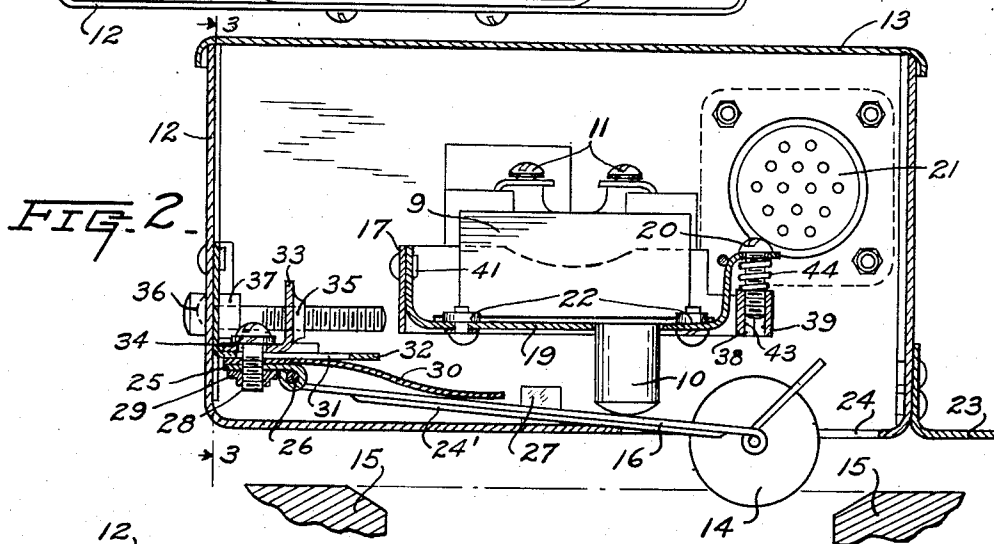
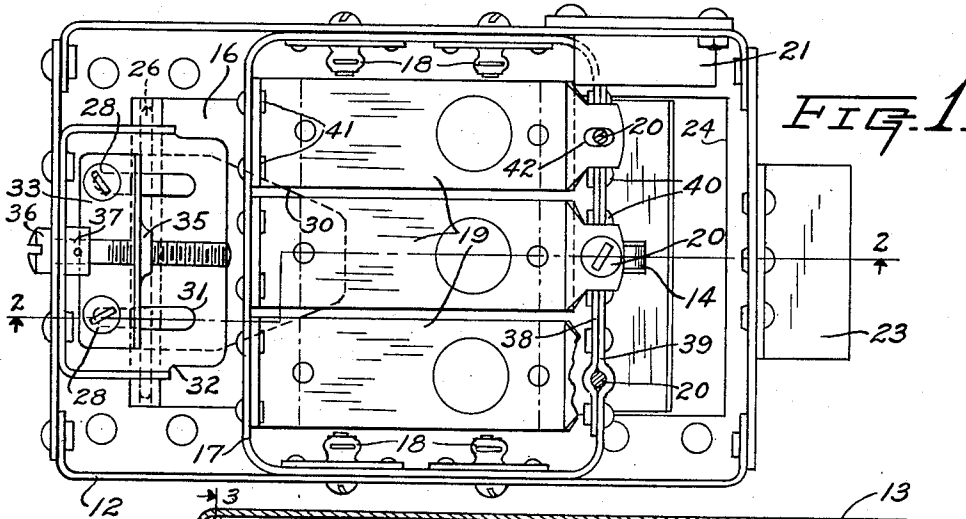


FIG. 3.

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2 Sheets-Sheet 2

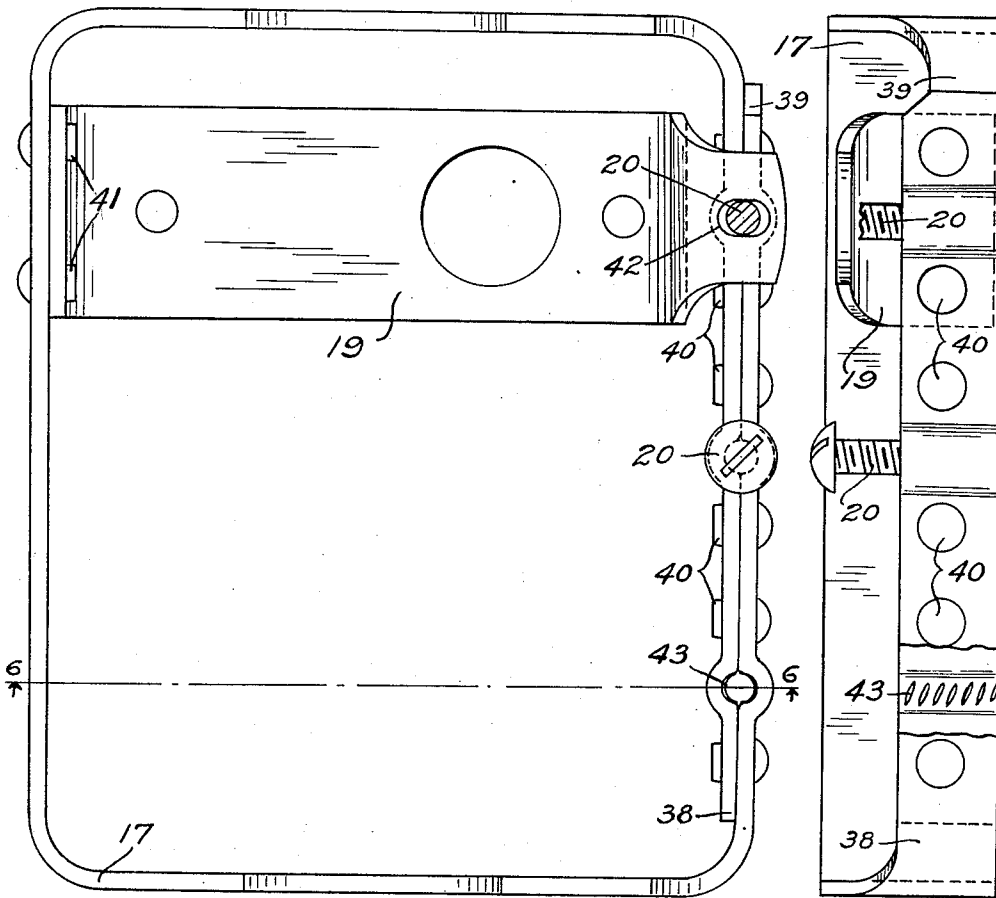


FIG. 4.

FIG. 5.

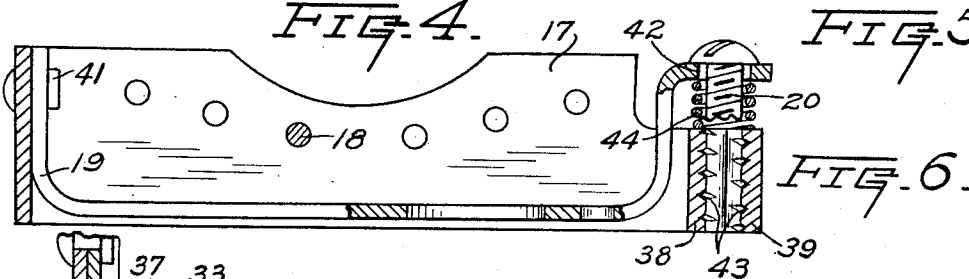


FIG. 6.

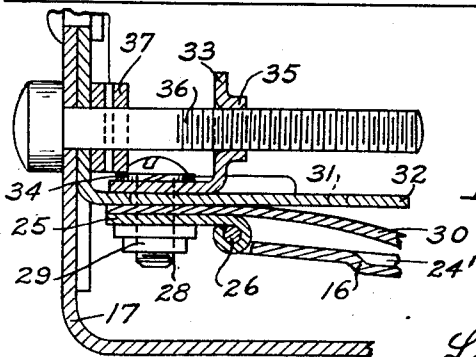


FIG. 7.

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## UNITED STATES PATENT OFFICE

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## SWITCH ASSEMBLAGE

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16 Claims. (Cl. 200—5)

Our invention relates generally to improvements in the art of manufacturing composite assemblies, and relates more specifically to various improvements in the construction and operation of electric switch structures and more especially in the mounting and actuating mechanisms therefor.

An object of the present invention is to provide an improved electric switch assembly which is simple and compact in construction, and which is also highly efficient in operation.

It is frequently desirable in various industries, to mount one or more relatively sensitive and similar but independent electric switch units operable by means of common actuating mechanism, in a single housing; and when such assemblies are utilized in places where they are subject to considerable vibration and jarring, it is necessary for proper performance and in view of the sensitive nature of the several units, to provide for accurate and independent but permanent adjustment thereof. These assemblies should also be as compact and sturdy as possible, and provision should be made for rapid removal and replacement of the relatively delicate switch units; and when the several units have been installed within the common protecting housing, they should be effectively locked in finally adjusted position so that proper subsequent operation thereof is assured. While it has heretofore been attempted to provide such composite switch assemblies, these prior structures have not been entirely satisfactory, either because they were too complicated and difficult to assemble and dismantle, or because the individual switch units could not be properly adjusted and retained in adjusted position; or because the several switches could not be readily compactly grouped and housed in enclosures of minimum size from which they could be readily removed.

It is therefore a more specific object of our present invention to provide an improved composite switch and actuating assembly which meets all of the above mentioned requirements, and which is extremely flexible in its adaptations.

Another specific object of this invention is to provide an improved multiple electric switch assembly comprising any desired number of individual switches grouped and nested within a compact housing, and wherein the switch units are firmly normally supported, while being readily adjustable or removable.

A further specific object of the invention is to provide a plural switch structure wherein several independent electric switches are operable by means of simplified but highly efficient common operating mechanism, and are adapted to be accurately and conveniently adjusted so as to insure desired operation of the several units.

Still another specific object of the present in-

vention is to provide new and useful instrumentalities for readily effecting adjustment of a device such as a switch, relative to its support, and for locking the device in adjusted positions.

5 An additional specific object of our invention is to provide improved switch housing, supporting and operating mechanism which may be manufactured primarily of sheet metal and at moderate cost, and the various parts of which are readily accessible for adjustment and removal.

These and other objects and advantages of the present invention will be apparent from the following detailed description.

10 A clear conception of the several features constituting our present improvement, and of the mode of constructing and of operating switch assemblies built in accordance with the invention, may be had by referring to the drawings accompanying and forming a part of this specification, wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a top view of the improved multiple switch assembly with the housing cover removed and showing only the outlines of the individual switches in dot-and-dash lines;

Fig. 2 is an irregular vertical longitudinal section through the improved electric switch assembly, taken along the line 2—2 of Fig. 1;

20 Fig. 3 is a transverse vertical section through the same assembly, taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged top view of the switch supporting frame showing one of the switch mounting brackets in place;

Fig. 5 is an end view of the frame and bracket of Fig. 4, a portion of the frame having been broken away to reveal internal structure;

Fig. 6 is a section through the switch supporting frame of Fig. 4 taken along the line 6—6, and also showing the bracket partially in section; and

Fig. 7 is an enlarged central section through the suspension and supporting mechanism for the cam actuated switch operating roller.

45 While the invention has been shown herein as being specifically applied to a switch assembly having three similar snap switch units associated therewith and operable simultaneously by a single cam actuated roller, it is not our desire or intent to thereby unnecessarily limit the scope or utility of the several new features, some of which may be advantageously applicable to other types of mechanisms.

Referring to the drawings, the improved electric switch assembly shown therein comprises in general a series of three interchangeably similar but independent snapaction switches 9 each operable by a plunger 10 and each having a set of terminal attaching screws 11; a main housing

12 and a removable cover 13 normally enclosing all of the switches 9; a single actuating roller 14 cooperable with movable spaced cams 15 disposed outside of the housing 12 and being carried by a plate lever 16 swingably suspended within the housing and cooperating with all of the plungers 10 to operate the switches 9; a main approximately rectangular sheet metal frame 17 removably mounted within the housing 12 by means of screw and nut assemblages 18 and surrounding the switches 9; and a series of three independently adjustable sheet-metal switch mounting brackets 19 suspended from the common removable frame 17 and each being provided with an independent adjusting screw 20.

The snap switches 9 may be of any desired type wherein the movable contact is displaceable by means of a plunger 10, and the wires which are connected to the switch terminals 11 may be conducted through a perforated bushing 21 secured to one side of the housing 12. The several switches 9, of which there may be any desired number, may also be secured to their mounting brackets 19 by means of screw and lock washer assemblages 22 as shown in Figs. 1 and 2; and the main housing 12 and cover 13 may be formed in any suitable manner as of sheet metal, the housing also being provided with a suspension bracket 23. The housing 12 is additionally provided with a lower elongated opening 24 through which the switch actuating roller 14 projects, and the actuating cams 15 may assume various forms and are movable back and forth relative to the housing 12, in a manner whereby they will contact the roller 14 and swing the plate 16 upwardly or inwardly so as to move the plungers 10 and operate the switches 9.

Since the individual switches 9 are ordinarily rather sensitive in action, it is important to have both accurate timing of operation, and accurate cooperation of all of these switches with the common actuating lever. It should therefore be possible to vary or adjust the timing of operation, and we have provided simplified and improved mechanism for effecting such adjustment as clearly shown in Figs. 1, 2, 3 and 7. The roller suspension plate lever 16 which is formed of sheet metal and is provided with longitudinal ribs 24' in order to enhance its strength, has the roller 14 rotatably suspended from one end, and has its opposite end swingably secured to a transverse lower plate 25 by means of a pivot pin 26, while the medial portion of the lever 16 is swingable between guiding ears 27. The lower plate 25 is pierced by two cap screws 28 with which clamping nuts 29 coact beneath the plate 25; and a leaf spring 30 which is also pierced by the cap screws 28, coacts with the top of the plate 25 and resiliently engages the top of the lever 16 so as to constantly urge the roller 14 outwardly. The cap screws 28 also extend through elongated parallel slots 31 formed in a suspension bracket 32 which is rigidly attached to an end wall of the housing 12; and an upper plate 33 is also pierced by the cap screws 28 and is slidable along the top of the fixed bracket 32 in a direction parallel to the slots 31. Lock washers 34 are interposed between the heads of the cap screws 28 and the upper plate 33, and this plate also has an integral threaded boss 35 the screw threads of which are engaged by an adjusting screw 36 journaled for rotation in the bracket 32 and in the adjacent wall of the housing 12, but which is fixed against axial displacement by a collar 37 fastened to the screw.

This improved assemblage of elements is obviously such, that when the cap screws 28 are loosened, and the central adjusting screw 36 is rotated, the upper plate 33 will be shifted upon the fixed bracket 32 and the cap screws 28 will move along and within the parallel slots 31 thereby simultaneously shifting the lower plate 25, the roller suspension pivot 26, the lever 16, and roller 14 to different positions relative to the main housing 12. The screw 36 may be thus rotated from the exterior of the housing 12, and when proper adjustment of the roller 14 relative to the actuating cams 15 has been effected, the cap screws 28 may again be tightened so as to lock the roller suspension plate 25 in adjusted position. It is to be noted that the leaf spring 30 is also adjustable with the plates 25, 36 and cap screws 28, so as to constantly urge the roller 14 outwardly, and the guiding ears 27 which are formed integral with the housing 12 constantly cooperate with the sides of the plate lever 16 so as to prevent lateral displacement of this lever.

As shown in Figs. 1, 2, 4, 5 and 6, the switch supporting frame 17 may be formed of a single strip of resilient sheet metal having the opposite ends 38, 39 thereof overlapped and firmly united by means of spaced rivets 40. The individual switch mounting brackets 19 are also formed of strips of resilient sheet metal and have their rear ends firmly attached to the rear wall of the frame 17 by means of rivets 41, while the front ends of the U-shaped brackets 19 are spaced from and project over and beyond the frame ends 38, 39, being provided with elongated openings 42 through which the adjusting screws 20 extend loosely. The successive local portions of the frame ends 38, 39 between the successive sets of rivets 40 are bent to form screw receiving sockets having partial threads 43 indented therein as clearly indicated in Figs. 4, 5 and 6; and these sockets are slightly elliptical in shape so that when the threaded ends of the screws 20 are driven into coaction with the partial threads 43, the resiliency of the metal in the frame ends 38, 39 will cause the screws 20 to be firmly clamped and locked in various positions of adjustment. Each adjusting screw 20 is also embraced by a stiff compression spring 44 coacting with the frame ends 38, 39 and with the adjacent bracket 19 so as to keep the ends of the brackets against the adjusting screw heads, and by manipulating the screws 20, the individual switches 9 may obviously be independently adjusted and locked in position to cause the operating plungers 10 of the switches to properly cooperate with the actuating lever 16. As previously indicated, the frame 17 is removably suspended within the main housing 12 by means of the bolt and nut assemblages 18, and the individual switches 9 are likewise removably attached to their brackets 19 with the aid of screw and lock-washer assemblages 22.

During manufacture of the improved switch assemblage, most of the parts can obviously be constructed of sheet metal with the aid of punches and dies, and standard screws, bolts and rivets may also be utilized in completing the assemblages. The switches 9 and brackets 19 may be assembled within the frame 17 before this frame is finally attached within the housing 12, and the roller adjusting mechanism may also be initially assembled upon the bracket 32 before this bracket is permanently mounted within the housing 12. After the various elements have

thus been mounted within the housing 12, the cap screws 28, adjusting screw 36, and adjusting screws 20 may obviously be readily manipulated upon removal of the cover 13, and the terminal screws 11 are also readily manipulable through the open top of the housing. The mechanism should then be adjusted for proper timing and proper operation of the individual switches 9, and proper timing may obviously be effected by manipulating the screws 28, 36, while the adjusting screws 20 may be manipulated to insure proper actuation of the individual switches 9 by the common lever 16.

During normal operation of the assemblage the cams 15 will function to periodically and alternately engage the roller 14, so as to cause the lever 16 to engage the plungers 10, thereby causing these plungers to operate the switches 9. As the actuating cams 15 are moved out of engagement with the roller 14, the leaf spring 39 will urge the roller 14 outwardly through the housing opening 24 and will thus permit the plunger actuating springs to return the plungers 10 to their outermost positions. Depending upon the type of switches 9 which are selected, the movement of the plungers 10 inwardly may either open or close the switches 9, whereas outward movement of these plungers 10 will produce reverse operation. It is also to be noted that the various adjustments may be made after the switch assemblage has been installed, and the switch mechanism can be normally concealed by applying the cover 13 to the housing 12 thereby effectively protecting the various mechanisms.

From the foregoing detailed description, it will be apparent that our present invention provides an improved switch assemblage which is extremely simple, compact and durable in construction, and which is moreover highly efficient and flexible in operation. The improved multiple electric switch assemblage may obviously comprise any desired number of individual switches compactly grouped or nested within a common housing, and in which the several independent switch units are normally firmly supported while also being readily adjustable and removable. The plural switch structure embodies improved mechanism for operating several independent electric switches by means of simplified operating mechanism which is conveniently and accurately adjustable so as to insure proper timing of the operation of the several switch units. The present improved mechanism also embodies means for readily effecting adjustment of the individual switches 9 relative to their support, and for automatically locking the switch units in adjusted position, without the aid of lock nuts or other complicated locking mechanisms. The present improved switch structure may also be manufactured of sheet metal with the aid of punches and dies and at moderate cost, and the various parts are conveniently accessible for adjustment and removal thereof. Features of the present improvement have gone into extensive commercial use and have proven highly successful and satisfactory in operation.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of use herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

We claim:

1. In combination, a housing having an open top and an opening in its bottom, a frame detach-

ably suspended between the side walls of said housing, several brackets suspended from one end wall of said frame and having opposite ends overlying the opposite frame end, independent switches mounted upon said brackets and having operating plungers extending toward said housing bottom, a common actuator for said plungers suspended within said housing and projecting through said bottom opening, and means coacting with said overlying bracket ends for effecting independent adjustment of said brackets relative to said frame to vary the positions of said plungers relative to said common actuator.

2. In combination, a housing having an open top and an opening in its bottom, a frame detachably suspended between the side walls of said housing, several brackets suspended from one end wall of said frame and having opposite ends overlying the opposite frame end, independent switches mounted upon said brackets and having operating plungers extending toward said housing bottom, a common actuator for said plungers suspended within said housing and projecting through said bottom opening, means coacting with said overlying bracket ends for effecting independent adjustment of said brackets relative to said frame to vary the positions of said plungers relative to said common actuator, and means suspended from an end wall of said housing for varying the position of said common actuator along said bottom opening.

3. In combination, an approximately rectangular housing having top and bottom openings, an approximately rectangular open frame within said housing and detachably secured to the opposite side walls thereof, several brackets secured to one end wall of said frame and having their opposite ends independently movable relative to the other end wall, a switch mounted upon each of said brackets and having an actuating plunger extending toward said bottom housing opening, a common actuating lever for all of said plungers swingably suspended from an end wall of said housing and having an actuating roller projecting through said bottom opening, and a screw coacting with said opposite end of each of said brackets and with the adjacent frame end wall for adjusting each of said plungers relative to said lever independently of all others.

4. In combination, an approximately rectangular housing having top and bottom openings, an approximately rectangular open frame within said housing and detachably secured to the opposite side walls thereof, several brackets secured to one end wall of said frame and having their opposite ends independently movable relative to the other end wall, a switch mounted upon each of said brackets and having an actuating plunger extending toward said bottom housing opening, a common actuating lever for all of said plungers swingably suspended from an end wall of said housing and having an actuating roller projecting through said bottom opening, a screw coacting with said opposite end of each of said brackets and with the adjacent frame end wall for adjusting each of said plungers relative to said lever independently of all others, and an adjusting screw for said roller journaled in an end wall of said housing and coacting with the fulcrum of said lever to shift said roller along said bottom opening.

5. In combination, a housing having opposite side walls and an opening between said walls, a frame suspended from said walls within said housing and having overlapping resilient ends

provided with intervening notched sockets, several brackets suspended from said frame and having end portions overlying said sockets, an independent switch unit carried by each of said brackets, a common actuator for all of said units projecting through said housing opening, and an adjusting screw for each bracket coacting with its overlying end and with the adjacent notched socket of said frame.

6. In combination, a housing having opposite side walls and an opening between said walls, a frame suspended from said walls within said housing and having overlapping resilient ends provided with intervening notched sockets, several brackets suspended from said frame and having end portions overlying said sockets, an independent switch unit carried by each of said brackets, a common actuator for all of said units projecting through said housing opening, an adjusting screw for each bracket coacting with its overlying end and with the adjacent notched socket of said frame, and means within said housing and associated with an end wall thereof for sliding said actuator relative to said frame to vary the timing of said switches.

7. In combination, a housing having opposite side walls and an opening between said walls, several independent switch units suspended from said frame between said walls, a common actuator for all of said units movable through said opening toward and away from said frame, a lever support for said common actuator having a fulcrum within said housing near an end wall of the latter, and an adjusting screw for said lever fulcrum journaled in said housing end wall and extending toward said frame.

8. In combination, a housing having opposite side walls and an opening between said walls, several independent switch units suspended from said frame between said walls, a common actuator for all of said units movable through said opening toward and away from said frame, a lever support for said common actuator having a fulcrum within said housing near an end wall of the latter, a bracket secured to said end wall and extending toward said frame, a plate carrying said lever fulcrum and being slidable along said plate, and an adjusting screw journaled in said end wall and coacting with said plate to slide the same along said bracket and to move said actuator along said opening.

9. In combination, a housing having an opening therein, a group of independent switch units mounted within said housing, a common actuating roller for all of said units movable through said opening, a lever on which said roller is journaled and having a fulcrum pivot within said housing, a bracket mounted within said housing and having elongated spaced slots, a support for said lever pivot slidable along said bracket, and an adjusting screw journaled in said housing and coacting with said support to slide the same along said slots.

10. In combination, a housing having an opening therein, a group of independent switch units mounted within said housing, a common actuating roller for all of said units movable through said opening, a lever on which said roller is journaled and having a fulcrum pivot within said housing, a bracket mounted within said housing and having elongated spaced slots, a support for said lever pivot slidable along said bracket, an adjusting screw journaled in said

housing and coacting with said support to slide the same along said slots, and set screws coacting with said slots to lock said support in various positions of adjustment.

11. In combination, a housing, a frame suspended within said housing and being formed of a single strip of sheet metal having overlapping ends locally distorted to provide successive sockets, a series of independent switch supporting brackets having their corresponding ends secured to said frame and having their opposite ends overlying said sockets, and a cap screw coacting with each of said sockets and with the adjacent overlying bracket ends for effecting independent adjustment of said brackets relative to said frame.

12. In combination, a unitary approximately rectangular frame formed of resilient material and having overlapping ends locally bulged to provide a succession of parallel centrally split sockets, a series of independent switch supports spanning said frame and having their corresponding ends spanning said sockets, and a screw piercing each of said support ends and being driven into the adjacent socket to expand the same and to clamp the screw in adjusted position.

13. In combination, a frame having coacting sheet metal portions provided with local bulges providing a succession of parallel centrally split sockets each half of which is provided with a series of partial screw threads, a series of supporting brackets each having a portion provided with an opening disposed in axial alinement with one of said sockets, and an adjusting screw for each of said brackets piercing the opening thereof and having its screw threaded portion driven into the corresponding socket in engagement with the partial screw threads thereof.

14. In combination, a supporting frame having coacting resilient portions provided with cooperating bulges forming a centrally split socket each half of which has notches therein, a bracket having a portion provided with an opening disposed in substantial alinement with said socket, and an adjusting screw for said bracket piercing said opening and having a threaded portion coacting with said notches and wedged therein by the resiliency of said frame portions.

15. In combination, a supporting frame having coacting resilient portions provided with cooperating bulges forming a centrally split socket each half of which has notches therein, a bracket having a portion provided with an opening disposed in substantial alinement with said socket, an adjusting screw for said bracket piercing said opening and having a threaded portion coacting with said notches and wedged therein by the resiliency of said frame portions, and a compression spring embracing said screw and coacting with said frame and bracket.

16. In combination, a frame having cooperating resilient bulges forming a split socket and being provided with notches facing the socket, a member having an opening disposed in substantial alinement with said socket, and an adjusting screw coacting with said member at said opening and having a threaded portion coacting with said notches and wedged within said socket by the resiliency of said bulges.

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