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2,611,049

ELECTRIC MAT SWITCH

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2 SHEETS—SHEET 2

Fig. 3

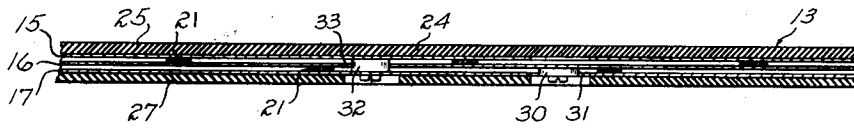


Fig. 4

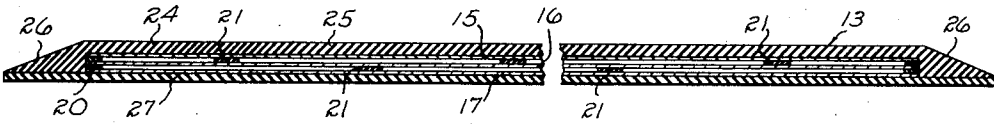
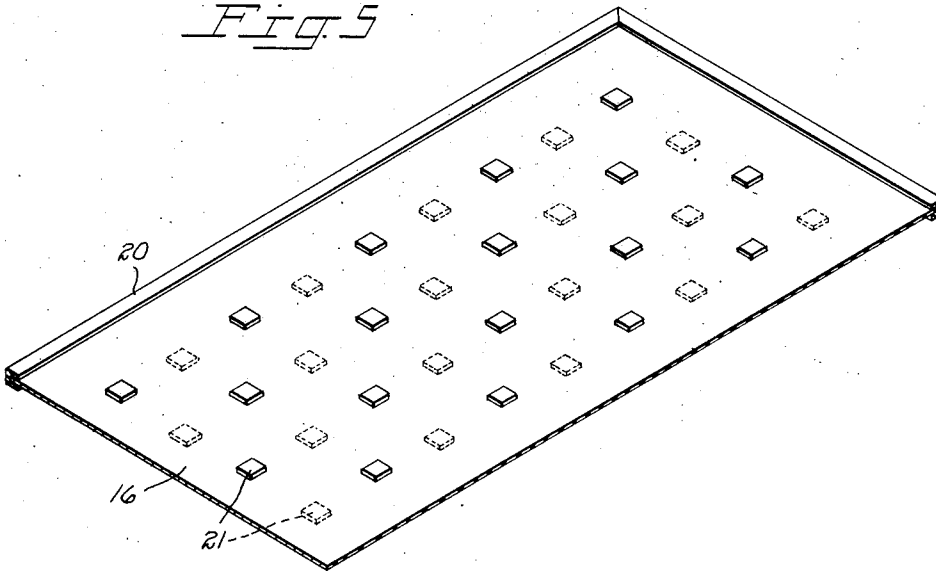


Fig. 5



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ELECTRIC MAT SWITCH

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1

The present invention relates generally to means for controlling the operation of automatically operated doors and the like, and more particularly to an improved electric mat switch for such use having improved operating characteristics and yet simple and economical in construction so that it may be easily fabricated and assembled at relatively low cost.

It is an object of the present invention to provide an electric mat switch for use in installations of automatically operated doors and the like which will have a uniformly high degree of sensitivity throughout its full area so that an electrical circuit through the electric mat switch will be established at substantially the same pressure throughout regardless of the particular area of the mat which is stepped upon or otherwise actuated without at the same time being sensitive to vibrations or pressures not resulting from intended operation of the switch tending to cause the contacting members to close.

A further object of the invention is to provide an electric mat switch of the character referred to which will be of economical construction so that it may be fabricated and assembled without complicated hand operations and without the need for careful and skilled workmanship with the result that the mat may be made at low cost.

A further object of the invention is to provide an electric mat switch having the characteristics referred to which will retain these characteristics over long periods of time so that the switch will operate effectively and efficiently after long periods of use and without change.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

Figure 1 is a fragmentary perspective view of a doorway and door with the electric mat switch of the present invention disposed in the doorway;

Fig. 2 is a plan view partially in cross section showing the details of construction of the mat switch;

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a cross sectional view taken along the line 4—4 of Fig. 2; and

Fig. 5 is a cross sectional, fragmentary perspective view of the central contactor plate of the

2

electric mat switch showing the separating elements.

The view shown in Fig. 1 of the drawings illustrates one use of the electric mat switch of the present invention. As shown in Fig. 1, a doorway 10 disposed in a wall 11 is provided with a door 12 which is arranged for actuation toward and away from a closed position in the doorway 10 by any suitable electrically controlled mechanism (not shown). The electric mat switch 13 of the present invention is disposed at the bottom of the doorway 10 and is of sufficient length so that anyone intending to pass through the doorway 10 must step on the mat switch well in advance of the doorway and will remain on the switch for an appreciable distance beyond the doorway 10.

As best shown in Figs. 3 and 4 of the drawings, the electric mat switch 13, constructed in accordance with the present invention, is composed of three superposed metal plates 15, 16 and 17. The top two plates 15 and 16 are formed of flexible sheet metal which is sufficiently flexible to bend or flex under the pressure of someone stepping on the mat but sufficiently resilient so that they will not be permanently deformed under such pressures. Suitable metal plates for use in a commercial embodiment of the electric mat switch of the present invention have been made from plate aluminum sheets having a thickness of about $\frac{1}{16}$ ". For convenience and ease of manufacture all three plates 15, 16, and 17 may be formed of the same sheet metal, although the bottom plate 17 may be of a more rigid nature, if desired, without departing from the scope of the invention.

As will be appreciated, the plates 15, 16 and 17 may be of any desired size but in the preferred embodiment will be generally rectangular in cross section of sufficient width to extend substantially entirely across the doorway and of sufficient length to extend a suitable distance outwardly on either side of the door way.

In accordance with the invention, the edge of the central metal plate 16 is received in an insulating channel strip 20 extending around the periphery thereof and preferably adhesively secured thereto. The channel strip 20 may be made of any suitable non-conducting material and preferably is of a slightly resilient nature. I have found, for example, that a very satisfactory channel may be composed of vinyl plastic, although other commercially available plastic materials or rubber or the like could be substituted therefor.

Disposed on the opposite surfaces of the central metal plate 16 are a plurality of staggered

separating members which, in the illustration shown in the drawings, consist of a plurality of small squares 21 composed of non-conducting material which again may be vinyl plastic or any other similar material. As best shown in Fig. 5 of the drawings, the squares 21 on one side of the metal plate 16 are in staggered relationship with respect to the squares 21 on the opposite face of the plate. While the separating members have been illustrated in the drawings as being small squares 21, it will be appreciated that the separating members could have any other desired shape, it being important only that the members on one side of the plates 16 shall be in displaced relationship with the separators on the opposite side of the plate so that they are not in vertical alignment and small enough so that they do not overlap. The squares 21 of plastic or other suitable material may be secured to the plate 16 to avoid displacement in any suitable manner such as by the use of adhesive material. In one commercial embodiment of the electric mat switch of the present invention, it has been found advantageous to form the squares 21 of thin vinyl sheet material cut into pieces of the order of $\frac{3}{8}$ " square. The squares 21 are preferably separated into transverse and longitudinal rows which are approximately 2" or more apart. The squares in succeeding rows are staggered with respect to each other so that in any one row the squares will be separated by a distance of approximately 4" or more. However, the distance between any two squares will be considerably less and preferably not exceeding about 3".

The outer metal plates 15 and 17 are then disposed on opposite sides of the central metal plate 16 and may be secured in position by cementing same to the periphery of the channel strip 20, the channel strip 20 being securely fixed in turn to the central plate 16 by adhesive material or the like, as previously mentioned.

In accordance with the invention, the sandwich composed of the metal plates 15, 16 and 17 is inserted within an envelope 24, preferably made of waterproof plastic material and so formed that it entirely surrounds the sandwich composed of the three metal plates. As best illustrated in Figs. 3 and 4, the envelope may be composed of a relatively heavy tread section 25 formed with a tapered edge portion 26 defining the periphery of the mat and forming a recess beneath the tread section 25. The sandwich composed of the metal plates 15, 16 and 17 may then be disposed in the recess and fixed in place by the application of a closing sheet 27 which may be cemented or otherwise joined to the bottom of the tapered edge portion 26. While the above appears to be the most convenient way in which to form the envelope portion, it is appreciated that the envelope could be molded in one piece surrounding the sandwich formed of the metal plates 15, 16 and 17.

In accordance with the invention, means is provided to establish an electric connection to the central sheet 16 and a second connection jointly to the outer metal plates 15 and 17. As best shown in Figs. 2 and 3, a terminal 30 may be secured at one edge to the central metal plate 16, there being provided an enlarged opening 31 in the lower metal plate 17 to provide sufficient clearance therefor without short-circuiting. In similar manner a terminal 32 may be connected to both the outer metal plates 15 and 17, in which case the central metal plate 16 is

provided with an enlarged opening 33 to receive the terminal 32 without short-circuiting.

By establishing one connection to the central plate 16 and a second connection to the outer plates 15 and 17, it will be appreciated that a contact will be established through the electric mat switch when either of the outer plates 15 or 17 is brought into contact with the central plate 16. By reason of the fact that the plates 15 and 17 are separated from the central plate 16 by separators 21 which are in staggered relationship, it is ensured that an electric contact will be established between one of the outer plates and the central plate regardless of where pressure is brought to bear on the mat and this contacting is accomplished primarily by the flexing of the metal plates without dependence upon highly resilient separators which normally will deteriorate when used over long periods of time. In other words, the electric mat switch will have the desired degree of sensitivity substantially uniformly throughout and will not have any areas so sensitive that contact will be established by vibration or minor pressures not intended to actuate the switch. Furthermore, the opening of the switch after the pressure is removed is caused by the resiliency of the metal sheets and not dependent on the action of resilient separating members, whereby positive action is ensured over long periods of time.

The electric mat switch of the present invention, as described above, is simple and easy to fabricate and assemble, so that it may be produced at low cost. Furthermore, the sandwich composed of the metal plates 15, 16 and 17 normally will not be damaged in use over long periods of time, and replacement of the upper tread section usually will be all that is required to place the electric mat switch in original new condition.

While the electric mat switch of the present invention has been described and illustrated as a single switch extending through the doorway 10, it will be obvious that separate but abutting switches made in accordance with the invention could be provided for opposite sides of the doorway 10, if desired.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. A switch of the floor mat type for controlling door actuating mechanisms and the like comprising three superposed generally parallel imperforate sheet metal plates, the upper two plates being sufficiently flexible and resilient to permit flexing responsive to predetermined operating pressures to effect engagement between at least two of said three plates, means normally separating the plates in said superposed parallel relationship comprising a plurality of spaced apart thin non-conducting elements disposed on each side of the intermediate plate, the elements between the bottom and intermediate plates being disposed in staggered relationship with respect

5

to the elements between the intermediate and top plates, and means for forming one electrical connection with the intermediate plate and a second electrical connection jointly with the top and bottom plates.

2. A switch of the floor mat type for controlling door actuating mechanisms and the like comprising three three superposed generally parallel imperforate sheet metal plates, the upper two plates being sufficiently flexible and resilient to permit flexing responsive to predetermined operating pressures to effect engagement between at least two of said three plates, means normally separating the plates in said superposed relationship comprising a plurality of thin spaced apart non-conducting elements of relatively small area, means for positioning the elements between the plates so that the elements between the intermediate and top plates are not in alignment vertically with the elements between the intermediate and bottom plates, and means for forming one electrical connection with the intermediate plate and a second electrical connection jointly with the top and bottom plates.

3. A switch of the floor mat type for controlling the operation of door actuating mechanisms and the like comprising three superposed generally parallel sheet metal plates, the upper two plates being sufficiently flexible and resilient to permit flexing responsive to predetermined operating pressures to effect engagement between at least two of said three plates, a plurality of small separating elements composed of non-conducting sheet material uniformly arranged between the upper and intermediate plates in non-alignment vertically with similarly uniformly arranged separating elements between the intermediate and bottom plates, means for holding the plates in superposed relationship including an envelope of resilient non-conducting material receiving the superposed plates, and means forming one electrical connection with the intermediate plate and a second electrical connection jointly with the top and bottom plates.

4. A switch of the floor mat type for controlling the operation of door actuating mechanisms and the like comprising three superposed generally parallel sheet metal plates, the upper two plates being sufficiently flexible and resilient to permit flexing responsive to predetermined operating pressures to effect engagement between at least two of said three plates, an edging strip disposed between the top and intermediate plates and between the intermediate and bottom plates at the peripheries thereof, a plurality of thin separating elements of relatively small area disposed between the top and intermediate plates and between the intermediate and bottom plates, means for retaining the elements on opposite sides of the intermediate plate at regularly spaced intervals with the elements on one side being disposed at the spaces between the elements

6

on the other side, a cover for the plates including a tread section extending over the top plate, and means forming one electrical connection with the intermediate plate and a second electrical connection jointly with the top and bottom plates.

5. A switch of the floor mat type for controlling the operation of door actuating mechanisms and the like comprising three superposed generally parallel sheet metal plates, the upper two plates being sufficiently flexible and resilient to permit flexing responsive to predetermined operating pressures to effect engagement between at least two of said three plates, a plurality of small pieces of thin plastic sheet material secured to opposite sides of the intermediate plate at regularly spaced intervals but with the pieces on one side of the plate in staggered relationship with respect to the pieces on the other side, means forming one electrical connection with the intermediate plate and a second electrical connection jointly with the other two plates, and an envelope of non-conducting material for the superposed plates including a tread section extending over the top plate.

6. A switch of the floor mat type for controlling door actuating mechanism and the like comprising three superposed generally parallel imperforate sheet metal plates, means forming one electrical connection with the intermediate plate and a second electrical connection jointly with the top and bottom plates, means separating the plates in said superposed relationship comprising a first layer of regularly spaced-apart thin non-conducting elements disposed between the upper two plates and a second layer of regularly spaced-apart thin non-conducting elements disposed between the lower two plates, said first and second layers of elements being arranged in vertical disalignment and said upper two plates being sufficiently resilient to permit flexing relative to each other and to the bottom plate whereby engagement is effected between said upper two plates upon the application of predetermined operating pressures in the space between adjacent elements in the first layer and normal to said plates and whereby engagement is effected between the lower two plates upon the application of predetermined operating pressures in the space between adjacent elements in the second layer and normal to said plates.

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