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Svensson

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[54] **COUNTERWEIGHT ARRANGEMENT FOR A RACK AND PINION ELEVATOR**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **B66b 17/12**

[58] **Field of Search** 187/1, 2, 6, 17, 19, 20, 187/27, 94; 254/175.5, 175.7; 240/69

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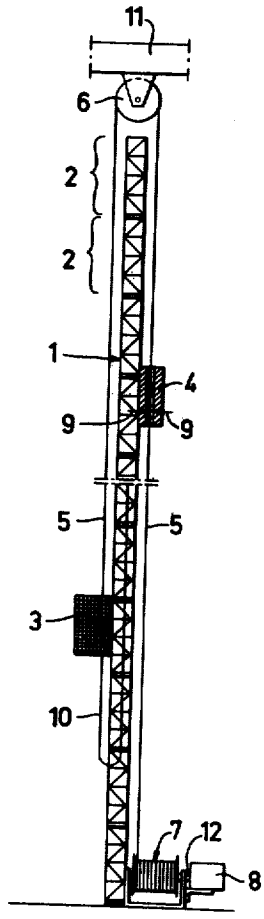
[57] **ABSTRACT**

In a rack elevator for a great hoisting height, which is provided with a counterweight cable and a counterweight, the influnce of the dead weight of the counterweight cable increasing with increasing hoisting height is reduced by the counterweight cable on the counterweight side constantly extending to the lower end of the elevator, where it is maintained stretched by a reeling device. In order that the counterweight cable might be easily extended in building the elevator, the counterweight is moreover steplessly displaceably attachable at different places along the counterweight cable.

6 Claims, 4 Drawing Figures



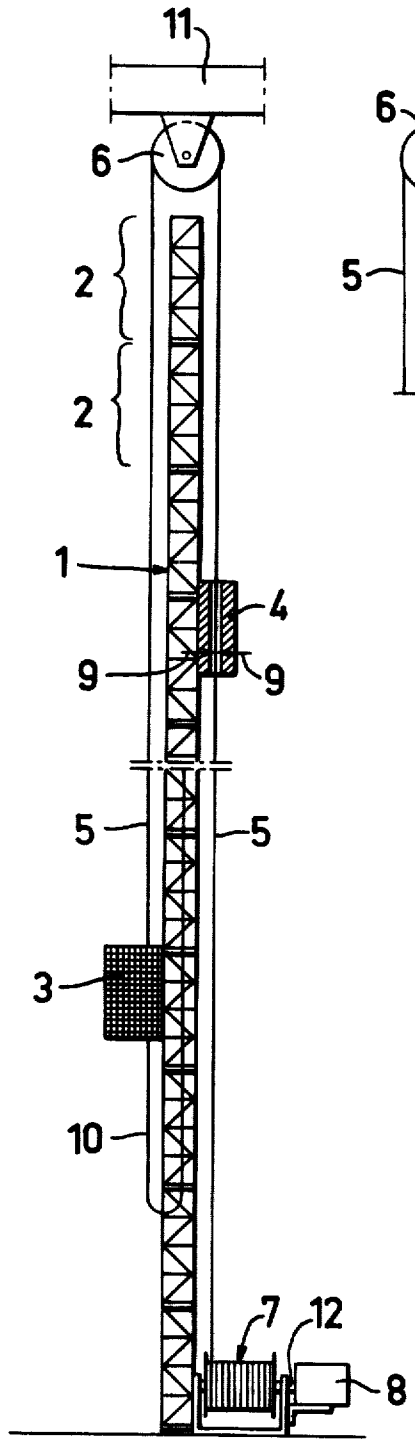


FIG.1

FIG.1A

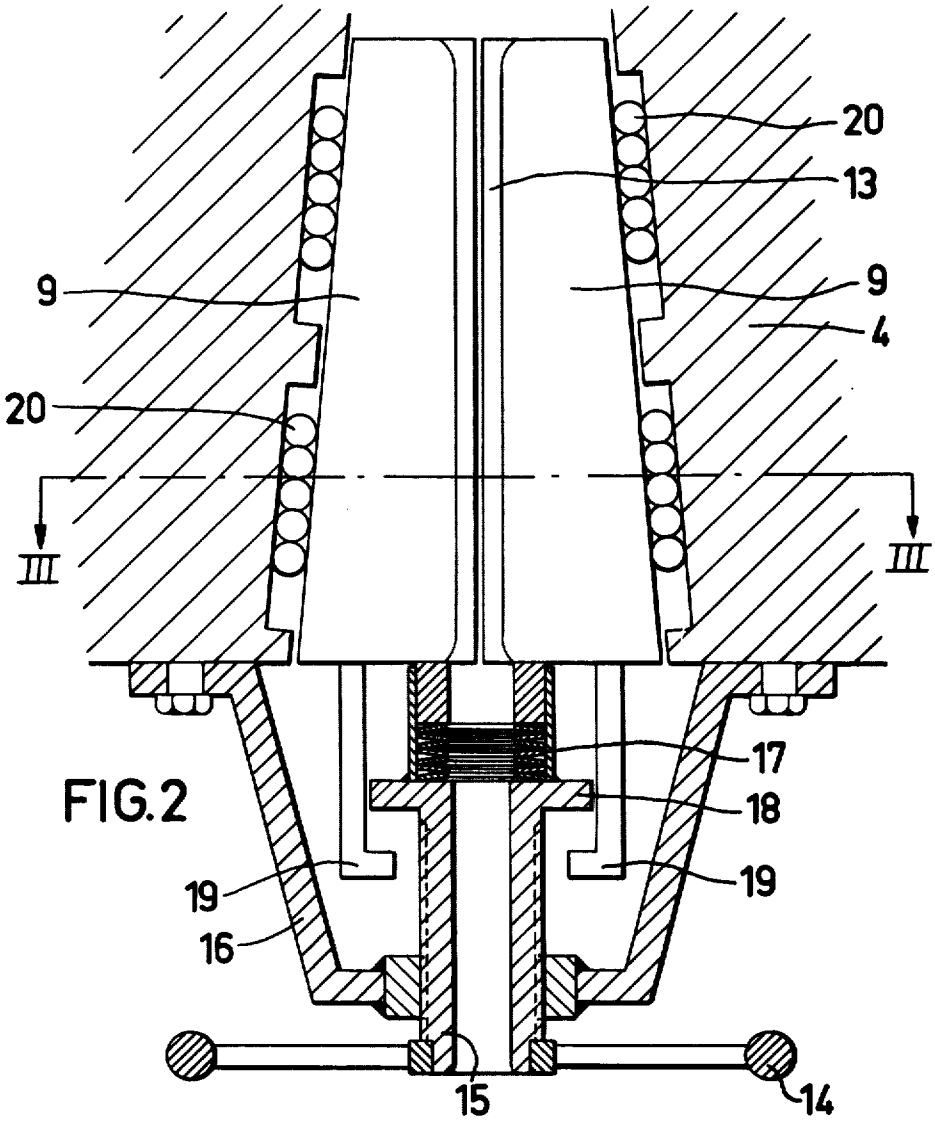


FIG. 2

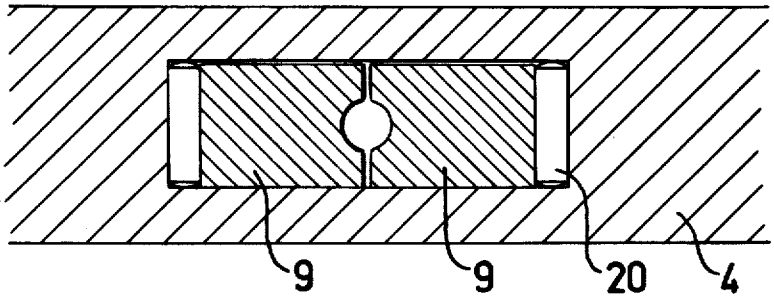


FIG. 3

COUNTERWEIGHT ARRANGEMENT FOR A RACK AND PINION ELEVATOR

The invention relates to a device for elevators of the type wherein hoist machinery is arranged in a load carrier and drives the load carrier, preferably by means of pinion and rack, along a path, whose length can be changed, the load carrier being unloaded by a counterweight via a cable placed over a pulley at the upper end of the path, and a cable for power supply to the hoist machinery is hanging in the load carrier.

To increase the lifting capacity of rack elevators the weight of the lift cage is generally partly balanced by means of a counterweight which, for instance in elevators where the lift cage is guided along a mast, runs on the rear side of the mast and is connected to the lift cage by a cable running over a pulley placed on the top of the elevator mast.

However, as elevators become increasingly higher, it has been found that the weight of the counterweight cable gets so heavy at hoisting heights of 400–500 m that it influences the load capacity of the elevator. Another problem is the extension of the counterweight cable concurrently with the building up of the elevator, it being very difficult to house the whole length of the cable at the initial stage.

The foregoing disadvantages are essentially eliminated by the present invention which operates to assure that the same line weight on both sides of the mast is always present when the lift cage is at its lowermost position and the counterweight at the top, the balancing being constant independently of the mast height. When the lift cage is at its uppermost position, the whole counterweight cable is on the counterweight side of the mast. On the side of the cage there is then the cage cable transferring power and operating impulses to the lift cage. In rack elevators with the hoist machinery in the lift cage the weight of this cable per length unit is of the same magnitude as that of the counterweight cable, and a counterbalancing is obtained, which varies only a little with the mast height.

Illustrative examples of the invention will now be described in connection with the enclosed drawing, in which

FIG. 1 shows an elevator mast with lift cage, counterweight cable and counterweight according to the invention,

FIG. 1A shows an alternative method of arranging a pulley at the top of the elevator mast,

FIG. 2 shows a device for attaching the counterweight to the counterweight cable, and

FIG. 3 shows a section III—III of the device in FIG. 2.

With reference to FIG. 1 a mast 1 comprises a plurality of sections 2 along which mast a lift cage 3 is displaceably guided. The elevator is operated by means of a gear driven by a motor in the lift cage, which gear cooperates with a rack arranged along the mast 1. As the drive means is no part of the invention, it has been omitted in the drawing.

The weight of the lift cage 3 is unloaded by a counterweight 4 displaceably guided along the rear side of the mast 1, to which counterweight the lift cage 3 is connected by means of a cable 5, which runs from the lift cage up to a pulley 6 arranged at the top of the mast 1, where the cable 5 is diverted, after which it runs down to the counterweight 4, which is detachably and steplessly attachable to the cable at an arbitrary place thereof by means marked by arrows 9. From this point the cable 5 runs unguided further down to a cable drum 7, on which the cable 5 is wound. The cable 5 is maintained constantly wound on the cable drum and stretched by the same by means of a device 8, which e.g. can consist of a motor and a hydraulic coupling the output shaft 12 of which is connected to the drum 7 and provides the drum with a constant torsional moment, which is continually capable of maintaining a superfluous part of the counterweight cable 5 wound on the drum 7. Under the lift cage an electrical cable 10 for transferring control impulses and electric power to the hoist motor is hanging.

In FIG. 1 the device is used in casting e.g. a tower by means of a sliding form (indicated at 11), arranged at the top of the tower being built and in which sliding form concrete is cast, said sliding form slowly moving upwards with increasing height of the tower. The pulley 6 is preferably attached to the sliding form, which is shown in FIG. 1. The lift cage 3 is used for transports to and from the sliding form at the upper portion of the growing tower. As the height of the tower is increased, new mast sections 2 must be added to the mast 1 and the counterweight 4 must be moved downwards a little on its part of the cable 5.

The counterweight 4 is moved relative to the cable 5, when required as discussed above, by first tacking the counterweight to the mast 1, after which the counterweight is disconnected from the cable and then the lift cage is moved downwards or upwards a certain distance, after which the counterweight is again attached to the cable 5 by means of the means 9.

In FIG. 1A the pulley 6 is shown as arranged on the uppermost mast section instead. This design is preferred for the arrangement of the pulley, in case a sliding form movable above the mast top or the like should not be available.

A suitable device for detachably attaching the counterweight 4 to the cable 5 is shown in FIG. 2 and 3. The means 9 engaging the cable comprises two jaws, which are movably arranged in a channel tapering in an upward direction within the counterweight 4. The channel 13 for the cable extends between the jaws 9, which channel continues downwards through a device for operating the jaws 9. This device includes a wheel 14 with a central hub 15, which is screwed into a holder 16 connected to the counterweight 4. The hub 15 is engaged with the jaws 9 via cup springs 17, so that jaws 9 are brought into engagement with the cable by screwing the hub 15 in an upward direction.

When the counterweight 4 is to be disengaged from the cable the hub 15 is screwed in a direction away from the counterweight 4 until a flange 18 of the hub 15 comes into engagement with a pair of hooks 19 connected with the jaws 9, after which the jaws 9 are drawn downwards by means of the hooks 19 and are thereby released from the cable. For reducing the friction between the jaws 9 and the counterweight 4 rolling elements 20 are arranged between these parts.

What is claimed is:

1. An elevator comprising a vertically oriented mast having a rack extending along said mast, a load carrier mounted for vertical movement along said mast, motor means carried by said load carrier and having an output gear in drive engagement with said rack for moving said load carrier along said mast, and counterweight means

comprising a pulley mounted for rotation adjacent the top of said mast, a rotatable cable drum mounted at a fixed position adjacent the lower end of said mast, a counterweight cable attached at one of its ends to said load carrier and extending upwardly from said load carrier over said pulley and thence downwardly to said cable drum whereby the other end of said cable is always located at the lower end of said mast thereby to assure that the counterweight cable includes a section which always extends along the entire length of said mast on the side of said pulley opposite to said load carrier regardless of the position of said load carrier along said mast, said cable drum being operative to automatically take in and feed out said counterweight cable as the vertical position of said load carrier is varied along said mast, and a counterweight attached to said counterweight cable section between said pulley and said cable drum.

2. The structure of claim **1** wherein said load carrier comprises an elevator cage for movement along one side of said mast, said counterweight cable section extending along the entire length of said mast adjacent the side of said mast opposite to said cage.

3. The structure of claim **2** wherein said counterweight is slidably displaceable along said counterweight cable section, and means for selectively locking said counterweight to said cable section at a desired position along its length.

4. The structure of claim **1** wherein said pulley is attached to a support member separate from said mast located adjacent to and vertically spaced from the top of said mast.

5. The structure of claim **4** wherein said mast comprises a plurality of separable vertical sections to permit the height of said mast to be varied, said support member being vertically displaceable to assure that said pulley remains located adjacent the top of said mast as the height of said mast in varied.

6. The structure of claim **4** wherein said cable drum has a capacity sufficient to house the entire counterweight cable.

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