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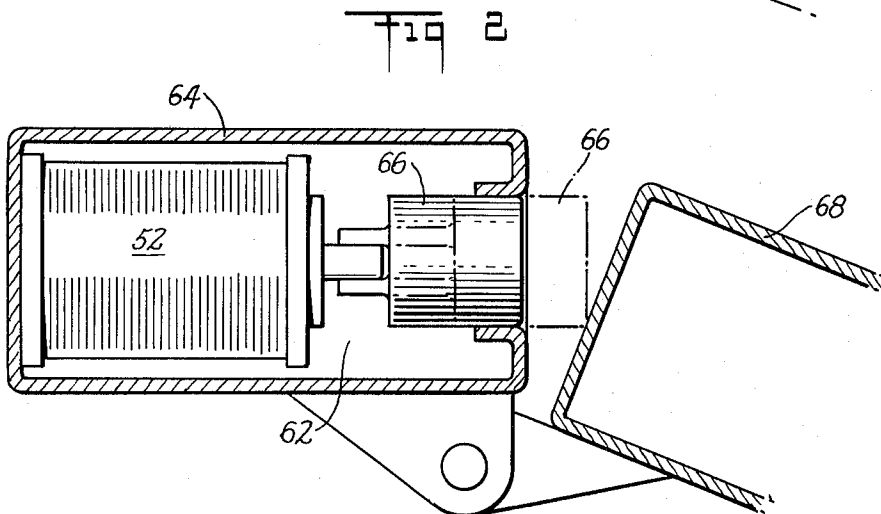
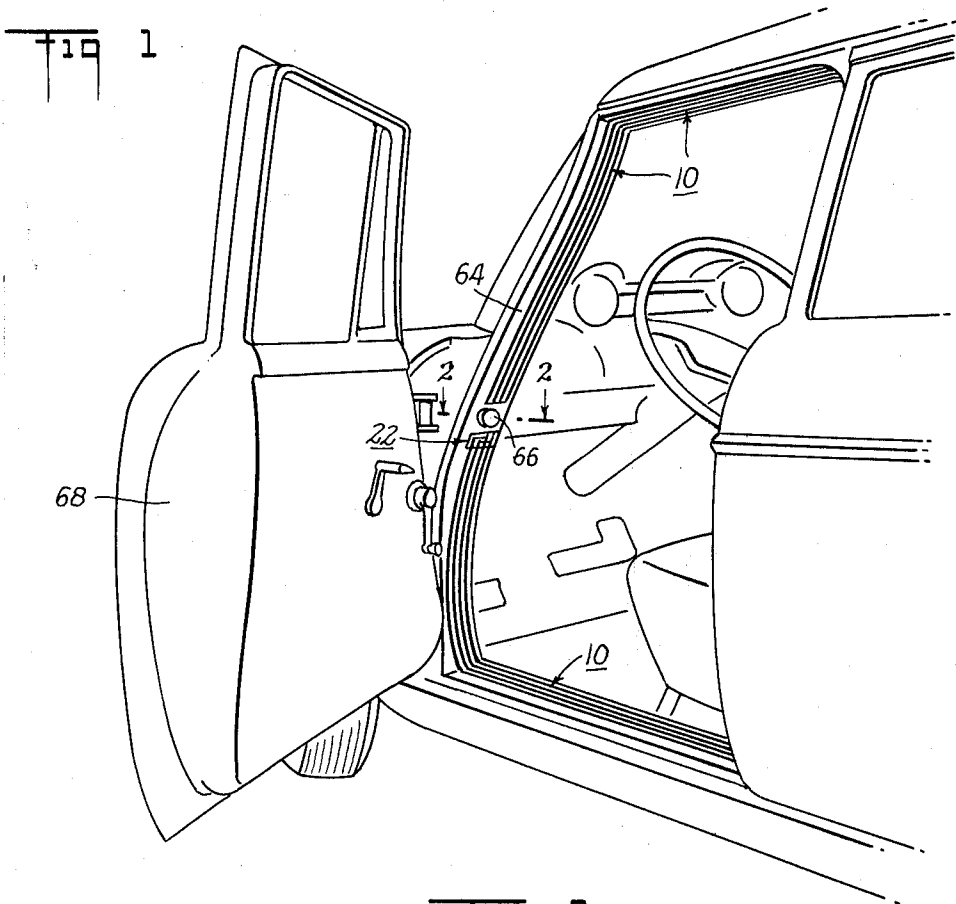
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3,231,880

DETECTION RESPONSE MECHANISM

Filed June 18, 1962

2 Sheets-Sheet 1



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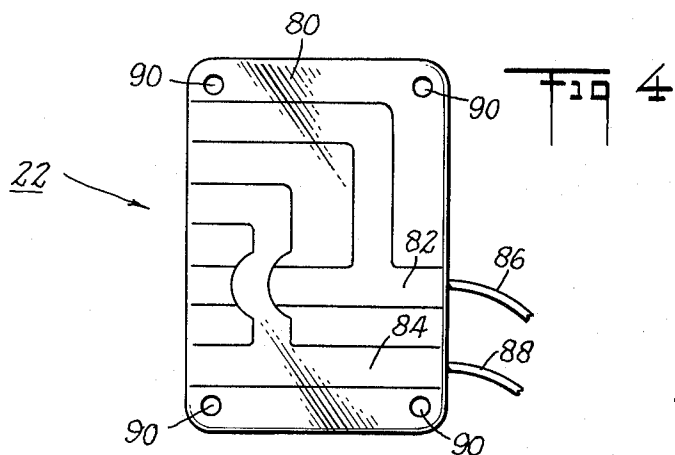
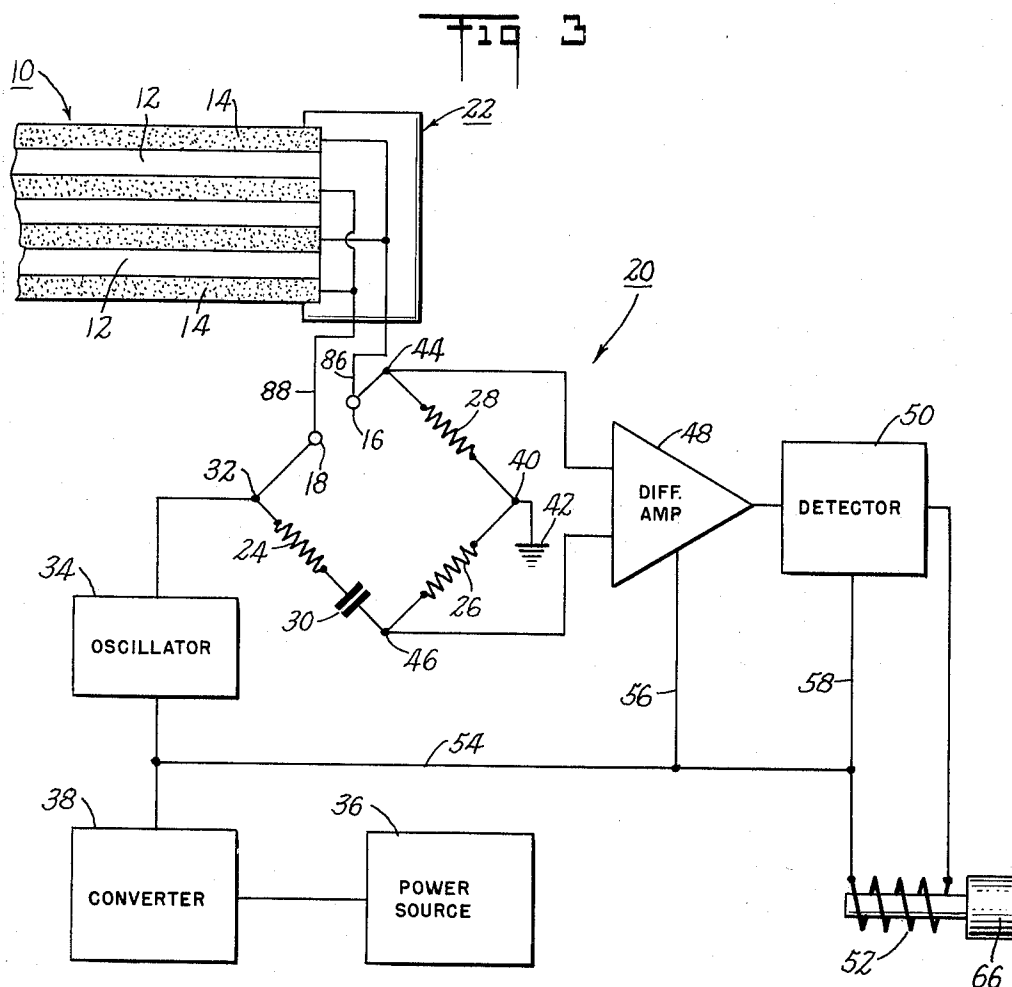
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DETECTION RESPONSE MECHANISM

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2 Sheets-Sheet 2



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DETECTION RESPONSE MECHANISM

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3 Claims. (Cl. 340-258)

This invention, in its broadest aspects, relates to novel electrical means for detecting objects and to means for utilizing said detection to operate a response mechanism. More particularly, this invention concerns itself with an electrical system including novel sensing means electrically coupled to a capacitance circuit. The circuit is preferably coupled to a response mechanism, such as an alarm mechanism, a window or door closing mechanism, or a door jamming mechanism to prevent closure. The latter is particularly suited for application to automobile doors to prevent slamming of the door on an occupant's finger.

Probably the most pertinent prior art is seen in U.S. Patent No. 2,601,250. In the structure shown, a sliding elevator door has a leading edge which contains a plurality of cold cathode gas tubes with antennas extending vertically therefrom within the edge. Should the door close on a passenger going into or out of the elevator, the leading edge will contact his body. The change in capacitance as a result of the presence of his body fires the tube. Since the tube is coupled to a door opening mechanism, it will cause immediate opening. No injury to the passenger will therefore occur.

Unfortunately, the system disclosed is complicated in structure and expensive to manufacture, install and maintain. In addition, shielding means are required to prevent unwanted firing of the tube. Furthermore, the antenna system is inflexible and requires a heavy supporting and insulating structure. All of these undesirable features prevent adaptation of the system to everyday usage where such a mechanism would be highly desirable.

A mechanical device for preventing injury to fingers accidentally placed in a door hinge is seen in Patent No. 474,633. Here, a sheet of flexible material covers the hinge portion of the door. Many other hinge safety devices are in existence, but in each instance, they only protect the hinge portion of the door. One such device useful for automobile doors, is seen in U.S. Patent No. 2,086,529, but here again only the hinge is protected.

An object of this invention is to provide a novel electrical device for detecting the presence of objects.

Another object is to provide a novel sensing means for use in said novel electrical device.

Still another object is to provide a novel connector for use with said novel sensing means.

A further object is to provide an electrical device of the above character capable of being used with a response mechanism.

A still further object of this invention is to provide a novel safety device for application to a door, especially an automobile door, to prevent accidental crushing of occupant's fingers and the like.

Another object is to provide a novel alarm mechanism for application to a door jamb or window sill.

Another object is to provide a novel window or door closing mechanism which is actuated by rain falling thereon.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, the apparatus embodying features of construction, combination and arrangement of parts which are adapted to effect such steps, and the article which possesses the characteristics, properties and rela-

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tion of elements, all as exemplified in the detailed disclosure hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

FIGURE 1 is a broken perspective view showing use of the device of this invention upon an automobile door.

FIGURE 2 is a cross-sectional view of the jamb of the automobile door taken along line 2-2 of FIGURE 1 to illustrate the action of the wedge in preventing closure of the door.

FIGURE 3 is a plane view of an electrical circuit for use in the device of this invention.

FIGURE 4 is a broken perspective view of the novel connector of this invention.

Similar reference characters refer to similar parts throughout the several views of the drawing.

The invention herein comprises the combination of a novel sensing means and connector, a capacitance sensitive circuit and actuation means controlled by said circuit for initiating a mechanism operatively connected thereto. In one important embodiment, said actuation means includes a solenoid which moves a wedge into and out of a door hinge so that the door cannot be slammed shut on a hand or finger within the jamb.

More particularly, the invention herein includes a novel sensing means comprising an adhesive-backed flexible tape with parallel strips of conductive material longitudinally affixed to the face or the back of the tape. These strips of conductive material are conductively secured to one end to a connector having a novel design. The design includes attachment features to the tape which insure simplified connection and continued good conduction with the tape. The connector, in turn, communicates with a capacitance sensitive circuit. Thus, when an object is disposed across the strips on the tape, its capacitance is detected by the capacitance sensitive circuit. The circuit operates an electrical actuating means; such as a door jamming mechanism, a burglar alarm, or a window or door closing means to cause an appropriate responsive action.

The invention will now be described in detail with repeated reference to the accompanying drawing.

FIGURES 1 and 3 illustrate the sensing means, generally indicated by numeral 10. It consists of a tape 12, with a pressure sensitive adhesive or like material on one side to facilitate its adherence to a surface where objects are to be detected. Typical uses are in a door jamb, on a window sill, on a fence, or at the boundary of a guarded area. Its face has superimposed parallel strips 14 of conductive material adhered thereto. Each alternate strip is connected in parallel as at input terminal 16 and 18 of a capacitance circuit, generally indicated at 20 in FIGURE 3.

A connector 22, to be described in detail below, facilitates connection of the tape to the input terminals of the circuit.

The input terminals comprise one leg of a Schering bridge, which is balanced in the absence of a body close to tape 12. The bridge includes resistance elements 24, 26 and 28, and a capacitor 30.

The bridge is powered through its apex 32 by oscillator 34, typically producing 1000 cycles per second. Depending on the particular installation, the oscillator is supplied with power from source 36, which may, for example, be a 12 volt automobile battery. If a high volt current source, such as house wiring, is utilized and if tubes are the active elements in the capacitance circuit, power conversion may be necessary. This can be accomplished via converter 38.

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The supply current to the bridge is grounded via apex 40 to ground 42.

The two remaining apexes 44 and 46 of the Schering bridge are connected across a differential amplifier 48. Any unbalance in the voltage of the bridge caused by presence of a body will be amplified by the differential amplifier. Its output is converted to D.C. by detector 50 to produce a current suitable for energizing a response mechanism; such as solenoid 52.

The amplifier 48, the detector 50 and the solenoid 52 may be supplied by the same current source as oscillator 34 via main conductor 54 and branch conductors 56, 58 and 60 respectively.

In FIGURE 2, there is illustrated one embodiment of a response mechanism. It comprises solenoid 52 contained within a well 62 of a door jamb 64. Thus, when the solenoid 52 is actuated by the presence of a body; such as a finger, an elbow, a wrist or the like in proximity to tape 10, wedge 66 will be immediately ejected outwardly to prevent closure of door 68. Hence, injury to fingers, elbows, wrists, etc., will be prevented.

Other typical uses for the invention includes actuation of a door or window closing motor or a burglar alarm. In the latter instance, the tape 10 is affixed to the window and doors of a building and may, if desired for greater effectiveness, be hidden from view by a coat of paint. In the former instance, the face of the tape is left exposed so that upon contact with snow or rain the Schering bridge is unbalanced and the closing motor is actuated.

In FIGURE 4, there is shown the connector for use with the novel sensing means. It consists of a transparent or translucent plate 80 with two conductive paths 82 and 84 molded therein for alignment with the alternate conductive strips of tape 12. The back or unexposed side of the plate when secured to the tape contains a pressure sensitive adhesive which retains the plate in a secured position. Lead wires 86 and 88 extend from one edge of the plate for connection to input terminals 16 and 18. Screw orifices 90 permit affixation to a fixed surface.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method and in the article set forth without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are 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.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Electrical means for detecting occupant's fingers and the like in a door jamb of a hinged door and a response mechanism capable of preventing said hinged door from fully closing, said electrical means being particularly suited for easy application to said door jamb and comprising a tape having a layer of adhesive secured to its backside for affixing said tape to said jamb of said door, and a plurality of exposed conductive strips secured to its face side, a capacitance change detecting circuit with input terminals, and means for connecting the exposed strips of said tape to said input terminals, and said re-

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sponse mechanism comprising a solenoid which operates to mechanically block said hinged door against closing, said solenoid being in circuit with said electrical means.

2. Electrical means for detecting occupant's fingers and the like in a door jamb of a hinged door and a response mechanism capable of preventing said hinged door from fully closing, said electrical means being particularly suited for easy application to said door jamb and comprising a tape having a layer of adhesive secured to its backside for affixing said tape to said jamb of said door, and a plurality of exposed conductive strips secured to its face side, a capacitance change detecting circuit with input terminals, and means for connecting the exposed strips of said tape to said input terminals, said means comprising a plate with a plurality of conductive strips exposed on its undersurface for abutment against said strips and door jamb affixing means, and said response mechanism comprising a solenoid which operates to mechanically block said hinged door against closing, said solenoid being in circuit with said electrical means.

3. Electrical means for detecting occupant's fingers and the like in a door jamb of a hinged door and a response mechanism capable of preventing said hinged door from fully closing, said electrical means being particularly suited for easy application to said door jamb and comprising a tape having a layer of adhesive secured to its backside for affixing said tape to said jamb of said door, and a plurality of exposed conductive strips secured to its face side, a capacitance change detecting circuit with input terminals, said circuit comprising a Schering bridge, a differential amplifier and power means for said bridge and amplifier, and means for connecting the alternate exposed strips of said tape to each other in parallel and to said input terminals, and said response mechanism comprising a solenoid which operates to mechanically block said hinged door against closing, said solenoid being in circuit with said electrical means.

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NEIL C. READ, *Primary Examiner*.