March 12, 1957 F. L. ZELLNER 2,785,239

NEUTRAL-SEEKING, DOUBLE-THROW WALL SWITCHES

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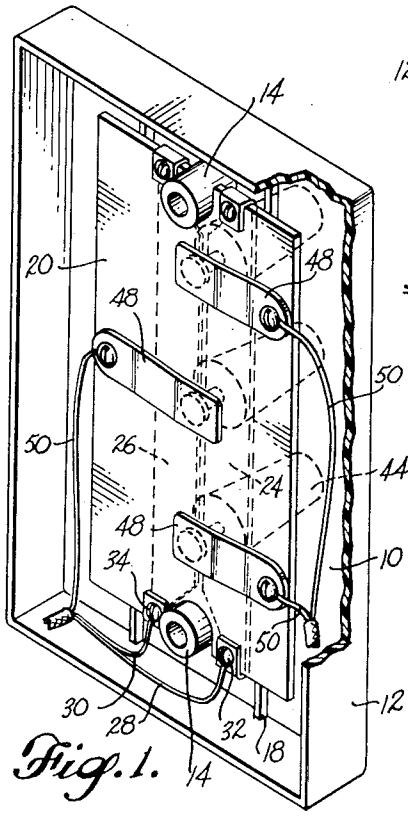


Fig. 1.

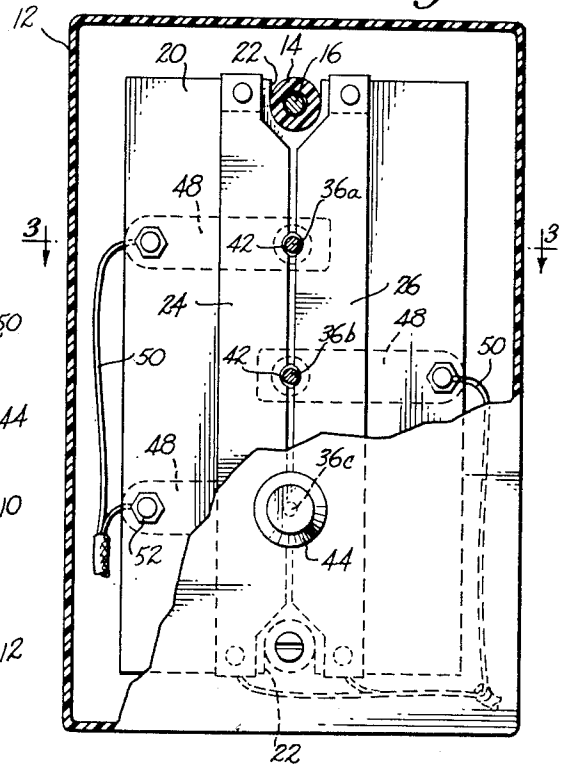


Fig. 2.

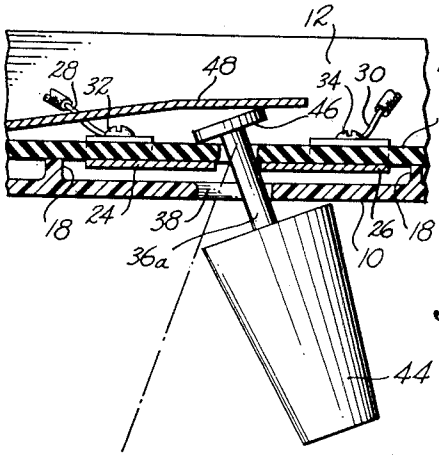


Fig. 4.

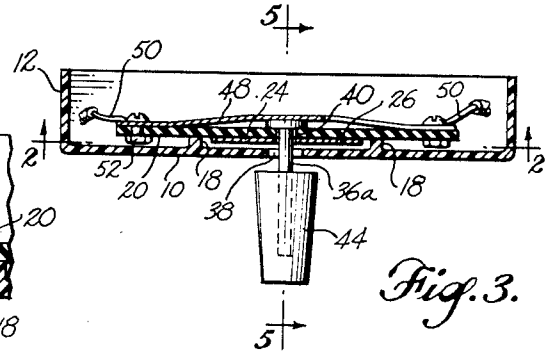


Fig. 3.

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NEUTRAL-SEEKING, DOUBLE-THROW WALL SWITCHES

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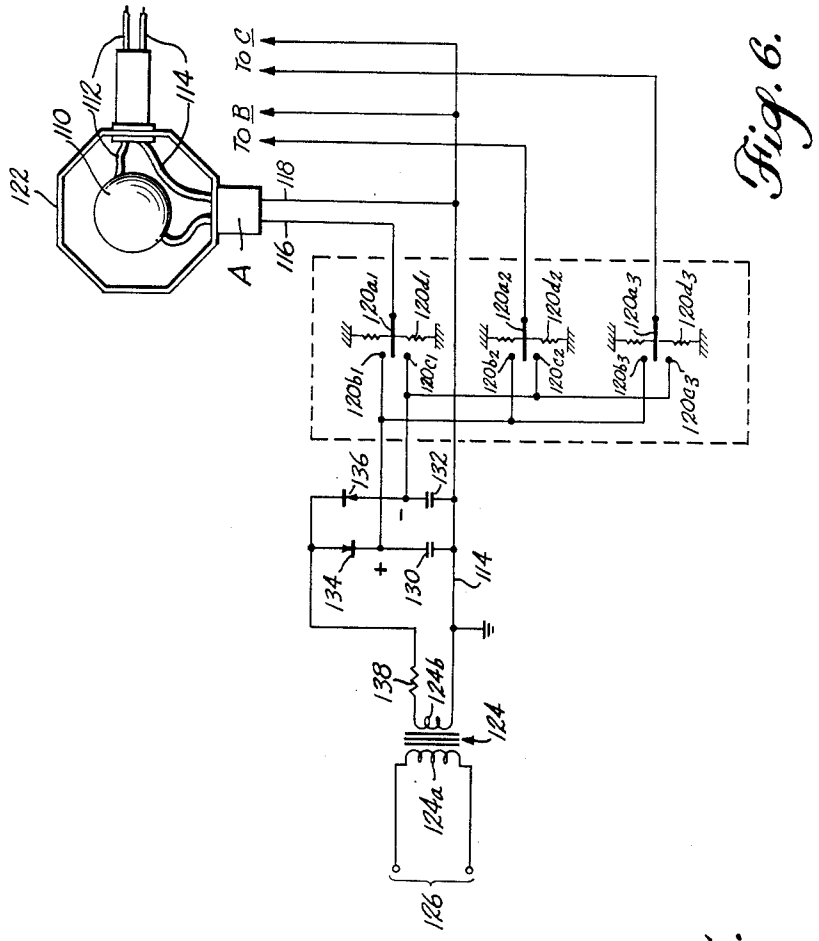


Fig. 6.

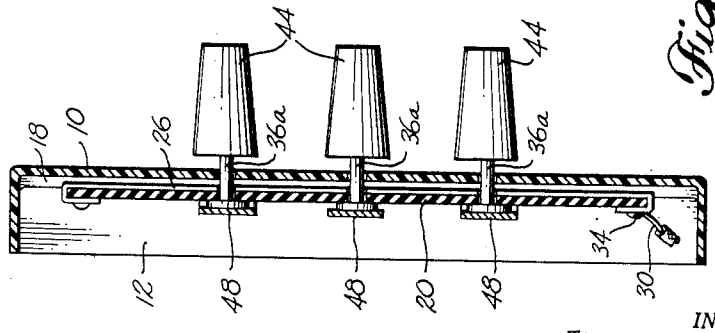


Fig. 5.

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NEUTRAL-SEEKING, DOUBLE-THROW WALL SWITCHES

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6 Claims. (Cl. 200—6)

This invention relates to improvements in wall switches, particularly in those of the neutral-seeking double-throw type which may be used for selectively applying direct voltage of either polarity to one or more polarized relays. A preferred application of the invention is in low voltage switching circuits as disclosed and claimed in copending application Serial No. 522,548, filed July 18, 1955, by the present applicant. The present invention is herein illustratively described by reference to the presently preferred form thereof; however, it will be recognized that certain modifications and changes therein may be made with respect to details without departing from the essential or characterizing features involved.

The above-cited copending patent application discloses an improved low-voltage switching circuit for use in systems for low-voltage relay control of lighting and the like, and the present invention comprises an improved wall switch which may be used therein and for other purposes as well. An object of the present invention is such a wall switch of relatively shallow and compact form permitting the entire switch to be mounted against the outside face of a wall without need of recessing any portion thereof into the wall. With such a switch, used in connection with low-voltage wiring, no recessed wall box or shielding devices need be used and the wall need pass only the low-voltage wires leading to and from the switch terminals, consequently greater flexibility in location and greater ease of installation is achieved. Nevertheless it will be recognized that such switch may be mounted on a recessed switch box, if desired.

Another object of the invention is an improved wall-mounted switch of the described type which is relatively simple, reliable and inexpensive to construct and install, and one which is rugged and durable.

Another object of the invention is such a wall switch the construction of which lends itself readily to the incorporation of from one to a sizable number of switch units therein compactly and conveniently from the standpoint of the packaging or housing and wiring of the switch components.

In its disclosed form the invention comprises in combination with a mounting plate preferably having side flanges extending therearound to form a switch housing, and means for securement of such housing to a wall or other support, an insulating terminal plate mounted on the back side of said mounting plate and carrying a pair of electrical contact busses in generally parallel spaced relationship on the front side of said terminal plate. The contact busses are adapted to be connected to energizing conductors of relatively opposite polarity. One or more elongated switch rods having control handles on their outer ends project through individual apertures in said plates and extend through the space between the contact busses at successive locations along the length of said busses. These switch rods having enlarged transversely extending heads on the inner ends thereof which are adapted to bear against the back side of the terminal plate as angular positioning elements.

Individual spring means, preferably in the form of electrical contact strips, press said rods outwardly in relation to said plates and thereby press said heads against said terminal plate back side for maintaining said rods normally perpendicular to the plates. In this neutral position, the rods are held out of contact with the contact busses by the walls of the mounting plate apertures which are relatively only slightly larger in diameter than the individual switch rods. However, the terminal plate apertures are relatively materially larger than the rods, at least in the cross-sectional dimension transverse to the contact busses, whereby such rods may be swung into and out of engagement with either contact bus against spring force.

These and other features, objects and advantages of the invention, including certain details of the presently preferred form thereof as herein illustrated will become more fully evident from the following description thereof by reference to the accompanying drawings.

Figure 1 is a rear perspective view of the improved switch having three switch units or rods, with a part of the switch housing broken away to illustrate certain details.

Figure 2 is a front view of the switch with portions broken away in a plane parallel to the mounting plate and at a location between such plate and the terminal plate, as shown by the line 2—2 in Figure 3.

Figure 3 is a transverse sectional view taken on line 3—3 in Figure 2.

Figure 4 is an enlarged fragmentary transverse sectional view of a portion of the switch as shown in Figure 3, to illustrate the switching action.

Figure 5 is a longitudinal sectional view taken on line 5—5 in Figure 3.

Figure 6 is a circuit diagram illustrating application of the switch to the low-voltage switching system of the type disclosed in the above-cited copending application.

Referring to the drawings, the mounting plate **10**, preferably of generally rectangular form as shown, has a flange **12** which extends around its entire perimeter and projects perpendicularly from the back side thereof to contact the surface of a wall or other support on which the switch is to be mounted. The width of the flange need be only sufficient to form a relatively shallow space behind the plate **10** adequate to accommodate the switch assembly as hereinafter described. Midway between the long sides of the mounting plate and near the respective opposite ends thereof the plate has apertures and is provided with apertured bosses **14** aligned therewith projecting from the back side of such plate approximately to the plane of the free edge of the flange **12** to receive mounting screws **16**. Reinforcing ribs **18** projecting from the back side of the plate on opposite sides of the longitudinal center line thereof not only stiffen the plate but serve as abutment elements against which the terminal plate, to be described, is positioned. The mounting plate with its edge flange and apertured ends reinforced by the bosses **14** constitutes the switch housing and as illustrated represents a presently commercially available unit, although one normally used for other purposes. The same is or may be molded of a suitable plastic material including hard rubber or other hard plastic substance having the property of electrical insulation and adequate strength.

The insulating terminal strip or plate **20** is preferably smaller than the mounting plate **10** but of the same rectangular proportions. The terminal plate, also of suitable hard plastic material or the like, fits into the housing comprising the flanged mounting plate at a central location contacting the compartment ribs **18**, hence in parallel relation to the mounting plate, as shown in Figure 3. The terminal plate is centered in the housing by notching the

ends thereof at 22 to receive snugly the annular bosses 14 in the notches. Preferably some pressure is required to force the terminal plate into the housing past the bosses 14. This action is accompanied by slight distortion of the two plates, whereby resilience of the plate material causes the terminal plate to be gripped and held frictionally between the bosses 14.

The terminal plate 20 carries a pair of contact busses 24 and 26 which extend in parallel spaced-apart relationship along the length of the front side of the plate, i. e. that adjoining the back side of the mounting plate 10. These contact busses extend the full length of the terminal plate in the illustration and are adapted to be energized by voltages of relatively opposite polarity, as by means of the conductors 28 and 30, respectively (Figure 1). The conductors 28 and 30 are secured to the contact busses at one end of the latter by means of the bus mounting screws 32 and 34 passing through apertures in the reversely-bent end portions of the busses and aligned apertures in the mounting plate.

One or more (three in the example) switch rods 36*a*, 36*b*, 36*c*, etc. pass through central apertures 38 in the mounting plate and aligned apertures 40 in the terminal plate, through the space between the contact busses 24 and 26. The terminal plate apertures are preferably of the same cross-sectional shape as the rod and only slightly larger in diameter than the rod where the rod passes through them. The inner edges of the contact busses are notched at 42 to provide clearance between the contact busses and the sides of the switch rod with the rods disposed perpendicular to the plane plates and centered therebetween by the walls of the terminal plate apertures. The opposite edges of such terminal plate apertures are chamfered. The apertures 38 in the mounting plate are enlarged or elongated in the direction transverse to the length of the mounting plate so that the switch rods may be swung laterally from side to side in the apertures from the normal position shown in Figure 3 to the inclined position shown in Figure 4 or the opposite inclined position represented by the broken line in Figure 4. Since the aperture in the terminal plate is only slightly larger than the rod, the sides of the rod are normally held completely out of contact with the inner edges of the contact busses 24 and 26, that is when the rod is disposed perpendicularly to the planes of the plates. However, when the rod is tilted or inclined as in Figure 4, one side thereof is brought into contact with the adjacent edge of the contact bus toward which the rod is tilted, establishing electrical contact therebetween. The rod may be brought into contact with the opposite contact bus by tilting the rod in the opposite direction.

The rods 36*a*, 36*b* and 36*c* have enlarged operating handles 44 on their outer ends projecting through the apertured mounting plate and carry enlarged transversely disposed heads 46 on their opposite or inner ends. In the example the heads 46 are of disk shape and in the normal position of the rods bear flatly against the back side of the terminal plate 20 (Figure 3). In order to maintain the switch rods normally in their perpendicular positions shown in Figure 3 and also in order to establish electrical contacts therewith, the terminal plate 20 carries a plurality of spring strips mounted on the back side thereof (i. e. on the side adjacent the supporting wall) by means of screws and nuts 50 and 52 anchoring one end of each spring strip near a longitudinal edge of the terminal plate. Each such spring strip extends from the edge of the plate inwardly thereof and into overlapping contact with one of the switch rod heads 46, to press the rod head firmly against the back side of the terminal plate. Preferably the spring strips 48 associated with successively located switch rods are mounted on alternately opposite sides of the mounting plate for convenience in assembly of the switch parts and in making wiring connections thereto (Figure 2). The resilient force of the spring strip against the end face of the rod head 46 establishes good electrical contact between such elements. Also such spring force opposes tilting of the switch rod out of its normal position perpendicular to the plates, so that when the switch rod handle is released from the hand of the operator pressure of the spring strip restores the rod to its normal or neutral position.

The mounting screws 50 for the spring strips 48 serve as electrical terminals for the securement of the ends of electrical conductors 50 to the spring strips. Also such mounting screws 50 serve as pivot elements about which the spring strips may be swung in a plane generally parallel to the terminal plate so as to disengage and reengage the end faces of the switch rod heads 46 selectively to permit removal of the switch rods from the assembly for purposes of maintenance or repair, also for convenience in assembly of the switch parts at the outset. For that purpose the switch rod handles 44 are preferably threaded on or otherwise removably secured to the switch rods so that they may be removed therefrom readily when it is necessary or desirable to disassemble the switch. Preferably the assembly comprising the terminal plate 20, the contact busses 24 and 26 and the resilient strips 48 is entirely prefabricated before its assembly with the mounting plate and switch rods 36*a*, 36*b* and 36*c*.

It will be observed, in the actuation of the switch rods to either position of contact thereof with one or the other of the contact busses 24 or 26, that there is a sliding action under surface-to-surface pressure which takes place both between the switch rod head 46 and its associated resilient strip 48 and between the switch rod and the contact bus which it engages. This sliding contact action between the switch rod and head and its associated electrical contact elements in the switch insures a low-resistance electrical contact between such elements, and thereby insures that dust or corrosion will not impair the reliability of the switch to establish low-resistance electrical contact. This feature is, of course, highly advantageous in low-voltage circuits where low-resistance contacts are essential to normal operation of energized equipment.

Because of the mutual series alignment of the switch rods in their normal positions perpendicular to the mounting plate, an operator may readily actuate all switch units at once, if desired, or may selectively actuate any individual switch unit independently of the others. Mounting of the contact busses between the parallel insulating plates for edge engagement by lateral movement of the switch rods in either direction makes for a highly compact, physically shallow, easily wired and simple construction which is particularly advantageous in the type of application herein described.

Figure 6*a* illustrates schematically a low-voltage switching circuit of the type which may incorporate the improved switch. In this figure the switch elements **120***a*1, **120***a*2 and **120***a*3 represent the three switch rods 30*a*, 36*b* and 38*c*, respectively, the switch contact points **120***b*1, **120***b*2 and **120***b*3 represent the switch contact bus 24, whereas the contact points **120***c*1, **120***c*2 and **120***c*3 represent the switch contact bus 26. The spring means **120***d*1, **120***d*2 and **120***d*3 represent the respective resilient strips 48 associated with the individual switch rods in the drawings illustrating the improved switch.

The polarized relay A, connected by conductors 116 and 118, respectively, to the switch element **120***a*1 and the ground conductor 140, controls energization and de-energization of the electrical device 110, such as a lamp, mounted in the housing 122 and energized through high-voltage conductors 112 and 114. Similar connections are made between the ground conductor and the switch elements **120***a*2 and **120***a*3 with the polarized relays B and C, respectively, of different electrical devices (not shown) to be energized. As explained in the above-cited copending patent application alternating voltage is applied to terminals 126 for energizing the primary 124*a* of the transformer 124 in order to produce at the secondary 124*b* thereof a low alternating voltage for use,

after rectification, in controlling the polarized relays. One side of the secondary **124***b* is grounded, whereas the opposite side thereof is connected through a series resistance **138** to one terminal each of the half-wave rectifiers **134** and **136**, but with relatively opposite polarity in relation thereto. The remaining terminal of rectifier **134** is connected to the three switch contact points **120***b***1**, **120***b***2** and **120***b***3**, whereas the remaining terminal of rectifier **136** is connected to the switch contact points **120***c***1**, **120***c***2** and **120***c***3**. A condenser **130** is connected between ground and the latter terminal of rectifier **134**, whereas a condenser **132** is similarly connected between ground and the latter terminal of rectifier **136**. Condenser **130**, therefore, normally carries a charge of one polarity (positive in the example), whereas condenser **132** normally carries a charge of the opposite polarity. Actuation of the switch elements **120***a***1**, **120***a***2** or **120***a***3** to engage one or the other of the associated switch contacts subjects the polarized relay connected to the switch element to a positive or negative current surge for actuating such relay into its opposite position of operation if the polarity selected is correct to accomplish reversal of relay position. Since the associated storage condenser **130** or **132** discharges abruptly through the polarized relay, there will be positive and immediate actuation of the relay but without appreciable arcing at the contacts of the switch on release thereof, so that the improved switch in such a circuit has a relatively long life free of maintenance difficulties, even though the contact established between the switch rods **136***a*, etc., and the contact busses is essentially an edge contact. Such contact may be increased in area by appropriately thickening and shaping the adjacent side or edge of the switch contact busses if desired.

It will be evident that the invention is not necessarily limited to the illustrated application thereof, nor to the illustrated details of construction, but may vary, within the scope of the appended claims.

I claim as my invention:

1. A wall-mountable switch device comprising, in combination, a mounting plate of insulating material of generally elongated shape adapted for securement thereof against a wall or other support, said mounting plate having a flange extending around the edge thereof and projecting transversely from the back side thereof, said mounting plate further having a pair of mounting elements including portions projecting from the back side and near opposite extremities thereof, a terminal plate of insulating material of generally elongated proportions formed to be received and held frictionally between said pair of mounting elements disposed generally parallel to said mounting plate, a pair of conductive contact busses carried by said terminal plate in the front side thereof in generally parallel spaced-apart relationship extending lengthwise thereof, a plurality of elongated conductive switch rods extending transversely through mutually aligned apertures in the mounting plate and terminal plate through the space between said contact busses at different locations spaced apart successively along such busses, an enlarged conductive head formed transversely on the inner end of each such switch rod, resilient electrical contact strips mounted on the back side of said terminal strip and pressing forwardly against the respective conductive switch rod heads to make electrical contact therewith and normally to press such heads flatly against the back side of said terminal plate, thereby yieldably to maintain such rods in normal positions disposed substantially perpendicular to such plate, said terminal plate apertures being relatively only slightly larger than said switch rods passing therethrough, and said mounting plate apertures being relatively materially larger than said rods in at least the direction perpendicular to the length of said contact busses, to permit tilting of such rod in either sense out of normal position along said direction, said contact busses being spaced apart in said direction at the locations of said rods by a distance slightly exceeding said terminal plate aperture width, whereby in the normal positions of said rods the walls of the latter apertures maintain such rods out of contact with said contact busses whereas in the tilted positions of such rods the sides thereof are brought into engagement with one such contact bus or the other, and operating handles on the front ends of the switch rods, said electrical contact resilient strips and said contact busses being adapted for connection thereof to different electrical conductors.

2. The switch device defined in claim 1, wherein the resilient strips are mounted on the terminal plate to pivot thereon about respective axes perpendicular to such plate, thereby to permit disengaging the strips from the switch rod heads to permit removal of the latter from the switch device.

3. A wall-mountable switch device comprising, in combination, a mounting plate of insulating material of generally elongated shape adapted for securement thereof against a wall or other support, a terminal plate of insulating material of generally elongated proportions formed to be received and held frictionally between said pair of mounting elements disposed generally parallel to said mounting plate, a pair of conductive contact busses carried by said terminal plate on the front side thereof in generally parallel spaced-part relationship extending lengthwise thereof, a plurality of elongated conductive switch rods extending transversely through mutually aligned apertures in the mounting plate and terminal plate through the space between said contact busses at different locations spaced apart successively along such busses, an enlarged conductive head formed transversely on the inner end of each such switch rod, resilient electrical contact strips mounted on the back side of said terminal strip and pressing forwardly against the respective conductive switch rod heads to make electrical contact therewith and normally to press such heads flatly against the back side of said terminal plate, thereby to yieldably maintain such rods in normal position disposed substantially perpendicular to such plate, said terminal plate apertures being relatively only slightly larger than said switch rods passing therethrough, and said mounting plate apertures being relatively materially larger than said rods in at least the direction perpendicular to the length of said contact busses, to permit tilting of such rod in either sense out of normal position along said direction, said contact busses being spaced apart in said direction at the locations of said rods by a distance slightly exceeding said terminal plate aperture width, whereby in the normal positions of said rods the walls of the latter apertures maintain such rods out of contact with said contact busses whereas in the tilted positions of such rods the sides thereof are brought into engagement with one such contact bus or the other, and operating handles on the front ends of the switch rods, said electrical contact resilient strips and said contact busses being adapted for connection thereof to different electrical conductors.

4. A wall-mountable switch device comprising, in combination, a mounting plate of insulating material adapted for securement thereof against a wall or other support, a terminal plate of insulating material formed to be received and held frictionally between said pair of mounting elements disposed generally parallel to said mounting plate, a pair of conductive contact busses interposed between said terminal plate and said mounting plate in generally parallel spaced-apart relationship extending lengthwise of said plates, a plurality of elongated conductive switch rods extending transversely through mutually aligned apertures in the mounting plate and terminal plate through the space between said contact busses at different locations spaced apart successively along such busses, an enlarged conductive head formed transversely on the inner end of each such switch rod, resilient elec-

trical contact strips mounted on the back side of said terminal strip and pressing forwardly against the respective conductive switch rod heads to make electrical contact therewith and normally to press such heads flatly against the back side of said terminal plate, thereby yieldably to maintain such rods in normal positions disposed substantially perpendicular to such plate, said terminal plate apertures being relatively only slightly larger than said switch rods passing therethrough, and said mounting plate apertures being relatively materially larger than said rods in at least the direction perpendicular to the length of said contact busses, to permit tilting of such rod in either sense out of normal position along said direction, said contact busses being spaced apart in said direction at the locations of said rods by a distance slightly exceeding said terminal plate aperture width, whereby in the normal positions of said rods the walls of the latter apertures maintain such rods out of contact with said contact busses whereas in the tilted positions of such rods the sides thereof are brought into engagement with one such contact bus or the other, and operating handles on the front ends of the switch rods, said electrical contact resilient strips and said contact busses being adapted for connection thereof to different electrical conductors.

5. The switch device defined in claim 4, wherein the resilient strips are mounted on the terminal plate to pivot thereon about respective axes perpendicular to such plate, thereby to permit disengaging the strips from the switch rod heads to permit removal of the latter from the switch device.

6. A wall-mountable switch device comprising, in combination, a mounting plate of insulating material of generally rectangular shape adapted for securement thereof against a wall or other support, a terminal plate of insulating material of generally rectangular proportions formed to be received and held frictionally between said pair of mounting elements disposed generally parallel to said mounting plate, a pair of conductive contact busses interposed between said terminal plate and said mounting plate in generally parallel spaced-apart relationship extending lengthwise of said plates, a plurality of elongated conductive switch rods extending transversely through mutually aligned apertures in the mounting plate and terminal plate through the space between said contact busses at different locations spaced apart successively along such busses, an enlarged conductive head formed transversely on the inner end of each such switch rod, resilient electrical contact strips pressing the respective conductive switch rod heads forwardly normally to press such heads flatly against the back side of said terminal plate, thereby yieldably to maintain such rods in normal positions disposed substantially perpendicular to such plate, said terminal plate apertures being relatively only slightly larger than said switch rods passing therethrough, and said mounting plate apertures being relatively materially larger than said rods in at least the direction perpendicular to the length of said contact busses, to permit tilting of such rod in either sense out of normal position along said direction, said contact busses being spaced apart in said direction at the locations of said rods by a distance slightly exceeding said terminal plate aperture width, whereby in the normal positions of said rods the walls of the latter apertures maintain such rods out of contact with said contact busses whereas in the tilted positions of such rods the sides thereof are brought into engagement with one such contact bus or the other, and operating handles on the front ends of the switch rods, said electrical contact resilient strips and said contact busses being adapted for connection thereof to different electrical conductors.

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