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(54) Screw-nut elevator

(57) An elevator (1) having a frame (2), a fixed straight guide (9) fitted to the frame (2), a platform (12) movable along the guide (9), and an actuating device (13) for moving the platform (12); the actuating device (13) having an electric motor (22) and a cable transmission (14), the cables (15) of which have respective end portions connected integrally to the platform (12) and to the frame (2), and extend about transmission pulleys (17) carried by a counterweight (18) movable parallel to the guide (9) by a screw-nut screw assembly (19) activated by the electric motor (22).

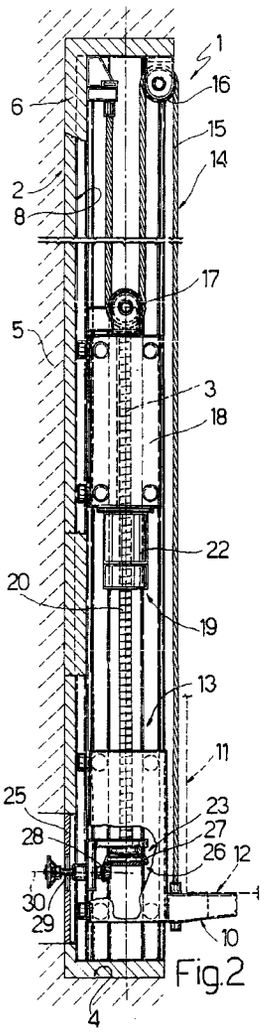

Fig.2

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Description

[0001] The present invention relates to an elevator, particularly for transporting people, comprising a guide; a horizontal platform connected in axially sliding manner to the guide; and an actuating device for moving the platform along the guide.

[0002] Known actuating devices normally comprise an electric drive motor; a reducer connected to the electric motor; a cable transmission interposed between the reducer and the platform; a counterweight movable parallel to the guide; and an emergency operating unit for manually operating the platform.

[0003] The motor, reducer and emergency operating unit are normally housed inside a so-called "drive compartment" formed at one axial end of the guide.

[0004] Though widely used, known elevators of the above type have several drawbacks, on account of the need for, the size, and hence the space occupied by the "drive compartment", which, being required by safety regulations to provide for troublefree access to the actuating devices and to ensure the safety of both qualified maintenance and repair workers as well as unqualified operators for manually operating the elevator in the event of a breakdown with people on board, is both expensive and time-consuming to produce.

[0005] It is an object of the present invention to provide an elevator designed to eliminate the aforementioned drawbacks in a straightforward, low-cost manner.

[0006] According to the present invention, there is provided an elevator, particularly for transporting people, comprising a frame, a fixed straight guide fitted to the frame, a platform connected in axially sliding manner to the guide, and actuating means for moving the platform along the guide; the actuating means comprising an electric drive motor; a cable transmission comprising at least a pair of cables, each having a respective first end portion connected integrally to said platform; and a movable element movable parallel to the guide; characterized in that each said cable comprises a respective second end portion connected integrally to said frame, and said movable element carries at least one transmission pulley of said cable; said actuating means also comprising transmission means interposed between said motor and said movable element and cooperating with said motor to move said movable element parallel to said guide.

[0007] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a side view, with parts removed for clarity, of a preferred embodiment of the elevator according to the present invention;

Figure 2 shows a section along line II-II in Figure 1;

Figure 3 shows a section along line III-III in Figure 1;

Figure 4 shows a larger-scale section of a detail in Figures 1 and 2.

[0008] Number 1 in Figures 1 and 2 indicates as a whole an elevator, preferably, though not exclusively, for transporting people.

[0009] Elevator 1 comprises a fixed supporting frame 2, which has a respective vertical axis 3, extends upwards from a supporting surface 4, and is connected integrally in known manner to a fixed, normally concrete, support 5. In the example shown, frame 2 has a substantially U-shaped cross section, and comprises an end wall 6 contacting fixed support 5, and two lateral walls 7. Lateral walls 7 extend perpendicularly to wall 6, are parallel to each other and spaced transversely, and define, together with a central portion of wall 6, a vertically elongated cavity 8.

[0010] A straight guide 9 is formed in known manner on frame 2, extends parallel to axis 3, and is fitted, in known manner not described in detail, with a movable frame 10. Frame 10 supports a car 11 (shown schematically), the floor 12 of which extends on the opposite side of lateral walls 7 to end wall 6 (Figure 3), and is moved in opposite directions along axis 3 by an actuating device 13.

[0011] Device 13 comprises a known cable transmission 14, 'in turn comprising a number of cables 15, each of which has opposite end portions connected to frame 2 and frame 10 respectively.

[0012] In the example shown, each cable 15 extends about a respective first pulley 16 carried by frame 2, and about a second transmission pulley 17 carried by a known counterweight 18. Counterweight 18 is housed in axially sliding manner inside cavity 8, and is moved in opposite directions along axis 3 by a powered screw-nut screw assembly 19 forming part of device 13.

[0013] More specifically, and as shown in Figures 1 and 2, assembly 19 comprises a screw 20 coaxial with axis 3; and a nut screw 21 connected to screw 20 and forming part of the rotor of a known hollow-shafted electric motor 22, the outer casing of which is connected integrally in known manner to, and moves together with, counterweight 18. A known braking device (not shown) is interposed between the outer casing and the rotor of motor 22.

[0014] In the example shown in Figures 1 and 2, screw 20 extends from supporting surface 4, has opposite end portions connected in rotary manner to and in axially fixed positions with respect to frame 2, and is of a length less than, and preferably equal to half or a third of, the maximum travel effected, in use, by movable frame 10 or by car 11. The length of cables 15 is determined in known manner according to the length of screw 20 and the maximum travel of car 11.

[0015] As shown in Figures 1 and 2, an actuating assembly 23 is interposed between screw 20 and frame 2, and provides for angularly and releasably locking screw 20 with respect to frame 2, and for permitting manual rotation of screw 20 to move frame 10, and hence car 11, in the event of a breakdown of motor 22 or when servicing elevator 1.

[0016] In the example shown, actuating assembly 23 is located adjacent to supporting surface 4, is accessible from the outside through a passage formed through frame 2 and support 5 and closed by a panel 25 fitted on the inside with an operating panel (not shown) , and comprises a perpendicular-axis bevel gear transmission 26. Transmission 26 comprises a first gear 27 fitted to an end portion of screw 20; and a second gear 28 fitted to a shaft 29, which has a respective axis 30 perpendicular to axis 3, and is connected to frame 2 to rotate in axially fixed manner about axis 30. Shaft 29 comprises a portion 31, which projects outwards of panel 25 and is fitted with a handwheel 32, a hub 33 of which is forced against an axial shoulder 34 of portion 31 by a threaded knob 35 screwed to a threaded end portion 36 of portion 31.

[0017] Shaft 29 is also connected to frame 2 by a releasable angular stop assembly 37, which forms part of assembly 23 and, as shown in Figure 4, comprises, in addition to knob 35, a sleeve 38. Sleeve 38 extends coaxially with axis 30 between frame 2 and hub 33, is welded integrally to hub 33, is connected in axially sliding and angularly fixed manner to shaft 29, is pushed towards knob 35 by a compression spring 39 coaxial with axis 30 and extending between frame 2 and sleeve 38, and comprises a pair of front retaining seats 40, each of which, when hub 33 is positioned contacting shoulder 34, is engaged positively by a respective axial pin 41 integral with and projecting from frame 2.

[0018] By rotating knob 35, assembly 37 is movable between a retaining work position in which sleeve 38 is set to a forward work position and pins 41 engage seats 40 to hold shaft 29, gear 28 and, hence, screw 20, in angularly fixed positions with respect to frame 2, and a release position in which sleeve 38 is detached from frame 2 and pins 41 extend outside seats 40 to permit rotation of shaft 29 about axis 30 and, hence, rotation of the screw about axis 3.

[0019] In normal operating conditions, assembly 37 is maintained in the retaining work position, and motor 22 is activated to move counterweight 18 and, hence, car 11. For any of various reasons, car 11 may be moved manually by simply turning handwheel 32, after first rotating knob 35 to move sleeve 38 into the detached position and, hence, assembly 37 into the release position.

[0020] As compared with known solutions, elevator 1 described above is extremely compact and cheap to produce, mainly due to the design characteristics of device 13, which is not only compact and cheap to produce in itself, but, unlike known solutions, also provides for eliminating the drive compartment, any maintenance or adjustments to device 13, in fact, being performed from the outside by simply removing panel 25.

[0021] Moreover, in the event, for example, of a breakdown or an emergency, car 11 may be regulated and/or moved manually by means of a straightforward handwheel on the outside of panel 25.

[0022] As opposed to requiring skilled personnel, car 11 may be operated manually in an emergency by any authorized person and in utmost safety at all times by working from outside elevator 1, i.e. with no need to operate, even for brief periods of time, underneath or on top of car 11, as with known solutions.

[0023] The characteristics of device 13, and in particular the fact that screw 20 is much shorter than the travel of car 11, provide for positioning assembly 23 at different points along guide 9 and, hence, for also positioning panel 25 at various intermediate points along guide 9 and not necessarily at one end or the other of guide 9 as with known solutions, so that, besides making better use of the space available, assembly 23 may be so located as to enable fast, easy access and so greatly reduce intervention time in the event of an emergency.

[0024] Elevator 1 as described above therefore provides for a high degree of efficiency and reliability by featuring components which are not only straightforward, easy to obtain and of proven reliability, but which also operate in the best possible conditions. In particular, though relatively long, screw 20 at no time operates in conditions of instability, by being subjected at all times to tensile stress and never to compression and, hence, ultimate-load deformation.

[0025] Clearly, changes may be made to elevator 1 as described herein without, however, departing from the scope of the present invention. In particular, nut screw 21 may be connected integrally to counterweight 18, and motor 22 may be connected angularly to screw 20 via the interposition of a device for disconnecting screw 20 from motor 22 to permit manual operation of screw 20 in the event of an emergency.

[0026] Finally, screw-nut screw assembly 19 may be replaced by a different, e.g. hydraulic, actuating device comprising at least one hydraulic actuator acting on an element movable parallel to the respective guide.

Claims

1. An elevator (1), particularly for transporting people, comprising a frame (2), a fixed straight guide (9) fitted to the frame (2), a platform (12) connected in axially sliding manner to the guide (9), and actuating means (13) for moving the platform (12) along the guide (9); the actuating means (13) comprising an electric drive motor (22); a cable transmission (14) comprising at least a pair of cables (15), each having a respective first end portion connected integrally to said platform (12); and a movable element (18) movable parallel to the guide (9); characterized in that each said cable (15) comprises a respective second end portion connected integrally to said frame (2), and said movable element (18) carries at least one transmission pulley (17) of said cable (15); said actuating means (13) also comprising transmission means (19) interposed between said motor (22) and said movable element (18) and cooperat-

ing with said motor (22) to move said movable element (18) parallel to said guide (9).

2. An elevator as claimed in Claim 1, characterized in that said transmission means (19) comprise screw-nut screw means.

3. An elevator as claimed in Claim 2, characterized in that said screw-nut screw means comprise at least a screw (20) coaxial with an axis (3) parallel to said guide (9) and connected to said frame (2) in an axially fixed position with respect to the frame (2); and at least a nut screw (21) connected to said screw (20) and to said movable element (18).

4. An elevator as claimed in Claim 3, characterized in that said screw (20) is of a length shorter than the maximum travel of said platform (12) along said guide (9).

5. An elevator as claimed in Claim 4, characterized in that the travel of said platform (12) is a whole multiple of the length of said screw (20).

6. An elevator as claimed in one of the foregoing Claims from 3 to 5, characterized in that said screw (20) is connected to said frame (2) so as to rotate about said axis (3) with respect to said guide (9); and by comprising angular locking means (23, 37) movable between a retaining position maintaining said screw (20) angularly fixed with respect to said guide (9), and a release position enabling said screw (20) to rotate freely about said axis (3) with respect to the guide (9).

7. An elevator as claimed in Claim 6, characterized in that said nut screw (21) is connected to said motor (22), and is connected in rotary manner to said movable element (18) so as to rotate with respect to the screw (20) in opposite directions about said axis (3) when said angular locking means (23, 37) are set to the angular retaining position.

8. An elevator as claimed in Claim 6 or 7, characterized in that said actuating means (13) also comprise manual actuating means (23, 32) for rotating said screw (20) about said axis (3) with respect to said guide (9) when said angular locking means (23, 37) are set to the release position.

9. An elevator as claimed in Claim 8, characterized in that said angular locking means (23, 37) and said manual actuating means (23, 32) comprise a common gear transmission (26).

10. An elevator as claimed in Claim 9, characterized in that said gear transmission (26) comprises a first gear (27) fitted to a portion of said screw (20); and a second gear (28) connected to said frame (2) and activated, in use, by an operator.

11. An elevator as claimed in Claim 10, characterized in that said angular locking means (23, 37) also comprise releasable angular retaining means (38, 41) for locking said second gear (28) in an angularly fixed position with respect to said frame (2).

12. An elevator as claimed in Claim 10 or 11, characterized in that said gears (27)(28) are bevel gears rotating about respective axes (3) (30) substantially perpendicular to each other.

13. An elevator as claimed in any one of the foregoing Claims, characterized in that said movable element (18) is a counterweight.

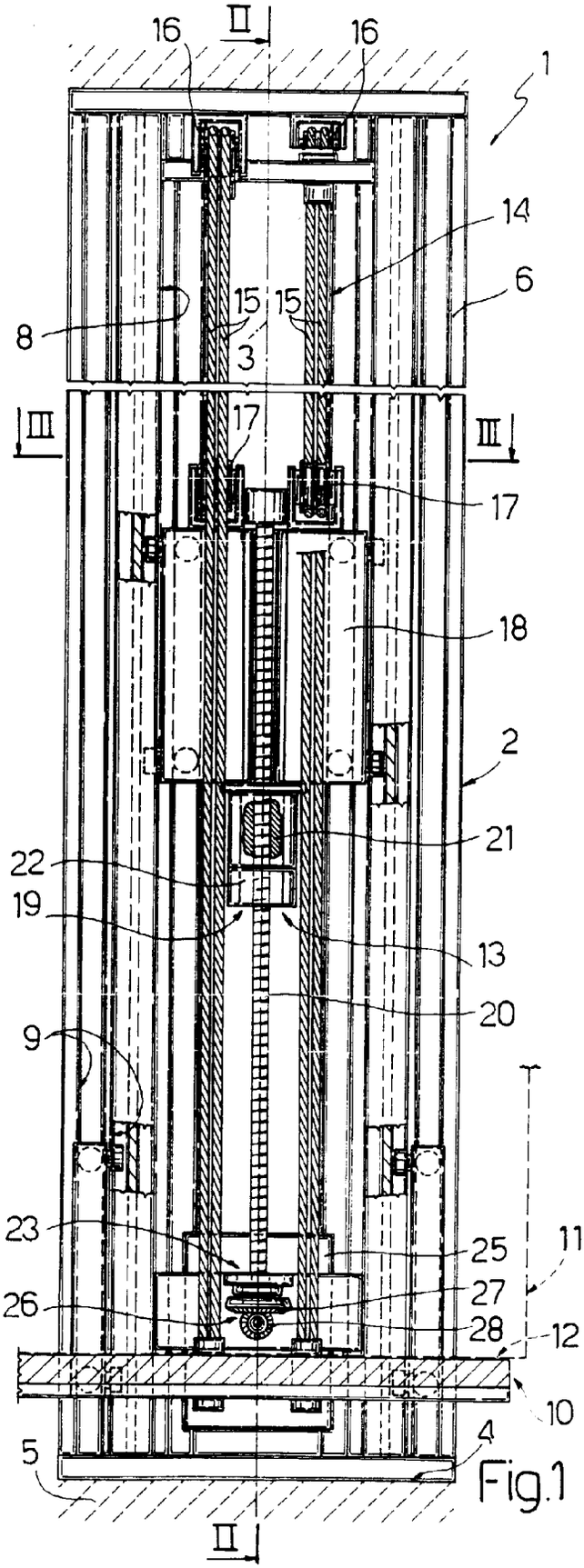
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Fig.1

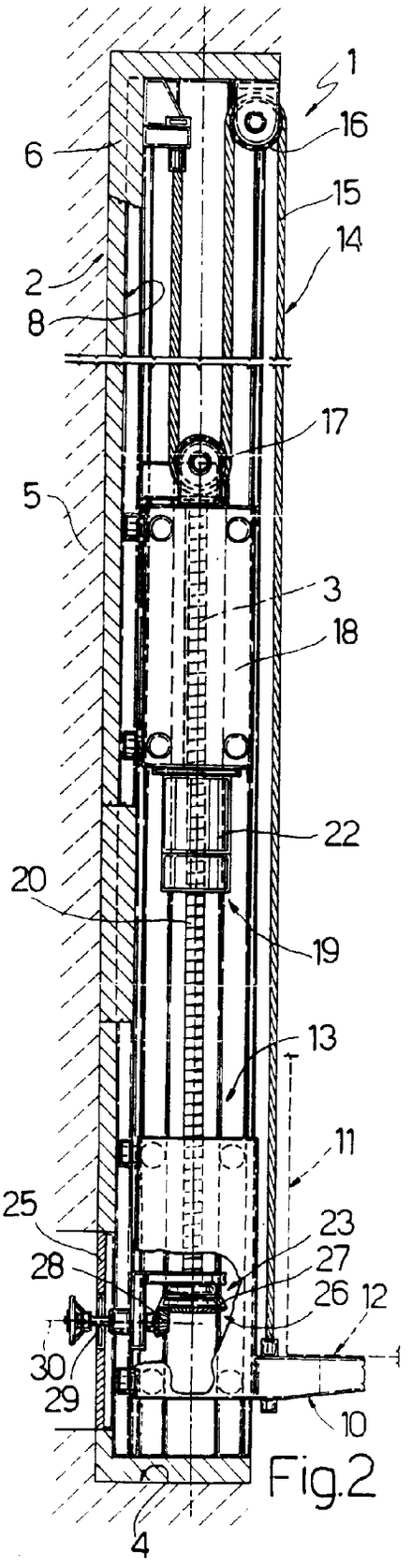
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Fig.2

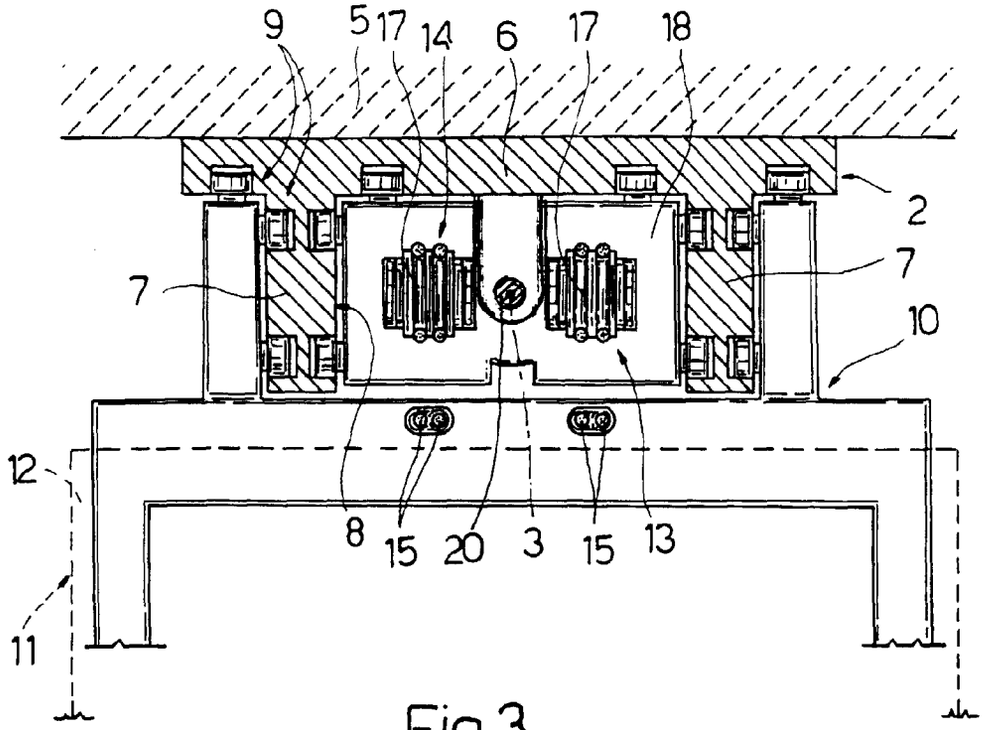
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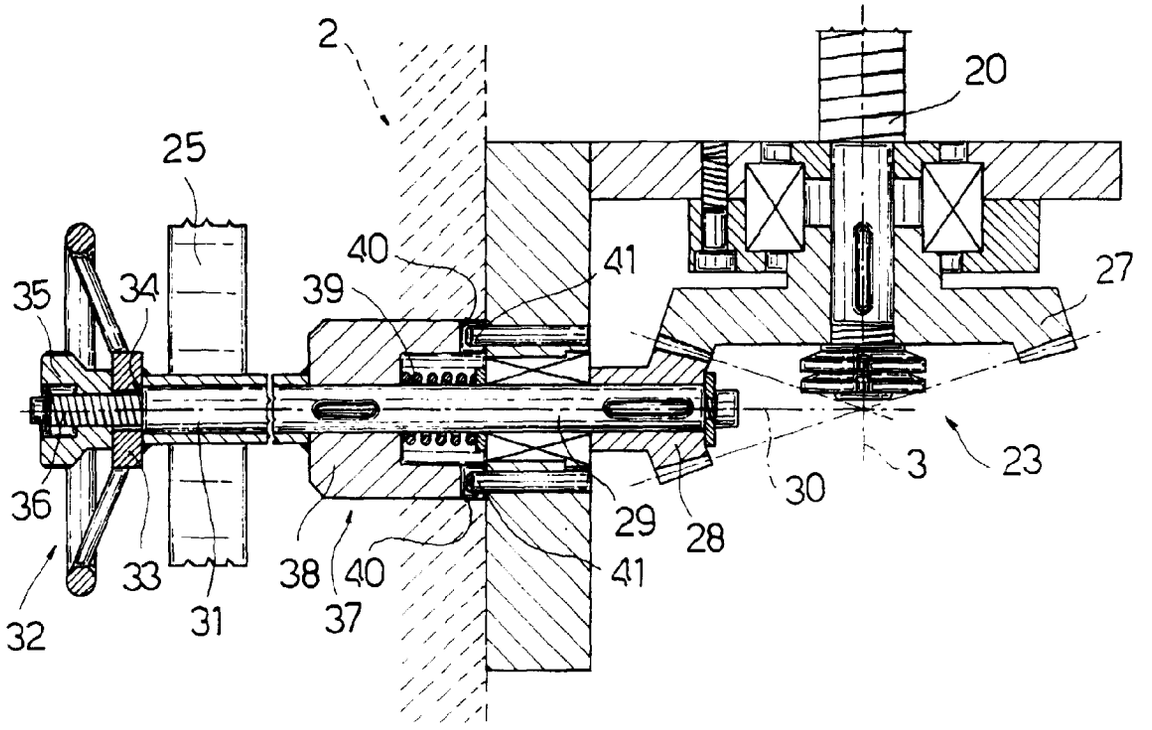
Fig.3

Fig.4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