

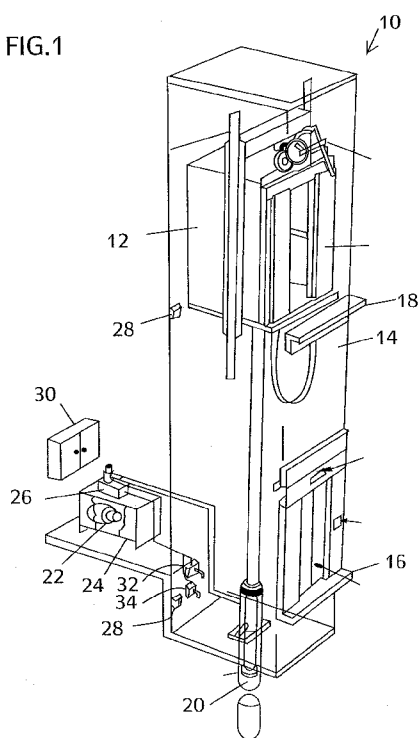


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- (72) Inventors; and
(71) Applicants : YAKUEL, Arik [IL/IL]; 9 Aharon Brand, 93878 Jerusalem (IL). YAKOVSON, Hilel [IL/IL]; 6 Nahal Yaale, 99620 Beit Shemesh (IL).
- (72) Inventor: BRAND, Dvir; 64 Hertzal, 44213 Kfar Saba (IL).
- (74) Agent: DR. MARK FRIEDMAN LTD.; Dr. Mark Friedman, Moshe Aviv Tower, 54th floor, 7 Jabotinsky St., 5252007 Ramat Gan (IL).
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(54) Title: SABBATH ELEVATOR

FIG.1



(57) Abstract: A Sabbath elevator includes an elevator cabin displaceable along an elevator shaft between a plurality of levels, and a drive system for displacing the elevator cabin upwards and downwards along the elevator shaft. A number of electrically operated sensors are deployed to detect correct alignment of the elevator cabin at each of the levels. A controller actuates the drive system to displace the elevator cabin downwards from an upper of the levels towards a lower of the level and, during the descent of the elevator cabin, deactivates the electrically operated sensors while operating a timer. At the end of a predefined time period sufficient to complete the descent, the controller reactivates the electrically operated sensors for use in verifying correct alignment of the elevator cabin with the lower level.



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Sabbath Elevator

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to systems and methods for implementing Sabbath Elevators in accordance with Jewish law and, in particular, addresses problems specific
5 to the descent of such an elevator.

Generally speaking, in a Sabbath Elevator (or “Sabbath Lift”), all commands to raise, lower and stop the lift cabin, and to open and shut the doors, are carried out automatically by the electrical control system at preset times by means of a timer—with no human intervention. On completion of each operation the timer starts the countdown
10 leading to the subsequent operation, which is performed on expiry of the allotted time.

For observant Jews, the use of a Sabbath Lift is problematic, despite all operations being carried out automatically by a timer as described above. The main cause of the problem is a sequence of electrical operations carried out in the course of the lift’s ascent and descent. Even though the lift ascends and descends automatically,
15 stopping at each floor, without the passengers having to press the electrical operating buttons—and even in the case of a non-electrically driven lift, such as a hydraulic lift—many of the control operations, which are in fact electrical functions, are nevertheless activated by the lift cabin. And persons using the lift are considered to have had a share in the electrical operations on account of their body weight.

The reason for this is that, under Jewish religious law, Jews are not permitted to carry out any actions on the Sabbath involving electricity—any act of closing an electrical circuit is forbidden. Some of the Rabbinical authorities have ruled that closure of a non-energised electrical circuit is also forbidden, if it is due to carry a current at a later stage. Additionally, even causing small changes in electric current flowing in an
20 existing circuit is prohibited by some Rabbinical authorities.

This prohibition on closure of an electrical circuit on the Sabbath also applies to passive closure of the circuit by the presence of a person’s body, for example through his body weight—not necessarily by manual closure of the circuit. The prohibition is also in force when the action (circuit closure) is performed simultaneously by more than

a single individual, or when the person is a passive accomplice to other persons or objects in the circuit closure operation. Such would be the case for example with a person occupying a descending lift cabin that operates electrical switches on its way down (these switches serve as monitoring devices and are located at each floor; they provide a clear indication of the exact location of the lift cabin at any given instant, as well as enabling the door to be opened at precisely the right position in line with the lift shaft opening, so that passengers can exit and enter the lift in safety).

This religious law lays down that the presence of a person inside a lift cabin going down and causing the operation of electrical switches turns the person into an “accomplice” in operating the switches, which is a forbidden action, on account of his body weight “aiding” the descent of the lift. If the lift is carrying several passengers, then all of them would be regarded as “accomplices” in closing the circuit, which is an action forbidden on the Sabbath.

Even were the electrical circuit closure operation to be replaced by some other operation, forbidden on the Sabbath by some of the ruling authorities, such as interruption of a light beam to conceal it from a photo-electric cell, or moving a proximity sensor towards a particular point causing a change in electrical current as the lift approaches some predetermined location—in such cases as well would the lift passengers be considered as having performed an act forbidden on the Sabbath.

In addition to the aforementioned problem, there is a further issue: The passengers’ body weight causes the lift cabin to descend slightly faster under the influence of gravity. The lift cabin thus arrives a little sooner at each point where an act forbidden on the Sabbath is committed (such as the operations referred to above: closure of an electrical circuit, interruption of a light beam, activation of a proximity sensor and the like). Hastening the performance of a forbidden act is an infraction in itself, and here also the persons occupying the descending lift cabin become “accomplices” in committing an act prohibited on the Sabbath. Hastening the performance of a forbidden act is an infraction even if this is to a very small degree in terms of time (fractions of a second).

On the other hand, when the lift cabin is ascending, all the operations described (closure of a circuit, interruption of a light beam, presentation of a proximity sensor and the like) may be performed by the lift cabin without the passengers being regarded as accomplices, and without their occupation of the lift cabin causing them to infringe the Sabbath laws. This is because their body weight “opposes” the ascent of the lift cabin, so that the passengers do not take part in the lifting operation (on the contrary, the lift mechanism has to exert itself more on the way up to overcome the occupants’ body weight). Moreover, the presence of persons in the lift cabin causes a slight delay in the arrival time of the lift cabin at the next point where a forbidden act is committed. Such a delay, albeit caused by the weight of the persons occupying the lift, is permitted on the Sabbath.

Thus, in summary, there are a number of issues regarding implementation of a Sabbath Elevator which are specific to the elevator’s operation during descent:

1. On its way down, the lift cabin operates electrical switches that cause it to slow down and stop at predetermined points corresponding to the lift shaft openings, so as to ensure safe opening of the lift cabin doors. Alternatively, other operations may replace switch operation for establishing the lift cabin position, which are also forbidden on the Sabbath.
2. Operations forbidden on the Sabbath performed by the descending lift cabin are considered to have been carried out with the collaboration of the passengers.
3. Hastening the performance of forbidden acts as a result of the additional weight belonging to the lift cabin occupants is also an infraction.

SUMMARY OF THE INVENTION

The present invention provides systems and methods for implementing Sabbath Elevators in accordance with Jewish law and, in particular, addresses problems specific to the descent of such an elevator.

According to the teachings of an embodiment of the present invention there is provided, a Sabbath elevator comprising: (a) an elevator cabin displaceable along an elevator shaft between a plurality of levels; (b) a drive system for displacing the

elevator cabin upwards and downwards along the elevator shaft; (c) a plurality of electrically operated sensors deployed to detect correct alignment of the elevator cabin at each of the levels; and (d) a controller associated with the drive system and the electrically operated sensors, the controller including control circuitry configured to:

5 (i) actuate the drive system to displace the elevator cabin downwards from an upper of the levels towards a lower of the level, (ii) during the descent of the elevator cabin, deactivate the electrically operated sensors and operate a timer, and (iii) at the end of a predefined time period sufficient to complete the descent, reactivate the electrically operated sensors for use in verifying correct alignment of the elevator cabin with the
10 lower level.

According to a further feature of an embodiment of the present invention, the drive system is a hydraulic drive system, and wherein the descent is achieved by opening of a hydraulic valve to allow descent of the elevator cabin under gravity.

15 According to a further feature of an embodiment of the present invention, the descent is stopped hydraulically by closure of at least one valve actuated by motion of the elevator cabin on reaching a predefined stopping location.

According to a further feature of an embodiment of the present invention, the at least one valve is implemented as at least two valves including a first valve deployed for throttling flow of hydraulic fluid prior to the elevator cabin reaching the predefined
20 stopping location and a second valve deployed for stopping flow of the hydraulic fluid when the elevator cabin reaches the predefined stopping location.

According to a further feature of an embodiment of the present invention, the predefined stopping location is below a correct alignment of the elevator cabin with the lower level, and wherein the controller is further configured to activate the drive system
25 after the predefined time period to displace the elevator cabin upwards from the predefined stopping location to the correct alignment of the elevator cabin as detected by a corresponding one of the electronically operated sensors.

According to a further feature of an embodiment of the present invention, the predefined stopping location corresponds to correct alignment of the elevator cabin with
30 the lower level.

According to a further feature of an embodiment of the present invention, the controller is configured to actuate the drive system to stop the descent at a given elapsed time after initiating the descent, the given elapsed time being sufficient to allow the elevator cabin to reach a location below a correct alignment of the elevator cabin with the lower level, and wherein the controller is further configured to activate the drive system after the predefined time period to displace the elevator cabin upwards from the predefined stopping location to the correct alignment of the elevator cabin as detected by a corresponding one of the electronically operated sensors.

There is also provided according to the teachings of an embodiment of the present invention, a Sabbath elevator comprising: (a) an elevator cabin displaceable along an elevator shaft between a plurality of levels; (b) a drive system for displacing the elevator cabin upwards and downwards along the elevator shaft; (c) a non-electric weighing mechanism deployed to support at least a part of the elevator cabin so as to receive the weight of occupants of the elevator cabin; and (d) a braking subsystem associated with the elevator cabin, the braking subsystem being linked to the weighing mechanism so as to be actuated by a weight of occupants of the elevator cabin to selectively brake a speed of descent of the elevator cabin sufficiently to prevent an increase in the speed of descent due to the weight of the occupants.

According to a further feature of an embodiment of the present invention, the braking system includes: (a) a hydraulic pump mounted on the elevator cabin having a gear engaged with a timing chain or toothed rack extending along the elevator shaft; and (b) a flow limiting valve deployed in a fluid flow circuit with the hydraulic pump and arranged such that the weight of the occupants of the elevator cabin acts on the flow-limiting valve, thereby actuating the flow-limiting valve to limit fluid flow through the hydraulic pump.

According to a further feature of an embodiment of the present invention, the braking system is configured to provide a continuously variable braking effect varying as a continuous function of the weight of occupants of the elevator cabin.

According to a further feature of an embodiment of the present invention, the braking system is configured to switch between a minimum-braking state and a maximum-braking state in response to a weight of occupants above a given value.

5 According to a further feature of an embodiment of the present invention, the braking subsystem is configured to selectively brake a speed of descent of the elevator cabin sufficiently to decrease the speed of descent as a function of increasing weight of the occupants.

10 According to a further feature of an embodiment of the present invention, the at least a part of the elevator cabin supported by the weighing mechanism comprises a suspended floor of the elevator cabin deployed for receiving the weight of occupants of the elevator cabin.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

15 FIG. 1 is a schematic isometric illustration of a Shabbat elevator, constructed and operative according to an embodiment of a first aspect of the present invention;

FIG. 2 is a schematic isometric cut-away view of an elevator cabin according to an embodiment of a further aspect of the present invention;

20 FIG. 3 is a schematic isometric view of a hydraulic pump for use in a braking system of the second aspect of the present invention;

FIG. 4 is a schematic isometric view of an elevator cabin according to a variant embodiment of the present invention;

FIG. 5 is an enlarged view of the region of FIG. 4 designated "V"; and

FIG. 6 is an additional partial isometric view of the elevator cabin of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides systems and methods for implementing Sabbath Elevators in accordance with Jewish law and, in particular, addresses problems specific to the descent of such an elevator.

5 The principles and operation of systems and methods according to the present invention may be better understood with reference to the drawings and the accompanying description.

10 Referring now to the drawings, Figure 1 shows schematically a Sabbath elevator, generally designated **10**, constructed and operative according to a certain embodiment of a first aspect of the present invention.

15 In general terms, Sabbath elevator **10** includes an elevator cabin **12** displaceable along an elevator shaft **14** between a plurality of levels, here shown as a lower level **16** and an upper level **18**. A drive system is provided for displacing elevator cabin **12** upwards and downwards along elevator shaft **14**. In the non-limiting example illustrated here, the drive system includes a hydraulic cylinder **20** driven via fluid pressure from a pump **22** which directs fluid from a reservoir **24** via an arrangement of valves or “valve block” **26**. As will be discussed below, various aspects of the invention apply equally to a range of other hydraulic and non-hydraulic elevator designs. Sabbath elevator **10** further includes a plurality of electrically operated sensors **28** deployed to detect correct alignment of elevator cabin **12** at each of levels **16** and **18**.

20 A controller **30**, associated with the drive system and with electrically operated sensors **28**, includes control circuitry (either dedicated logic circuitry or a general purpose processing system with one or more processors executing suitable software) configured to:

- 25 • actuate the drive system to displace elevator cabin **12** downwards from upper level **18** towards lower level **16**;
- during the descent of the elevator cabin, deactivate electrically operated sensors **28** and operate a timer function of the controller; and

- at the end of a predefined time period sufficient to complete the descent, reactivate electrically operated sensors **28** for use in verifying correct alignment of the elevator cabin with the lower level.

“Deactivation” of electrically operated sensors **28** is typically achieved by interrupting a supply of electrical power to those sensors, although it could equally be achieved by any other electrical or mechanical intervention that disables their sensing operation.

According to a first particularly preferred subset of implementations, the drive system is a hydraulic drive system, which may employ a hydraulic cylinder located under the cabin as shown, a side-mounted hydraulic cylinder with a pulley and cable mechanism for an increased cabin motion for a given cylinder length, or a hydraulic motor-driven pulley system. In all of these cases, descent of the cabin is preferably achieved by opening of a hydraulic valve to allow descent of the elevator cabin under gravity.

In the case of a hydraulic implementation of any of these types, stopping of the descent is preferably achieved hydraulically by closure of at least one, and preferably two, valves actuated by mechanical interaction with motion of elevator cabin **12** on reaching a predefined stopping location, without electrical sensing. Most preferably, a first valve is deployed for throttling the flow of hydraulic fluid prior to elevator cabin **12** reaching the predefined stopping location, thereby slowing the cabin, and a second valve is deployed for stopping flow of the hydraulic fluid when the elevator cabin reaches the predefined stopping location. These valves may be the valves within valve block **26** which are normally employed for controlling the downward motion of the elevator, or they may be additional dedicated control valves added to the valve block or located elsewhere on a bypass flow line, which allow controlled drainage of hydraulic fluid from cylinder **20** to reservoir **24** while the valve block valves are all closed.

Mechanically initiated actuation of the descent-controlling valves is preferably achieved using corresponding mechanical sensors **32** and **34** deployed to be actuated by mechanical interaction with the elevator cabin, or some other mechanically associated component that moves in unison with the elevator cabin. Mechanical sensors **32** and **34**

are linked by a non-electric linkage, for example, a mechanical linkage or cable, a hydraulic or pneumatic connection or the like, to the corresponding valves in valve block 26. In the case of a separate bypass flow path from cylinder 20 to reservoir 24 (not shown), the hydraulic valves may be integrated with the corresponding sensors 32 and 34 located directly on the bypass flow path.

According to a subset of implementations of the present invention, corresponding to Solution 1 below, the predefined stopping location is chosen to be below a correct alignment of the elevator cabin with the lower level. In this case, controller 30 then activates the drive system after the predefined time period to displace elevator cabin 12 upwards from the predefined stopping location to the correct alignment of the elevator cabin as detected by the corresponding electronically operated sensor 28.

In an alternative subset of implementations corresponding to Solution 2 below, the predefined stopping location corresponds to correct alignment of elevator cabin 12 with the lower level.

According to a further subset of implementations, corresponding to Solution 3 below, instead of employing hydraulic valve actuators 32 and 34, controller relies on timing of the descent, actuating the drive system to stop the descent at a given elapsed time after initiating the descent. The given elapsed time is chosen empirically for the given installation to be sufficient to allow elevator cabin 12 to reach a location below a correct alignment of the elevator cabin with the lower level under the full range of normal operating conditions and loads. Controller 30 then activates the drive system after the predefined time period to displace elevator cabin 12 upwards from the stopping location to the correct alignment of elevator cabin 12 as detected by a corresponding one of the electronically operated sensors 28.

In all of the above cases, the electronically operated sensors 28 can be any suitable sensors including but not limited to mechanical switches, optical sensors and proximity sensors (for example, inductive). In order to avoid concerns that may be raised by closing of an electric circuit even when disabled, there is a preference for non-contact sensors such as optical sensors and proximity sensors. Suitable sensors of all of

the above types are widely commercially available, and their manner of deployment is well known in the art.

The aforementioned solutions will now be described in more detail.

Solution No. 1

5 The problems described above may be resolved as follows:

 Shortly before transmission of the “Descend” command to the lift cabin, the control system performs two operations:

— Start of timer countdown;

— Disconnection of the electrical control switches located at each floor from the
10 electrical system.

 Under this arrangement, closure or opening of the electrical switches in the lift shaft by the lift cabin on its way down is of no significance on the Sabbath, since no current is due to flow through them following their closure by the lift cabin as it passes in their vicinity. The lift cabin, having received a “Descend” command, goes down,
15 encounters the switch on its way and closes the circuit; however it does not stop, as the switch has been disconnected from the system, but continues on its way. When the lift cabin has passed the switch location, the switch is reopened.

 Following this, the cabin stops at a point located below (typically by a few centimetres) the point at which the switch would have stopped it to enable the door to
20 be opened.

 How is stopping in a manner permissible on the Sabbath accomplished? The lift is slowed down prior to stopping and immediately afterwards brought to a complete halt by means of a pair of hydraulic valves. These hydraulic valves are installed in the lift shaft at predetermined positions, as stated, below the stopping point required for
25 opening the door. When the lift cabin reaches the first valve and presses it via a mechanical transmission mechanism, the valve reduces oil circulation in the system and the lift slows down; a short time later, when the lift cabin reaches the second valve and presses it as well, this valve completely stops oil circulation in the hydraulic system and the lift cabin comes to rest. The lift stops at a point below the opening, so that the door
30 cannot be safely opened at this juncture; and furthermore, the control system has not yet

received an electrical signal indicating the location of the lift cabin in line with the door, therefore it will not allow the door to be opened at this stage.

The next stage is to enable the lift cabin to reach the shaft opening and the door to be opened:

5 When the lift is stationary at the lower position, and at the conclusion of the interval preset on the timer, the timer reconnects the electrical switches to the control system, and shortly after that sends an “Ascend” command to the lift cabin. The cabin goes up, encounters the electrical switch on the way up, closes it, and is brought to a halt electrically by the control system exactly opposite the opening. At this point the
10 electrical control system issues an “Open door” command, following which the countdown starts leading to automatic initiation of the next operation—descent or ascent.

As stated, the slowing down and stopping operations of the lift cabin when descending are carried out purely hydraulically. Closing the hydraulic valves affecting
15 the deceleration and stopping of the lift does not entail closure of electrical circuits, and no desecration of the Sabbath is involved. On the other hand, closure of the electrical switch is effected when the lift is on the way up, which, as explained above, is permissible.

The lift cabin thus stops at the end of the movement at the preset position in line
20 with the opening, without the occupants being involved in actions forbidden on the Sabbath, as set out above.

Solution No. 2

Facing the opening on each floor, a proximity switch is installed instead of the electrical switch closing the electrical circuit mechanically. A proximity switch closes
25 an electrical circuit electronically owing to inductive changes/modification of a magnetic field and the like, operating by means of a pair of components being brought close to each other. One of these components is permanently mounted adjacent to the opening on each floor where the lift calls, and the other is attached to the lift cabin; when the latter is brought near to the permanent component, an
30 electromagnetic/inductive change occurs in the permanent component notifying the

control system that the lift cabin has reached the exact position required, and door opening is enabled. The proximity switch has no Halachic significance when isolated from the electrical system, and bringing the components close to each other is not forbidden on the Sabbath.

5 Mode of Operation

Shortly before the “Descend” command is transmitted to the lift cabin, the control system starts a countdown on the timer and disconnects the electrical switches (proximity switches) installed on each floor from the electrical system. In this situation, as stated, bringing the two parts of the switch close to each other by the lift cabin on the Sabbath is inconsequential, as they are isolated from the electrical system.

At a desired distance (for example, a few centimetres) before it reaches the stopping point on the floor in question, the lift cabin encounters the first hydraulic valve, which slows it down purely hydraulically, and at the precise position in line with the shaft opening it closes the second hydraulic valve, which stops it at the opening.

Following a predetermined interval of time (counted from the instant the “Descend” command is issued) the timer reconnects the electrical control system to the switch. Since both parts of the switch are adjacent to each other, notification is sent to the control system that the proximity switch is “closed”.

The system thus verifies that the lift cabin is located where the door may be opened, upon which a door opening command is transmitted.

As far as the Halacha is concerned, renewal of the current in the electrical proximity switch by the timer following a preset time breaks the causal connection between the weight of the passenger that had a share in lowering the lift cabin, and hastening the flow of electrical current in the circuit.

25 Solution No. 3

Shortly before transmission of the “Descend” command to the lift cabin, the control system performs two operations:

— Start of timer countdown;

— Disconnection of the electrical control switches located at each floor from the electrical system.

The lift cabin receives a “Descend” command and descends for a period preset by the timer. At the end of the preset time the lift cabin receives a “Halt” command
5 from the operating system and stops. The time is calculated such that the lift cabin stops below the lift shaft opening.

Immediately after issue of the “Halt” command the control system carries out two operations:

- Reconnection of the electrical control switches located at each floor;
- 10 — “Ascend” command issued to the lift cabin.

The cabin goes up, encounters the electrical switch on the way up, closes it, and is brought to a halt electrically by the control system exactly opposite the opening. At this point the electrical control system issues an “Open door” command, following which the countdown starts, leading to automatic initiation of the next operation.

- 15 In this case the lift cabin will not be stopped at a precise location as in the previous solutions, on account of variations in the cabin weight due to the passengers’ presence as well as other factors such as the hydraulic fluid temperature. This however does not constitute a problem, as the cabin will be raised until it reaches the required position and will be stopped by the electrical switch mounted precisely at the opening.
- 20 This option is suitable for implementation in a wide range of types of elevator system, including fully electric (non-hydraulic) systems.

Option for Multiple Stops Using a Single Pair of Hydraulic Valves

- The various solutions described thus far may be adopted directly for use in a scenario where a multi-floor elevator stops at each required level while ascending and
25 then descends in a single motion to the lowest (or just below the lowest) level.

Where it is desired to stop at multiple levels also during the descent, to obviate the need to install hydraulic valves on each floor at which the lift is to call, a single pair of hydraulic valves may be installed, to be operated by cams mounted on a continuous chain. The chain will be attached to the lift cabin, so that the chain and cams move in

unison with the cabin, opening and closing the valves when the elevator cabin is located precisely at the required position.

Weight-Compensated Descent

As an alternative approach to preventing earlier actuation of any sensors due to the weight of occupants within the elevator cabin, a further aspect of the present invention provides a non-electrical weight-compensated braking system which prevents any increase in the speed of descent due to the weight of the cabin occupants. An exemplary implementation of this aspect of the invention is illustrated herein with reference to FIGS. 2-6.

This aspect of the present invention is applicable to an elevator cabin 12 displaceable along an elevator shaft with any type of drive system for displacing the elevator cabin upwards and downwards along the elevator shaft, such as, for example, the overall system illustrated in FIG. 1. In this case, there is also provided a non-electric weighing mechanism deployed to support at least a part of the elevator cabin so as to receive the weight of occupants of the elevator cabin, and a braking subsystem associated with the elevator cabin. The braking subsystem is linked to the weighing mechanism so as to be actuated by a weight of occupants of the elevator cabin to selectively brake a speed of descent of the elevator cabin sufficiently to prevent an increase in the speed of descent due to the weight of the occupants.

In the preferred example illustrated here, the weighing mechanism supports a suspended floor 50 of the elevator cabin on which occupants of the elevator cabin stand. Suspended floor 50 hangs from an upper frame 52 which can move vertically relative to the remainder of cabin 12. A spring 54 or the like biases upper frame 52 towards a slightly raised position and provides a load-responsive displacement, thereby serving as the weighing mechanism. A non-electrical linkage uses this displacement to actuate the braking mechanism.

The braking mechanism may be any suitable type of braking mechanism, including but not limited to: hydraulic braking mechanism, friction-based braking mechanisms (such as a friction-locking device acting on an elongated cable, as is well known in the field of emergency evacuation descent devices), and simple mechanical

friction braking of various guide-wheels or the like engaging surfaces of the elevator shaft. By way of one non-limiting particularly preferred example, this aspect of the invention is illustrated herein employing a hydraulic braking arrangement.

Specifically, as best seen in FIGS. 3 and 5, the braking system is here
5 implemented using a hydraulic pump 56, mounted on elevator cabin 12, having a gear 58 engaged with a timing chain 60 or toothed rack (not shown) extending along the elevator shaft. It should be noted that the phrase “hydraulic pump” is here used synonymously with “hydraulic motor” to refer to a device in which mechanical rotation is interconverted with hydraulic fluid flow. Flow of hydraulic fluid through motor 56 is
10 limited by a flow limiting valve 62 deployed in a fluid flow circuit with the hydraulic pump. Valve 62 is deployed so as to be actuated by displacement of upper frame 52 so that the weight of the occupants of the elevator cabin acts on the flow-limiting valve, thereby actuating the flow-limiting valve to limit fluid flow through the hydraulic pump. In the schematic implementation of FIG. 2, a control lever 64 provides the
15 linkage between upper frame 52 and valve 62. In an alternative implementation illustrated in FIG. 6, a linear bearing and actuator rod 66 pulls downward on an actuator surface of valve 62.

The flow-limiting characteristics of valve 62, and the corresponding braking effect of the device, can be selected according to the desired functionality. According to
20 a first option, the braking system is configured to provide a continuously variable braking effect varying as a continuous function of the weight of occupants of the elevator cabin. This is achieved in the exemplary embodiment illustrated here by use of a continuously variable throttling valve.

In this case, it will be appreciated that the weighing mechanism, the flow-
25 restricting valve and the linkage between them can be designed to achieve a desired degree of braking as a function of increased weight. Specifically, in certain cases, the braking subsystem is configured to selectively brake a speed of descent of the elevator cabin sufficiently to actually decrease the speed of descent as a function of increasing load from the weight of the occupants.

In an alternative implementation, the braking system is configured to switch between a minimum-braking state (most preferably approaching zero braking) and a maximum-braking state in response to a weight of occupants above a given value. This may be achieved in the illustrated embodiment by using a valve which switches
5 between two well-defined states of minimally-restricted flow and a flow-restricting state.

Structurally, it will be clear that each of the above described options may be implemented using standard control hardware, typically including an electronic controller including at least one processor, timing circuitry, a switching unit, and
10 various other standard hardware components as are known in the field of elevator control systems. The controller is configured, by hardware and/or software stored in a non-transient data storage medium, to perform the various sequences of operations described above, which themselves also constitute steps of various methods according to the teachings of the present invention.

15 It will be appreciated that the above descriptions are intended only to serve as examples, and that many other embodiments are possible within the scope of the present invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A Sabbath elevator comprising:
 - (a) an elevator cabin displaceable along an elevator shaft between a plurality of levels;
 - (b) a drive system for displacing said elevator cabin upwards and downwards along said elevator shaft;
 - (c) a plurality of electrically operated sensors deployed to detect correct alignment of said elevator cabin at each of said levels; and
 - (d) a controller associated with said drive system and said electrically operated sensors, said controller including control circuitry configured to:
 - (i) actuate said drive system to displace said elevator cabin downwards from an upper of said levels towards a lower of said level,
 - (ii) during the descent of the elevator cabin, deactivate said electrically operated sensors and operate a timer, and
 - (iii) at the end of a predefined time period sufficient to complete the descent, reactivate said electrically operated sensors for use in verifying correct alignment of said elevator cabin with said lower level.
2. The Sabbath elevator of claim 1, wherein said drive system is a hydraulic drive system, and wherein said descent is achieved by opening of a hydraulic valve to allow descent of said elevator cabin under gravity.
3. The Sabbath elevator of claim 2, wherein the descent is stopped hydraulically by closure of at least one valve actuated by motion of said elevator cabin on reaching a predefined stopping location.
4. The Sabbath elevator of claim 3, wherein said at least one valve is implemented as at least two valves including a first valve deployed for throttling flow

of hydraulic fluid prior to said elevator cabin reaching said predefined stopping location and a second valve deployed for stopping flow of the hydraulic fluid when said elevator cabin reaches said predefined stopping location.

5. The Sabbath elevator of claim 3, wherein said predefined stopping location is below a correct alignment of said elevator cabin with said lower level, and wherein said controller is further configured to activate said drive system after said predefined time period to displace said elevator cabin upwards from said predefined stopping location to said correct alignment of said elevator cabin as detected by a corresponding one of said electronically operated sensors.

6. The Sabbath elevator of claim 3, wherein said predefined stopping location corresponds to correct alignment of said elevator cabin with said lower level.

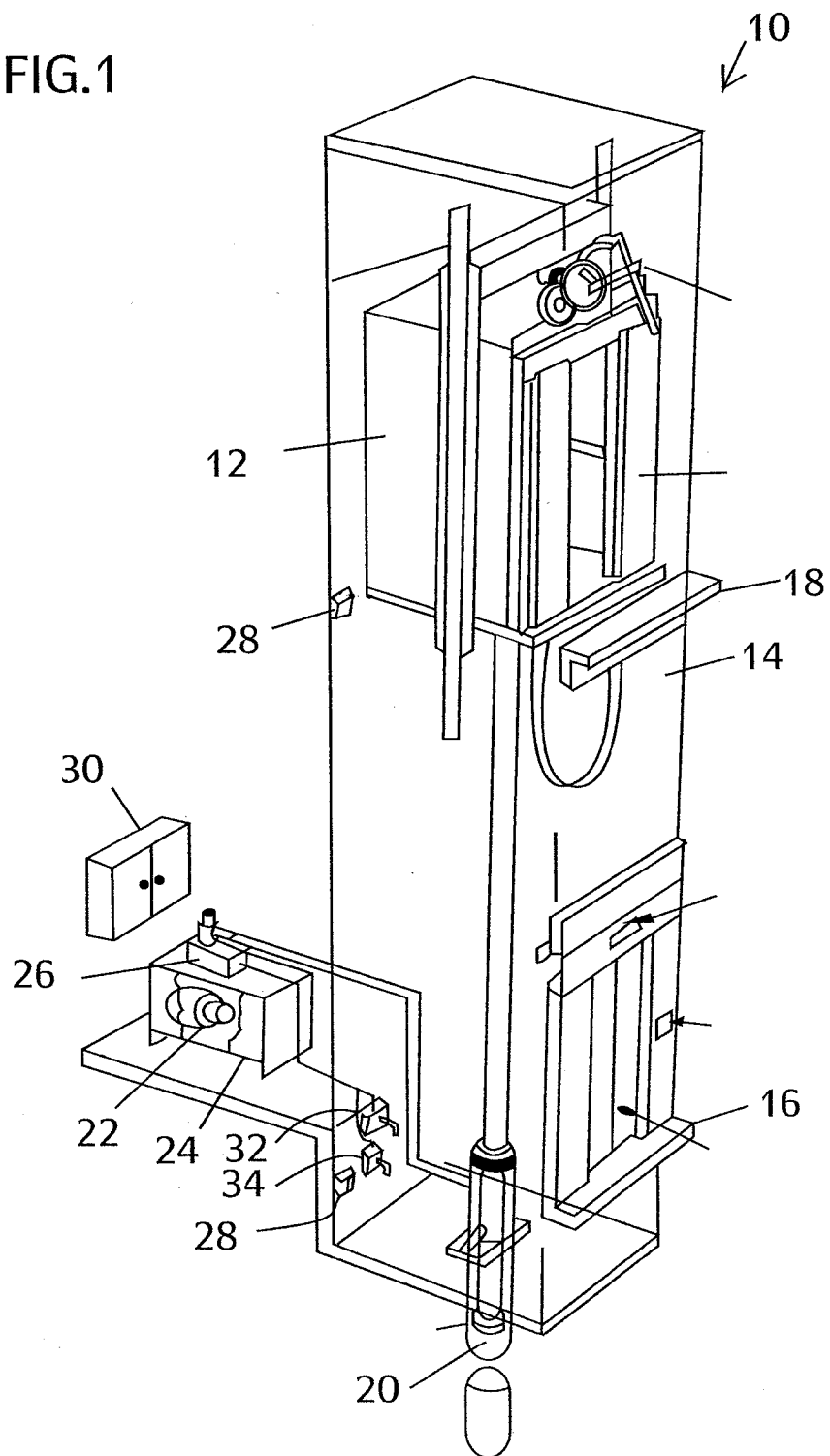
7. The Sabbath elevator of claim 1, wherein said controller is configured to actuate said drive system to stop the descent at a given elapsed time after initiating the descent, said given elapsed time being sufficient to allow said elevator cabin to reach a location below a correct alignment of said elevator cabin with said lower level, and wherein said controller is further configured to activate said drive system after said predefined time period to displace said elevator cabin upwards from said predefined stopping location to said correct alignment of said elevator cabin as detected by a corresponding one of said electronically operated sensors.

8. A Sabbath elevator comprising:

- (a) an elevator cabin displaceable along an elevator shaft between a plurality of levels;
- (b) a drive system for displacing said elevator cabin upwards and downwards along said elevator shaft;
- (c) a non-electric weighing mechanism deployed to support at least a part of said elevator cabin so as to receive the weight of occupants of said elevator cabin; and

- (d) a braking subsystem associated with said elevator cabin, said braking subsystem being linked to said weighing mechanism so as to be actuated by a weight of occupants of said elevator cabin to selectively brake a speed of descent of said elevator cabin sufficiently to prevent an increase in said speed of descent due to the weight of the occupants.
9. The Sabbath elevator of claim 8, wherein said braking system includes:
- (a) a hydraulic pump mounted on said elevator cabin having a gear engaged with a timing chain or toothed rack extending along said elevator shaft; and
 - (b) a flow limiting valve deployed in a fluid flow circuit with said hydraulic pump and arranged such that the weight of the occupants of the elevator cabin acts on said flow-limiting valve, thereby actuating said flow-limiting valve to limit fluid flow through said hydraulic pump.
10. The Sabbath elevator of claim 8, wherein said braking system is configured to provide a continuously variable braking effect varying as a continuous function of the weight of occupants of the elevator cabin.
11. The Sabbath elevator of claim 8, wherein said braking system is configured to switch between a minimum-braking state and a maximum-braking state in response to a weight of occupants above a given value.
12. The Sabbath elevator of claim 8, wherein said braking subsystem is configured to selectively brake a speed of descent of said elevator cabin sufficiently to decrease said speed of descent as a function of increasing weight of the occupants.
13. The Sabbath elevator of claim 8, wherein said at least a part of said elevator cabin supported by said weighing mechanism comprises a suspended floor of said elevator cabin deployed for receiving the weight of occupants of said elevator cabin.

FIG.1



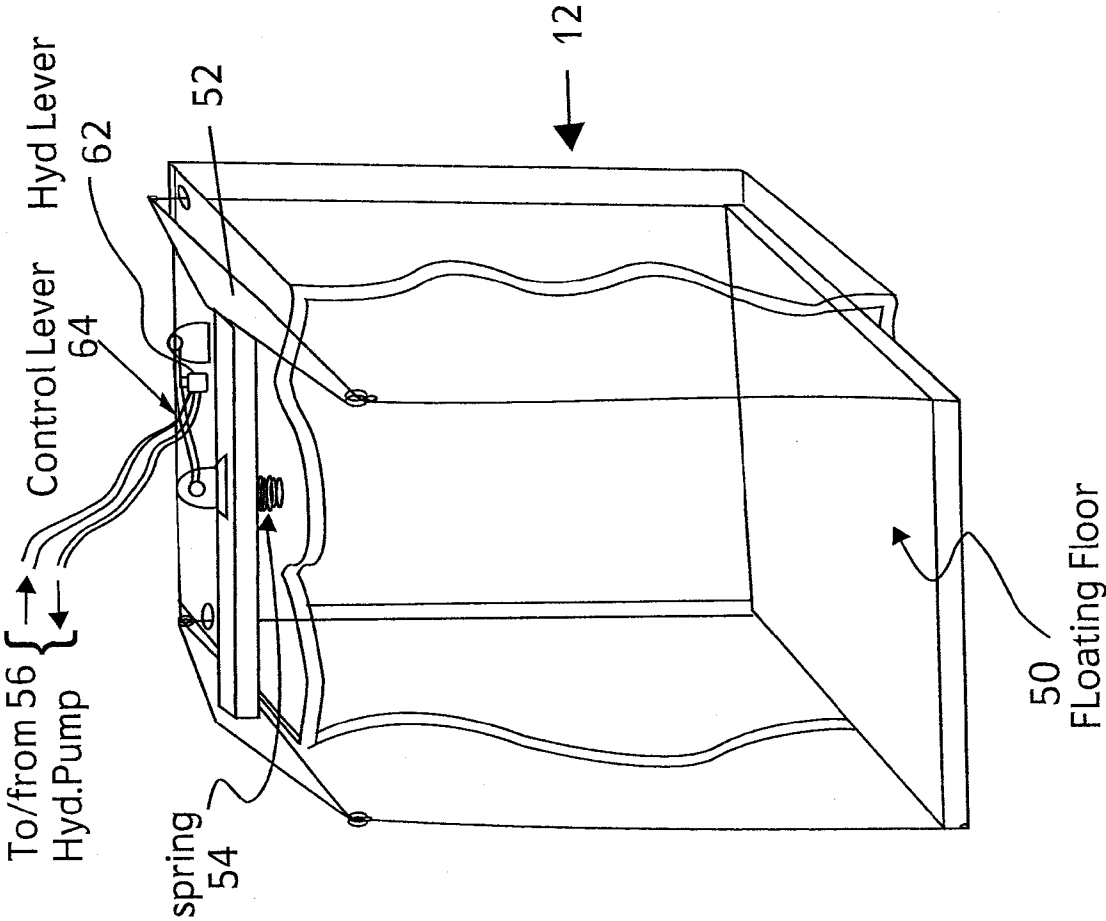
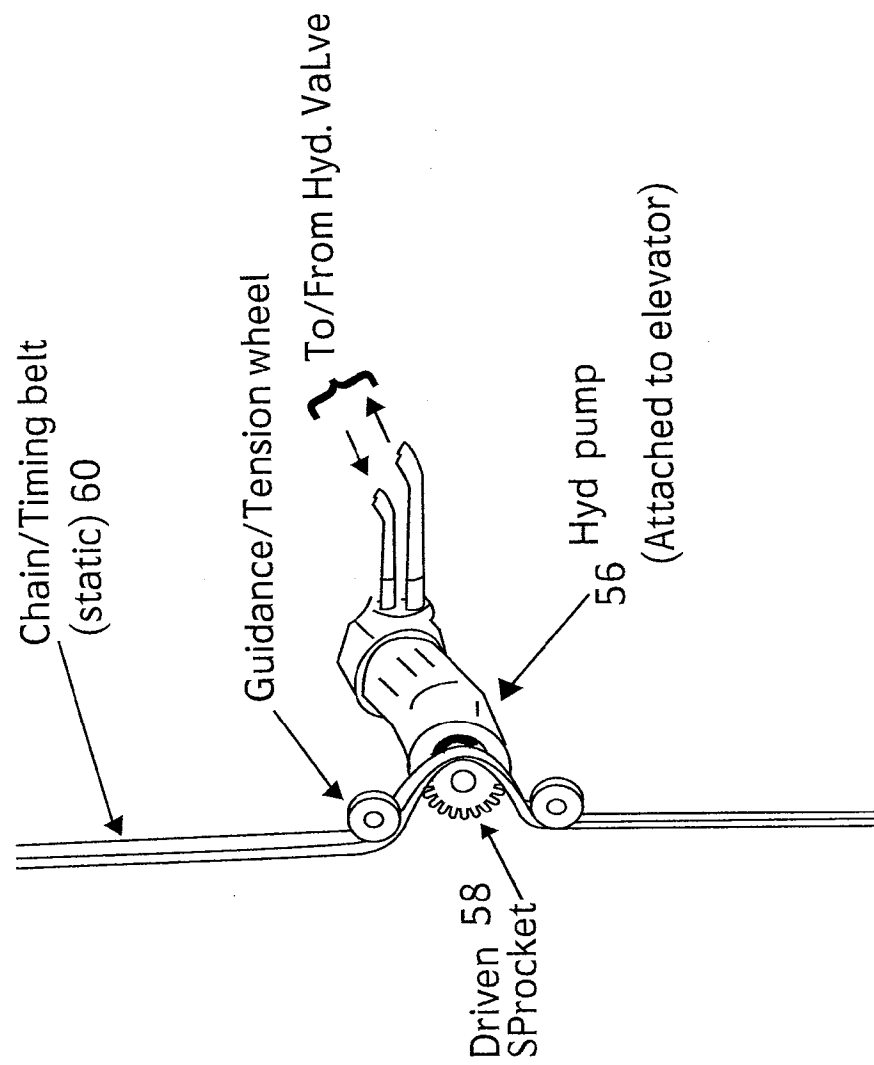


FIG. 2

FIG.3



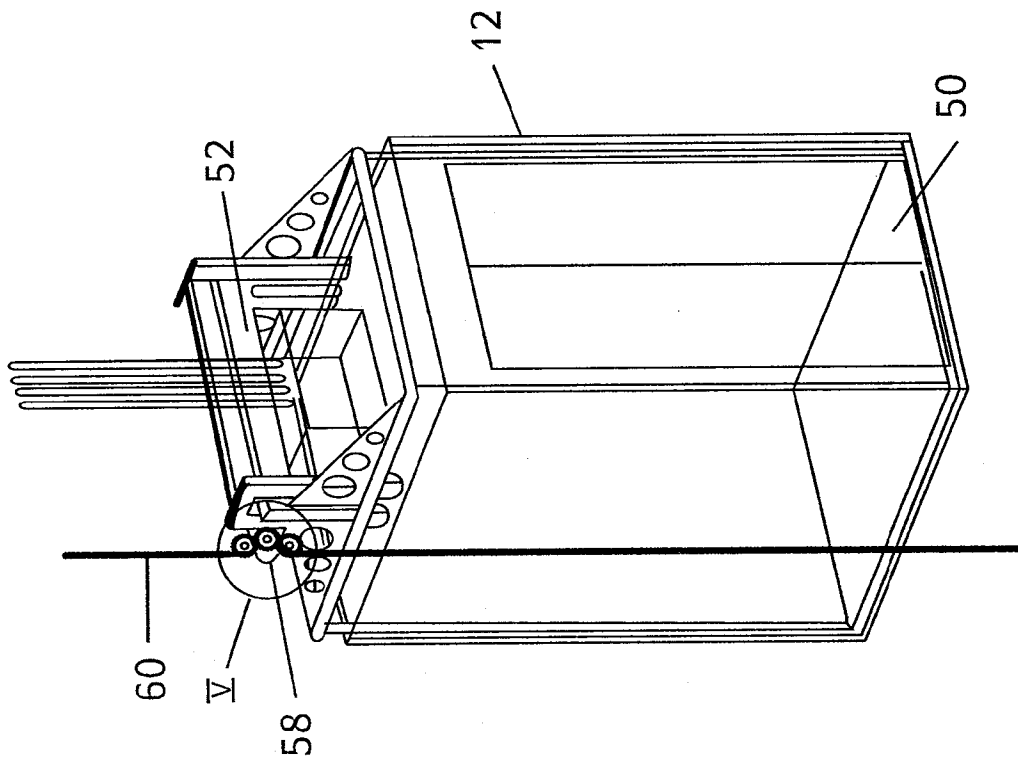


FIG. 4

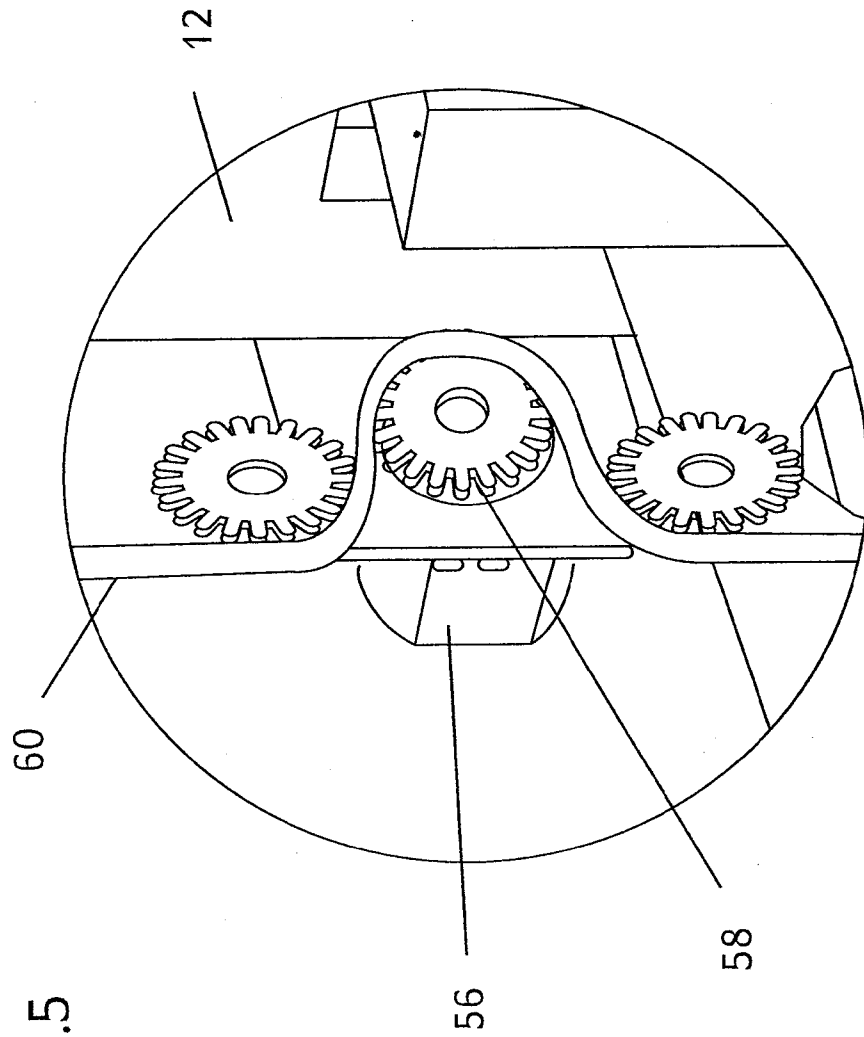
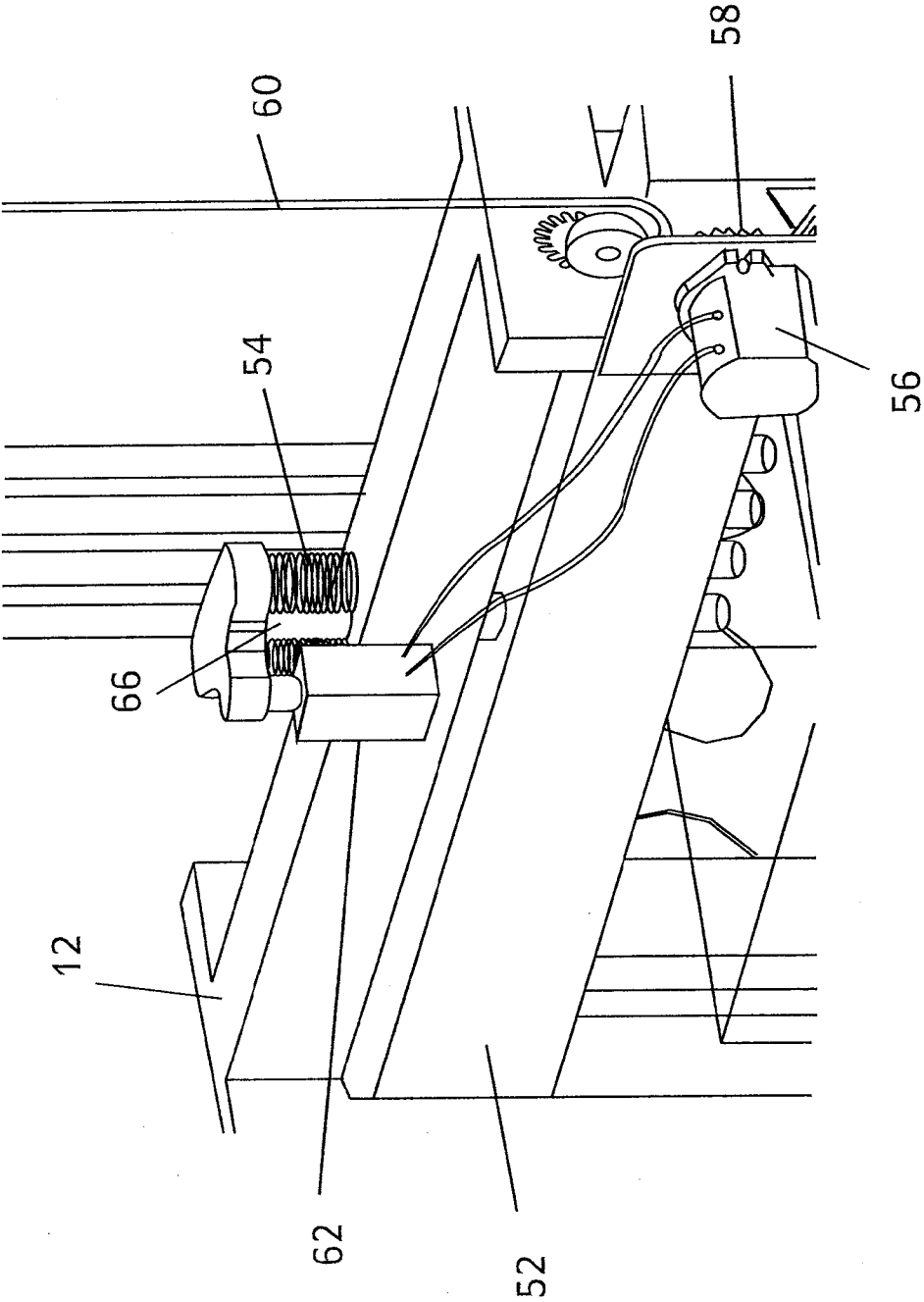


FIG. 5

FIG.6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2014/050716

A. CLASSIFICATION OF SUBJECT MATTER

IPC (2014.01) B66B 1/24, B66B 1/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC (2014.01) B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Databases consulted: Google Patents, FamPat database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IL 122745 A Schnaidman [IL] 30 Oct 1998 (1998/10/30) Entire document	8,10,12,13
A	Entire document	1-7
X	US 4071116 A SHAAREI ZEDEK HOSPITAL [IL] 31 Jan 1978 (1978/01/31) Entire document	8,11
A	Entire document	1-7
Y	US 7311179 B1 Franklin [US] 25 Dec 2007 (2007/12/25) Entire document	9
A	WO 2013035060 A1 G L GLAT LIFT LTD [IL] 14 Mar 2013 (2013/03/14) Entire document	1-13

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

28 Oct 2014

Date of mailing of the international search report

28 Oct 2014

Name and mailing address of the ISA:

Israel Patent Office

Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel

Facsimile No. 972-2-5651616

Authorized officer

ORGAD Yaniv

Telephone No. 972-2-5651787

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2014/050716

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet):

* This International Searching Authority found multiple inventions in this international application, as follows:

Invention/s 1 This invention relates to "Shabbat" elevator with a Claim/s 1-7
control circuit that deactivates the elevator cart
alignment sensor for a pre-determined time prior to
the cart descent.

Invention/s 2 This invention relates to a "Shabbat" elevator Claim/s 8-13
having a mechanical weighing system linked to a
mechanical braking system for the purpose of
compensating for the force applied by the elevator's
occupants during the cart descent.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/IL2014/050716

Patent document cited search report	Publication date	Patent family member(s)	Publication Date
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		IL 122745 A	30 Oct 1998
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		US 2014174860 A1	26 Jun 2014
US 7311179 B1	25 Dec 2007	US 7311179 B1	25 Dec 2007
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		US 7975807 B2	12 Jul 2011
		WO 2009082412 A1	02 Jul 2009