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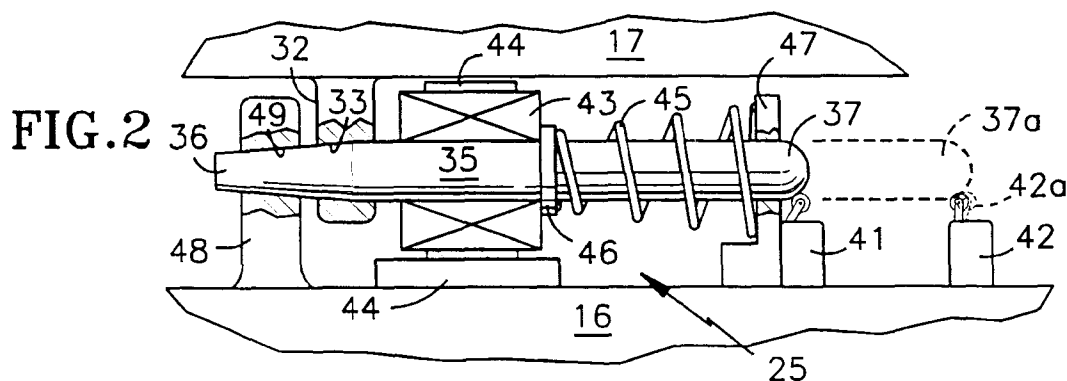
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(54) **Locking a horizontally moveable elevator cab to an elevator platform**

(57) An elevator cab lock (25) includes a lug (32) on a horizontally moveable elevator cab (17) that receives a bolt (35) which is urged into the lug by a spring (45) and retracted from the lug by means of a solenoid (43)

disposed on the elevator car frame. Switches (41, 42) keep track of the position of the bolt; locks may be used on car frames, landings and carriers in various configurations.



Description

This invention relates to positively locking an elevator cab to an elevator platform, such as a car frame, a landing or a carrier.

The sheer weight of the rope of the hoisting system of a conventional elevator limits their practical length of travel. To reach portions of tall buildings which exceed that limitation, it has been common to deliver passengers to sky lobbies, where the passengers walk on foot to other elevators which will take them higher in the building. However, the milling around of passengers is typically disorderly, and disrupts the steady flow of passengers upwardly or downwardly in the building.

All of the passengers for upper floors of a building must travel upwardly through the lower floors of the building. Therefore, as buildings become higher, more passengers must travel through the lower floors, requiring that more of the building be devoted to elevator hoistways (referred to as the "core" herein). Reduction of the amount of core required to move adequate passengers to the upper reaches of a building requires increases in the effective usage of each elevator hoistway. For instance, the known double deck car doubled the number of passengers which could be moved during peak traffic, thereby reducing the number of required hoistways by nearly half. Suggestions for having multiple cabs moving in hoistways have included double slung systems in which a higher cab moves twice the distance of a lower cab due to a roping ratio, and elevators powered by linear induction motors (LIMs) on the sidewalls of the hoistways, thereby eliminating the need for roping. However, the double slung systems are not effective for shuttling passengers to sky lobbies in very tall buildings, and the LIMs are not yet practical, principally because, without a counterweight, motor components and power consumption are prohibitively large.

In order to reach longer distances, an elevator cab may be moved in a first car frame in a first hoistway, from the ground floor up to a transfer floor, moved horizontally into a second elevator car frame in a second hoistway, and moved therein upwardly in the building and so forth. Since the loading and unloading of passengers takes considerable time, in contrast with high speed express runs of elevators, another way to increase hoistway utilization, thereby decreasing core requirements, includes moving the elevator cab out of the hoistway for unloading and loading, as described in our European patent application claiming priority of U.S. patent application Serial No. 08/565,606 and filed contemporaneously herewith.

An object of the invention is to positively lock a horizontally moveable elevator cab to an elevator platform, which may be a vertically moving car frame, a landing, or a horizontally moveable carrier. Another object is to provide such a lock which positively locks the cab against relative vertical motion when it is on an elevator platform.

According to the present invention, a cab lock, comprising a strike having a bore therethrough and a lock bolt operable to move into said strike, extends between a horizontally moveable elevator cab and an elevator platform, such as a car frame. According to the invention further, the strike has a horizontal bore and a lock bolt is moveable thereto horizontally, thereby firmly locking the cab against relative vertical motion when it is on the car frame.

According still further to the invention, the lock bolt may be disposed on the platform and the strike may be disposed on the cab, or the strike may be disposed on the platform and the lock bolt disposed on the cab. According to the invention, the lock may extend between the bottom of the cab and the platform, or it may extend between the top of the cab and the platform.

In further accord with the invention, a cab/car lock for locking a horizontally moveable elevator cab positively to an elevator platform includes a bolt which is extended into a strike by means of a spring, so as to remain in the locked position even with loss of power, and a solenoid is used to unlock the cab from the car by pulling the bolt out of the strike against the action of the spring.

The platform may be a landing in a building or a cab carrier, as well as a car frame.

Other objects, features and advantages of the present invention will become more apparent in the light of the following detailed description of exemplary embodiments thereof, as illustrated in the accompanying drawings, in which:

Fig. 1 is a simplified front elevation view of a horizontally moveable elevator cab in a car frame with cab locks according to the invention.

Fig. 2 is a partial, simplified, partially sectioned side elevation view of a cab lock in accordance with the invention.

Fig. 3 is a stylized, simplified side elevation view of the elevator frame of Fig. 1 with the cab removed therefrom to a landing which also has cab locks in accordance with the present invention.

Fig. 4 is a simplified front elevation view of an elevator car frame with cab locks positioned in the center of the cab.

Fig. 5 is a circuit diagram of bipolar solenoid energization which may be used in the present invention.

Fig. 6 is a circuit diagram of switches which may be incorporated in the present invention for safety and control purposes.

Fig. 7 is a simplified front elevation view of a portion of a horizontally moveable elevator cab in a car frame having a cab lock working with a lug atop a cab.

Fig. 8 is a simplified front elevation view of a portion of a horizontally moveable elevator cab in a car frame having a lug and a cab lock disposed atop a cab.

Referring to Fig. 1, an elevator car frame 10 includes a plank 11, a crosshead 12 that supports roping 13, a stile 14, 15 on each side of the frame, and a car platform 16. A horizontally moveable cab 17 has doors

18, and wheels or rollers 19 to allow it to be moved. As seen in Fig. 3, the car frame 10 may have braces 20, 21 between the car platform 16 and the stile 14 (along with the stile 15, not shown) for stability. The braces 20, 21 are omitted from Fig. 1 for clarity. In Fig. 1, a pair of cab locks 25, 26 are shown in the operative position, locking the cab 17 to the car.

Referring to Fig. 2, each lock 25 is shown working with a strike, such as a lug 32 securely fixed to the horizontally moveable elevator cab 17. Each lug 32 has a bore 33 disposed therein to form a lock strike which receives a lock bolt 35. The bore 33 and the working end 36 of the lock bolt 35 may be tapered so as to facilitate mating the bolt 35 with the hole 33 despite minor variations in positioning of the cab 17 on the car frame 10, while also forming a fairly tight fit. The other end 37 of the bolt 35 may also be tapered to serve as a cam for actuating a pair of spring loaded, cam operated switches 41, 42. In the embodiment of Fig. 5, the bolt 35 is permanently magnetized, such as with the end 37 comprising a north magnetic pole and the end 36 comprising a south magnetic pole (or vice versa). A solenoid 43 may have current flow in one direction to drive the bolt into the locked position (as shown in Figs. 1 and 2) and current flow in the opposite direction to cause the bolt to withdraw (to the left in Fig. 2), into a fully unlocked position where the end 36 is totally clear of the lug 32, against the force of a compression spring 45 acting between a flange 46 on the bolt 35 and a lug 47 disposed on the car platform 16. The solenoid 43 is disposed rigidly to the car platform 16 by a suitable bracket 44. In its preferred form, the invention also includes a lug 48 which may have a tapered hole 49 to form a second strike affixed to the car platform 16.

Fig. 3 is a quasi-sectional view taken along the surface of a near wall (not shown) of a landing 70. Rigidly affixed to that wall are a pair of locks, only lock 25a being shown, which are in a position similar to that of the locks 25, 26 on the car platform 16, so as to permit locking the cab onto a landing. The locks may be identical to those used on the car platform 16. As seen in Fig. 3, the locks 25, 26 may be positioned on the platform 16 between the stile 14 and the stile 15 (not seen in Fig. 3). On the other hand, the locks 25 and 26 may be positioned other than between the stiles, such as the lock 25 being at the front left of the car frame 10 and the lock 26 being at the right rear of the car frame 10, as viewed in Fig. 1. Or, as viewed in Fig. 4, the locks 25 (and 26) may be mounted at the front and rear center of the platform 16. Or other combinations may be used, preferably including at least two locks in each case so as to stabilize the position of the car.

In Fig. 5, a bridge switching circuit 50 allows providing current in either of two directions to the solenoid 37 and a solenoid 51 of an additional cab lock, such as the cab lock 26. When a "set car/cab lock" signal is provided on a line 52, it will operate a pair of switches 53, 54 so that current will flow from a positive source 55 through

the switch 53, the coils 37, 51, and the switch 54, back to a negative voltage source 56. On the other hand, in response to a "reset car/cab lock" signal on a line 60, a latch 61 is set, the output of which operates a pair of switches 62, 63 so that current flows through the switch 62, through the coils 43, 51 in the opposite direction, through the switch 63 and back to the negative source 56. The latch 61 will hold the coil in a reset or unlocked position (left in Figs. 1 and 2) against the spring 45 until the latch 61 is reset by a signal on the line 52. Once the lock is locked, it will be held in the locked position by the spring 45 in the embodiment shown. The switches 53, 54, 62, 63 may be field effect transistor switches, or any other suitable type of switch.

The cam operated switches 41, 42 (Fig. 2) may be utilized for safety and control purposes by providing "cab/car lock locked" and "cab/car lock unlocked" signals on respective lines 66, 67 as shown in Fig. 6. Therein, a normally closed contact 41a is closed only when the lock is fully locked as shown in Fig. 2, and the switch 41 is not actuated. Similarly, a normally closed contact 68a of another cab lock, such as the cab lock 26, is operated only when its bolt is to the right (Fig. 1) of the switch 42 sufficiently so that it is not actuated. A normally open contact 42b is closed only when the bolt is sufficiently far to the left, as shown by the dotted lines 37a in Fig. 2, so that it actuates the switch 42, as shown by the dotted lines 42a in Fig. 2. A normally open contact 69b (of car lock 26) is closed only when the bolt 35 is fully retracted (to the right in Fig. 1) so that its end 36 is totally clear of the lug 32, thereby permitting horizontal motion of the cab 34 without any interference from the bolt 35 (or the bolt of the cab lock 26). Figs. 5 and 6 depict circuitry for use with two cab locks (as in Fig. 1). If more cab locks are used, there will be more coils in parallel in Fig. 5 and more switches in series in Fig. 6.

Another embodiment of the invention is shown in Fig. 7 in which a lug 32 is disposed to the canopy 73 of the cab 17 and the lock 25b is secured to the car frame by brackets 74.

The embodiments described thus far have the solenoid 37 and the lugs 47, 48 disposed on the car platform 16 or on a platform comprising the landing 70 with the lug 32 disposed on the cab 34. On the other hand, the lug 32 may be disposed on either the car frame 10 or on the wall of the landing 70, with the solenoid 37 disposed on the cab 17. In Fig. 8, a lock 25c includes a lug 32a disposed on the stile 14 and the solenoid 37 fastened to the canopy of the cab 17. However, it is easier to maintain electrical communication with the solenoids (such as solenoid 37) and the switches (such as the switches 41, 42) of each of the cab locks if they are associated with the car frames, rather than with the cab 17 which may require special handling of electrical signals when it is transferred from one car frame to another or from a car frame to a landing.

Switches similar to switches 41, 42, respectively, may be provided as described hereinbefore in the em-

bodiments of Figs. 7 and 8. For simplicity, only one lock is shown in Figs. 4, 7 and 8 preferably, two locks, or more, will be used. Proximity sensors or other form of position detectors may be used in place of the cam operated switches 41, 42 in all of the prior embodiments. A strike disposed on a surface may comprise a bore formed in a lug which is fastened to such surface, or it may comprise a bore formed in such surface.

Thus, although the invention has been shown and described with respect to exemplary embodiments thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions and additions may be made therein and thereto, without departing from the scope of the invention, which is defined by the claims.

Claims

1. An elevator comprising:

an elevator car frame;
a horizontally moveable elevator cab; and
a cab lock extending between said car frame and said cab and operable to lock said cab to said frame, said cab lock comprising a strike having a bore therethrough and a lock bolt operable to extend into said strike so as to lock said cab to said car frame.

2. An elevator according to claim 1 wherein said strike has a substantially horizontal bore therethrough, said bolt being operable horizontally to pass into said strike.

3. An elevator according to claim 1 or 2 wherein said strike is disposed on said cab and said bolt is disposed on said car frame.

4. An elevator according to claim 3 further comprising: a second strike having a substantially horizontal bore therethrough disposed on said car frame, said bolt being operable to pass through said first-named strike and into said second strike.

5. An elevator according to claim 1 or 2 wherein said strike is disposed on said car frame and said bolt is disposed on said cab.

6. A cab lock for an elevator cab which is horizontally moveable between a landing of a building and an elevator car frame vertically moveable in a hoistway toward and away from said landing, said cab lock firmly locking a surface of said cab to either a surface of an elevator platform comprising either said car frame or said landing, comprising:

a first part of said cab lock disposed on a sur-

face of said cab;

a plurality of second parts of said cab lock, one of said second parts being disposed on a surface of said car frame, so as to interact with said first part on said cab when said cab is positioned on said car frame, and one of said second parts being disposed on a surface of said landing so as to interact with said first part on said cab when said cab is positioned on said landing;

one of said parts comprising a strike disposed on the related one of said surfaces and having a bore therethrough, and

the other of said parts comprising a lock bolt disposed on the corresponding one of said surfaces with selectively operable means for moving said lock bolt into a bore to lock said cab to said car frame or to said landing, and for alternatively moving said bolt clear of any strike so that said cab may be moved horizontally relative to said car frame and/or said landing.

7. A cab lock according to claim 6 wherein:

said strike has a horizontal bore; and
said selectively operable means moves said lock bolt horizontally into a bore to lock said cab to said car frame or to said landing.

8. A cab lock according to claim 6 or 7 wherein:

said selectively operable means includes a spring to move said lock bolt into a bore to lock said cab to said car frame or to said landing, and a solenoid to pull said lock bolt out of said bore against said spring so as to unlock said cab from said car frame.

9. A cab lock according to claim 6, 7 or 8 wherein one of said parts comprises a strike formed in a lug extending outwardly from the related one of said surfaces.

10. A cab lock according to claim 6 wherein:

said first part of said cab lock comprises a lock bolt.

11. A cab lock according to claim 6 wherein:

said second part of said cab lock comprises a lock bolt.

12. A cab lock for firmly locking a surface of a horizontally moveable elevator cab to a surface of a vertically moveable elevator car frame, comprising:

a strike disposed on one of said surfaces and having a substantially horizontal bore;
a lock bolt disposed on the other of said surfaces for substantially horizontal movement into

and out of said bore; and
selectively operable means for moving said bolt
into said bore to lock said cab to said car frame,
and for moving said bolt clear of said strike so
that said cab may be moved horizontally rela- 5
tive to said car frame.

13. A cab lock according to claim 12 wherein
said selectively operable means includes a
spring to move said lock bolt into a bore to lock said 10
cab to said car frame or to said landing, and a so-
lenoid to pull said lock bolt out of said bore against
said spring so as to unlock said cab from said car
frame.

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14. A cab lock according to claim 12 wherein said strike
is formed by a lug extending outwardly from one of
said surfaces.

15. A cab lock according to claim 12 wherein said strike 20
is disposed on a surface of said cab and said bolt
is disposed on a surface of said car frame.

16. A cab lock according to claim 12 wherein said strike 25
is disposed on a surface of said car frame and said
bolt is disposed on a surface of said cab.

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FIG.1

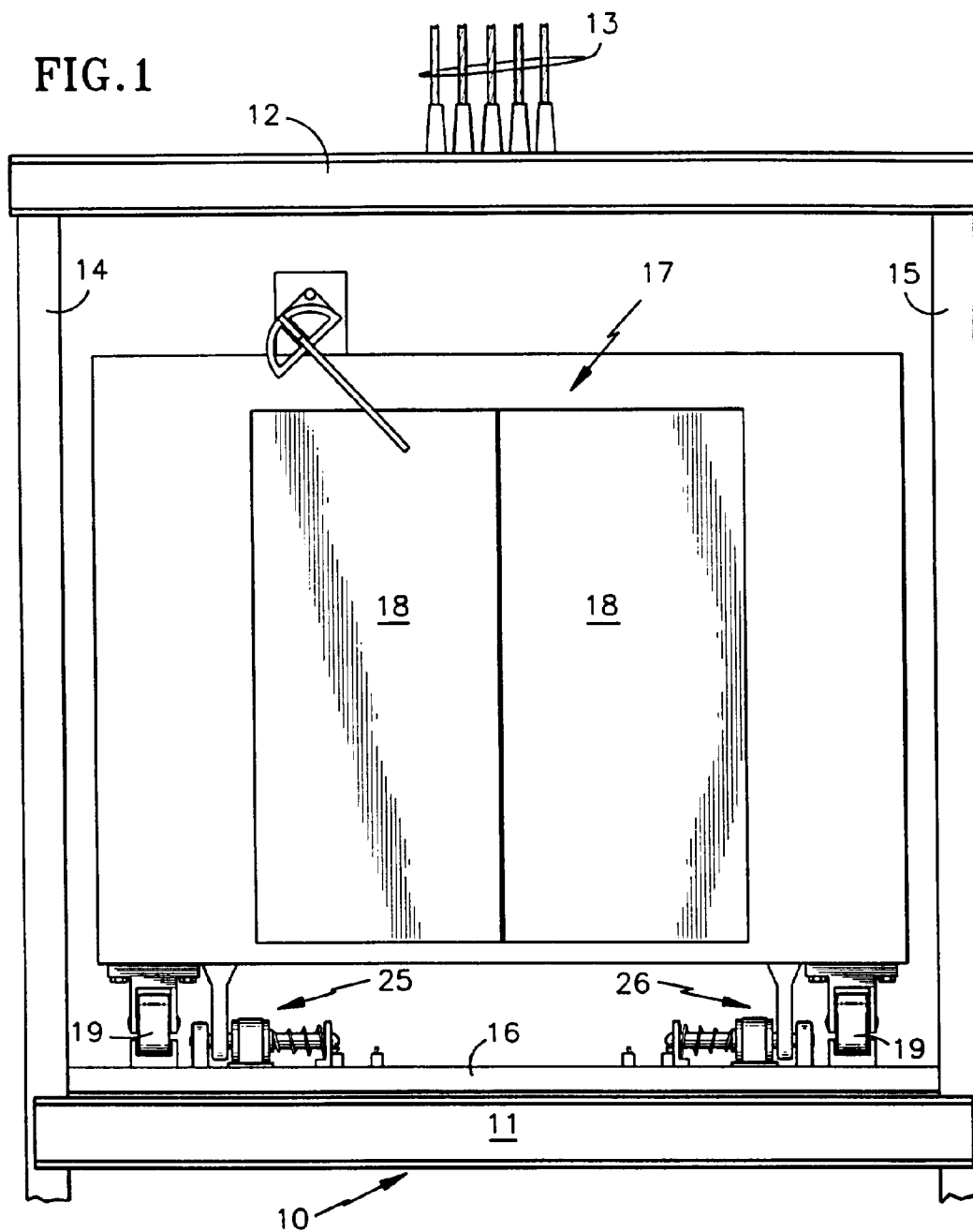


FIG.2

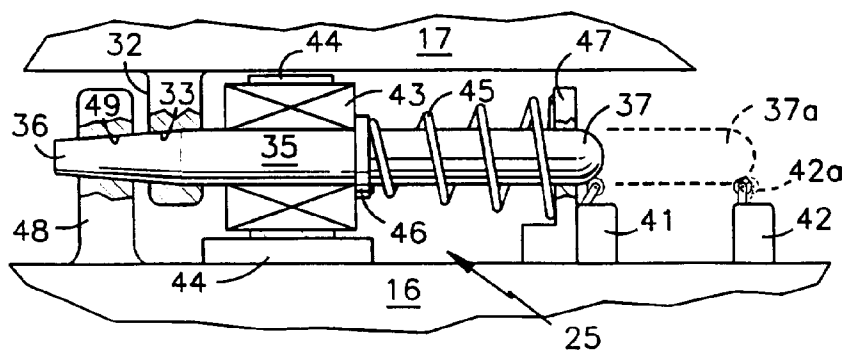


FIG.3

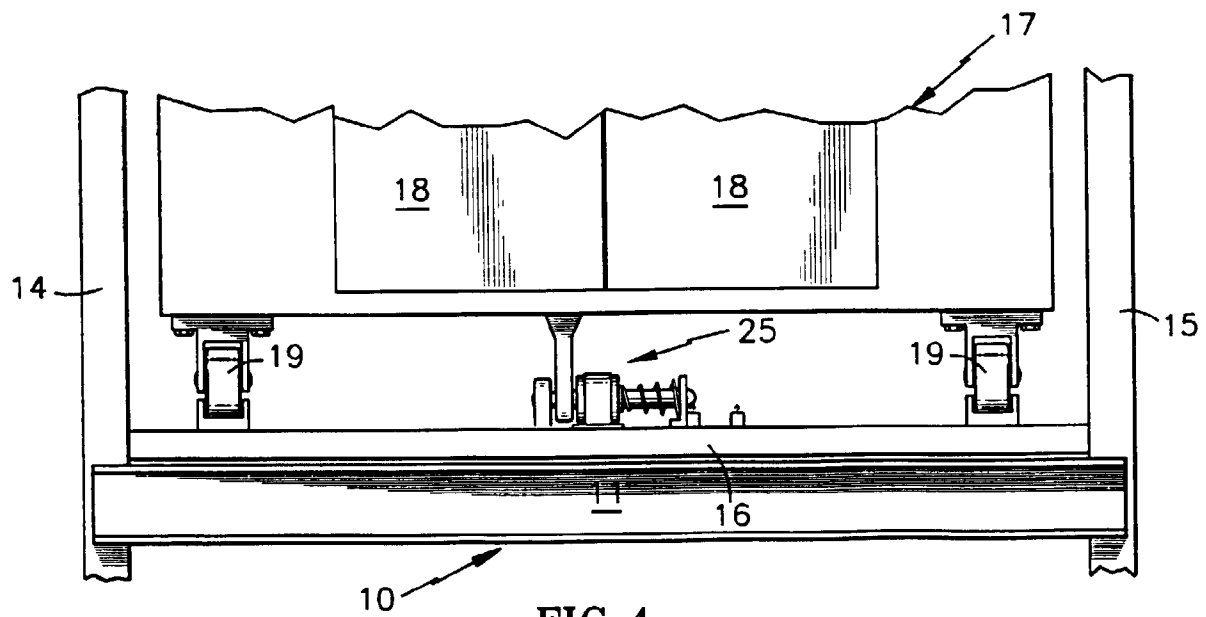
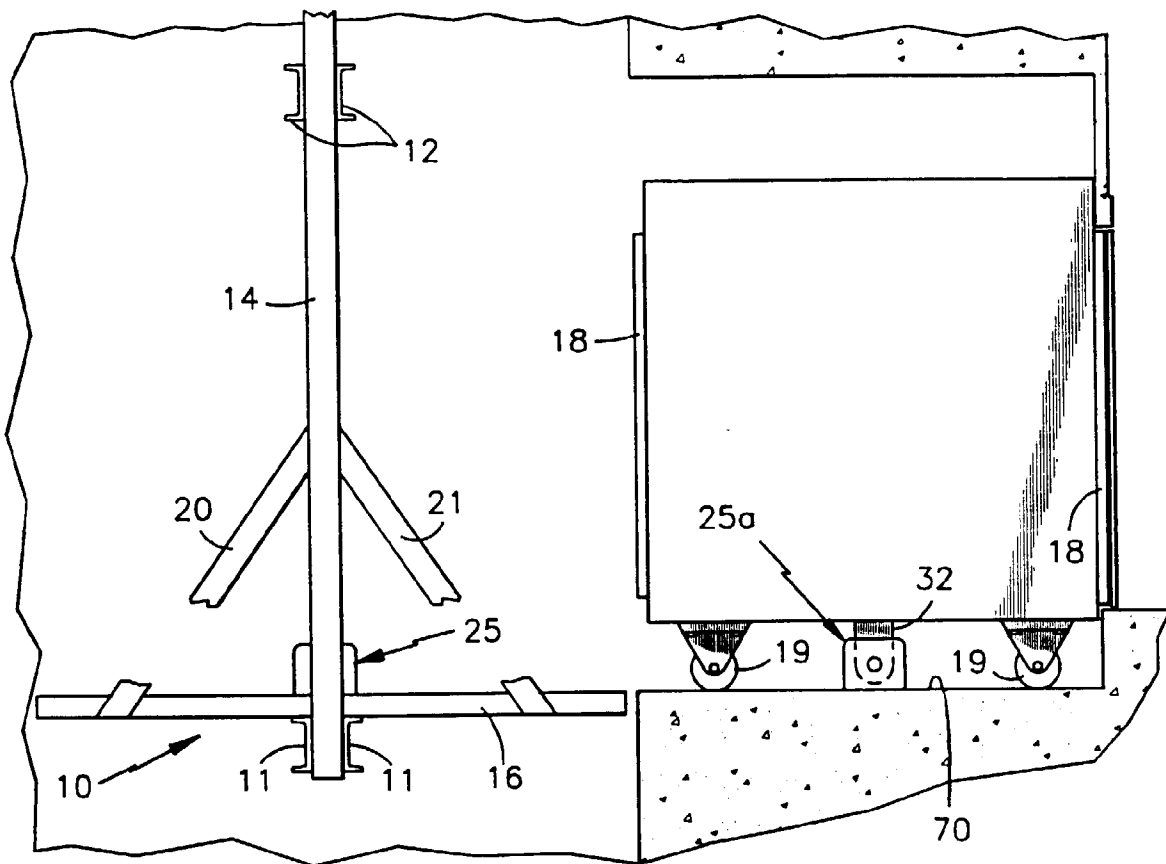


FIG.4

