United States Patent [19]

Hubbard et al.

[11] **3,903,647**

[45] **Sept. 9, 1975**

[54] **AUTOMATIC SLIDING DOOR**

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[52] **U.S. Cl.** **49/27**; 200/61.43

[51] **Int. Cl.²** **E05F 15/14**

[58] **Field of Search** 49/26–28; 200/61.43

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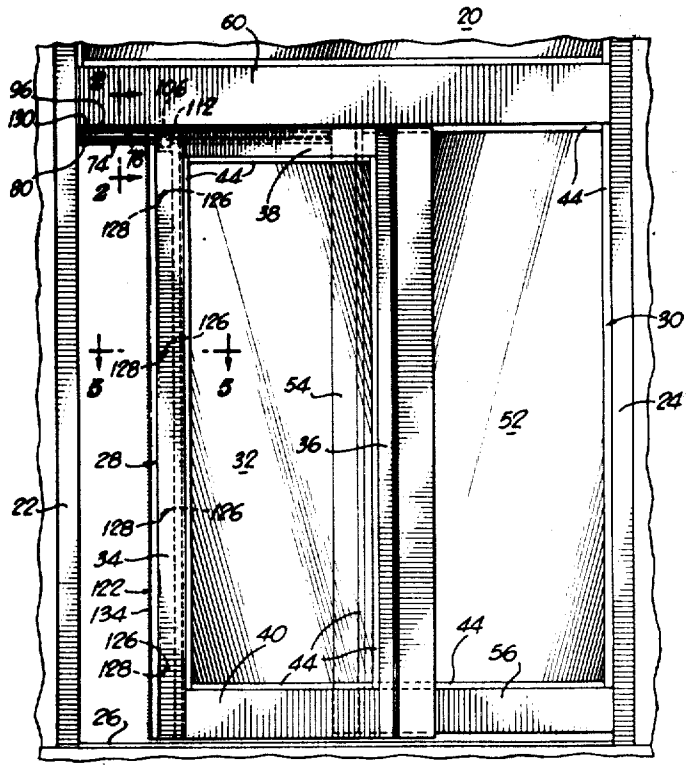
Primary Examiner—Kenneth Downey

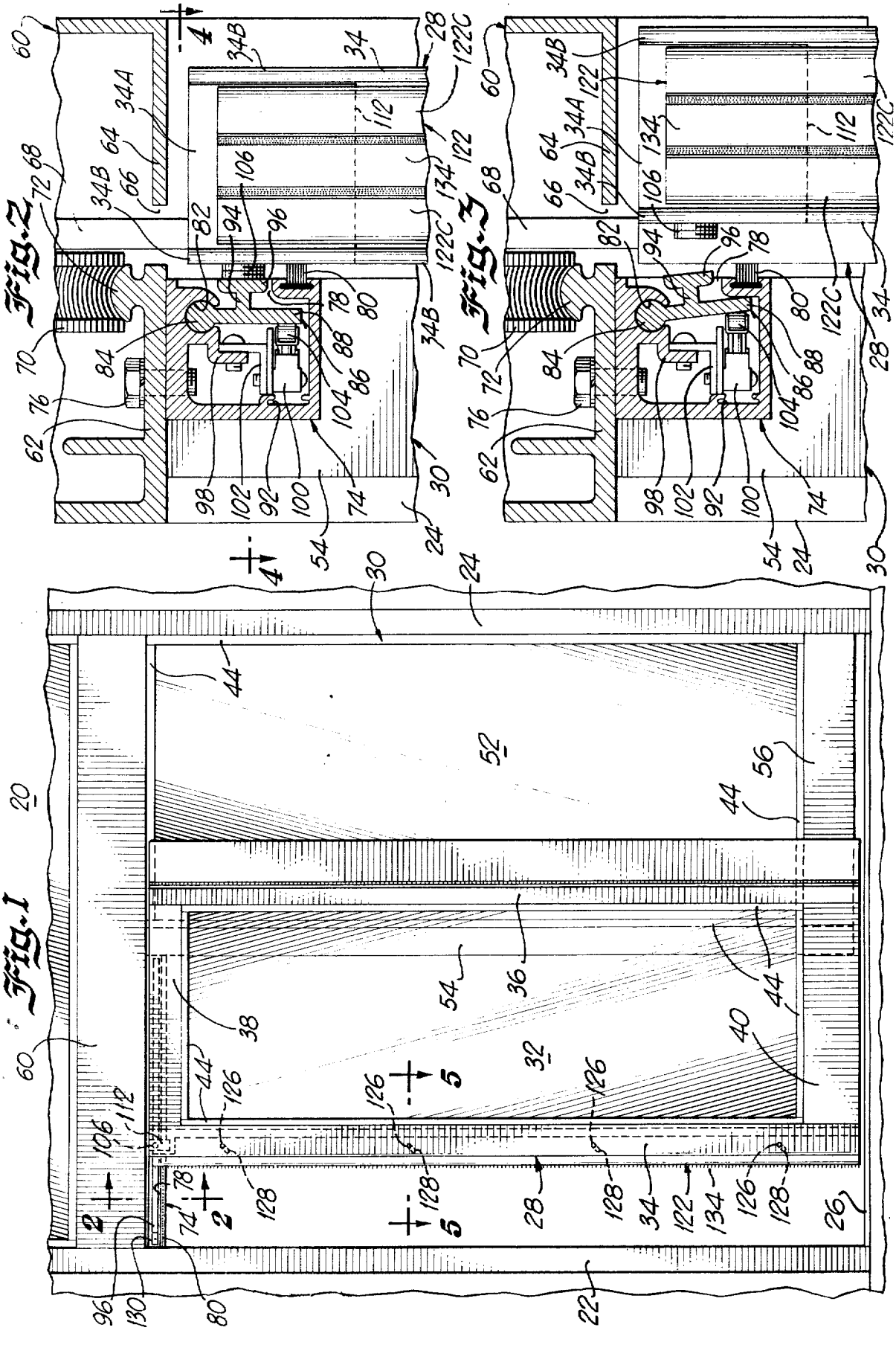
Attorney, Agent, or Firm—Mason, Kolehmainen, Rathburn & Wyss

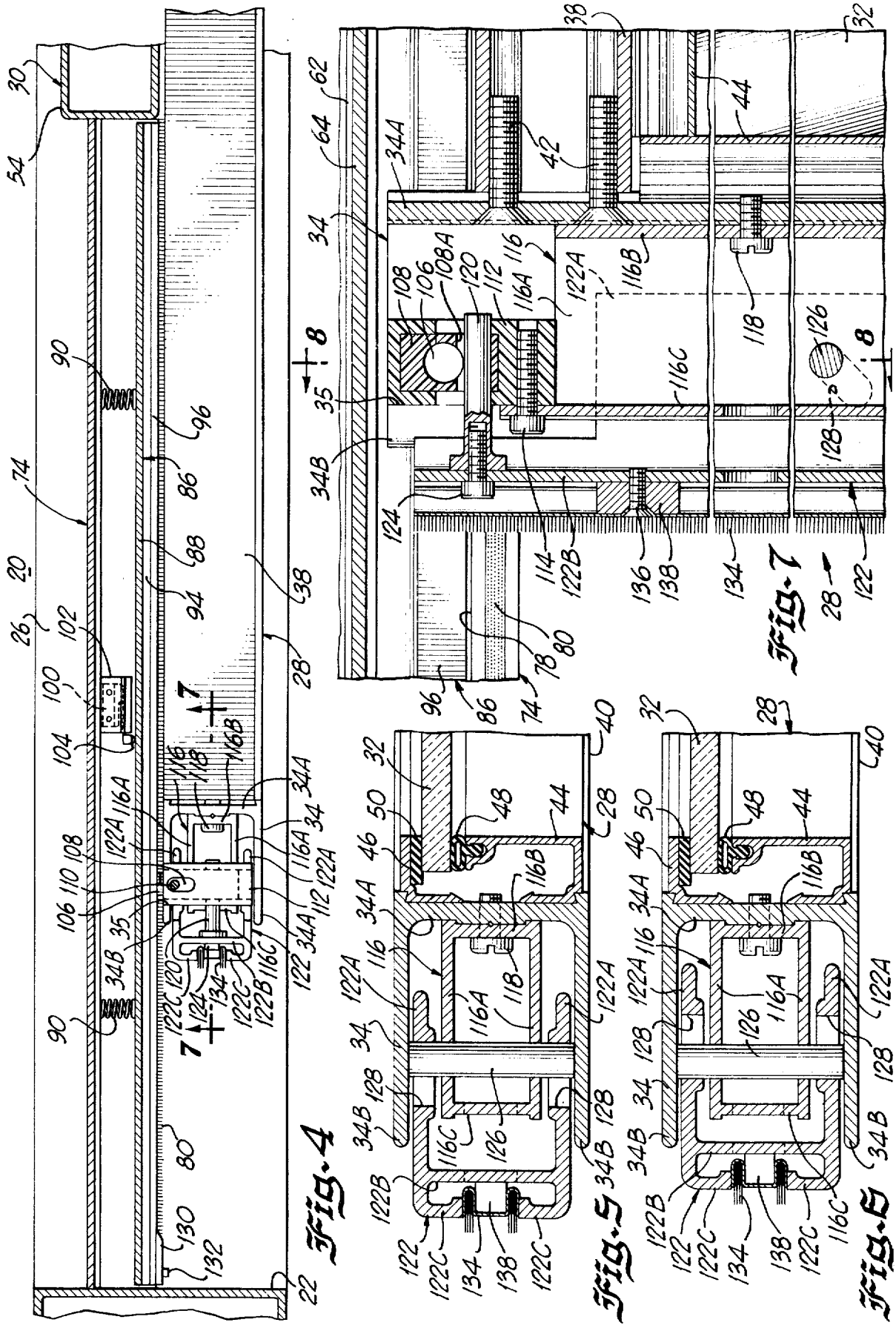
[57] **ABSTRACT**

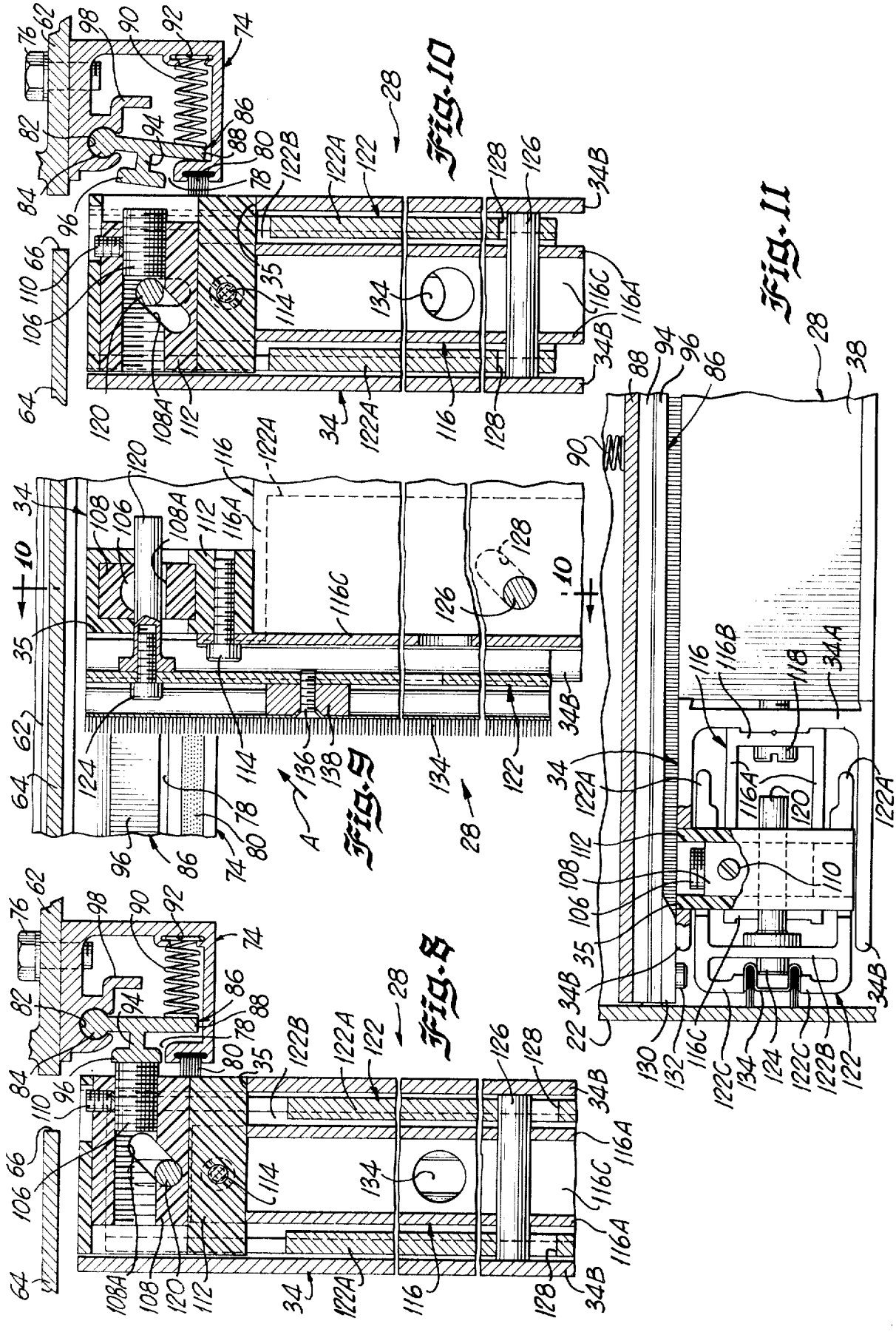
An automatic sliding door with a safety device for preventing the closure of the door when an object is encountered includes a sliding door mounted for movement along an upper track toward and away from a door jamb. A pressure sensitive nose member is mounted along leading edge of the door and causes activation of a safety switch for controlling the door to open when an object is encountered by the nose member during closing movement. The safety switch is mounted in a housing which supports an elongated actuator extending parallel of the door track and facing an upper portion of the sliding door. The actuator is mounted for pivotal movement toward and away from the door about an axis parallel of the track and engages the safety switch to maintain normal operation until a contact member on the door is retracted from the actuator. The contact member is normally engaged in sliding contact with the elongated actuator as the door opens and closes. The pressure sensitive nose member on the leading edge of the door is adapted to withdraw the contact member away from the actuator upon engagement of the nose member with an obstruction during a closing movement and this activates the control system to move the door to the open position.

8 Claims, 12 Drawing Figures




FIG. 1
FIG. 2
FIG. 3
20
22
24
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34
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54
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62
64
66
68
70
72
74
76
78
80
82
84
86
88
92
94
96
98
100
102
104
106
112
122
122C
126
128
130
134
344
348
2
4
5


FIG. 4
FIG. 5
FIG. 6
FIG. 7


FIG. 8
FIG. 9
FIG. 10
FIG. 11

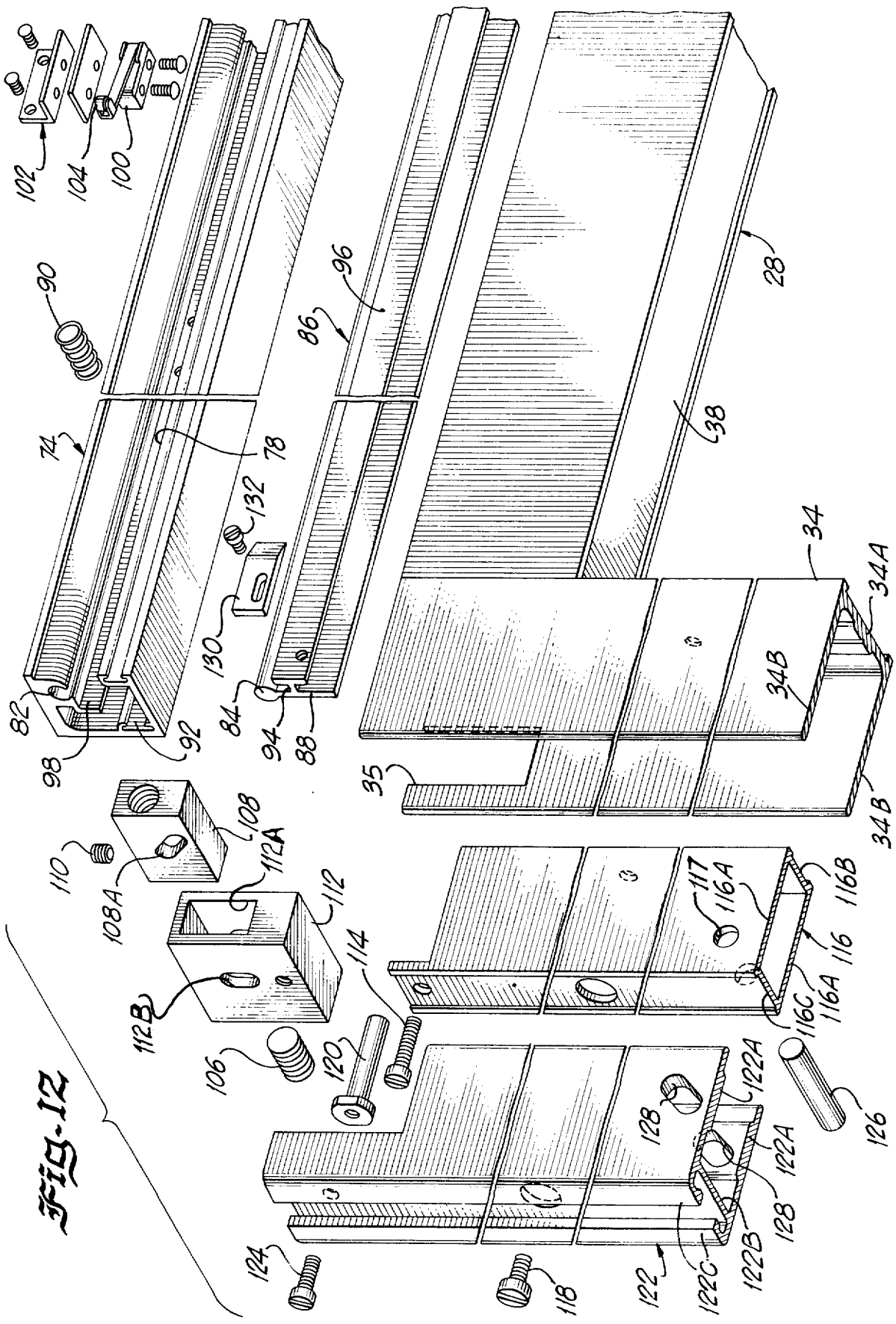

102
104
100
90
74
78
132
130
82
98
92
84
94
88
86
96
28
38
34
34A
34B
35
108
110
108A
112A
112
112B
114
106
120
117
116A
116B
116
116C
122A
126
128
122B
122C
122
124
118

FIG. 12

AUTOMATIC SLIDING DOOR

The present invention relates to automatic sliding doors and more particularly to electrically controlled sliding doors having an improved safety system for initiating automatic opening of the door upon the engagement of an obstruction in the closing path of the door.

Modern sliding glass doors and other types of sliding panel doors having relatively narrow stiles and rails for supporting the glass or panels thereof have little if any room for enclosing complex electrical equipment within the door itself and accordingly great difficulty has been encountered in providing safety systems for these types of doors. Unlike elevator doors, which are generally opaque and have most of the electrical mechanism mounted within the door itself, narrow-stile panelled doors do not provide sufficient room for weathertight enclosure of the necessary electrical control components for an adequate safety system. Moreover, in presently available sliding doors of the character described, the threshold strip and the outer edges of the door activating control mats are insensitive and do not function to open the door in the event of encountering obstruction during closing action.

The present invention is designed to provide an automatic sliding door with a safety system operable to open the door when an obstruction is encountered even when a person may be positioned on the threshold or an insensitive portion of the activating mat. The system operates whenever a pressure sensitive nose carried on the leading edge of the sliding door engages an obstruction and this causes the door to open and thus prevent injury by closure upon the person, limbs or materials between the door and the door jamb.

It is an object of the present invention to provide a new and improved automatic electrically controlled sliding door.

Another object is to provide a new and improved automatically controlled sliding door of the type described having a safety device for activating the door to an open position when an obstruction is encountered during closing movement.

Another object of the present invention is to provide a new and improved safety system for convenient installation on existing automatic sliding door installations.

Another object of the present invention is to provide a safety system which will function on a sliding door of the type which is designed to pivot outwardly in an emergency. Many sliding doors include a panic safety feature which permits the door to pivot outwardly for escape from an emergency condition in a building.

Another object of the present invention is to provide a new and improved automatic sliding door of the character described wherein the door may be opened in a plurality of different ways including, normal operation by a person walking on a switch mat, a safety operation anytime a pressure sensitive nose member encounters an obstruction during closing or when the sliding door is pivoted outwardly by pressure in a panic situation.

Another object of the invention is to provide a new and improved automatic sliding door incorporating a safety system in which the door mounted components are mechanical in nature and which requires no electrical wiring or electrical components located on or within the door itself.

Yet another object of the invention is to provide a new and improved automatic, electrically controlled sliding door wherein all of the safety system components are mounted in an enclosure secured to the door frame rather than the moving door.

These and other object and advantages of the present invention are accomplished in an illustrative embodiment comprising an automatic, electrically controlled sliding door mounted for movement along an upper track toward and away from a door jamb adjacent the leading edge of the door when in a closed position. The automatic door includes a safety device comprising an elongated actuator extended parallel of the door track and facing an upper portion of the sliding door. The actuator is pivotally mounted for movement toward and away from the upper portion of the door about an axis parallel of the track and safety switch means is mounted intermediate the length of the actuator for response to movement thereof toward and away from the door. The safety switch is wired in parallel with the normal door opening switches for actuating the electrically controlled operator system of the door. A contact member is mounted on the door for normal continuous sliding contact with the elongated actuator as the door opens and closes and the contact member normally maintains the actuator in a pivotal position away from the door during normal operation. A pressure sensitive nose member is mounted on the leading edge of the door and is mechanically interconnected to withdraw the contact member away from the switch actuator upon sensing the engagement of an obstruction during the closing of the door. The safety switch is also actuated by a pivotal opening of the door in a panic situation.

For better understanding of the present invention reference should be had to the following detailed description taken in conjunction with the drawings in which:

FIG. 1 is an elevational view of an automatic sliding door constructed in accordance with the features of the present invention.

FIG. 2 is a fragmentary, vertical cross-sectional view taken substantially along lines 2—2 of FIG. 1.

FIG. 3 is a fragmentary, vertical cross-sectional view similar to FIG. 2 but illustrating the elongated actuator of a safety system of the invention in another of its operative positions.

FIG. 4 is a horizontal cross-sectional view taken substantially along lines 4—4 of FIG. 2.

FIG. 5 is a fragmentary horizontal, cross-sectional view taken substantially along lines 5—5 of FIG. 1 and illustrating the leading edge of the door and the pressure sensitive nose member thereon in one of its operating positions.

FIG. 6 is a view similar to FIG. 5 but showing the pressure sensitive nose member in another of its operative positions.

FIG. 7 is a vertical, cross-sectional view taken substantially along lines 7—7 of FIG. 4, and showing the nose member in one of its operative positions.

FIG. 8 is a transverse, vertical, cross-sectional view taken substantially along lines 8—8 of FIG. 7.

FIG. 9 is a fragmentary, vertical, cross-sectional view similar to FIG. 7 but showing the pressure sensitive nose member on the leading edge of the door in another of its operative positions.

FIG. 10 is a transverse, vertical, cross-sectional view taken substantially along lines 10—10 of FIG. 9.

FIG. 11 is a fragmentary, horizontal, cross-sectional view similar to FIG. 4 but showing the door in the fully closed position, and

FIG. 12 is an exploded, perspective view of the upper end portion of the leading edge of the sliding door and portions of the adjacent safety system in accordance with the invention.

Referring now more particularly to the drawings, therein is illustrated in a new and improved automatic sliding door employing a safety system in accordance with the features of the present invention. The sliding door is of a type generally similar to that as shown and described in the U.S. Pat. No. **3,619,946** and is adapted to open and close an entranceway generally indicated by the reference numeral **20** (FIG. **1**). The entranceway is framed by a pair of vertical jambs **22** and **24** extending upwardly from a horizontal threshold **26** and a panel type, sliding door **28** is adapted to move toward and away from one of the jambs (the left-hand jamb **22** as shown in FIG. **1**) to open and close the entrance while a fixed (or movable) door panel or side lite **30** is provided on the opposite side of the entrance to fill the opening as best shown in FIG. **1**. The sliding door **28** is provided with a relatively large center panel **32** of glass or other material supported in a frame comprising a pair of relatively narrow, vertical stiles **34** and **36** interconnected at their upper and lower ends by a top rail **38** and a bottom rail **40**, respectively. As best shown in FIGS. **5**, **6**, **7** and **11**, the vertical stile **34** is of a generally U-shaped transverse cross-section and the webs thereof are interconnected to the ends of the upper and lower rails **38** and **40** by means of cap screws **42**. As best shown in FIGS. **5**, **6** and **7**, the panel or glass **32** is held in place by means of inner and outer glass stops **44** and **46** and suitable gaskets **48** and **50** are provided between the glass stops and the panel to insure a weather-proof door.

The fixed door panel **30** or side lite includes a relatively large, center panel **52** of glass or other material supported between the right-hand entrance jamb **24** and a parallel, relatively narrow, vertical stile or post **54**. A lower rail **56** is connected between the stile **54** and the jamb **24** and at the upper end, the entire entrance is framed with a box-like transom bar **60** which supports sliding door **28** for sliding closing, and opening movement toward and away from the left-hand door jamb **22**. The panel **52** of the side lite **30** is glazed with suitable glass stops **44** and **46** and sealing gaskets **48** and **50** to provide a weather tight enclosure.

The relatively large transom bar **60** supports the sliding door **28** and provides an enclosure or housing for the door operator and control system (not shown) which may be of the general type shown and described in the aforementioned Crocker patent in detail, which patent is incorporated herein by reference. The door operator for moving the sliding door **28** between the open and closed positions is electrically controlled and hydraulically operated and is normally activated by a person walking on a threadle or mats (not shown) such as the mats **26** and **27** shown in the Crocker patent. Pressure on the mats actuates the door operator to open the door. In the absence of the pressure of a person or object on a mat for a specific period of time, the door operator is programmed to return the door **28** to the closed position wherein the left-hand stile **34** of the door is positioned closely adjacent the left-hand jamb **22** of the entranceway **20**, as shown in FIG. **11**.

As best shown in FIGS. **2**, **3**, **8** and **10**, the transom bar **60** is preferably formed of an extrusion and includes a pair of lower flanges **62** and **64** having inside facing edges spaced apart to provide a continuous slot or opening **66** for accommodating a pair of hangers **68** which support the sliding door **28**. Each hanger is provided with a roller **70** adjacent the upper end adapted to ride upon an integrally formed rail or track **72** on the inside flange **62** adjacent the inner edge thereof as best shown in FIGS. **2** and **3**.

In accordance with the present invention, a safety system adapted for use with the sliding door **28** includes an elongated housing **74** preferably formed of extruded metal and having a box-like square or rectangular transverse cross-section as shown in FIGS. **2**, **3**, 8 and **10**. The housing is adapted to be attached to the inside lower flange **62** of the transom bar **60** and extends between the stile **54** of the side lite or door panel **30** and the left-hand jamb **22** of the entrance way **20** as best shown in FIG. **4**. The safety housing is dimensioned to the desired length and is easily installed even in existing sliding door installations without major modifications being needed. Thus, the safety system of the present invention is useful for safety modification of sliding door installations already in existence as well as the particular type of new sliding doors shown in the drawings herein and in the previously mentioned U.S. Pat. No. **3,619,946**.

The housing includes an upper wall adapted to be secured to the flange **62** of the transom bar **60** with a plurality of cap screws **76** or other suitable fastening means. The housing is formed with an elongated opening **78** on one side facing outwardly towards the upper portion of the sliding door **28** and below this opening, the outer wall of the housing is provided with a weather stripping member **80** adapted to seal against the inside face of the sliding door. As best shown in FIGS. **2**, **3**, 8, 10 and **12**, the extruded housing is provided with a downwardly opening, elongated groove **82** on the underside of the top wall of a substantially circular cross-section. This elongated groove is adapted to provide pivotal support for an enlarged, bulbous upper edge portion **84** of an elongated switch actuator **86** which is mounted in the housing and extends substantially the entire length thereof. As best shown in FIGS. **2**, **3**, **8** and **10** the elongated switch actuator **86** includes a downwardly depending, strip like, main body portion **88** and the body is pivotable toward and away from the door **28** between a normal operating position (as shown in FIG. **2**) wherein the body is in a substantially vertical position and an outwardly inclined safety position (FIG. **3**) wherein the lower edge of the body bears against the lower portion of the outer side wall of the housing **74**, which engagement limits the pivotal movement thereof.

The switch actuator **86** is biased outwardly toward the position of FIG. **3** by plurality of coil springs **90** spaced at intervals along the length of the housing and positioned with their axes generally transverse to the housing as best shown in FIG. **4**. The inner ends of the coil springs are seated and secured in place within an elongated groove **92** formed on the inside surface of the lower portion of the inside wall of the housing **74**. The switch actuator **86** also includes an outwardly extending rib **94** at right angles to the body **88** and the rib is formed with a contact strip **96** at the outer end thereof having a planar outer contact face directly op-

posite and facing the inside surface of the sliding door **28.** The rib **94** and integral contact strip **96** provides lateral stiffness for the body **88** of the switch actuator along its entire length. Accordingly, if the contact strip **96** is restrained by contact with the door at any point along its length, the springs **90** will be compressed and unable to pivot the actuator to the safety actuating position of FIGS. **3** and **10.**

The elongated housing **74** is also provided with an inwardly formed downwardly depending rib **98** and this rib provides support for a normally open, safety switch **100** which is mounted on the rib about midway of its length by means of an L-shaped bracket, shim and screws **102** (FIGS. **2, 3** and **4**). The safety switch includes an operator **104** normally depressed by the lower portion of the switch actuator body **88** and when the actuator is pivoted from the normal position of FIG. **2** to the position of FIG. **3,** the switch operator is no longer restrained and activates the switch to change from its normally open to a contact closed position whereby the operator of the door is energized to move the door toward the open position. The switch **100** is wired in parallel with the one or more mat activated switch systems which provide normal operation of the door. During normal closing action of the door **28** when no obstructions are encountered by the leading edge, the switch actuator **86** is maintained in the normal or vertical position (FIG. **2**) against the bias of the springs **90** because of engagement against a contact button **106** on the door which slidably engages the face of the contact strip **96.** The contact button is formed of nylon or other plastic material having a low coefficient of friction suitable for repeated sliding engagement with the face of the contact strip **96** during normal operation of the sliding door. The contact buttom is threaded externally for position adjustment and is mounted in a threaded axial core of a rectangular slide block **108** mounted adjacent the upper leading edge corner of the sliding door **28.**

The slide block **108** is best illustrated in FIGS. **8, 10** and **12** and the internally threaded bore which receives the contact button **106** permits adjustments to be made as wear occurs on the contact button. A set screw **110** is provided to secure the adjusted position of the contact button in the slide block. The slide block is mounted for a sliding movement transversely of the door within a rectangular cross-sectional bore **112A** formed in a support block **112.** The support block is secured in place by means of a cap screw **114** and is positioned adjacent the upper end of an elongated tubular base member **116** mounted within the channel shaped stile **34** of the door.

The tubular base is secured in place to the web **34A** of the door stile by a plurality of cap screws **118** and as best shown in FIGS. **5** and **6,** is seated between the opposite side flanges **34B** of the door. The member **116** is of rectangular, transverse cross-section and includes a pair of opposite sides **116A** spaced inwardly of the opposite side flanges **34B** of the U-shaped door stile **34.** The tubular support member includes a base **116B,** normal to the sides **116A** and the base is secured to the web **34A** of the door stile by a plurality of cap screws **118.** An opposite side **116C** of the tubular support **116** faces outwardly towards the door jamb **22** and a suitable hole is provided in an upstanding portion of the side **116C** so that the cap screw **114** can pass through to secure the support block **112** in place adjacent the upper end of the door. The outer face of the support block **112** is extended through a U-shaped slot **35** (FIG. **12**) formed in the inside flange **34B** of the door stile **34.**

In order to activate the safety switch **100** when desired by withdrawal of the contact button **106** away from the contact strip **96** of the switch actuator **86,** the slide block **108** is provided with a transversely extending sloped groove or slot **108A** which receives the shank of an actuator pin **120** secured to the upper end of a pressure sensitive nose member **122.** The pin **120** extends through a vertical slot **112B** in the support block **112** to engage the sloping slot **108A** to move the block **108** and contact button **106** toward and away from the contact strip **96.**

The nose member **122** is mounted in the leading edge of the door **28** and is supported on the tubular support **116** and extends substantially the entire length of the leading edge. The nose member is of a generally U-shaped transverse cross-section including a pair of opposite side flanges **122A** and an integral web **122B.** As best shown in FIGS. **5** and **6,** the flanges **122A** project into the space between the flanges **34B** of the door stile **34** and the opposite facing sides **116A** of the tubular support **116** which is fixedly secured to the web **34A** of the door stile. As shown in FIGS. **7** and **9,** the actuator pin **120** is attached to an upwardly extending portion of the web **122B** of the pressure sensitive nose by means of a cap screw **124.**

The nose is supported on the leading edge of the sliding door **28** for limited vertical and horizontal translational movement relative to the door stile **34,** so that if an object is encountered by the nose during closure of the door, the member is elevated and moved inwardly in the direction of the arrow "A" of FIG. **9.** For this purpose a plurality of cross pins **126** are provided on the tubular support **116** to extend outwardly through circular openings **117** provided in the opposite side walls **116A** as best shown in FIG. **12.** These cross pins are received in inwardly and upwardly sloping slots **128** formed at appropriate intervals in the side flanges **122A** of the nose member **122.** If an object or person is present above the threshold **26** as the sliding door **28** moves toward the closed position and the nose member **122** encounters the obstruction, the nose is lifted upwardly and inwardly until the obstruction is cleared. Upon clearance, the nose member returns to its normal operating position of FIG. **7** under the influence of gravity. The engagement of the cross pins **126** with the inclined slots **128** provide for vertical and horizontal relative movement between the pressure-sensitive nose member and the door stile **34.** When lifting movement occurs, the actuator pin **120** is elevated from the position of FIG. **8** to the position of FIG. **10** and this causes the slide block **108** and contact button **106** carried thereby to be retracted outwardly away from engagement with the contact strip **96** of the safety actuator **86.** As previously indicated, when this action occurs, the safety switch **100** is actuated to the closed position and the operator of the sliding door is energized to drive the door towards the open position. After an obstruction is cleared the nose member moves downwardly and outwardly relative to the door stile to a normal operative position as shown in FIG. **7,** and the contact button **106** again bears against the strip **96** to deactivate the safety switch **100.**

In order to prevent the sliding door **28** from automatically returning to the open position during normal op-

eration each time the nose member engages the left-hand door jamb **22** during normal closing action, the contact strip **96** of the switch actuator **86** is provided with a short cam **130** secured in position adjacent the door jamb by a set screw **132**. During normal closure action as the nose member **122** on the leading edge of the door **28** engages or approaches the door jamb **22** and the contact button **106** is retracted as previously described, the switch actuator **86** will not be actuated because the cam **130** engages the inside flange **34B** of the door stile **34** (as shown in FIG. **11**) and this engagement prevents the pivotal movement of the switch actuator **86** to the position of FIGS. **3** and **10** even though the contact button **106** may be fully retracted.

The pressure-sensitive nose member **122** is provided with a pair of curved outer flange portions **122C** on the leading edge which define a continuous slot therebetween for supporting a weather strip **134** for engagement with the door jamb **22** when the door is closed. The weather strip **134** is secured in position by cap screws **136** and positioning blocks **138** as shown in FIGS. **7** and **9** and can be replaced from time to time as wear or damage occurs.

From the foregoing it will be seen that the safety system of the sliding door does not require any electrical wiring on the door itself and the system can be readily installed on most existing sliding doors without requiring extensive modification. Moreover, the safety system permits the doors to operate in a normal fashion without interference and provides an added safety feature. The system also provides for opening of the door in a panic situation should the door be pivoted outwardly by excessive pressure from the inside of the building.

Although the present invention has been described by reference to a single embodiment thereof, it will be apparent that numerous other modifications and embodiments will be devised by those skilled in the art which will fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A safety device for an automatic electrically controlled sliding door mounted for movement along an upper track toward and away from a door jamb adjacent a leading edge of said door in a closed position, said safety device comprising an elongated actuator extended parallel of said track and facing an upper portion of said sliding door, said actuator pivotally mounted for movement toward and away from said upper portion of said door about an axis parallel of said track, safety switch means intermediate the length of said actuator responsive to movement thereof toward and away from said door for actuating the electrical control of said door to open the same, a contact member on said door positioned for sliding contact with said elongated actuator as said door opens and closes for normally maintaining said actuator in a pivotal position away from said door and pressure sensitive means carried adjacent said leading edge of said door interconnected to withdraw said contact member away from said actuator upon engagement of said pressure sensitive means with an obstruction during closing of said door.

2. The safety device of claim **1** including an elongated housing for supporting and enclosing said actuator and said safety switch means, said housing having an elongated opening along one side facing said door for receiving said contact member in sliding contact with said actuator mounted in said housing.

3. The safety device of claim **2** wherein said housing and actuator are pivotally interconnected.

4. The safety device of claim **3** wherein said housing is formed with a longitudinal groove on an inside surface of substantially circular transverse cross-section, said actuator having an elongated enlarged edge portion of substantially circular transverse cross-section and received in said groove to permit pivotal movement of said actuator toward and away from said opening in said housing side.

5. The safety device of claim **3** wherein said housing and actuator are pivotally interconnected substantially the entire length thereof.

6. The safety device of claim **5** wherein said pivotal interconnection between said housing and actuator comprises a ball and socket profile in transverse cross-section.

7. The apparatus of claim **4** wherein groove is formed on a top wall of said housing and opens facing downwardly, said enlarged edge of said actuator being formed along an upper edge thereof, said actuator further including a body portion depending downwardly of said upper edge pivotal toward and away from said opening in said housing.

8. The apparatus of claim **7** wherein said actuator includes an elongated rail portion extending outwardly of said body portion toward said opening of said housing, said rail portion having an outer face for sliding contact with said contact member as said door is opened and closed.

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