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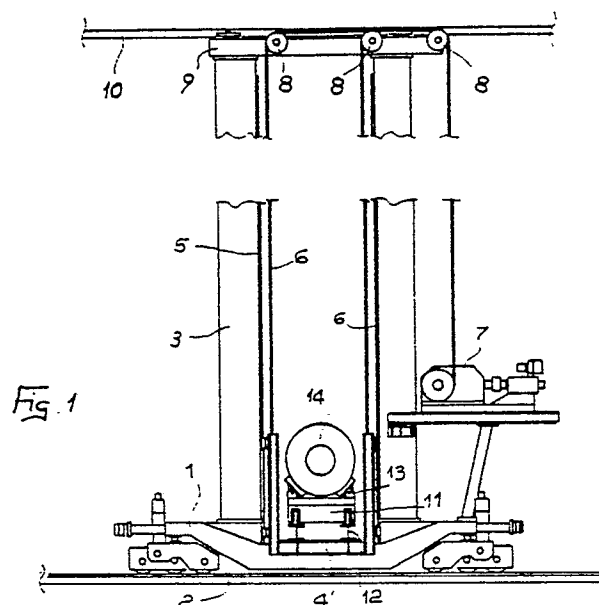
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54 **Lifting carrier truck, especially for stores with mechanical handling for heavy objects.**

57 A lifting carrier truck, especially for stores with mechanical handling, comprising a truck movable on rails in a passageway between opposite racks of shelves, the truck carrying columns extending through the entire height of the racks, along which columns a cradle can be vertically raised, wherein the cradle has a width substantially equal to, or slightly less than, the free space between each pair of facing racks, and above which cradle there is a movable carriage, adapted for carrying an object to be placed in the rack, which carriage loads the cradle only vertically, and can be displaced between a carrying position, in which the carriage rests entirely on the cradle, and a position for depositing on or collecting from the rack, in which the carriage rests entirely upon the rack itself.



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Lifting carrier truck, especially for stores with mechanical handling for heavy objects.

The subject of the present invention is a lifting carrier truck, especially for stores for mechanical handling for heavy objects.

For storing objects of every class, stores or warehouses with mechanical handling are frequently used, in which the objects are placed in appropriate arrangement racks or shelves, and are taken from them, by means of lifting carrier trucks, remotely controlled by means of a central processing, which in addition regulates the store to obtain maximum benefit from its capacity.

Such lifting carrier devices are usually composed of a truck, travelling on a bottom monorail, equipped with columns guided at the top by an upper monorail, along which columns a cradle slides vertically, the cradle being equipped with means for arranging and removing the object from the collecting rack or from an intake or discharge location.

Usually, the means for depositing or collecting are telescopic or similar devices, supporting the load throughout its displacement, from the cradle to the rack where it is then deposited and vice versa, thus transferring the weight of the object handled to the columns of the lifting carrier in the form of vertical loads and bending moments throughout the entire movement cycle of the object itself.

Many forms of lifting carrier trucks of this class are known, but they always relate to structures adapted for handling objects of limited weight, for which problems of elastic deformation under load such as might interfere with functional capability do not arise, for example for the realization of the transfer of the conveyed object from the cradle of the lifting carrier to the rack, or for taking it from the rack.

In particular, for example in the steel-making industry, the problem arises of placing into a mechanically operated store products of weights of several tons, such as for example rolls of sheet or "coils".

A lifting carrier for the movement of objects of such weights is therefore subjected to very high loads; in particular the members for picking up and putting down the object on the rack, usually by sliding the object in its lateral displacement towards the rack, by making use of telescopic cantilever beams or the like, would give rise, if constructed in such a manner, to very high bending moments in the structure, for which the structure itself would have to be designed.

This, however, would require considerable heights for the extensible elements or the like, for picking up and depositing the object in the rack; as a consequence of this there would need to be

constructed a rack of corresponding dimensions, suitable for accepting in height not only the object to be housed but also the relevant gripping and transfer members.

This would mean that, in order to house a heavy object of a certain dimension, the relevant rack location would have to have much larger dimensions, defined by the space necessary for the aforementioned translation members, with a notable increase in cost and reduced use of the available space.

It is also possible to construct a carriage carrying the load, movable on the cradle of the lifting carrier and bearing in whole or in part, when displaced laterally, on the rack, but in such a form of construction the problem arises of guaranteeing the continuity of the movement of said carriage between the cradle, which is movable, and the rack, which is fixed, by closing the free space existing between them, which is moreover necessary for allowing free relative movement, and also for permitting the elastic deflections resulting from the loading of the structure.

Said results are achieved by the present invention, which provides a lifting carrier truck, especially for stores with mechanical handling, comprising a truck movable on rails in a passageway between opposite racks, the truck carrying columns extending throughout the entire height of the racks, along which columns a cradle is vertically movable, wherein the cradle has a width substantially equal to, or slightly less than, the free space between each pair of facing racks and above it there is present a movable carriage, adapted for carrying an object to be placed in the rack, which carriage bears only vertically on the cradle and can be translated between a carrying position, in which the carriage rests entirely on the cradle, and a position for depositing in or collecting from the rack, in which the carriage rests entirely upon the rack itself.

In greater detail, the cradle possesses runways equipped with rails, on which the carriage carrying the load can be moved horizontally, transversely to the direction of movement of the truck, having associated motor devices, and in correspondence with these runways there are present fixed runways, equipped with rails, on the racks, movable means being present for closing the free space between the runways of the cradle and the runways of the facing rack, there being also present members for horizontally locking and accurately centering the cradle relative to the preselected rack, with the respective runways in alignment.

The movable means for closing the free space

between the runways of the cradle and the runways of the facing rack are constituted of hinged bars at the ends of the runways of the cradle, the bars having a length greater than the free space existing between the runways of the cradle and the runways of the racks, the bars having a profile corresponding to that of the support rails for the carriage on said runways, which bars can pivot between a raised position, which does not interfere with the movements of the cradle and of a truck which supports it, and a lowered position, with the free end bearing against relative support members at the end of the runway of the facing rack.

The bars are each equipped with mechanical transmission means for connecting with respective motors, a single common motor being provided for the pair of bars situated on the same side of the cradle, this motor being capable of being operated independently from the common motor coupled with the bars situated on the opposite side of the cradle.

The mechanical transmission means for connecting the bars to the respective motors comprise, for each bar, a crank connected by an associated connecting rod to a second crank integral with a motor shaft, one common motor shaft being provided for the bars situated on the same side of the cradle, connected to an associated motor.

The members for horizontally locking and accurately centring the cradle relative to the selected rack are constituted, at each side of the cradle, of a slider slidable parallel to the runways of the cradle and movable between a retracted position, not projecting beyond the sides of the cradle itself, and an extended position, projecting towards the facing rack, in correspondence with which each rack possesses a recessed seating, into which the slider engages with little lateral play.

The sliders are each equipped with mechanical transmission means for connecting with an associated motor, each motor being operated independently from the motor connected to the slider situated on the opposite side of the cradle.

The mechanical transmission means for connecting the sliders with the respective motors comprise, for each slider, a connecting rod connected to a crank, the crank being directly actuated by an associated motor.

Further details will become apparent from the following description, with reference to the attached drawings, in which there are shown:

in Figure 1, the lifting carrier according to this invention, in lateral view;

in Figure 2, the lifting carrier of Figure 1, seen from above;

in Figure 3, a section on the plane III-III of Figure 2;

in Figure 4, the raisable cradle of the lifting carrier with the associated transfer carriage, seen from above;

in Figure 5, the cradle of the lifting carrier and the transfer carriage, in front view;

in Figure 6, the cradle of the lifting carrier seen from above, with the transfer carriage omitted;

in Figure 7, a section on the plane VII-VII of Figure 6;

in Figure 8, a section on the plane VIII-VIII of Figure 6;

in Figure 9, a section on the plane IX-IX of Figure 6.

As Figure 1 shows, the lifting carrier according to this invention, intended for operating in a passageway of a store and for transferring rolls of metal sheet or coils between storage racks, comprises a truck 1, movable on a monorail 2 and equipped with columns 3 carrying a raisable cradle 4, shown in Figure 1 at its lowest level.

The cradle 4 can be raised, along respective guides 5 of the columns 3, by suspension cables 6 wound on a winch 7 and conducted around pulleys 8 at the heads 9 of the columns 3.

The head 9 in turn is guided, thereby imparting the necessary stability to the complex, on an upper monorail 10.

The cradle 4 of the lifting carrier carries a transfer carriage 11, movable on runways 12; on the carriage there is mounted a platform 13 for supporting a coil 14.

As can be seen from Fig. 2, the lifting carrier receives, on its carriage 11 of its cradle 4, the coil 14 from a transfer carriage 15, running on associated rails 16, in a service zone; it then moves from said zone to place the coil in one of the racks 17, in the position intended for it.

The removal of a coil from the rack 17 is carried out by the reverse procedure.

As Figures 4 and 5 show, the carriage 11 possesses wheels 18, which rest on the runways 12; the frame 19 of the carriage possesses hydraulic jacks 20, by means of which the platform 13, resting on them, can be raised and placed in the relative rack or on the transfer carriage 15.

The translatory movement of the carriage 11 is provided by the motor reduction units 21, while a hydraulic unit 22 provides the feed to the jacks 20.

The cradle 4 is illustrated in detail in Figures 6 to 9; it comprises a load-bearing frame, equipped with beams 23 on which the runways 12 rest, each runway being formed of a beam 24 and a rail 25 mounted on it.

Corresponding runways 26, shown partly in dot-and-dash line in Fig. 7, are provided in each of the racks 17 and on them the movement of the carriage 11 continues in its translatory lateral

movement for depositing or removing a platform 13 into or from a rack.

For bridging the space existing between the runways 12 of the cradle and the fixed runways of the racks, the width of which space cannot be reduced beyond certain limits in order to avoid obstruction to the movements of the lifting carrier, there are provided according to this invention, at the ends of each rail 25, bridge bars 27, hinged about horizontal axes on associated bearings 28.

As shown in dot-and-dash line in Figure 7, the bars 27 can be disposed in a raised position during the movement of the cradle 4 and of the lifting carrier 1, so as to leave the necessary clearance between said components and the fixed structures for guaranteeing the complete movement, without interference, even when deformations or flexure under load take place; for this purpose the bars 27 on one side of the cradle are connected to associated cranks 29, and these cranks are connected by means of connecting rods 30 to the cranks 31 carried by a shaft 32, rotatably driven by a motor-reduction unit 33. In an analogous manner, on the opposite side, the bars 27 are actuated by a second motor-reduction unit 33, independently of the first one, in such a way as to allow the lowering movement of the bars 27 for closing the space between the runways of the cradle and the fixed runways of the rack only on that side at which horizontal transfer of the carriage is intended.

The shaft 32, in contrast, ensures that on one side the movement of the bars 27 shall be simultaneous.

The constancy of level of the cradle, as the load on it varies during the lateral translatable movement of the carriage 11, which load comes to bear progressively on the fixed structure of the rack during the lateral translatable movement, is ensured by control means acting upon the winch 7, while small pivotal movements are compensated by the rotation of the bars 27 about the associated support bearings and about their supports on the fixed runways of the rack.

For the purpose of ensuring, in addition, the accuracy of alignment of the movable runways carried by the cradle with the fixed runways provided on the rack, and for maintaining said alignment during the entire movement of the carriage, there is provided, on the two opposite sides of said carriage, a slidable slider 34, guided in a support 35 equipped with roller 36, the slider being adapted for engaging, in the advanced position shown in dot-and-dash line in Figures 6 and 8, into a corresponding recessed seating 37 of the fixed rack.

The translatable movement of the sliders 34 is provided, for each of them, by an associated motor-reduction unit 38, rotatably actuating a crank 39 connected by a connecting rod 40 to the slider

34.

The structure according to this invention, therefore, allows the translatable movement of especially heavy loads, such as coils of weights of tens of tons, to be carried out from the cradle of the lifting carrier to the relevant rack and vice versa, without the movement of such masses, even at high levels, causing inadmissible flexure or loading of the structure.

In fact, the continuity of the runways formed between cradle and desired rack allows the carriage moving on these runways to move laterally, progressively transferring its own weight and the conveyed weight from the cradle to the fixed rack, without the carriage itself having to be supported by cantilevering from the columns of the lifting carrier, thereby causing loads and flexure in the load-bearing structure of said lifting carrier, and in turn demanding resistance from the fixed structure of the rack, which itself is already dimensioned for supporting the maximum weight of the object intended for it.

Furthermore, the structure according to this invention enables the overall height of each rack location to be limited to the maximum dimension of the object to be placed in it plus the depth of the carriage, which is appreciably less than the space necessary for allowing entry into the rack of a telescopic translatable element or the like, as previously known, for the handling and removal from said rack of a stored object, with resultant improvement in the volumetric efficiency of use of the store, that is to say of the ratio between the total useful volume stored and the total volume occupied by the store itself.

The movements of the bars 27 and of the sliders 34, as also the movements of the carriage 11, are governed by position control members, safety means and a central processing unit, which may be of known type and are therefore not described in further detail here.

Numerous variants can be introduced, without thereby departing from the scope of the invention in its general characteristics.

Claims

1. Lifting carrier truck, especially for stores with mechanical handling, comprising a truck movable on rails in a passageway between opposite racks, the truck being equipped with columns extending throughout the entire height of the racks, along which columns a cradle can be vertically raised, characterized by the fact that the cradle has a width substantially equal to, or slightly smaller than, the free space between each pair of mutually opposite racks, and on the cradle there is provided a

movable carriage, adapted for carrying an object to be placed in the rack, which carriage bears only vertically upon the cradle and can be moved in translation between a carrying position, in which the carriage rests entirely upon the cradle, and a position for depositing in or collecting from the rack, in which the carriage rests entirely upon the rack itself.

2. Lifting carrier truck according to Claim 1, characterized by the fact that the cradle possesses runways equipped with rails, on which the carriage carrying the load, capable of moving horizontally transversely to the direction of movement of the truck, bears, the carriage having associated motor devices, and in correspondence with these runways fixed runways with associated rails are provided on the racks, movable means being provided for closing the free space between the runways of the cradle and the runways of the facing rack, there being also provided members for horizontally locking and accurately centring the cradle relative to the preselected rack, with the respective runways in alignment.

Lifting carrier truck according to Claim 2, characterized by the fact that the movable means for closing the free space between the runways of the cradle and the runways of the facing rack are constituted of bars hinged to the ends of the runways of the cradle, the bars having a length greater than the free space existing between the runways of the cradle and the runways of the racks, and having a profile corresponding to that of the support rails for the carriage on said runways, which bars can pivot between a raised position, where they do not interfere with the movements of the cradle and of the truck carrying it, and a lowered position, with their free ends bearing on associated support members at the ends of the runways of the facing rack.

4. Lifting carrier truck according to Claim 3, characterized by the fact that the bars are each equipped with mechanical transmission means for connecting with respective motors, one single common motor being provided for the pair of bars situated on the same side of the cradle, and capable of being actuated independently of the common motor coupled to the bars situated on the opposite side of the cradle.

5. Lifting carrier truck according to Claim 3, characterized by the fact that the mechanical transmission means for connecting the bars to the respective motors comprise, for each bar, a crank connected by means of an associated connecting rod to a second crank integral with a motor shaft, one common motor shaft being provided for the bars situated on the same side of the cradle, this shaft being connected to a relative motor.

6. Lifting carrier truck according to Claim 2, characterized by the fact that the members for horizontally locking and accurately centring the cradle with respect to the preselected rack are constituted, on each side of the cradle, of a slider slidable parallel to the runways of the cradle, and movable between a retracted position, where it does not project beyond the sides of said cradle, and an extended position, projecting towards the facing rack, in correspondence with which each rack possesses a recessed seating, into which the slider engages with limited transverse play.

7. Lifting carrier truck according to Claim 6, characterized by the fact that the sliders are each equipped with mechanical transmission means for connecting to a respective motor, each motor being capable of being operated independently of the motor connected to the slider situated on the opposite side of the cradle.

8. Lifting carrier truck according to Claim 7, characterized by the fact that the mechanical transmission means for connecting the sliders with respective motors comprise, for each slider, a connecting rod connected to a crank directly operated by a relative motor.

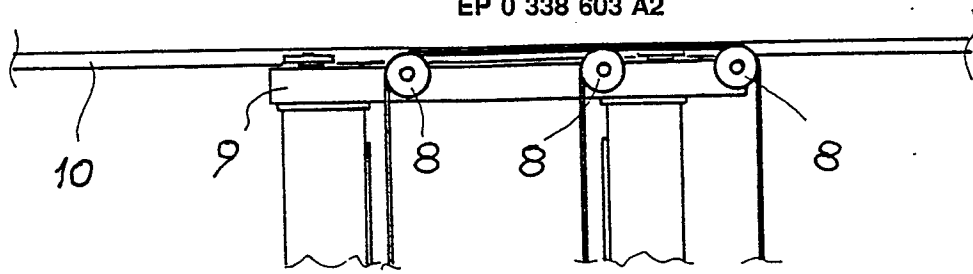


Fig. 1

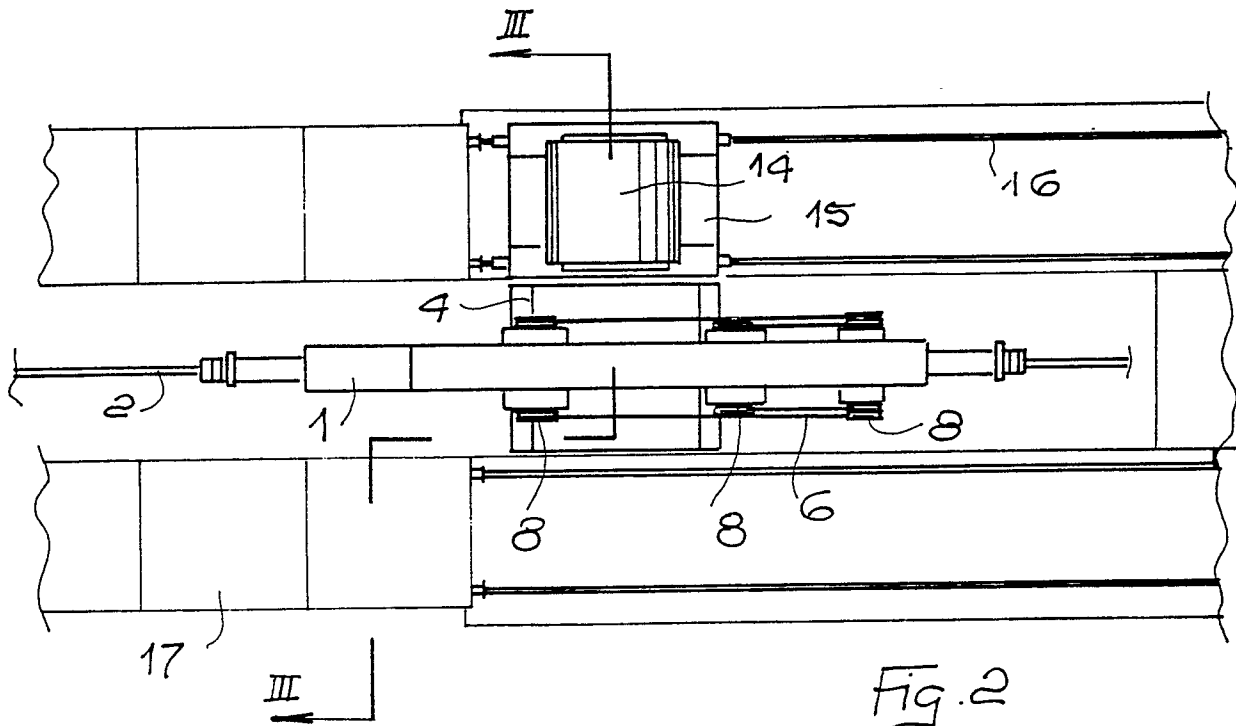
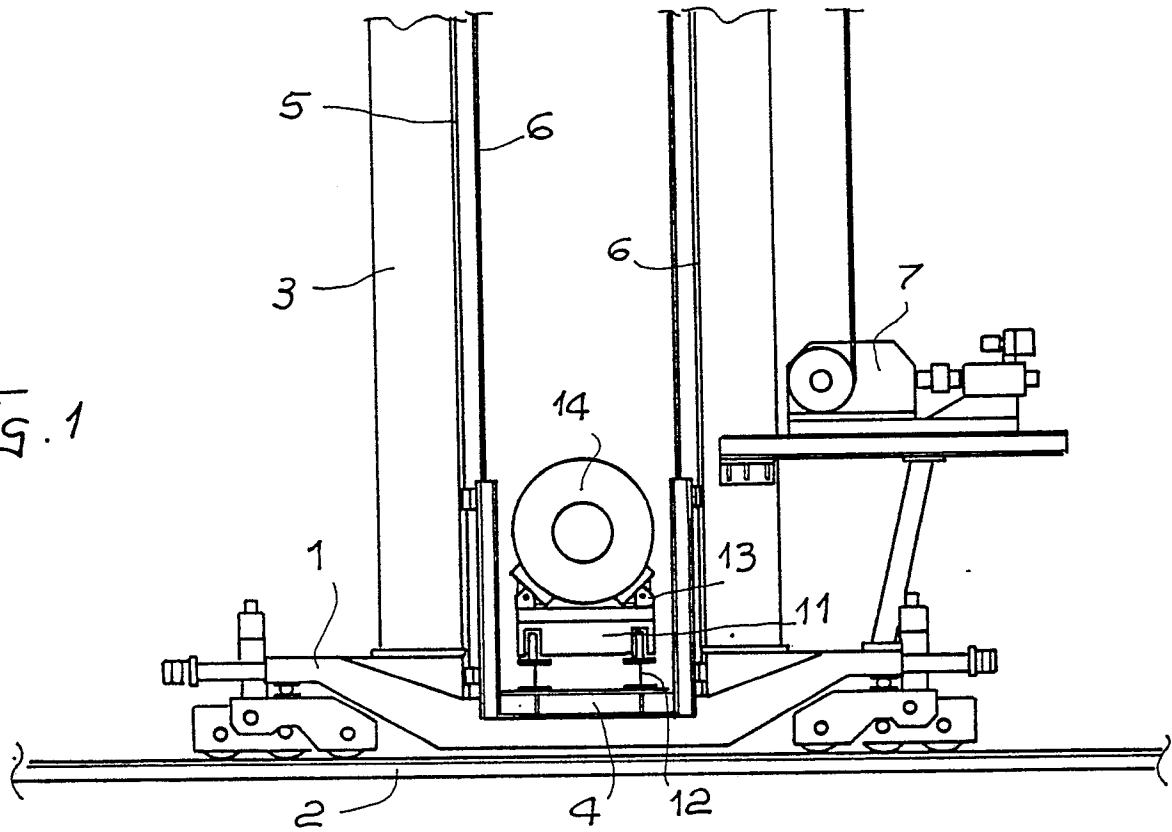


Fig. 2

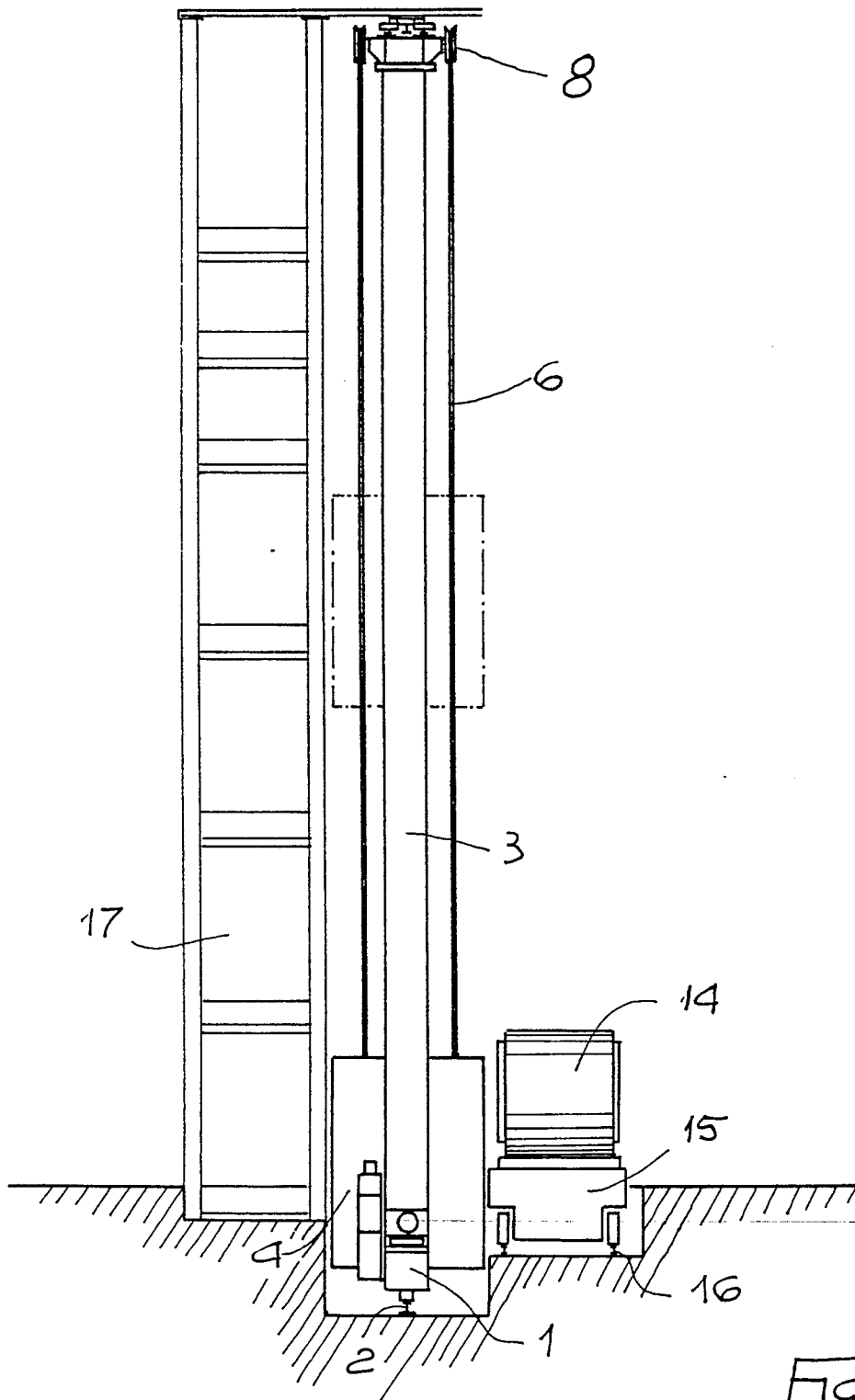


Fig. 3

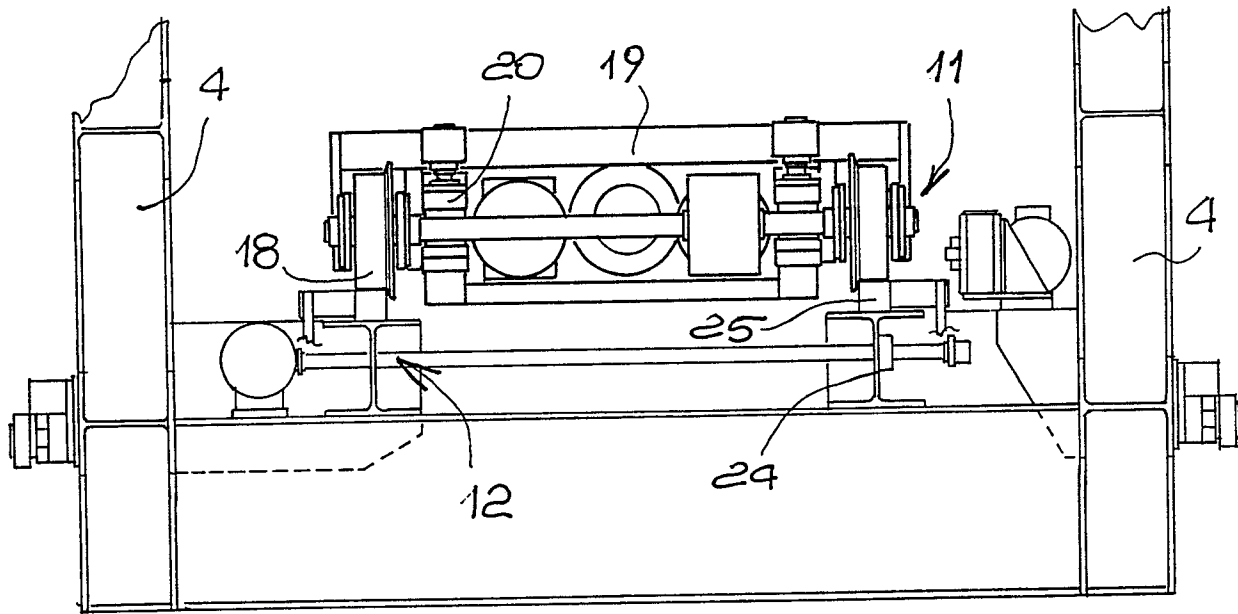


Fig. 5

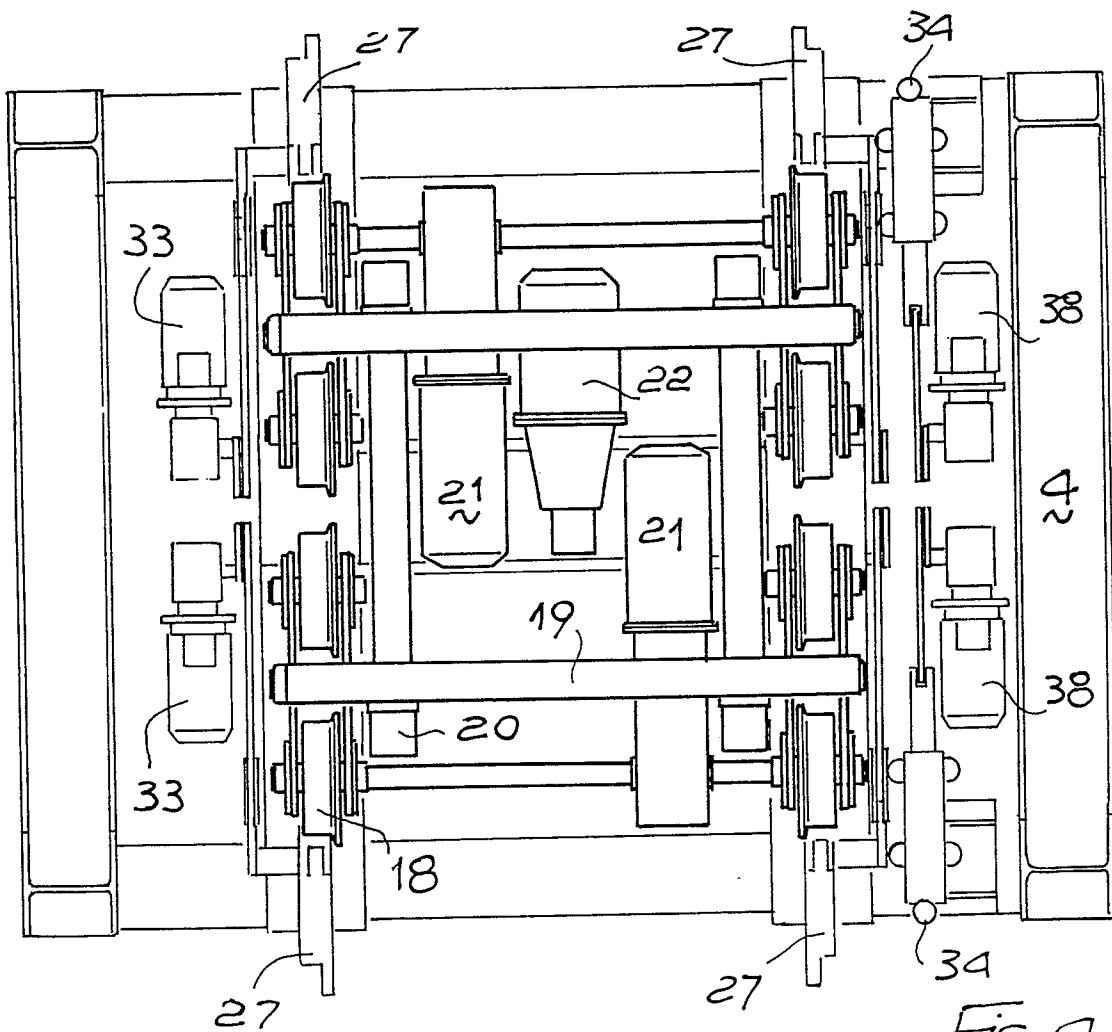


Fig. 4

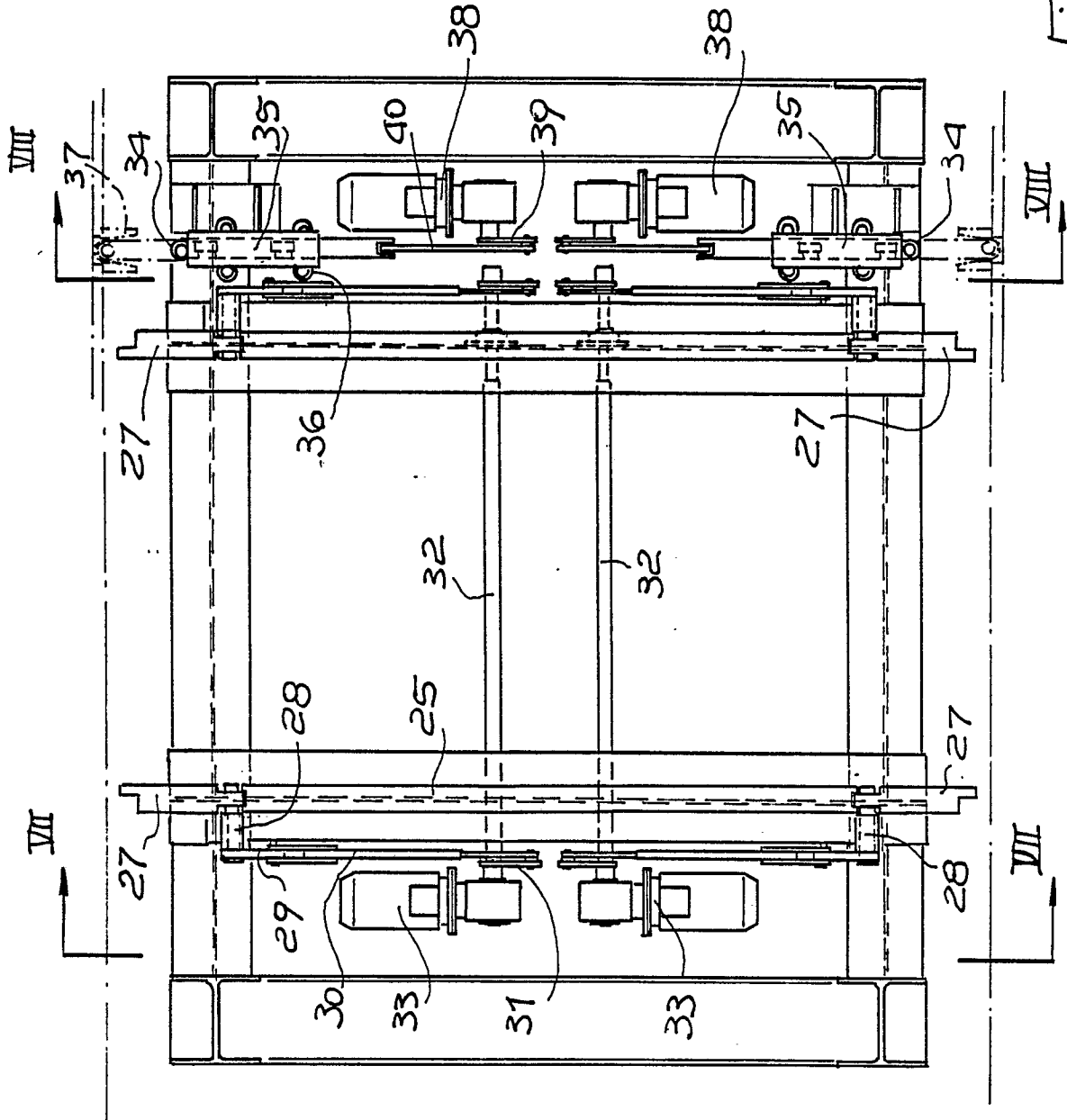


Fig. 6

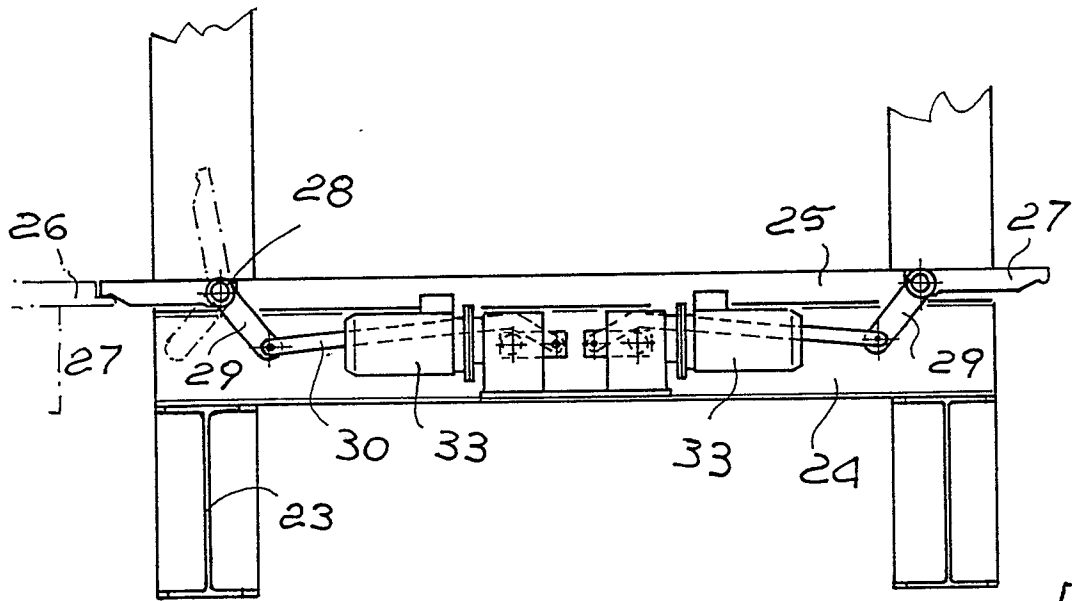


Fig. 7

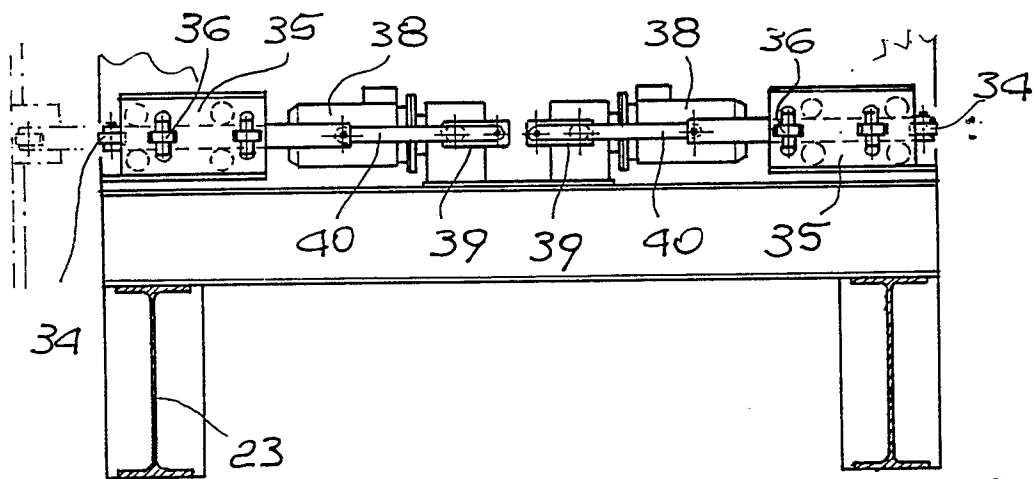


Fig. 8

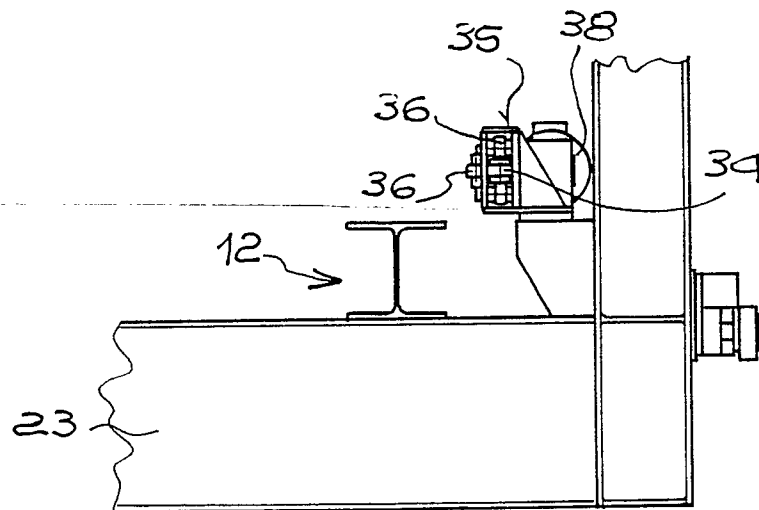


Fig. 9