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(71) Applicant: **KONE OY**
SF-00330 Helsinki 33 (FI)

(72) Inventor: **Mittermayr, Franz**
A-3211 Loich 22 (AT)

(74) Representative: **Zipse + Habersack**
Kemnatenstrasse 49
D-80639 München (DE)

(54) **Apparatus for synchronising the movements of the door panels of a telescopic elevator door**

(57) The door panels of a telescoping elevator door are suspended by means of a roller arrangement. The apparatus for synchronising the movements of the door panels comprises a flexible synchronising means (32). Two rollers (3a, 103a) in the roller arrangement are pro-

vided with a guide (31, 131) adapted for the synchronising means (32). The synchronising means (32) is passed in the roller arrangement over two rollers (3a, 103a) provided with a guide.

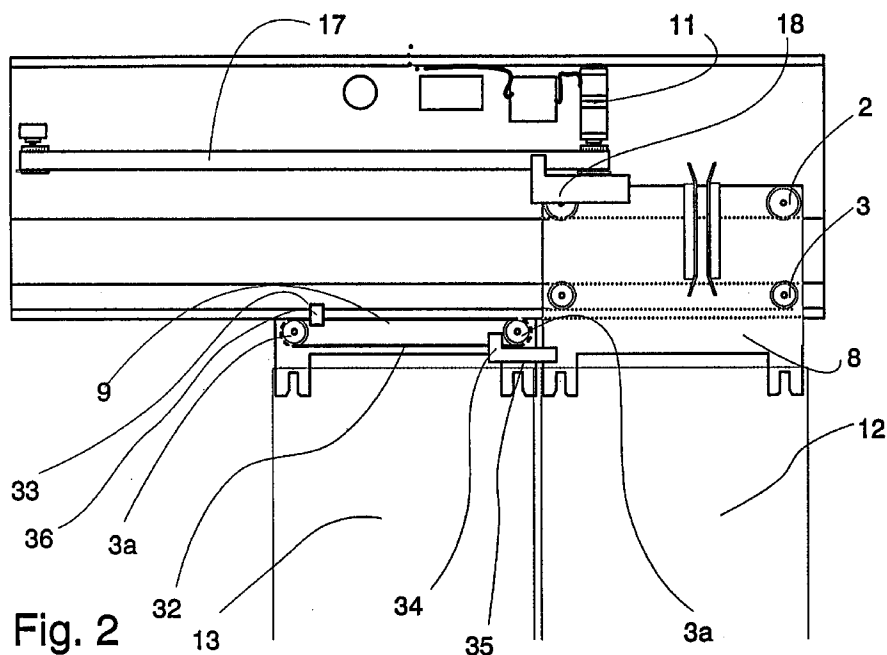


Fig. 2

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Description

The present invention relates to an apparatus for synchronising the movements of door panels as defined in the preamble of claim 1.

In telescoping elevator doors with door panels suspended by means of rollers running on a runner rail, the synchronisation of the door panels is often implemented by adapting the movements of the fast and slow door panels to each other using e.g. a rigging that halves the speed of the fast door panel. Such a rigging usually comprises a driving rope and at least two rope pulleys.

From publication DE A 1456404, a solution is known in which the synchronisation of the door panels is implemented using a driving rope running in a rope groove in the door supporting roller. In the apparatus presented in DE A 1456404, the door supporting roller is pressed against a roller race with a force depending on the weight of the door. Similarly, the roller is pressed against the driving rope with a force depending on the tightness of the rope. As the grooves in the supporting roller determine different perimeters, some sliding of the roller relative to the synchronising rope or the supporting rail necessarily occurs, causing wear of the roller. Even if the rollers are manufactured with the same designed perimeter of the grooves, small differences in perimeter may arise. Vibration of the door panels is also probable, especially if the friction forces in the roller with respect to the supporting rail and to the driving rope are nearly equal.

Relating to the synchronisation of the movements of the door panels of an elevator door, a new solution for implementing the synchronisation using a rope, belt or similar rigging is presented. The apparatus of the invention is characterized by what is said in the characterization part of claim 1. Other embodiments of the invention are characterized by what is presented in the other claims.

The advantages achieved by the invention include the following:

- The invention can be implemented without separate pulleys for a rope, belt or equivalent, thus reducing the manufacturing costs of the door. Savings are made in both materials and amount of work.
- The door has a simpler structure and the layout of its parts can be made clearer as the door comprises fewer separate parts.
- Expressly the fact that the synchronising means is passed over counter rollers means avoiding the problem that, as the grooves in the supporting roller determine different, sometimes just slightly different perimeters, some sliding of the roller relative to the synchronising rope or the supporting rail necessarily occurs. During normal movement of the door, the counter roller need not be pressed with a substantial force against the roller race. Thus, since the force is practically null, the frictional interaction between the roller race and the counter roller is also null. Therefore, no wear occurs even if the peripheral speed of

the roller circumference on the race should differ from the speed of movement of the roller.

In the following, the invention is described by the aid of a few application examples by referring to the attached drawings, in which

- Fig. 1 presents the overhead beam of a door implemented according to the invention,
- Fig. 2 presents the door of Fig. 1 as seen from a different direction,
- Fig. 3 presents a roller provided with a rope groove, and
- Fig. 4 presents another roller provided with a rope groove.

Figures 1 and 2 illustrate an overhead supporting beam 1 for a door implemented according to the invention and the suspension of the door panels 12 and 13 on the overhead beam. Fig. 1 shows the door as seen from the direction of the beam end and Fig. 2 as seen from the side of the fast door panel 12. Fig. 1 shows the cross-sectional form of the overhead beam and the placement of the panel supporting rollers 2 and their counter rollers 3,3a relative to the supporting beam 1. Formed in the supporting beam are roller races 4,5 for the rollers 2,3,3a. The roller races have an upward stop face 6 for the supporting rollers 2 and a downward stop face 7 for the counter rollers 3,3a. The rollers 2,3,3a are rotatably mounted on supporting plates 8,9 supporting the door panels. In the telescoping door structure, the upper roller race 4 is primarily intended for the suspension of fast door panels. The lower roller race 5 is primarily intended for the suspension of slow door panels. A preferable form of the overhead supporting beam 1 is as follows. The roller races 4,5 are shaped in the form of a flat-backed letter C, with their open sides facing towards opposite sides of the overhead supporting beam 1. The upper C-shape 4 starts directly from the upper cleat of the lower C-shape 5. The stop faces 6,7 on the roller races 4,5 consist of the curved upper and lower surfaces of the C-shapes. Starting from the upper cleat of the upper C-shape, the overhead supporting beam 1 is so bent that it again continues upwards. The upper part 10 of the overhead supporting beam 1 can be provided with one or more elbows to stiffen the beam structure and/or to produce a box-like shape.

At least the supporting rollers 2 and possibly also the counter rollers 3,3a have a groove on their circumference that fits the curved stop faces 6,7 of the roller races. The counter rollers 3a mounted on the supporting plate 9 of the slow door panel 13 are provided with rope grooves 31, through which the synchronising rope 32 is passed. The synchronising rope 32 forms a loop which at one point 33 is immovably fixed to the roller race 5 by means of a fixture 36 or otherwise immovably fixed relative to the beam 1 and at another point 34 to a fixture 35 on the fast door panel 12. These points 33,34 move in opposite directions in relation to the slow plate 9 when

the door is opened or closed because they are attached to parts of the loop that move in opposite directions. Therefore, the fast door panel 12 with its supporting plate 8 and the slow door panel 13 with its supporting plate 9 move in synchronism aside from the door opening and back to close the door opening. A driving gear 11 drives a belt 17 which further moves the supporting plate 8 supporting door panel 12 by means of an intermediate piece 18.

Fig. 3 presents a roller 3a. The bottom of the groove for the roller race is provided with a rope groove 31. Fig. 4 presents another type of a roller 103a with a rope groove 131. The rope groove 131 is placed on a bellying 104 at one side of the roller that does not come into contact with the roller race engaged by the roller. Rollers with a rope groove are also applicable as door supporting rollers and they can be used to pass the synchronising rope, although in a practical application it would seem to be more advantageous to pass the synchronising rope over the counter rollers. When rollers with a rope groove are used as counter rollers, they need not necessarily be provided with a groove for the roller race but only with a groove for the rope.

It is obvious to a person skilled in the art that the embodiments of the invention are not restricted to the examples described above, but that they may instead be varied in the scope of the claims presented below. For instance, instead of using a synchronising rope running in rope grooves, the invention can be implemented using a belt or a similar synchronising means which has a flexibility resembling that of a rope or belt and is capable of guided motion on rollers. The guide used to guide a belt or the like differs from a rope groove in shape, but the function of the shape of the guide made in the roller is the same, i.e. to keep the belt or the like on the roller.

Claims

1. Apparatus for synchronising the movements of telescoping elevator door panels suspended by means of a roller arrangement, which apparatus comprises a flexible synchronising means (32) and in which apparatus at least two rollers (3a,103a) in the roller arrangement are provided with a guide (31,131) adapted for the synchronising means (32), **characterized** in that the rollers (3a,103a) provided with a guide, over which the synchronising means (32) is passed, are counter rollers.
2. Apparatus according to claim 1, **characterized** in that the rim of the roller (3a,103a) is provided with a groove designed to accommodate curved stop faces (6,7) of roller races.
3. Apparatus according to claim 1 or 2, **characterized** in that the guide (31) is placed on the rim of the roller (3a).
4. Apparatus according to any one of the preceding claims, **characterized** in that the guide (131) is formed in a bellying (104) on one side of the roller (103a), which bellying does not come into contact with the roller race.
5. Apparatus according to any one of the preceding claims, **characterized** in that the guide (31,131) is a rope groove and the synchronising means (32) is a rope.
6. Apparatus according to claim 6, **characterized** in that the counter rollers (3a,103a) mounted on the supporting plate (9) of the slow door panel (13) are provided with rope grooves (31,131), through which the synchronising rope (32) is passed, and the synchronising rope (32) forms a loop which at one point (33) is immovably fixed to the roller race (5) by means of a fixture (36) or otherwise immovably fixed relative to the overhead supporting beam (1) and at another point (34) to a fixture (35) on the fast door panel (12), and that said points (33,34) are so selected that, when the door is being opened or closed, they move in opposite directions in relation to the slow plate (9).

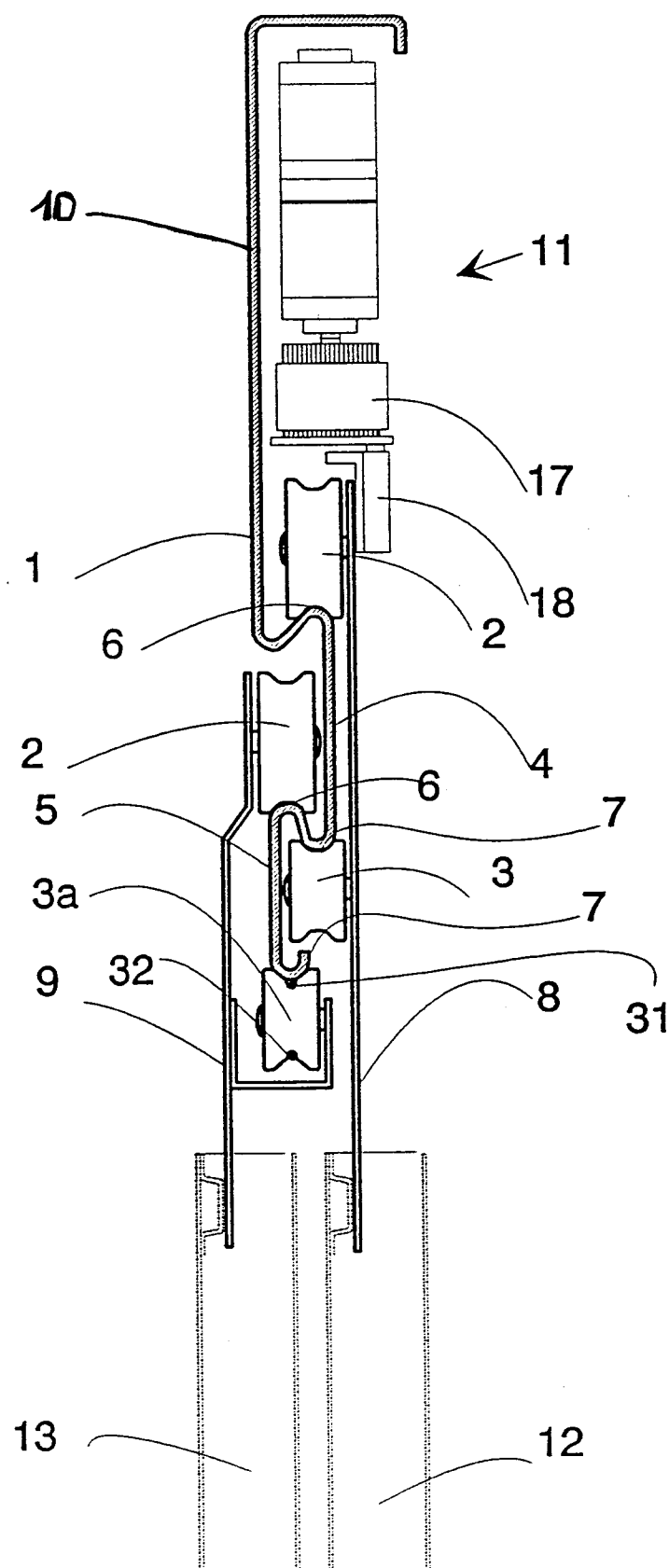


Fig. 1

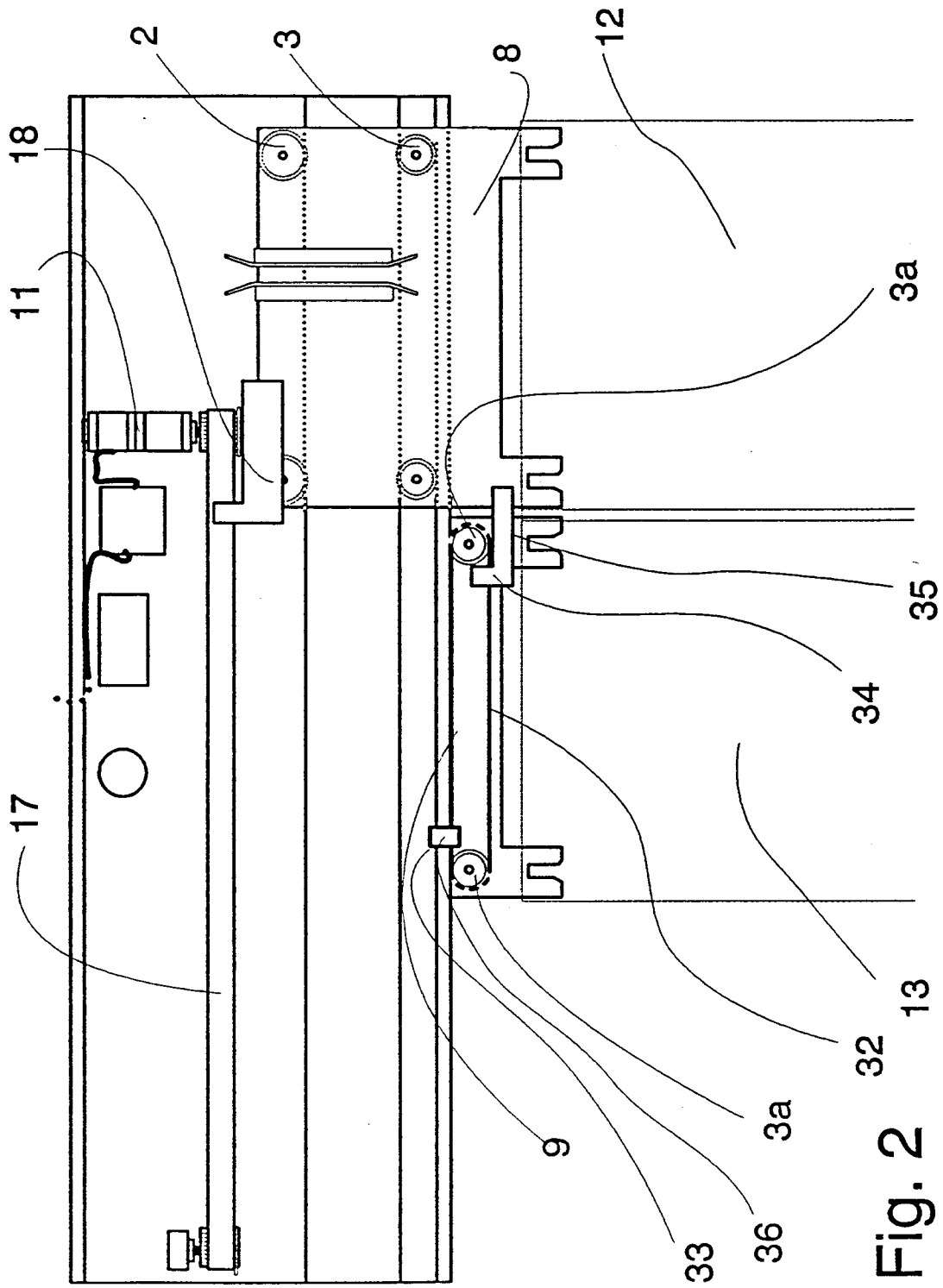


Fig. 2

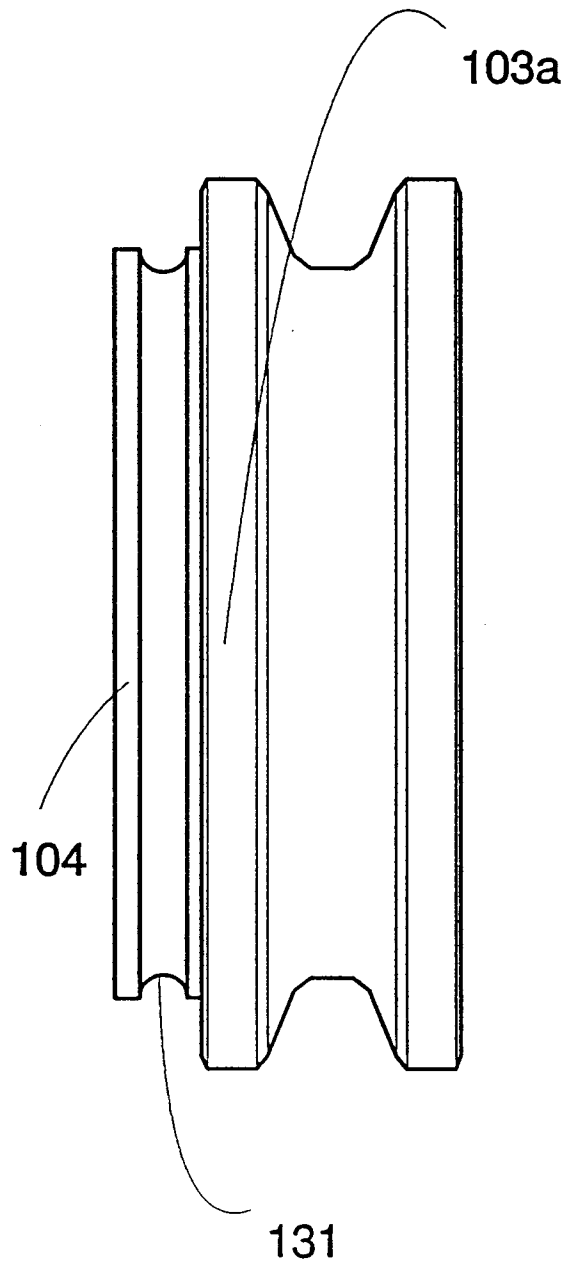


Fig. 4

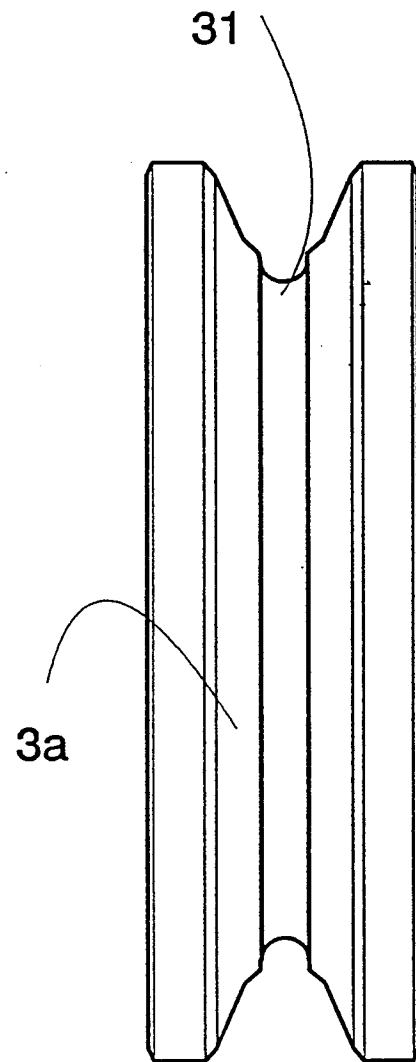


Fig. 3