Jan. 13, 1953 S. S. ROBY 2,625,621

ELECTRIC MAT SWITCH

Filed Feb. 11, 1950 2 SHEETS--SHEET 1

Fig. 1

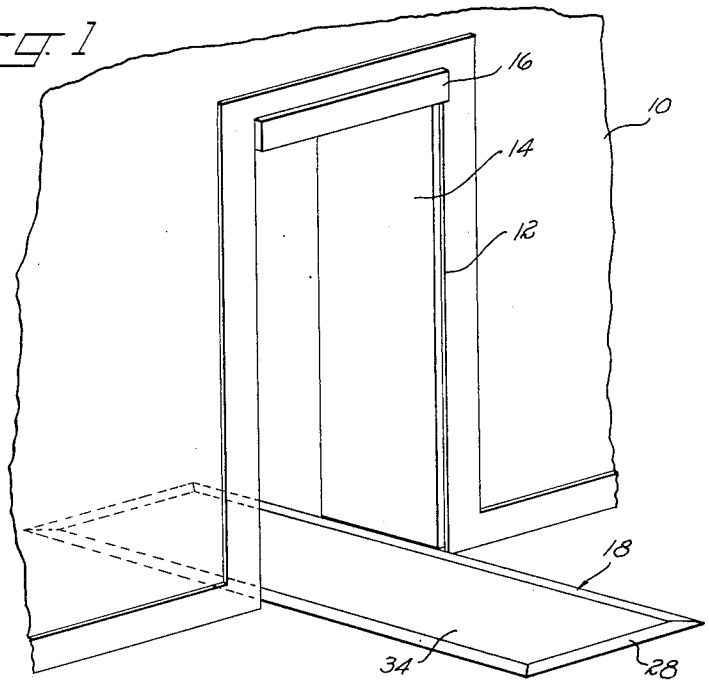
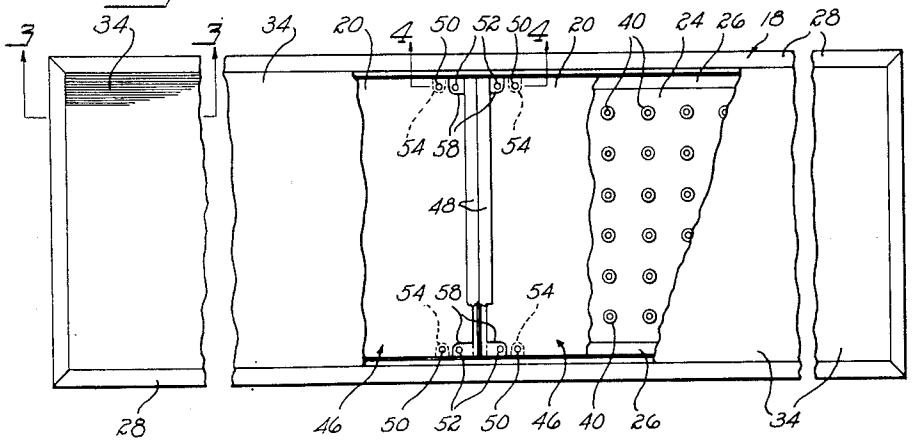


Fig. 2



Inventor

SHELDON S. ROBY

By

Lindsey, Prutzman & Just

Attorneys

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Filed Feb. 11, 1950 2 SHEETS—SHEET 2

Fig. 3

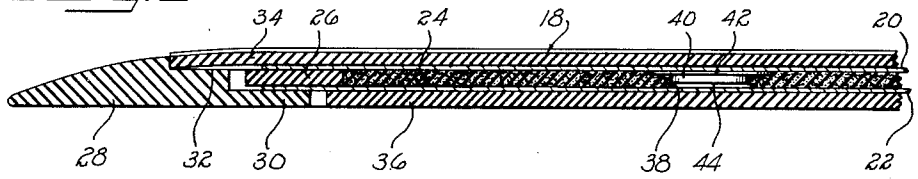


Fig. 4

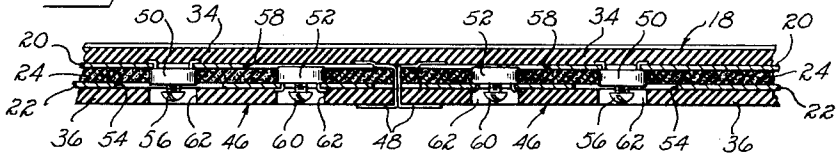


Fig. 5

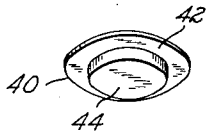


Fig. 6

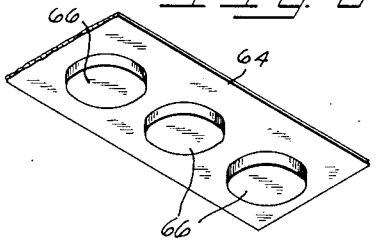
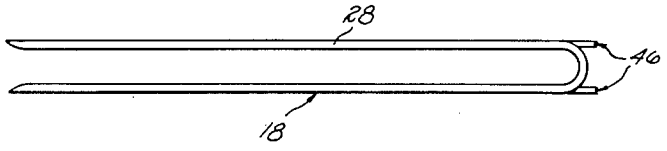


Fig. 7



Inventor
SHELDON S. ROBY

By
Lindsey, Prutzman & Just
Attorneys

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ELECTRIC MAT SWITCH

Sheldon S. Roby, Meriden, Conn., assignor to The Stanley Works, New Britain, Conn., a corporation of Connecticut

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5 Claims. (Cl. 200—86)

1

This invention relates to improvements in an electric mat switch and, more particularly, to an electric mat switch of the type used for controlling the operation of doors as a result of pressure being applied against the mat as by a person stepping thereupon.

Various types of electric mat switches have heretofore been used for purposes of controlling doors which are operated electrically or otherwise for purposes of opening and closing said doors. However, said mat switches have usually employed expensive and complicated contact members and operating mechanism therefor which render such mat switches relatively expensive to manufacture. Further, the tread members of mat switches are the portions thereof susceptible to greatest wear and, when the tread member or sheet of said mat switches became worn beyond further use, it was necessary to discard the entire mat switch and replace it with a new one.

It is an object of the present invention to provide an electric mat switch containing contact members so constructed that they are inexpensive to produce and embody with the mat switch, whereby the cost of producing such mat switches is materially less than those heretofore used.

It is another object of the invention to provide an electric mat switch having a tread member or sheet switch which may readily be replaced by separating it from the contact unit or units of the mat switch when the tread member becomes worn beyond further use, said tread member then being replaced by a new one readily fitted upon the previously used contact unit or units.

It is a further object of the invention to provide an electric mat switch of substantial length which may readily be folded upon itself without injury to any part thereof, whereby the mat switch may be more compactly handled and packaged.

Still another object of the invention is to provide a relatively thin electric mat switch having terminals which may be connected in an electric circuit by which the operation of the door is controlled, the construction of said terminals being such as to conform to the uniform overall thinness of said mat switch.

Details of these objects and of the invention, as well as other objects thereof are set forth in the following specification and are illustrated in the attached drawings forming a part thereof.

In the drawings:

Figure 1 is a fragmentary perspective view of a doorway and door, and an electric mat switch

2

positioned for controlling the operation of said door and embodying the principles of the present invention.

Fig. 2 is a foreshortened plan view of the electric mat switch illustrated in Fig. 1 but shown on a larger scale, and portions of said mat switch being broken away so as to illustrate details thereof.

Fig. 3 is a further enlarged fragmentary sectional view of a portion of the mat switch illustrated in Fig. 2 and taken along the line 3—3 thereof.

Fig. 4 is a sectional view similar to Fig. 3 but taken on the line 4—4 of Fig. 2.

Fig. 5 is a perspective view of one embodiment of contact button embodied in the present invention.

Fig. 6 is a fragmentary perspective view of another embodiment of contact member which may be embodied in the present invention.

Fig. 7 is an edge view of an electrical mat switch similar to that shown in Fig. 2 and folded upon itself for compact handling.

Referring to the drawings, in which like reference numerals are used to indicate like parts, Fig. 1 illustrates a perspective view of a wall 10 having a doorway 12 therethrough, said doorway being capable of being closed by a door 14 which is pivoted adjacent one edge relative to one side of the doorway 12. The door may be moved to and from closed position by any suitable mechanism, not illustrated herein, in accordance with well known principles employed for this purpose. Such mechanism may, for example, be contained within a casing 16 installed at the top of the doorway 12, the operation of said mechanism being controlled electrically by an electric mat switch 18 which, in the embodiment illustrated in Fig. 1, extends outward in opposite directions from the doorway 12 and is disposed upon the floor surface at the base of the wall 10. A suitable circuit, not illustrated herein, extends between the terminals of the mat switch 18, to be described hereinafter, and the operating mechanism for the door 14.

The mat switch 18 is preferably generally flexible, whereby the same lies flat upon the surface supporting the same and readily assumes the contour of said surface. Usually, when such mat switches are used relative to a doorway and extend therethrough, the conventional door sill or threshold strip is omitted. However, if such door sill or threshold strip is not omitted, the construction of the mat switch is such that it may be

adapted to extend over said sill or strip in a manner described hereinafter.

In accordance with the present invention, the mat switch 18 comprises an upper contact plate 20 which may be formed from a unitary sheet of any suitable metal, such as aluminum. Said upper contact plate extends preferably substantially across the entire width of the mat switch 18 and, if desired, may extend for the entire length of the switch 18. A similar lower contact plate 22 is mounted in parallel relationship to upper contact plate 20 and is held in spaced relationship from the latter by an elastic, readily compressible sheet 24 of any suitable electrical insulating material, such as sponge rubber. The sheet 24 may be substantially co-extensive in length and width with the upper and lower contact plates 20 and 22. In the preferred embodiment of the invention, however, the sheet 24 is slightly shorter and narrower than said contact plates and the edges of the compressible sheet 24 are surrounded by a border strip 26 of suitable material, such as rubber of a somewhat less compressible nature than the sheet 24, said border strip 26 being formed, for example, from rubber similar to that employed for use in rubber matting and treads. The border 26 is also preferably relatively narrow and extends to the edges of the upper and lower contact plates 20 and 22 or slightly therebeyond, as illustrated in Fig. 3.

A flexible edging strip 28 surrounds the superposed upper and lower contact plates and sheet 24 and is provided with an extension 30 of less thickness than the main body of the edging strip 28, said extension extending a limited distance beneath the lower contact plate 22 so as to underlie the same, as clearly illustrated in Fig. 3. The upper surface of the edging strip 28 is also stepped to provide a recess 32 which receives the edges of a flexible tread sheet 34 which extends across the upper surface of upper contact plate 20 between the upright walls defining recess 32 in the edging strip 28. The edging strip 28 may be formed from any suitable material, such as a durable type rubber, and the upper surface of said strip is tapered toward the outer edge thereof, as shown in Fig. 3, to prevent a person from tripping or stumbling against the edge of the mat switch 18.

Extending between the inner edges of the extension 30 of the edging strip 28 which surrounds the contact plates and underlying the lower contact plate so as to support the same from engagement with a floor surface, for example, is a bottom or base member 36 which may be formed from any suitable material, such as, for example, metal, rubber, fabric or synthetic resin. Said member preferably has substantially the same thickness as extension 30 of edging strip 28.

In order to provide means for effectively and positively establishing electrical contact between the two contact plates 22 and 24 by simple means which may be manufactured and assembled inexpensively, the compressible sheet 24 is provided with a plurality of apertures 38 which are spaced apart, in transverse directions to each other, any suitable distances for purposes of receiving contact buttons 40 formed from suitable material, such as aluminum, and provided with an annular flange 42 extending laterally outward from one end of each button. The buttons 40 are simply dropped into apertures 38 and one of the contact plates such, for example, as the upper contact plate 20 is then placed over the contacts, whereby the plate abuttingly engages the flanges 42 of all the buttons as illustrated in Fig. 3. The flange 42 of each button becomes slightly compressed into the adjacent surface of the compressible sheet 24, as shown in Fig. 3, and the resilience of sheet 24 alone holds the flanges of all the buttons 40 firmly in contact with plate 20 when assembled without requiring any other connecting means therebetween.

The other end 44 of each button extends to within a short distance of the other contact plate, such as lower plate 22, as illustrated in Fig. 3. This is the normal position of each contact button relative to the contact plates when no pressure is applied against tread sheet 34. However, when pressure is applied against tread sheet 34, such as when a person steps thereupon, the portion of the upper contact plate 20, against which pressure is so applied, will be moved toward the lower contact plate 22, compressing the portion of sheet 24 therebetween and causing the ends 44 of certain of the buttons 40 to be moved into engagement with lower contact plate 22. When the upper and lower contact plates have been connected in the circuit referred to above by means to be described hereinafter, such engagement of the ends 44 of the contact buttons with lower contact plate 22 will close the circuit controlling the operating mechanism for the door and thereby cause said door, for example, to be moved from the closed to the open position thereof illustrated in Fig. 1.

The buttons 40 are spaced apart in transverse direction to each other suitable distances so that when a person, for example, steps upon the mat switch 18 at any portion thereof within the inside edges of edging strip 28, at least one button 40 will establish electrical contact between the upper and lower contact plates of the mat switch. Conversely, when pressure is released from the mat 18, such as when the person steps off the mat after having passed through the doorway 12, for example, the natural resilience of the compressible sheet 28 will function to disengage the ends 44 of all the contact buttons 40 from contact with the contact plate into engagement with which they have previously been moved. Such disengagement will take place instantly when, for example, the person steps off of the mat switch 18. The constant engagement of the sheet 24 with the flanges of each button will also insure positive disengagement of the ends 44 of the buttons from the contact plate engaged thereby when the mat switch was compressed by a person stepping upon it.

The above described components of the mat switch 18 preferably are assembled as follows: sheet 24 is placed over contact plate 22 and cemented thereto, the contact buttons 40 are dropped into the apertures 38 of sheet 24, contact plate 20 is placed over the flanges 42 of buttons 40 and sheet 24 and united with the upper surface of sheet 24 by cementing or otherwise, and the thus assembled plates and sheet which hold the contacts 40 united therewith are then united with base member 36 such as by cementing said assembly to the lower contact plate 22. Thus, the contact plates 20 and 22, sheet 24 and base member 36 are secured together as a unit which without further connecting means maintains all of the contact buttons 40 in their operative position between the contact plates 20 and 22 and in contact with one of them at all times. Such unit is flat, relatively thin, flexible, and compact and is mounted between the inner edges of the edging strip 28, the edges of said unit resting

upon the continuous extension 30 of the continuous edging strip 28. The tread sheet 34 is then placed upon the contact unit referred to and the edges of said tread sheet are cemented into the recess 32 of edging strip 28.

The cemented tread sheet and edging strip thus comprises an envelope having an open bottom through which the contact unit may be inserted or removed as, for example, when the tread sheet 34 has been worn beyond further use and replacement thereof is required. The contact unit will also be inserted through said open bottom of said envelope when the mat switch is being assembled during manufacture thereof if desired. However, if the edging strip 28 is still useful upon the tread sheet 34 being worn beyond further use, the sheet 34 may be removed from the recess 32 of the edging strip and a new tread sheet may be substituted for the worn sheet by cementing the edges of the new sheet to the recess 32 of the edging strip.

The foregoing description applies to a mat switch, regardless of whether the same may be formed with a unitary contact unit, as described above, or a plurality of contact units disposed in end to end relationship as illustrated in Fig. 2. In Fig. 2, two contact units 46 are shown in exemplary end abutting relationship, said units, in cross section, being illustrated in detail in Fig. 4. When such a plurality of contact units 46 are used in a single mat switch, each unit preferably comprises united contact plates 20 and 22, a compressible sheet 24 and a base member 36. The end of each said unit which is arranged to be disposed adjacent the end of the other unit is preferably finished by a suitable insulative strip 48 cemented around said end of each unit, as illustrated in Fig. 4. Such strips may comprise, for example, material comprising flexible sheet synthetic resin or regenerated cellulose coated on one surface with a tacky type cement. Said plurality of contact units 46 are enclosed within a continuous edging strip 28 and are covered by a unitary tread sheet 34 extending across and between such plurality of units 46, as clearly illustrated in Fig. 4.

In the event a door sill or threshold strip is used at the bottom of the doorway 12, the mat switch 18 may be constructed so that, for example, a space is provided between the adjacent ends of the units 46 which are finished by strips 48, said space being sufficiently wide, for example, to accommodate the door sill or threshold strip while the tread sheet 34 preferably extends across said door sill or threshold strip in a continuous manner.

The provision of a plurality of contact units 46 disposed in end to end relationship, as described above, permits a mat switch of this nature to be folded upon itself in a manner similar to that illustrated in Figure 7, and the envelope structure referred to above, which at least partially encloses each of the contact units, will serve to maintain said contact units assembled with the tread sheet 34 and edging strip 28 when the mat is folded, as shown in Figure 7. To facilitate such folding, portions of the extension 30 of the edging strip 28 adjacent the juxtapositioned ends of the contact units are omitted, whereby said normally juxtapositioned ends of the contact units 46 may each extend a short distance outward from the curved portion of the folded envelope as illustrated in Fig. 7.

In order that the contact units may be connected in the control circuit of the door operating mechanism referred to above, terminal members are provided on each of the upper and lower contact plates 20 and 22. Such contact plates are clearly illustrated in Fig. 4 and comprise similar button-like terminals 50 and 52 which are affixed respectively by bent ears or otherwise, to the upper contact plate 20 and lower contact plate 22. Relative to the terminal 50 on the upper contact plate 20, the lower contact plate 22 is provided with a clearance aperture 54 having a greater area than that of the terminal 50 and being co-axial therewith. By such arrangement the terminal 50 may be sufficiently long so as to extend partly into or through the aperture 54 in the normal position thereof illustrated in Fig. 4 without making electrical contact between the upper and lower contact plates of the contact unit. Such arrangement thereby provides an effective, compact type of terminal 50 to which a circuit wire may be attached by a suitable screw 56 or otherwise, without adding to the overall thickness of the mat switch 18.

The terminal 52 which is fixed to the lower contact plate 22 is co-axial with an aperture 58 in the upper contact plate 20 and said aperture and terminal 52 function similarly to the terminal 50 and aperture 54. The terminal 52 is also provided with a wire attaching screw 60. When a plurality of contact units 46 are used in end to end relationship, each unit is provided with a pair of terminals 50 and 52 and clearance apertures 54 and 58 in the contact plates which cooperate therewith, as clearly shown in Fig. 4. In the preferred construction, the base member or members 36 are provided with openings 62 which are co-axial with terminals 50 and 52 and provide space to permit attaching circuit wires to the screws 56 and 60. Pairs of terminals 50 and 52 are also preferably provided on the contact units 46 adjacent opposite sides thereof, as clearly shown in Fig. 2, and the circuit wires may be led to said terminals through any suitable openings, not shown, formed in the base member 36 and the edging strip 28, preferably on the under surface thereof.

In another embodiment of the invention, it is contemplated that the contact buttons 40 may be formed in connected relationship rather than providing individual buttons. For example, a strip 64, such as illustrated in Fig. 6, may be arranged so as to have a series of button-like members 66 pressed so as to project from one surface of the strip 64, as clearly shown in said figure. By such an arrangement, the insertion of the button-like members within the apertures provided therefor in compressible sheet 24 is greatly facilitated and can be more quickly performed than by inserting individual buttons 40 as shown in Figs. 2, 4, and 5. In the embodiment illustrated in Fig. 6, the areas of the strip 64 which surround the button-like members 66 serve as flanges and correspond in function to the flanges 42 on buttons 40. Otherwise, the function of the strips 64 and the button-like members 66 thereon function similarly to the buttons 40 within the contact units 46. The strips 64 may be of any desired length, so as, for example, to extend for the full width or length of each of the contact units 46, the strips in the entire unit being disposed in parallel spaced relationship to each other.

It will be seen from the foregoing that the mat switch 18 embodying the principles of the present invention provide a construction which

may be manufactured much less expensively than the mat switches used heretofore for similar purposes. Also, the contact units of mat switch 18 are constructed so that electrical connection and disconnection is positively assured, the contact units may be readily and eaily removed from the envelope-like arrangement comprising the edging strip 28 and the tread sheet 34 when the latter becomes worn beyond further use and inserted within a new tread sheet and edging strip, compact and simple terminals are provided for the contact units to which circuit wires may easily be connected without adding to the overall thickness of the mat switch, and the mat switch may also be constructed so as to be foldable upon itself to render the same more compact for handling and shipping without in any way harming the mat switch of the function thereof.

While the invention has been illustrated and described in its preferred embodiments and has included certain details, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways, falling within the scope of the invention as claimed.

I claim as my invention:

1. A switch of the floor mat type comprising an upper contact plate, a lower contact plate, a perforate elastic insulating sheet interposed between said plates, said elastic sheet being substantially coextensive with said plates and contiguous therewith, a thin metallic positioning element overlying a portion of said insulating sheet and engaging one of said contact plates, said positioning element having at least one integrally formed contact button projecting into a perforation in said insulating sheet in normally spaced relation to said other contact plate, said positioning element being arranged for movement with said insulating sheet to effect engagement between said contact button and said other contact plate upon the application of pressure to said one contact plate, and said insulating sheet being arranged to separate said contact button and said other contact plate upon release of said pressure.

2. A switch of the floor mat type as defined in claim 1 wherein said elastic sheet is cemented to said contact plates and said thin metallic positioning element comprises a generally circular disk having a contact button projecting into a perforation in said insulating sheet, there being a plurality of said positioning elements disposed between said insulating sheet and said one contact plate.

3. In an electric switch of the floor mat type having a plurality of contact units arranged in end to end relation and comprising upper and lower contact plates, an elastic insulating sheet secured therebetween, and contact means extending from one plate toward the other through openings in the elastic sheet, the combination of a flexible edging strip surrounding said units and extending partially thereunder, and a flexible tread sheet overlying said units and detachably secured at its marginal portions to said edging strip to form an envelope therewith for enclosing the tops and edges of said units, said tread sheet being foldable upon itself adjacent the juxtapositioned ends of said units to permit disposition of said units in compact superposed relationship and to permit removal and insertion of said units relative to said envelope.

4. In an electric switch of the floor mat type having upper and lower contact plates, an elastic insulating sheet secured therebetween, and contact means extending from one plate toward the other through openings in the elastic sheet, the combination of a flexible insulating strip surrounding said plates and having an internally directed flange underlying a marginal portion of the lower contact plate, an insulating sheet secured to the underside of the lower contact plate with its periphery in spaced relation to said flange, and a flexible insulating sheet overlying said upper plate and having a marginal portion secured to said insulating strip.

5. A switch of the floor mat type comprising an upper contact plate, a lower contact plate, a perforate elastic insulating sheet interposed between said plates, a thin metallic positioning element comprising a strip transversely disposed in relation to said insulating sheet to overlie a portion thereof, said positioning element having a plurality of integrally formed contact buttons each projecting into a perforation in said insulating sheet, said positioning element being arranged for movement with said insulating sheet to effect engagement between said contact buttons upon the application of pressure to said one contact plate, and said insulating sheet being arranged to separate said contact buttons and said other contact plate upon release of said pressure.

SHELDON S. ROBY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,003,145	Marmion	Sept. 12, 1911
1,776,992	Brockman	Sept. 30, 1930

FOREIGN PATENTS

Number	Country	Date
392,936	Great Britain	May 25, 1933