United States Patent

Miller

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[54] **SAFETY EDGE CONSTRUCTION FOR A POWERED DOOR**

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[52] **U.S. Cl.**.....**307/119,** 200/61.43

[51] **Int. Cl.**.....**H01h 3/16**

[58] **Field of Search**....307/119; 200/61.43; 180/111, 180/112, 113; 49/27, 28, 26; 318/226, 282

[56] **References Cited**

UNITED STATES PATENTS

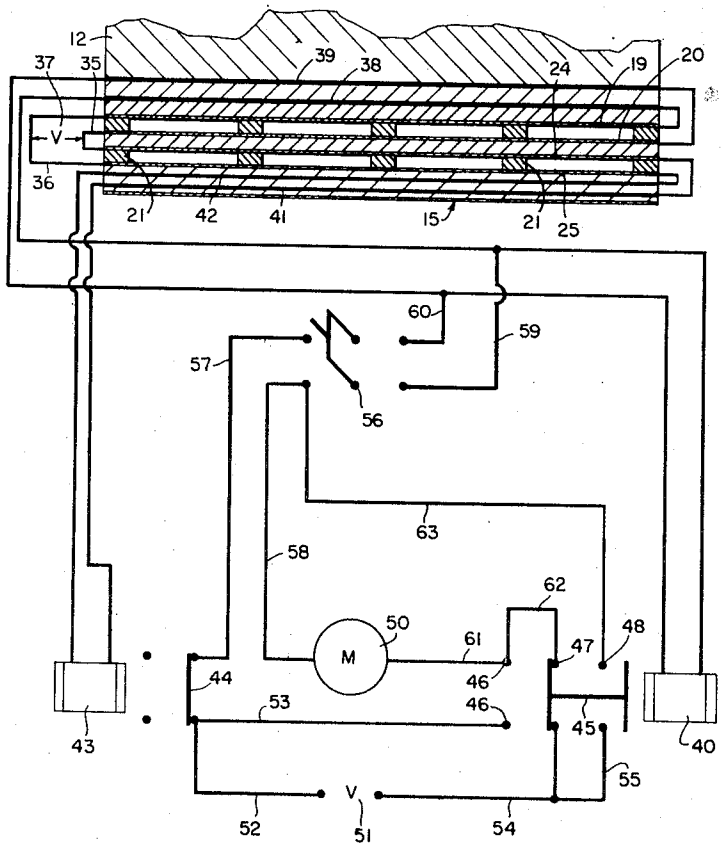
3,133,167	5/1964	Miller	200/61.43
3,471,969	10/1969	Littmann	200/61.42 X
3,537,211	11/1970	Guilbert	200/61.43 X

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[57] **ABSTRACT**

For a door electrically powered by a reversible motor, a pair of elongate resiliently compressible edge assemblies having respective pairs of contacts, the contacts of each pair being engageable with each other upon compression of the assemblies, as by encountering an obstruction, and the contact pairs being sequentially operable and electrically connected to sequentially deenergize a door motor and reenergize the motor in the opposite direction.

6 Claims, 5 Drawing Figures



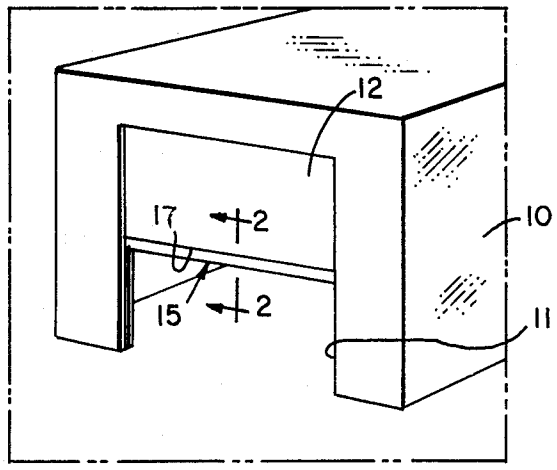


FIG. 1

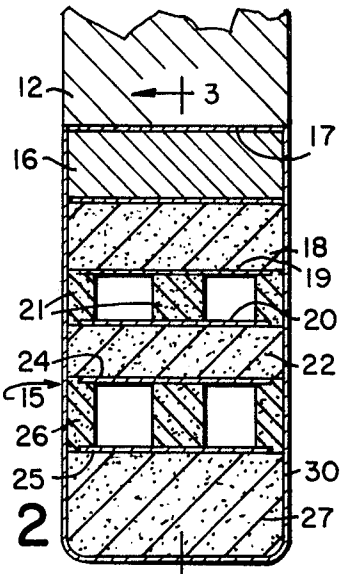


FIG. 2

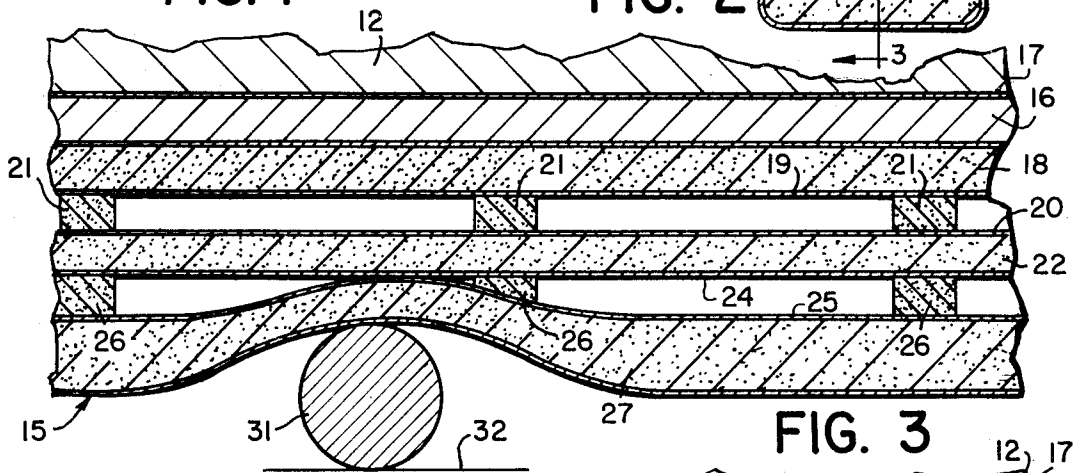


FIG. 3

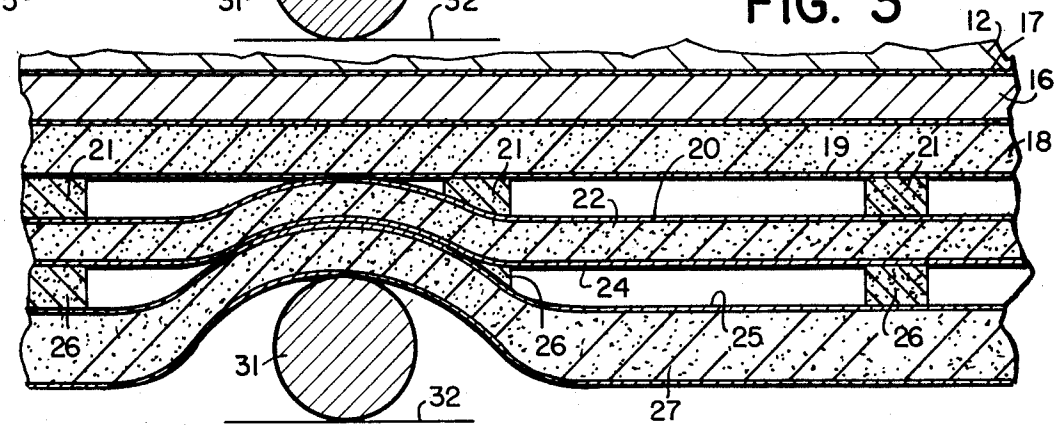


FIG. 4

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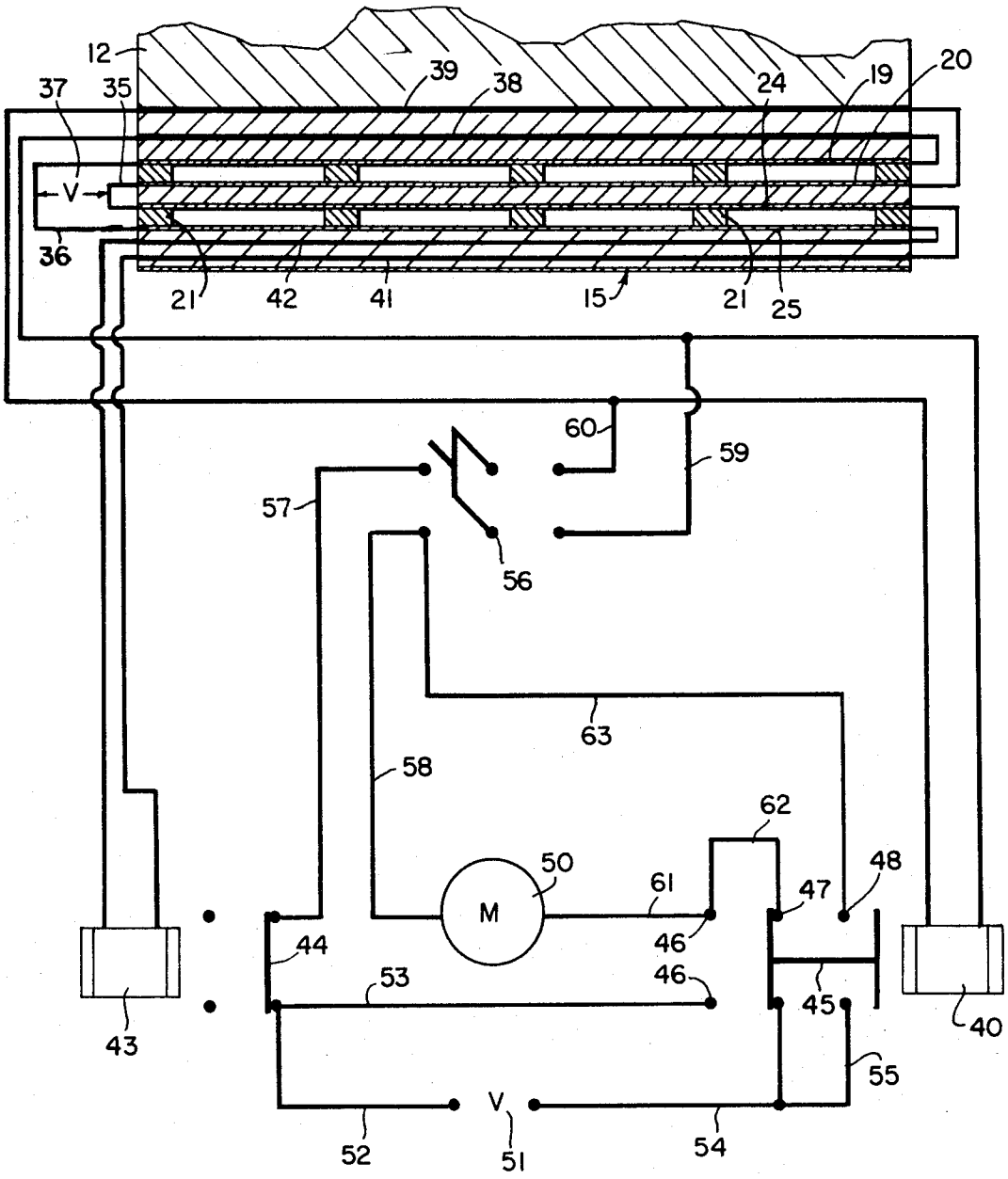


FIG. 5

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SAFETY EDGE CONSTRUCTION FOR A POWERED DOOR

BACKGROUND OF THE INVENTION

As is well known to those versed in the art, safety edges for powered doors have been employed wherein the door immediately stops its closing movement upon encountering an obstruction to avoid or minimize possible damage. Such constructions have been satisfactory under many circumstances, for example this prior art construction is shown in the U.S. Pat. No. 3,133,167 to Miller.

However, under certain conditions it has been found desirable to not only immediately stop closing movement of a door upon encountering an obstruction, but to promptly reverse and open the door upon such occurrence.

SUMMARY OF THE INVENTION

Accordingly, it is an important object of the present invention to provide a safety edge construction for a powered door of the type described, which automatically stops its closing movement upon encountering an obstruction, and promptly reverses its movement to open for immediately disengaging any encountered obstruction and affording full access through the doorway.

It is still another object of the present invention to provide a safety edge construction having the advantageous characteristics mentioned in the preceding paragraph, which may utilize a single, reversible motor for driving the door, and effect the stopping and reversing operation without unduly taxing the motor.

It is still another object of the present invention to provide a safety edge construction of the type described which is extremely simple, both mechanically and electrically, to obtain an extremely high degree of reliability throughout a long useful life.

Still another object of the present invention resides in the provision of a safety edge construction of the type described which is adapted for economic manufacture and installation, and which requires a minimum of maintenance and repair.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the construction hereinafter described, and of which the scope will be indicated by the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective view illustrating a door of the present invention in position in a doorway of a stationary structure or building.

FIG. 2 is a partial sectional elevational view taken generally along the line 2—2 of FIG. 1.

FIG. 3 is a partial longitudinal sectional elevational view taken generally along the line 3—3 of FIG. 2, illustrating an initial condition of encountering an obstacle.

FIG. 4 is a sectional view similar to FIG. 3 illustrating a subsequent condition of encountering an obstacle.

FIG. 5 is a simplified schematic representation of the electrical circuitry of the instant device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, and specifically to FIG. 1 thereof, a building is there generally designated 10, and may be an aircraft hanger, or other building having a doorway or opening 11. Illustrated in position in the door opening 11 is a door 12, which may be an overhead type of door having a lower edge 17, and being provided on its lower edge 17 with a safety edge construction, generally designated 15, in accordance with the teachings of the present invention.

While the door 12 is illustrated as being of a vertically movable type, it is, of course, appreciated that the door may be otherwise, say horizontally movable, swingable or of any construction advantageously employing an obstacle encountering safety edge.

The safety edge 15 is best seen in FIGS. 2–4, and, as illustrated, includes an elongate backing member 16 adapted to extend closely along the door edge 17. The backing member may be of any suitable material, say a self-sustaining but flexible material, or otherwise as desired. Extending along and adjacent to the backing member 16 is an inner layer or strip of resiliently compressible material, such as plastic or rubber foam 18, while a contactor strip 19 of electrically conductive material, such as aluminum foil, or the like, may be secured along the outer edge of inner strip 18, remote from the door 12. An additional conductive strip 20 is arranged in facing spaced relation with respect to the conductive strip 19, and may be identical thereto or of other suitably flexible conductive material, being resiliently yieldably spaced from the strip 19 by a plurality of spacers 21. That is, the contact strips 19 and 20 extend longitudinally of the door edge 17, being coextensive therewith as desired, and are resiliently yieldably spaced from each other by a plurality of spacer members or blocks 21, which are spaced longitudinally of the door edge, see FIGS. 3 and 4.

On the outer side of contact strip 20, remote from the door 12, there is secured an elongate intermediate member or strip 22 of resiliently compressible material, such as synthetic or natural foam. Provided on the outer side of the intermediate foam strip or layer 22, remote from the door 12, is an additional elongate, flexible electrically conductive contact strip 24, and still another elongate, flexible electrically conductive contact strip 25 is located in outwardly spaced facing relation with respect to the former contact strip 24. Resiliently and yieldably maintaining the contact strips 24 and 25 in their spaced relation are a plurality of resiliently compressible spacer members or blocks 26 interposed between the contact strips at longitudinally spaced locations therealong.

In addition, an outermost elongate member or strip of resiliently compressible material 27, such as plastic or rubber foam, is secured in longitudinally extending relation along the outer side of contact strip 25, remote from door 12. Here again, the compressible strips 22 and 27, as well as the contact strips 24 and 25 may all be longitudinally coextensive, or substantially so, with the door edge 17.

For purposes of simplifying terminology, the inner foam strip 18 and the inner pair of contacts 19 and 20 may be considered as an inner assembly, while the outer foam strip 27 and the outer pair of contact strips 24 and 25 may be considered as an outer assembly.

In practice, it has been found satisfactory to externally cover or encase the foam strips **18**, **22** and **27**, and their interposed contact strips **19**, **20** and **24**, **25** in an outer covering **30**, preferably of a flexible, impervious sheet material. In this manner, the overall edge construction **15** is highly resistant or impervious to liquid and moisture, as well as being resistant to abrasion and wear.

As in said earlier U.S. Pat. No. 3,133,167, the facing, spaced pairs of contact strips **19** and **20**, and **24** and **25**, are deflectable into engagement with each other, say for closing an electric circuit, as will appear more fully hereinafter.

Referring now to FIG. **3**, wherein is illustrated an obstacle or obstruction **31**, say resting on a ground surface **32**. The door **12** is illustrated as moving downwardly, and the safety edge **15** has encountered the obstacle **31**. More specifically, the safety edge **15** has just encountered the obstacle **31** and moved sufficiently to initially engage the facing spaced, lower or outer pair of contact strips **24** and **25**. That is, the obstacle **31**, as seen in FIG. **3**, has deflected only the outer assembly **24**, **25**, **26** and **27**, without deflecting the inner assembly **18**, **19**, **20** and **21**. Therefore, the outer pair of contact strips **24** and **25** are deflected into engagement with each other, while the inner pair of contact strips **19** and **20** remain in spaced, nonengaging relation.

Upon slight continued downward movement of the door **12** to the position shown in FIG. **4**, the obstacle **31** has deflected not only the lower or outer assembly **24–27**, but has also deflected the upper or inner assembly **18–21**. Such deflection of the inner assembly **18–21** causes the inner contact strips **19** and **20** to be deflected into engagement with each other, as clearly illustrated in FIG. **4**. That is, both pairs of contact strips **19** and **20**, and **24** and **25** are in engaging relation in the later or subsequent condition of FIG. **4**.

Considering now the schematic representation of FIG. **5**, it will be seen that the door **12** is provided with the safety edge construction **15**, which includes the inner pair of contact strips **19** and **20** and the outer pair of contact strips **24** and **25**. The inner contact strips **19** and **20** may have one pair of adjacent ends connected, as by conductors **35** and **36** to an adjacent pair of ends of the respective contact strips **24** and **25**. Also, a voltage source **37** may be placed across the conductors **35** and **36**.

The other pair of adjacent ends of contact strips **19** and **20** may be connected, as by respective conductors **38** and **39** with a relay coil **40**. Similarly, the other pair of adjacent ends of contact strips **24** and **25** may be connected by conductors **41** and **42** to a relay coil **43**.

Associated with the relay coil **43** is a normally closed relay switch **44**. Associated with the relay coil **40** may be a relay switch **45** having three pairs of contacts, the contact pairs being respectively designated **46**, **47** and **48**. Also a motor is designated **50** and suitably connected in driving relation with respect to the door **12**. The motor **50** may be a conventional reversible motor.

An electric source of voltage **51** may be connected on one side by a conductor **52** to one side of the switch **44**, and by an additional conductor **53** to one of the contacts **46**. The other side of the voltage source **51** is connected by a conductor **54** to one contact **47**, and by an additional conductor **55** to one contact **48**.

A double-pole double-throw manual door operating switch is generally designated **56**, being connected on one side through a conductor **57** to switch **44** and a conductor **58** to one side of the motor **50**. On its other side the switch **56** is connected by a conductor **59** to conductor **38**, and by a conductor **60** to conductor **39**.

Further, the motor **50** is connected on its other side by a conductor **61** to a contact **46**, which contact is connected by a conductor **62** to one contact **47**. Also, the conductor **58** is connected by a conductor **63** to the other contact **48**.

In the condition illustrated in FIG. **5**, it will be appreciated that, upon closing the switch **56** to the left, the voltage **51** will be applied through conductor **52**, switch **44**, conductor **57**, switch **56** and conductor **58** to one side of the motor **50**, passing from the other side of the motor through conductor **61**, conductor **62**, contacts **47** of switch **45**, and conductor **54** to the voltage source for operating the door **12**. That is, in the above-described mode of operation, the motor will rotate in one direction, say a forward direction, to move the door **12** in one direction, say to close the door.

Upon swinging the switch **56** to the right, as seen in FIG. **5**, the coil **40** will be deenergized to release the switch **45** to shift leftward, and thereby close the pairs of contacts **46** and **48**, while opening the pair of contacts **47**. In this condition, the voltage **51** passes through conductors **52** and **53**, closed switch contacts **46** and conductor **61** to one side of the motor **50**, and thence passes from the motor through conductors **58** and **63**, closed switch contacts **48** and conductors **55** and **54** to return to the voltage source, having passed through the motor in the direction opposite to that first described for operating the motor in the reverse or door opening direction.

Should it be desired to reverse the closing direction of door movement responsive to the door edge construction **15** encountering an obstacle, assume again that the switch **56** has been shifted leftward. Upon initially encountering the obstacle, as in the condition of FIG. **3**, the contact strips **24** and **25** are engaged to effectively deenergize the coil **43** and open the switch **44**. This immediately deenergizes the motor **50** to halt closing movement of the door. Upon any slight continuation in movement, as would be normal by inertia, the upper or inner pair of contact strips **19** and **20** are engaged to deenergize the solenoid coil **40** and permit shifting movement of the switch **45** leftward. In this condition, the motor **50** is operated in reverse, as described in detail hereinbefore, to raise the door away from the encountered obstacle.

Upon downward door movement to its closed position engaging the threshold, without an obstruction on the threshold, it is desirable to effect engagement of the lower or outer contacts or switch strips **24** and **25**, without closing or engaging the upper or inner switch strips **19** and **20**. In this manner, the motor **50** will be deenergized, but will not be reversed, so that the door remains closed. This operation can easily be achieved by properly selecting the resilient deflectabilities of the various component parts. For example, the resiliently deflectable spacer blocks **20** are selected relative to the resiliently deflectable spacer members or blocks **21** so as to permit deflection of the former and engagement of switch strips **24** and **25** without sufficient deflection of spacer blocks **21** to enable the switch strips **19** and

20 to engage. By this means, a heretofore required limit switch actuated by the door upon movement to its closed position has been eliminated.

It will be understood that the circuitry of the instant invention has been illustrated and described in simplified and diagrammatic form sufficient to enable one skilled in the art to practice the invention.

From the foregoing, it is seen that the present invention provides a safety edge construction for a powered door which permits of utilizing a conventional reversible electric drive motor without unduly stressing the motor by instantaneous reversal of current, and which otherwise fully accomplishes its intended objects.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention.

What is claimed is:

1. A safety edge construction for a powered door including a reversible electric motor in driving relation with the door, said edge construction comprising an elongate inner assembly for extension along the edge of the door, said inner assembly being transversely compressible under a force directed toward the door edge and including a first pair of elongate flexible contacts extending in resiliently yieldable spaced apart relation longitudinally within an inner portion of said inner assembly, said first pair of contacts being engageable with each other upon transverse compression of said inner assembly, an elongate outer assembly extending along said inner assembly spaced remotely from the door edge, said outer assembly being transversely compressible under a force directed toward said door edge and including a second pair of elongate flexible contacts extending in resiliently yieldable spaced apart relation longitudinally within an inner portion of said outer assembly, said second pair of contacts being engageable with each other upon transverse compression of said outer assembly, a force directed against said outer assembly toward said door edge serving to initially compress said outer assembly and engage said second pair of contacts with each other and subsequently compress said inner assembly and engage said first pair of contacts with each other, and relay operated switch means connected between said motor and said pairs of contacts to deenergize the motor upon engagement of said second contacts and reenergize the motor in reverse direction upon engagement of said first contacts, to thereby sequentially stop and reverse the direction of a door upon hitting an obstacle.

2. A safety edge construction according to claim 1, said inner and outer assemblies comprising resiliently compressible foam material.

3. A safety edge construction according to claim 1, said first and second contacts comprising metal foil strips, and resiliently compressible spacer means between said strips.

4. A safety edge according to claim 1, said inner and outer assemblies comprising resiliently compressible foam material, and said first and second contacts comprising metal foil strips, and resiliently compressible spacers interposed at spaced locations between said strips.

5. A safety edge construction according to claim 1, said switch means comprising a normally closed switch connected for energizing said motor in a forward direction to close the door, and initial relay control means associated with said normally closed switch and connected to said second contacts to open said normally closed switch on engagement of said second contacts.

6. A safety edge construction according to claim 5, said switch means further comprising a normally open switch connected for energizing said motor in a reverse direction to open the door, and subsequent relay control means associated with said normally open switch and connected to said first contacts to close said normally open switch on engagement of said first contacts.

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