

Jam Detector For Electric Slide Door Assembly

The present invention generally relates to an electrically operated slide door assembly for selectively closing and opening the doorway leading into and out of a building, a room, a lift or the like and, more particularly to a jam detector operatively associated with the slide door assembly for detecting, and providing an indication of, whether or not a jam has occurred between the slide door assembly and the wall defining the doorway.

More specifically, the present invention, though not exclusively limited thereto, pertains to the jam detector suited for use in association with the lift door assembly.

As is well known to those skilled in the art, a lift for carrying passengers and/or freights up and down is equipped with an electrically operated slide door assembly for selectively closing and opening the doorway between the cage and the corridor. In most cases, the slide door assembly generally used in the lift comprises an outer door for each floor of a building and an inner door for the lift cage, these outer and inner doors being so operatively associated with each other that, when the lift cage arrives at, or is ready to leave from, a particular floor of the building, they can be simultaneously or in synchronized relation moved from a closed position towards an opened position or from the opened position

towards the closed position, respectively. When in the opened position, the lift door assembly is boxed in between a wall confronting the corridor and the wall defining the lift cage and on one side of the doorway
5 extending between the lift cage and the corridor.

Because of the nature and movability of the slide door assembly in the lift, a clearance is inevitably provided between the door assembly and the wall defining the lift cage on the one hand and between the door assembly
10 and the wall confronting the corridor on the other hand, and in particular the clearance between the door assembly and the wall defining the lift cage often times poses a problem that must be solved for the purpose of safeguarding passengers.

15 According to the prior art, the problem has often occurred that a portion of the clothing, i.e., a dress and/or skirt, of one of the passengers standing within the lift cage and near the door assembly and/or his or her hand are jammed in between the door assembly and the
20 wall defining the lift cage during the opening of the door assembly. This is particularly true when the lift cage is full of passengers and subsequently arrive at a designated floor whereat the door assembly is automatically opened.

25 The present invention has been devised with a view to providing a jam detector effective to substantially

eliminate or minimize the above described danger which the passenger may suffer from during the opening of the electrically operated slide door assembly.

According to the present invention, there is
5 provided an electrically actuated slide door assembly for a doorway comprising:-
at least one door slidable to close or open the doorway;
frame means defining a respective slot for receiving
10 the or each opening door;
and a jam detector located at or adjacent at least one of said slots; the jam detector comprising a sensor bar of a length generally equal to the height of the respective slot and supported for movement between
15 projected and retracted positions in a direction transversely of the longitudinal axis of the slot at also the direction of movement of the sliding door, a biasing means for urging the sensor bar to assume the projected position with one side of said sensor bar
20 being spaced a selected distance from the sliding door so as to be moved from the projected position towards the retracted position against the biasing means in the event that an object is accidentally jammed in between said one side of the sensor bar and the sliding door,
25 and at least one sensor for generating an electrical signal indicative of the occurrence of the jam in response to the movement of the sensor bar from the projected position towards the retracted position.

Preferably, where the slide door assembly comprises a pair of doors movable in opposite directions towards and away from each other and adapted to open in the middle, a respective jam detector being located at or adjacent both slots. Irrespective of the type of the slide door assembly, the slide door assembly to which the jam detector of the

present invention is utilized may be a door assembly in the lift.

Moreover, the jam detector of the present invention may be used in association with the door assembly of the lift cage. To this end, the sensor bar may be supported by one lateral edge of the cage defining wall which confronts the doorway.

The electrical signal generated from the sensor may be used either for reversing the motor used to open and close the door assembly or for providing a visual and/or audio indication of the occurrence of the jam.

These and other features of the present invention can readily be understood from the following detailed description thereof taken in conjunction with a preferred embodiment thereof with reference to the accompanying drawings, in which:

Fig. 1 is a schematic top sectional view of an essential portion of a lift cage to which the present invention is applied; and

Fig. 2 is a top sectional view, on an enlarged scale, of the portion indicated by the chain-lined circle in Fig. 1.

Referring first to Fig. 1, a lift cage 1 comprises a pair of opposite side walls 1a and 1b, a front wall 1c, a rear wall (not shown), a cage floor 2 and a ceiling panel (not shown), all being assembled together to render

the cage 1 to be of generally box-like configuration. The cage 1 has an entrance 3 defined in the front wall 1c, which entrance 3 is adapted to be selectively opened and closed by a pair of slide doors 5 supported in any known manner for movement in the opposite directions towards and away from each other in a plane parallel to the front wall 1c. These slide doors 5 are driven by a motor through a linkage system in any known manner, both of said motor and linkage system being not shown for the sake of brevity because they do not constitute any subject matter of the present invention.

The peripheral lip region of the front wall 1c confronting the entrance 3 is reinforced and decorated by a pair of side frames 4 of generally L-shaped cross-section and an overhead beam (not shown) spanning between the side frames 4 at the top of the entrance 3. As best shown in Fig. 2, one side edge of each of the side frames 4 opposite to the connection thereof to the front wall 1c is spaced a predetermined distance from the respective door 5, thereby forming a clearance g which extends lengthwisely of the respective side frame 4. It is this clearance g which, according to the prior art, a portion of the clothing of a passenger inside the lift cage 1 and/or his or her hand tend to be jammed in during the movement of the respective door 5 from a closed position towards an opened position.

A jam detector according to the present invention is, in the embodiment so far shown, employed for each door 5 and comprises, as best shown in Fig. 2, an elongated sensor bar 8 of a length generally equal to the height of the respective door 5 above the cage floor 2 and having two or more carrier blocks 7 rigidly secured at one end to the sensor bar 8 in spaced relation to each other. The other end of each of the carrier blocks 7 has a pin projection 7a formed integrally therewith, or otherwise rigidly connected thereto, in coaxial relation with said respective carrier block 7, a free end portion of said pin projection 7a opposite to the associated carrier block 7 being formed with an external thread as shown.

The sensor bar 8 is movable between projected and retracted positions in a direction transversely of the lengthwise direction of said bar 8 and also generally at right angle to the respective door 5 and is supported by generally U-sectioned brackets 6 equal in number to the number of the carrier blocks 7 in a manner as will now be described. As best shown in Fig. 2, each of the brackets 6 is rigidly secured to the respective side frame 4, having been confined within a space not exposed to the interior of the lift cage 1, i.e., interiorly of the respective side frame 4, and has a pair of arms 6a and 6b protruding away from the associated side frame 4. These arms 6a and 6b of each of the brackets 6 has reduced

and large diameter bearing holes defined therein,
respectively. The sensor bar 8 is movably supported
by these brackets 6 with the carrier blocks 7 and the
pin projections 7a extending axially movably through
5 the bearing holes, respectively, in the arms 6a and 6b
of the associated brackets 6 and is held in position
by corresponding nuts 10 threaded on the threaded free
end portions of the respective pin projection 7a.

A compression spring 9 employed for each carrier
10 block 7 is interposed between the arm 6a and an annular
end face of the respective carrier block 7 remote from
the sensor bar 8 such that the sensor bar 8 is normally
biased by said spring 9 to assume the projected position
as shown in Fig. 2. The position of the nuts 10 on the
15 threaded free ends of the respective pin projections 7a
is so adjusted as to render the sensor bar 8 to be spaced
a minimum possible distance from the inner surface of
the respective door 5, which minimum possible distance
may be either equal to or smaller than the clearance g.

20 The jam detector according to the present inven-
tion also comprises at least one sensor which may be,
as shown in Fig. 2, constituted by an electric switch
11 of a type having a spring-loaded actuator 11a. This
switch 11 is supported by a support bar 12 having one end
25 rigidly secured to, or otherwise integrally formed with
one of the brackets 6 and the other end carrying the
switch 11 in a manner with the tip of the actuator 11a

aligned with the associated pin projection 7a. Preferably, the switch 11 is adjustably mounted on the support bar 12 so that the space between the tip of the actuator 11a and the free end of the associated pin projection 7a opposite the carrier block 7 can be adjustable.

The electric switch 11 is, so far shown, adapted to generate an electrical signal only when the sensor bar 8 is moved from the projected position towards the retracted position against the associated spring 9.

10 The electrical signal so generated from the switch 11 may be used to reverse the motor so as to move the doors 5 towards the closed position and/or to provide a visual and/or audio indication of the displacement of the sensor bar 8 from the projected position. Since the displacement

15 of the sensor bar 8 from the projected position takes only when an object, such as the clothing and/or a passenger's hand is jammed in between the respective sensor bar 8 and the associated door 5 as the doors 5 move from the closed position towards the opened position,

20 it will readily be seen that the electrical signal emerging from the switch 11 is indicative of the occurrence of the jam.

From the foregoing, it has now become clear that, with the jam detector according to the present

25 invention, it is possible to provide a lift having a high safety factor, i.e., having a minimized possibility

of the occurrence of jamming of the passenger's clothing and/or hand.

Although the present invention has fully been described in connection with the preferred embodiment
5 thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. By way of example, although the jam detector has been described as employed in association with the inner door for the
10 lift cage, it may be employed also in association with each of the outer doors confronting the respective corridors at different floors.

In addition, although the switch 11 has been shown as operated by the pin projection 7a upon the
15 displacement of the sensor bar 8, it may be possible to arrange and locate the switch 11 so as to be operated directly by the sensor bar 8. Furthermore, the switch may be used for some or all of the carrier blocks 7.

Accordingly, such change and modifications
20 are to be understood as included within the scope of the appended claims, unless they depart therefrom.



CLAIMS

1. An electrically actuated slide door assembly for a doorway comprising:-
- 5 at least one door slidable to close or open the doorway;
- frame means defining a respective slot for receiving the or each opening door;
- and a jam detector located at or adjacent at least one
- 10 of said slots; the jam detector comprising a sensor bar of a length generally equal to the height of the respective slot and supported for movement between projected and retracted positions in a direction transversely of the longitudinal axis of the slot at
- 15 also the direction of movement of the sliding door, a biasing means for urging the sensor bar to assume the projected position with one side of said sensor bar being spaced a selected distance from the sliding door so as to be moved from the projected position towards
- 20 the retracted position against the biasing means in the event that an object is accidentally jammed in between said one side of the sensor bar and the sliding door, and at least one sensor for generating an electrical signal indicative of the occurrence of the jam in
- 25 response to the movement of the sensor bar from the projected position towards the retracted position.



2. A slide door assembly as claimed in Claim 1 wherein said at least one sensor is an electric switch.

5 3. A slide door assembly as claimed in Claim 1 or 2 including a pair of doors moveable in opposite directions towards and away from each other and adapted to open in the middle, a respective jam detector being located at or adjacent both slots.

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4. A slide door assembly as claimed in Claim 1 or 2 including a single slide door.

15 5. A slide door assembly as claimed in any preceding claim wherein the door assembly comprises a lift door assembly.

20 6. A slide door assembly substantially as herein described with reference to the accompanying drawings.
