

May 27, 1969

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3,446,264

FOLDING WALL SAFETY DEVICE

Filed Jan. 26, 1967

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FIG. 1

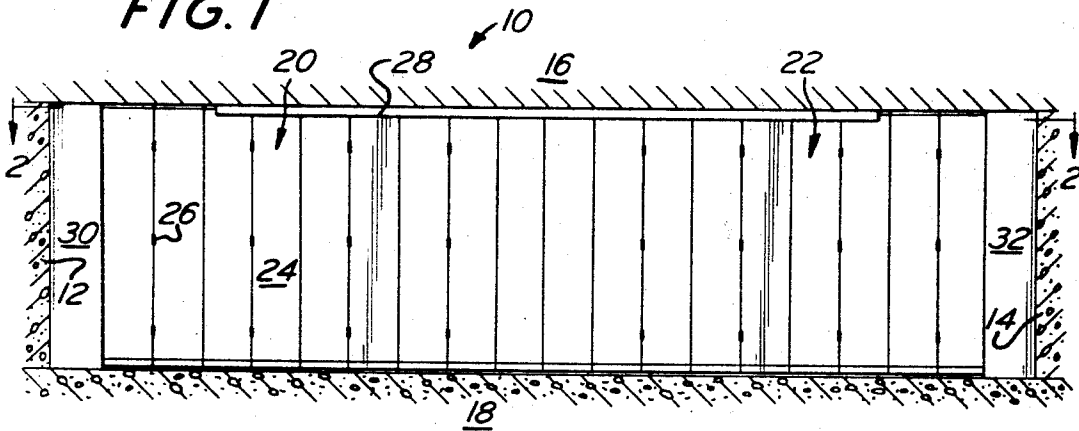


FIG. 2

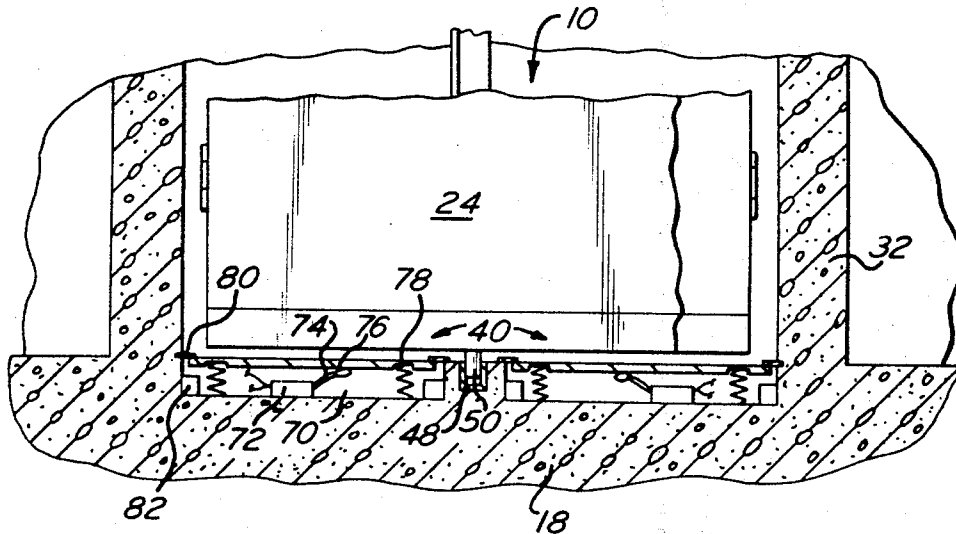
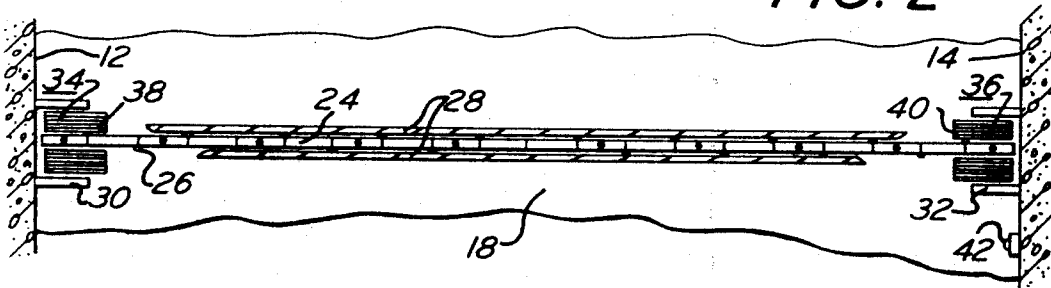


FIG. 11

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FIG. 3

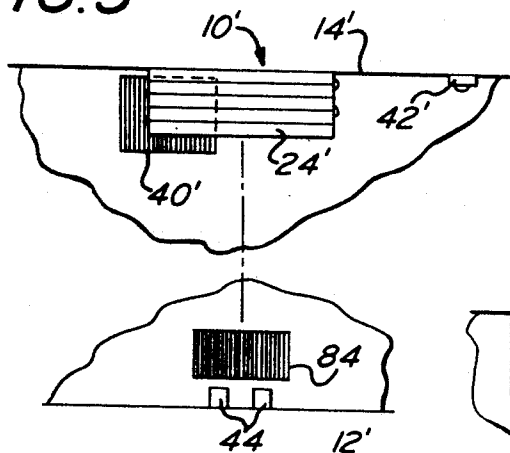


FIG. 4

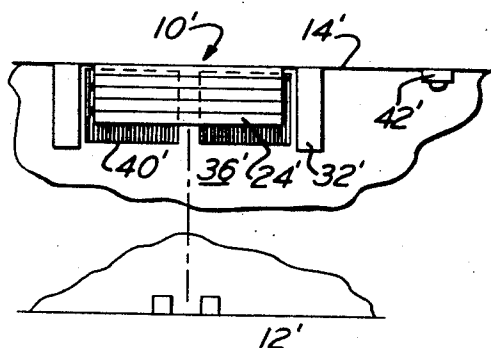


FIG. 5

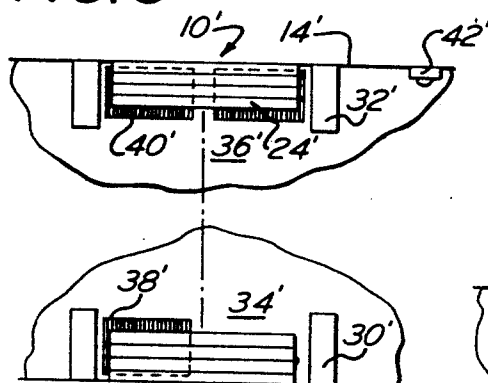


FIG. 6

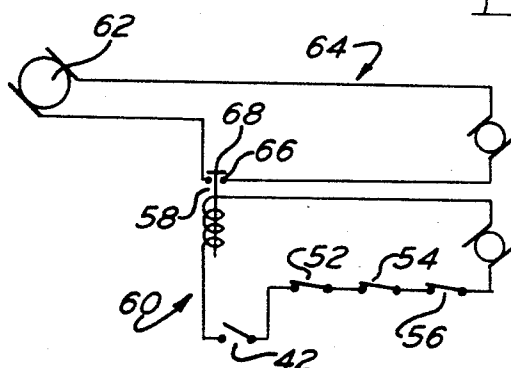
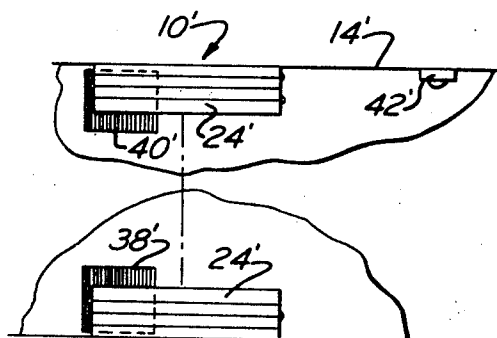


FIG. 10

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FIG. 7

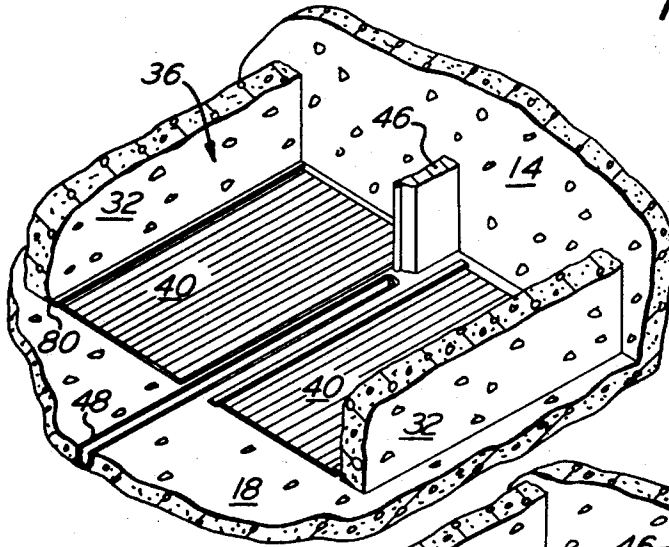


FIG. 8

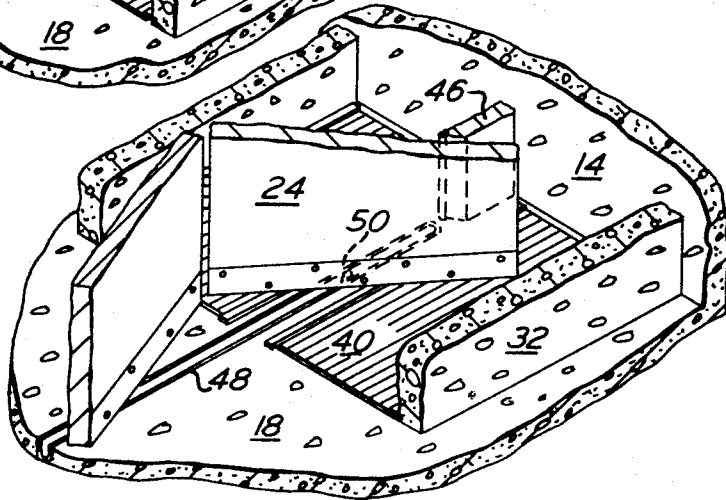
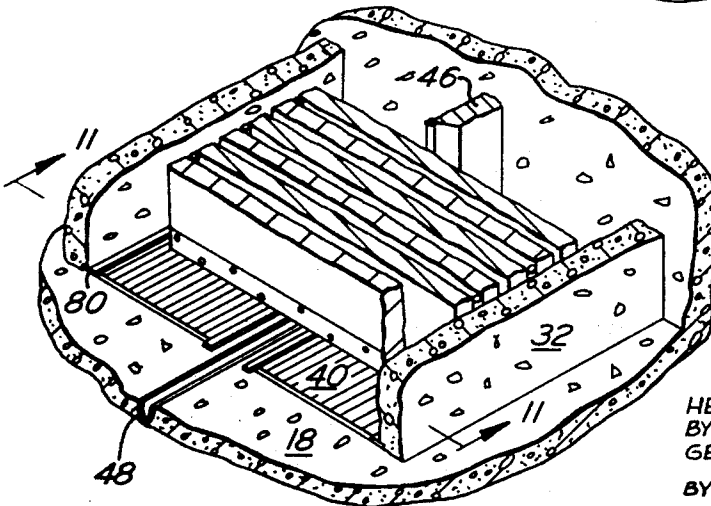


FIG. 9



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3,446,264

## FOLDING WALL SAFETY DEVICE

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U.S. Cl. 160—188

2 Claims

### ABSTRACT OF THE DISCLOSURE

A motor-driven folding wall or partition comprising hinged interconnected panels, and a safety device to prevent entrapment of persons or objects between the panels as the panels move from their in-line position to a folded or "stacked" position. Means are provided at danger areas not readily seen by persons operating the wall or partition for sensing the presence of persons or objects, and preventing movement of the wall or partition.

This invention relates to a folding wall safety device, and more particularly, to a device usable to prevent accidents due to the operation of motor-driven folding walls or partitions.

Motor-driven folding walls or partitions, which may be used as room dividers for schools, churches, hotels and other buildings, have grown increasingly popular in recent years. The advantages in building utility derived from their use are well known, and account for their success.

A problem has arisen in connection with the use of such walls or partitions, however. Thus, to impart to such walls or partitions a desirable appearance, and optimum acoustic and mechanical characteristics, it is necessary to use panels of heavy materials and construction. Such panels, when placed in motion, possess a great deal of inertia, and present a potential hazard to persons or objects caught between them as the wall or partition moves to its folded position. The problem is aggravated somewhat by the fact that in the most desirable installations of such walls or partitions, a pocket is provided to receive the panels as they reach their stacked position. This creates a blind area, in which persons or objects may be shielded from the view of a person operating the wall. The possibilities of personal injury or damage to the wall are apparent. The present invention provides a novel and unobvious solution to the foregoing problem.

It is an object of the present invention to provide a folding wall or partition and a safety device therefor.

It is another object of the present invention to provide a means whereby potential hazards to persons due to the operation of the motor-driven folding walls or partitions is eliminated.

It is still another object of the present invention to provide a means whereby damage to folding walls or partitions is avoided.

The invention has for a further object a means for preventing physical injury or damage to inanimate objects due to movement of mechanically actuated structures.

Other objects will appear hereinafter.

The foregoing objects of the present invention are achieved by providing, with a structure comprising a plurality of relatively movable parts, a means for sensing the presence of persons or objects in potential danger zones near the structure, and preventing operation of the structure while such persons or objects are in the danger zones.

For the purpose of illustrating the invention, there are

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shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a side elevation view of a folding wall forming a part of the present invention.

FIGURE 2 is a sectional top plan view, taken along the line 2—2 in FIGURE 1.

FIGURE 3 is a somewhat diagrammatical vertical view, partially broken away, showing the panels of a wall or partition in accordance with the present invention, and their spatial relation with a weight-responsive sensing means and a manual operator for the wall or partition.

FIGURE 4 is a view similar to that of FIGURE 3, showing an installation wherein the panels of the wall or partition are disposed in a pocket when in their folded or stacked position.

FIGURE 5 is a somewhat diagrammatical vertical view similar to that of FIGURE 4, but showing a wall or partition which includes two portions, each arranged to retract away from the other.

FIGURE 6 is another diagrammatical view, partially broken away, showing another folding wall or partition embodying principles of the present invention.

FIGURE 7 is a partial perspective view showing details of a construction in accordance with the present invention, and omitting the panels of the wall or partition for clarity.

FIGURE 8 is a view similar to FIGURE 7, showing panels of the folding wall or partition in an intermediate position, between their in-line and stacked positions.

FIGURE 9 is a view similar to FIGURE 7, showing the panels of the wall or partition in their stacked position.

FIGURE 10 is a schematic view of a control circuit forming a part of the present invention.

FIGURE 11 is a partial horizontal elevation view taken along the line 11—11 in FIGURE 9.

Referring to the drawings in detail, wherein like numerals indicate like elements, there is seen in FIGURE 1 a movable wall or partition designated generally by the reference numeral 10. Shown in cross section in FIGURE 1 are fixed portions of the building structure, including walls 12 and 14, a ceiling 16 and a floor 18. Thus, the movable wall or partition 10, when in the position shown in FIGURE 1, sub-divides an interior space of a building.

The wall or partition 10 includes a portion 20 on the left of FIGURE 1, and a portion 22 on the right. Each portion is made up of a plurality of rigid vertically extending panels 24, the panels being joined at their adjacent edges by hinges 26. As is best seen in FIGURE 2, the hinges on opposite edges of the respective panels are disposed at opposite faces thereof. Also, alternate panels are suspended or supported for translation along a line defining the in-line or wall-forming position of the panels, and for rotation about their own vertical centerline. The other alternate panels are preferably supported solely by their hinges. Lock bars 28 depend from the ceiling 16 and maintain the panels 24, except for those closest the walls 12 and 14, in their in-line position. Those skilled in the art will appreciate that a drive motor, which does not appear in FIGURE 1, may be coupled to the portions 20 and 22 in any well-known manner to move the panels 24 thereof to their stacked position. Stacking is accomplished by translation of the portion 22 toward the wall 14, and the portion 20 toward the wall 12. Panels 24, as they move clear of the lock bars 28 may fold accordion-fashion to form stacks adjacent the wall, with the individual panels assuming an orientation at right angles to the in-line position. The areas wherein the stacks are formed may hereinafter be referred to as stacking areas. The wall or partition shown in FIGURE 1, and also seen in plan view in FIGURE 2, may be characterized as a bi-

parting type, since it includes two portions moving toward opposite walls.

Those skilled in the art will appreciate that the principles of the present invention are applicable to single-stack walls or partitions, such as those shown in FIGURES 3 and 4, as well.

Referring to FIGURE 2, there are seen in cross-section pairs of vertically extending walls 30 and 32 extending away from the fixed walls 12 and 14, respectively. The walls 30 and 32 define between their faces pockets 34 and 36, in which the panels 24 are disposed when in their stacked position. Thus, the pockets 34 and 36 encompass and at least partially enclose the aforementioned stacking areas. The pockets 34 and 36 serve to protect the panels 24 in their stacked positions, and are also desirable for aesthetic reasons.

Also seen in FIGURE 2 are obstruction sensing devices 38 and 40, in this instance, weight responsive means, which form a part of the safety device of the present invention. A manual controller in the form of a hand operated electric switch 42 is disposed on the wall 14, and serves to control the drive motor in a manner to be more fully set forth hereinafter.

Referring now to FIGURES 3 to 6, there are seen several modified forms of the invention, which serve to illustrate the principles thereof. Elements corresponding to those previously described are designated by like primed numbers.

In FIGURE 3, there is seen a single-stack wall or partition in which the panels 24' are in their stacked position adjacent the wall 14'. Shown in dotted line is the in-line position of the panels. A jamb 44 is provided on the wall 12' to receive an edge of one of the panels 24' when all of the panels are in their in-line position. Obstruction sensing device 40' encompasses at least a portion of the floor in the stacking area. It should be apparent from FIGURE 3 that the obstruction sensing device 40' is so placed as to detect the presence of obstructions in the area adjacent to the wall wherein faces of the panels abut during stacking. It is in this area, it has been found, that the dangers obviated by the present invention are most acute.

Also apparent from FIGURE 3 is the fact that the location of the aforementioned obstruction sensing device 40' is out of the line of sight of a person positioned to operate the hand operated manual controller of 42'. Thus, the presence of a person or object in the danger zone and out of sight of the operator, prevents actuation of the drive means and movement of the panels. The operator of the manual controller of 42' will readily observe obstructions on the near side of the wall or partition, and accordingly, no obstruction sensing device is needed there. This, however, does not preclude the inclusion of such a device should extraordinary care be deemed advisable.

While the apparatus in FIGURE 3 does not include a pocket for the stacked panels, there is shown in FIGURE 4 a somewhat similar apparatus which includes a pocket 36' defined by walls 32'. The walls 32' make it desirable to provide obstruction sensing devices on each side of the wall or partition 10', since they cut off the portion of the danger zone on the near side of the wall or partition from the view of an operator positioned at the controller of 42'.

FIGURE 5 shows another modified form of the apparatus. The apparatus shown in FIGURE 5 includes a wall or partition of the bi-parting type, similar to that shown in FIGURES 1 and 2. In the particular installation shown, the manual controller of 42' is so positioned that an operator may readily observe the area within the pocket 34' on the near side of the wall or partition. Accordingly, no obstruction sensing device is placed in such area. No part of the stacking area within the pocket 36' is within the operator's line of sight, and accordingly, obstruction sensing devices are provided there as in FIGURE 4.

In FIGURE 6 there is shown yet another configuration of the present invention. Thus, there is shown in FIG-

FIGURE 6 a biparting wall or partition whose stacking area is not enclosed in a pocket. In such an arrangement, the operator adjacent the controller 42' has an unobstructed view of all but the far side of the wall or partition, and accordingly, obstruction sensing devices are needed only on that side. As in the case of the embodiment shown in FIGURE 3, should obstruction sensing devices be desired on the near side, they may be provided.

Referring now to FIGURES 7 to 9, there are seen detail views of the manner in which the panels 24 of the wall or partition 10 are received in the pocket. Preliminarily, it should be noted that while the pocket 36 shown to be defined by spaced walls 32 standing away from the fixed wall 14, the pocket may in fact be defined by a recess in the wall 14, per se. A stacking jamb 46 stands away from the wall 14, and extends in the direction of the in-line position of the panels 24. Also seen in FIGURES 7 to 9 is a channel 48 in the floor 18. Such channel receives a pin 50 depending from the panel 24 closest to the wall 14. The depending pin 50 and channel 48 serve to guide such panel for translation and rotation in the desired manner, but form, per se, no part of the present inventive concept.

FIGURES 7 to 9 clearly show the relationship between the obstruction sensing devices 40 and the stacking area. Also, it should be apparent from FIGURES 8 and 9 that any sizable object in the pocket 36 would be endangered by the panels 24, and vice-versa, as the panels move to their stacked position. The installation shown in FIGURES 7 to 9 shows the obstruction sensing devices 40 to substantially fill the pocket 36, and except for the area immediately adjacent the channel 48, cover the stacking area in its entirety. It is within the contemplation of the present invention that the obstruction sensing devices cover at least a portion of the stacking area, and most desirably, all area out of the line of sight of an operator.

Referring now to FIGURE 10, there is seen a schematic view of a control circuit forming a part of the present invention. Thus, there is seen in FIGURE 10 the manual controller 42. Ideally, the controller 42 is a key-operated switch of the off-on type. In series with the manual controller 42 are normally closed switches 32, 54 and 56. The switches 54 to 56 are contained in the obstruction sensing devices, as will be made clear hereinafter. It should be apparent that the circuit shown in FIGURE 10 is for an apparatus having three obstruction sensing devices, for example, that of FIGURE 5. In series with the manual controller 42 and the aforementioned switches 52 to 56 is a relay 58. The relay, switches, and the manual controller are all contained in a low-voltage loop, which may be termed for convenience the "control loop." The control loop is designated generally by the reference numeral 60. A drive motor 62, which are indicated above, may be coupled with the wall or partition in any suitable manner, is placed in a separate high voltage loop, termed for convenience the "power loop," designated generally by the reference numeral 62. Normally open contacts 66 in the power loop 64 are adapted to be closed by the armature 68 of the relay 58 upon actuation of such relay. Accordingly, the relay 58 serves to isolate the high voltage and amperage associated with the drive motor 62 from the control loop 60.

It should now be apparent that the presence of any person or object on the obstruction sensing devices 38 or 40 results in opening of a normally closed switch in series with the relay 58, and accordingly, by preventing actuation of the relay 58, prevents operation of the drive motor 62.

There is seen in FIGURE 11, in cross section, an exemplary obstruction sensing device of the weight-responsive type. A recess 70 is provided in the floor 18 on each side of the wall or partition 10 in the stacking area. The illustrated embodiment shows the aforementioned channel 48 and depending pin 50. It should be understood, however, that where these elements are not required, and it

is desired to provide obstruction sensing devices on both sides of the wall, a single large sensing device straddling the in-line position of the panels will suffice. Within the recess 70 there is a micro-switch 72, having a trip member 74. Overlying the recess, and normally just contacting the trip member 74 is a panel 76. The panel 76 may be provided with a rubber or plastic non-skid upper surface. Compression springs 78 urge the panel 76 upwardly against stops 80. The stops 80 are best secured to the floor 18, and may be seen in perspective in FIGURES 7 to 9. Thus, the panel 76, in its normal position, is retained generally flush with the surface of the floor 18 by the stops 80. The application of weight on the panel 76 sufficient to overcome the upward bias of the springs 78 causes motion of the trip member 74, and consequently, operation of the micro-switch 72. The micro-switch 72, it should be understood, is of the normally closed type, and corresponds to the aforementioned switches 52 to 56. Accordingly, the application of weight to the panel 76 is effective to prevent operation of the drive motor 62. Lower limit stops 82 may be provided in the recess 70 to limit downward movement of panel 76.

It will be appreciated that the weight of the obstruction necessary to prevent operation of the drive motor 62 will be determined by the upward biasing force of the compression springs 78. The size of such springs will be determined in each individual case by the consideration of the expected obstructions, and their probable minimum weight.

Referring once again to FIGURE 3, there is seen another possible application of the principles of the present invention. Thus, there is seen in FIGURE 3, an additional obstruction sensing device 84 adjacent the jamb 44 and a free edge portion of the wall 10' as it approaches its operative position. The sensing device 78, which operates in the same manner as those heretofore described, is effective to prevent injury to persons attempting to pass through the door opening as it closes. A sensing device similar to sensing device 84 may be placed adjacent the parting line of partitions of the bi-parting type.

The safety device herein disclosed may be used, if desired, with movable structures other than walls or partitions, and to walls or partitions other than those of the type illustrated. Thus, the principles of the present invention may be applied to other foldable structures, for example, foldable bleachers or the like.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

What is claimed is:

1. Apparatus comprising a folding wall having a plurality of rigid panels hingedly connected at adjacent edges

so that said panels are movable from an in-line position to a stacked position, said panels when in said stacked position being disposed in a stacking area defined by a pair of spaced vertically extending walls defining a pocket, drive means coupled to said panels for moving said panels between said positions, said drive means comprising an electric motor, control means for operating said drive means, said control means comprising an electric circuit coupled to said motor, said electric circuit including a hand-operated switch for selectively actuating said motor, and a safety device for preventing entrapment of persons or objects between adjacent panels as said panels move to their stacked position, said safety device comprising weight responsive means associated with a floor in said pocket, said weight responsive means being coupled to said control means and responsive to the weight of obstructions in said pocket to prevent operation of said drive means, said weight responsive means comprising a normally closed electric switch disposed remote from said hand-operated switch at a location out of the line of sight of a person positioned to operate said hand-operated switch.

2. Apparatus comprising a foldable structure having a plurality of rigid members hingedly interconnected at adjacent portions so that said members are movable from an operative position to a stacked storage position, drive means coupled to said members for moving said members between said positions, control means for operating said drive means, said control means including a hand-operated controller for actuating said drive means, said members being disposed when in said stacked position in a stacking area defined by spaced vertically extending walls defining a pocket, and a safety device for preventing entrapment of persons or objects between adjacent members as said members move to their stacked position, said safety device comprising obstruction sensing means associated with a floor in said pocket, said obstruction sensing means being coupled to said control means and responsive to the presence of obstructions in said pocket to prevent operation of said drive means, said obstruction sensing means being disposed remote from said hand-operated controller at a location out of the line of sight of a person positioned to operate said controller.

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U.S. Cl. X.R.

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