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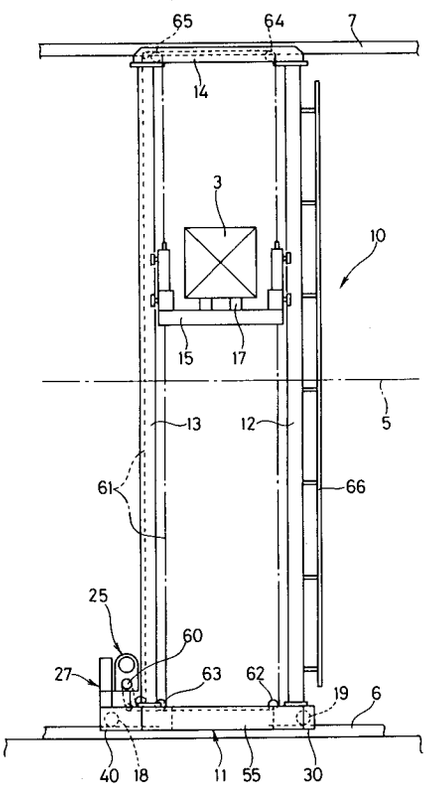
## (54) Handling apparatus for automatic warehousing.

(57) A handling apparatus for automatic warehousing of the type which is supported on and guided by a floor rail installed in, for example, a factory for movement along a predetermined track (5) provided in front of storage sections (2) of a rack (1). The handling apparatus (10) includes a lower frame (11), a pair of longitudinally spaced posts (12,13) extending upward from the lower frame (11), a vertically movable member (15) disposed between the posts (12,13), and a retractable handling element (17) provided on the vertically movable member (15) for entry and discharge of a load (3) relative to the rack (1). The lower frame (11) comprises a driven unit (30) carrying a wheel (18) and having a coupling portion (32) for one (12) of the posts, a drive unit (40) carrying a wheel (18) and having a coupling portion (42) for the other post (13) and a coupling portion (46) for a horizontal drive mechanism, and an intermediate unit (55) positioned between the two units (30,40).

FIG.1

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## FIELD OF THE INVENTION

The present invention relates to a handling apparatus for automatic warehousing of the type which is supported on and guided by a floor rail installed in, for example, a factory for movement along a predetermined track provided in front of storage sections of a rack.

## BACKGROUND OF THE INVENTION

An Automatic warehousing arrangement including racks and a handling apparatus has been known, as described in Japanese Patent Application Laid-Open No. 62-290609. In this known arrangement, a warehousing crane, or a handling apparatus comprises a lower frame, a pair of vertically extending support posts mounted on the lower frame in longitudinally spaced relation, an upper frame interconnecting the top ends of the support posts, and a vertically movable carriage guided along the suppot posts.

The lower frame carries a driving wheel and a driven wheel which are movable in rolling contact with a lower guide rail laid on the floor, the driving and driven wheels being disposed in longitudinally spaced relation. The lower frame also has mounted thereon a drive motor for driving the driving wheel, and a carriage elevating device for driving the vertically movable carriage to move upward and downward via a suspension chain. The vertically movable carriage has a load transfer device mounted thereon.

According to this known arrangement, the transfer of a load between the rack and the warehousing crane can be carried out by a combination of longitudinal movement of the warehousing crane on a predetermined track extending along the front side of the rack, an ascending and descending movement of the vertically movable carriage, and lateral stretching and retracting movement of the load transfer device. For this purpose, the longitudinal movement of the crane is performed by driving the driving wheel forward or reverse by the driving motor.

Usually, a warehousing crane is of such a configuration that the spacing between its support posts varies according to the configuration of the load to be handled and the height of the support posts varies according to the size of a warehouse in which the crane is to be employed. According to the above described known arrangement, however, the lower frame is a solid structure having a predetermined length. Therefore, the manufacturer is required to fabricate, only after receipt of an order, lower frames of such a configuration as to provide a spacing between support posts which matches the configuration of the load to be handled. This makes it impracticable for the manufacturer to cope with orders received from users.

## DISCLOSURE OF THE INVENTION

Accordingly, it is an object of the present invention to provide a handling apparatus for automatic warehousing which incorporates a lower frame such that major portions of the frame may be consistently used in the manufacture of dimensionally different cranes and may be fabricated prior to receipt of orders.

In order to accomplish this object, according to the invention there is provided a handling apparatus for automatic warehousing of the type which is supported on and guided by a floor rail for movement along a predetermined track provided in front of a rack, the handling apparatus comprising a lower frame, a pair of longitudinally spaced posts extending upward from the lower frame, a vertically movable member disposed between the posts, and a retractable handling element disposed on the vertically movable member for transfer of a load to and from the rack, said lower frame comprising, in combination, a driven unit carrying a wheel and having a coupler portion for one of the posts, a driving unit carrying a wheel and having a coupler portion for the other post and a coupler portion for a horizontal drive mechanism, and an intermediate unit located between the first mentioned two units.

According to such arrangement, the driven unit and the drive unit may be prefabricated at the manufacturer's factory site. Upon receipt of an order from a user, the manufacturer can fabricate an intermediate unit having a length sufficient to provide an interpost spacing suited to the configuration of the load to be handled. Thus, the drivem unit, the drive unit, and the intermediate unit can be coupled together, with the intermediate unit positioned in the middle. Then, posts having a height compatible with the size of a prospective warehouse are coupled with corresponding coupler portions of the driven unit and drive unit, and a horizontal drive mechanism is coupled with the corresponding coupler portion of the drive unit. In this way, a handling apparatus is completed.

Therefore, according to the present invention, driven units and drive units, as major components of lower frame assemblies, may be prefabricated for ready use in constructing dimensionally different handling apparatuses, thus enabling the manufacturer to quickly cope with orders received from users.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a handling apparatus for automatic warehousing according to one em-

bodiment of the present invention;
FIG. 2 is a front view of the handling apparatus shown in FIG. 1;
FIG. 3 is a side view of a lower frame of the handling apparatus;
FIG. 4 is a plan view of the lower frame shown in FIG. 3;
FIG. 5 is a perspective view of a drive unit of the lower frame;
FIG. 6 is a perspective view of a driven unit of the lower frame;
FIG. 7 is a partially cutaway view in perspective showing an intermediate unit of the lower frame;
FIG. 8 is a side view showing a modified form of the drive unit;
FIG. 9 is a front view of the drive unit shown in FIG. 8;
FIG. 10 is a sctional view showing a modified form of the intermediate unit;
FIG. 11 is a sectional view of the intermediate unit of FIG. 10 as seen at a different site;
FIG. 12 is a plan view showing the entire lower frame including the intermediate unit of FIG. 10;
FIG. 13 is a sectional view showing a joint portion between the intermediate unit of FIG. 10 and the driven unit or drive unit; and
FIG. 14 is a partially cutaway side view of that portion which is shown in FIG. 13.

## DESCRIPTION OF EMBODIMENTS

FIGS. 1 through 7 illustrate one embodiment of the invention. A pair of framework-shaped racks are shown in FIGS. 1 and 2, each having a plurality of vertically and horizontally partitioned storage sections 2. Each storage section 2 can support a load 3 directly therein through a support arm or support a load 3 placed on a pallet. The pair of racks 1 are arranged in parallel across a passage 4 within which is disposed a handling apparatus 10 movable on a predetermined track 5.

The handling apparatus 10 includes a carriage body which comprises a lower frame 11, a pair of longitudinally spaced posts 12, 13 mounted upright on the lower frame 11, and an upper frame 14 interconnecting the top ends of the posts 12, 13.

Disposed between the two posts 12, 13 is a vertically movable member 15 on which is mounted a handling element 17 in the form of a fork or the like which is retractably stretchable relative to storage sections 2 through the operation of a stretch / retract motion device 16. The lower frame 11 carries a drive wheel 18 and a driven wheel 19 which are movable in rolling contact with a floor rail 6, the drive wheel 18 and driven wheel 19 being longitudinally spaced from each other. The upper frame 14 carries guide rollers 20 guided along a ceiling rail 7.

The lower frame 11 comprises in combination a driven unit 30 by which is carried the driven wheel 19 and to which is coupled the one post 12, a drive unit 40 by which is carried the drive wheel 18 and to which is coupled the other post 13, and an intermediate unit 55 positioned between the units 30 and 40.

More particularly, the driven unit 30 consists of two halves, right and left, as shown in FIGS. 3, 4 and 6, and comprises two side plates 31, right and left, a flat plate-like post coupler portion 32 integrally formed with the side plates 31 at portions of upper edges thereof that are located outer side when viewed in the longitudinal direction of the lower frame 11, a flat plate-like guide wheel mount 33 integrally formed with the side plates 31 at portions of upper edges thereof that are located inner side when viewed in the longitudinal direction of the lower frame 11, and a cylindrical driven-wheel supporting portion formed at the middle of upper portions of the side plates 31 which extend longitudinally of the driven unit 30. The two halves are combined into an integral unit by welding or otherwise.

The two side plates 31 are each formed with longitudinally spaced rivet holes 35 for coupling with an intermediate unit 55. The post coupler portion 32 and guide wheel mount 33 are formed with vertically extending bolt holes 36, 37. The driven wheel 19 is supported between the two side plates 31 by means of an axle 38 passed through the driven wheel supporting portion 34.

The post 12 has, at its lower end, a flange 21 integrally formed therewith. The post 12 is mounted in position in such a way that the flange 21 is first placed on the post coupler portion 32 and then secured thereto by bolts and nuts 22 through bolt holes formed in the flange 21 as the bolt holes are aligned with corresponding bolt holes 36 of the post coupler portion 32, whereby the post 21 is coupled in its upright position with the post coupler portion 32.

The driven unit 40 consists of two halves, right and left, as shown in FIGS. 3 to 5, and comprises two side plates 41, right and left, a flat plate-like post coupler portion 42 integrally formed with the side plates 41 at the upper edges thereof and in the longitudinal midportion of the drive unit 40, a flat plate-like guide wheel mount 43 integrally formed with the side plates 31 at portions of upper edges thereof that are located inner side when viewed in the longitudinal direction of the lower frame 11, a flat plate-like vertical drive mechanism coupler portion 44 integrally formed with the one side plate 41 at a portion of the upper edge thereof that is located outer side when viewed in the longitudinal direction of the lower frame 11, a cylindrical drive-wheel supporting portion 45 formed at

the middle of upper portions of the side plates 41 which extend longitudinally of the drive unit 40, and a vertically extending plate-like horizontal drive mechanism coupler portion 46 integrally formed with the side plates 41 at the outer ends thereof as viewed in the longitudinal direction of the lower frame 11. The two halves are combined into an integral unit by welding or otherwise.

The two side plates 41 are each formed with longitudinally spaced rivet holes 47 for coupling with an intermediate unit 55. The post coupler portion 42, guide wheel mount 43, and vertical drive mechanism coupler portion 44 are formed with vertically extending bolt holes 48, 49, 50. The horizontal drive mechanism coupler portion 46 is formed with horizontally extending bolt holes 51. The drive wheel 18 is supported between the two side plates 41 by means of an axle 52 passed through the drive wheel supporting portion 45.

The post 13 has, at its lower end, a flange 23 integrally formed therewith. The post 13 is mounted in position in such a way that the flange 23 is first placed on the post coupler portion 42 and then secured thereto by bolts and nuts 24 through bolt holes formed in the flange 23 as the bolt holes are aligned with corresponding bolt holes 48 of the post coupler portion 42, whereby the post 13 is coupled in its upright position with the post coupler portion 42. The vertical drive mechanism 25 is coupled with the vertical drive mechanism coupler portion 44 by placing the former on the latter, then securing by bolts and nuts 26 through bolt holes provided in the vertical drive mechanism 25 as the bolt holes are aligned with corresponding bolt holes 50 of the coupler portion 44. The horizontal drive mechanism 27 is coupled with the horizontal drive mechanism coupler portion 46 in such a way that the mechanism 27 is abutted against the horizontal drive mechanism coupler portion 46 and then secured thereto by bolts and nuts 28 through bolt holes provided in the mechanism 27 as the bolt holes are aligned with corresponding bolt holes 51 of the coupler portion 46.

The intermediate unit 55 consists of a pair of channel sections 56, right and left, as shown in FIGS. 3, 4 and 7. These channel sections 56 are arranged so that their respective openings are oriented outward. Each channel section 56 is formed at opposite ends thereof with rivet holes 57, 58 which coincide with rivet holes 35, 47 of the side plates 31, 41. The interior of the channel sections 56 are utilized for wiring purposes and, therefore, the channel sections are each removably provided with a cover 59 at their open end side.

The intermediate unit 55 is coupled with both the driven unit 30 and the drive unit 49 in such a way that the channel sections 56 are abutted sideways against respective side plates 31 and 41 of the driven unit 30 and drive unit 40, rivets 29 being then fitted through aligned rivet holes 35, 57; 47, 58.

In FIGS. 1 through 4, the vertical drive mechanism 25 comprises a motor with a reduction gear or the like, with a drive wheel 60 mounted on the output shaft of the motor. A pair of rope elements or chains 61 trained around the drive wheel 60 is connected at one end to lower portions of a vertical movable member 15 at opposite ends thereof via lower guide wheels 62, 63 disposed at guide wheel mounts 33, 43. The other ends of the chains 61 are connected to upper portions of the vertically movable member 15 at opposite ends thereof via upper guide wheels 64, 65 provided on the upper frame 14. The horizontal drive mechanism 27 comprises a motor with a reduction gear or the like, and its output shaft is geared to the driving wheel 18. A ladder 66 is provided on the outer side of the post 12 as viewed in the direction of horizontal movement of the handling apparatus 10.

The manner of assembly operation will now be described.

Driven units 30 and drive units 40 are prefabricated at the manufacturer's factory. Upon receipt by the manufacturer of an order from a user, an intermediate unit 55 is fabricated which has a length L sufficient to provide such a spacing between posts 12 and 13 as is suited to the configuration of a load to be handled. An intermediate unit 55 is positioned between a driven unit 30 and a drive unit 40, and these units are coupled together by riveting. Then, posts 12, 13 having a height compatible with the size of the warehouse are coupled with respective post coupler portions 32, 42 of the driven unit 30 and drive unit 40 via bolts and nuts 22, 24. Top ends of the two posts 12, 13 are interconnected by an upper frame 14. A vertical drive mechanism 25 is coupled with a vertical drive mechanism coupler portion 44 of the drive unit 40 via bolts and nuts 26, and similarly a horizontal drive mechanism 27 is coupled with a horizontal drive mechanism coupler portion 46 via bolts and nuts. Thus, a handling apparatus 10 is completed.

Such a handling apparatus 10 and racks 1 are assembled at an erection site to form an automatic warehouse. In an automatic warehouse constructed in such a way, entry and discharge of a load 3 is carried out relative to a target storage section of a rack 1 by a combination of horizontal movement of the handling apparatus 10 on a predetermined track 5, ascending and descending movement of the vertically movable member 15, and lateral stretching and retracting movement of the handling element 17.

In the foregoing embodiment, coupling of the driven unit 30 and drive unit 40 with the intermediate unit 55 is effected by rivets 29. According to

the invention, such coupling may be carried out by other fastening elements, such as bolts and nuts, or welding, for example.

FIGS. 8 and 9 show a modified form of drive unit 40. In the embodiment illustrated in FIGS. 1 through 7, more particularly in FIG. 5, the vertical drive mechanism coupler portion 44 for mounting the vertical drive mechanism 25 to the drive unit 40 is integrally formed with the drive unit 40 by casting or otherwise. In the present modification, however, such a coupler portion is formed as a separate structure.

More particularly, a mounting seat 71 is removably provided in the drive unit 40. The mounting seat 71 is casting made and is formed on its underside with a lower coupler portion 72 facing sideways or downward and on its upperside with an upward facing upper coupler portion 73. The mounting seat 71, with the lower coupler portion 72 abutted against a side or upper surface of the body of the drive unit 40, is removably mounted to the drive unit 40 via a fastening element, such as a bolt.

The vertically drive mechanism 25 is mounted to the upper coupler portion 73 of the mounting seat 71. The vertical drive mechanism 25 has a motor 76 and a reduction gear 77. The reduction gear 77 is first abutted against the upper surface of the upper coupler portion 73 and is then removably mounted to the upper coupler portion 73 via a fastening element 78, such as a bolt.

The horizontal drive mechanism coupler portion 46 is integrally formed with the drive unit 40 in a sideward facing fashion.

According to such arrangement, plural kinds of mounting seats 71 and plural kinds of vertical drive mechanisms 25 are prefabricated at the manufacturer's factory. Upon receipt by the manufacturer of an order from a user, a horizontal drive mechanism 27 is mounted to the horizontal drive mechanism coupler portion 46 of the drive unit 40 of a lower frame 11 assembled according to the type or variety of apparatus ordered. The vertical drive mechanism 25 is mounted to the drive unit 40 via the mounting seat 71.

In this modified form, the drive unit 40 has no coupler portion for the vertical drive mechanism 25. Therefore, where the drive unit 40 is made of castings, molten metal run is so much improved and accordingly it can be fabricated in a more satisfactory condition. If it is desired to mount a different type of vertical drive mechanism, the existing vertical drive mechanism, together with the mounting seat 71 therefor, may be replaced in its entirety. In this way, the mounting seat 71 may be simultaneously replaced correspondingly to the change in variety of vertical drive mechanism 25. In this way, replacement with a different variety can be readily effected.

FIGS. 10 through 14 illustrate a modified form of intermediate unit 55. While this embodiment is same with the earlier described form in that the intermediate unit 55 comprises a pair of channel configured members, it is different in that the pair of channel members are disposed in face-to-face relation. The channel members each comprise, in integral fashion, a vertically extending longitudinal plate portion 81, transverse plate portions 82A, 82B extending laterally inwardly of the intermediate unit 55 from upper and lower ends of the longitudinal plate portion 81, a pair of locking plate portions 83A, 83B extending from the inner ends of the transverse plate portions 82A, 82B in vertically opposed directions, and a bulged portion 84 formed midway in the heightwise direction of the longitudinal plate portion 81 and projecting inwardly of the intermediate unit 55,

The bulged portion 84 occupies a larger part of the longitudinal plate portion 81 and is formed in such a way as to extend vertically via an upper bulge start point 85A and a lower bulge start point 85B which are inclined in an obliquely opposed fashion. Each channel member of the intermediate unit 55 which is formed in such a fashion has a pair of receses 86A, 86B, upper and lower, which are surrounded by transverse plate portions 82A, 82B, locking plate portions 83A, 83B, and upper and lower bulge start points 85A, 85B.

Rivet holes 57, 58 for coupling the intermediate unit 55 with both the drive unit 40 and the driven unit 30 are provided in the longinal plate portion 81 at both ends thereof as viewed in the longitudinal direction of the intermediate unit 55. In this embodiment, the drive unit 40 and driven unit 30 are each formed of an integral casting having a pair of vertically extending side plate portions 91, right and left, a flat plate-like post coupler portion 92 located between upper edges of the side plate portions 91, and an intermediate unit coupler members 93 projecting outwardly from outer surfaces of the side plate portions 91. The intermediate unit coupler members 93 are formed respectively with rivet holes 94 aligning with rivet holes 57, 58. Thus, the driven unit 30, drive unit 40, and intermediate unit 55 can be coupled together by fitting rivets 29 into rivet holes 57, 94 and 58, 94. In that case, the intermediate unit coupler member 93 is brought into abutment against the inner surface of the bulged portion 84.

The upper transverse plate portion 82A is formed at plural locations with vertically extending bolt holes 102 alignable with bolt holes 101 formed in the driven unit 30 and drive unit 40. At locations at which bolt holes 102 are formed there are formed through holes 103 extending from the upper bulged portion start point 85 A to an upper

portion of the bulged portion 84, which through holes 103 can be utilized in inserting bolts 104 upwardly through bolt holes 101, 102. Through insertion of such bolt 104 from below the bolt head 104a of the bolt is positioned in the upper recess 86A.

A whirl stop member 105 inserted from one longitudinal end of the intermediate unit 55 is disposed in the upper recess 86A. This whirl stop member 105 is a strip member having a sectional configuration consistent with the interior configuration of the recess 86A. On the top of the whirl stop member 105 there is formed an open topped groove 106 which permits entry of bolt head 104a only. The upper bulge start portion 85 A, at a specified location therein, is threadingly engaged by a slip-off preventing bolt 107 which is abuttable against the outer surface of the whirl stop member 105.

Therefore, after the driven and drive units 30, 40 and the intermediate unit 55 are coupled together, bolt 104 is inserted upwardly through the through hole 103 into bolt holes 101, 102, with bolt head 104a positioned within the upper recess 86A, and then whirl stop member 105 is inserted from one end of the intermediate unit 55 until its bolt head 104a is received in the open-topped groove 106. In this way, a predetermined number of bolts 104 can be enabled to project upwardly from the post coupler portion 92.

In this embodiment, the two posts 12, 13 are of a square cylinder shape and has at its lower end a flange 108 integrally formed therewith, which flange 108 is formed with a plurality of vertically extending bolt holes 109 alignable with the bolt holes 101 formed in the driven and drive units 30, 40. Therefore, with bolts 104 enabled to project from the post coupler portion 92, the flange 108 is placed on the post coupler portion 92 in such a way to enable the bolts 104 to pass through bolt holes 109, and then nuts 110 are applied on the tops of the bolts 104. Thus, posts 12, 13, in their upstanding position, are coupled with the post coupler portions 92.

As FIGS. 11 and 12 show, a pair of coupling plates 111, upper and lower, are disposed in a longitudinal center portion of the intermediate unit 55, the coupling plates 111 being coupled with the channel section members through rivets 112. The interior of the lower recess 86B is utilized for placement of wiring 113 or the like.

According to such a modified form of intermediate unit, there is no need for provision of such a cover 59 as used in the FIG. 7 embodiment, and some cost reduction can be achieved accordingly. Since channel section members are inwardly arranged, it is unlikely that the wiring 113 installed within such section member is exposed to the surface. This permits the lower frame 11 to be neatly constructed. The fact that the channel shaped intermediate unit 55 has an inwardly bulged portion 84 makes it possible to reduce possible outward bulging of the driven unit 30 and drive unit 40 accordingly. Thus, these units can be advantageously and inexpensively manufactured. The intermediate unit 55 has locking plate portions 83A, 83B and bulged portions 84 which are operative as ribs, and this provides greater torsion rigidity and sufficient strength characteristics.

In the above embodiment, bolt head 104a is prvented from whirling by means of the whirl stop member 105. As an alternative, it may be arranged that nut 110 is set in recess 86A thereby to stop whirling.

## Claims

1. A handling apparatus for automatic warehousing of the type which is supported on and guided by a floor rail for movement along a predetermined track provided in front of a rack, the handling apparatus comprising a lower frame, a pair of longitudinally spaced posts extending upward from the lower frame, a vertically movable member disposed between the posts, and a retractable handling element disposed on the vertically movable member for transfer of a load to and from the rack, said lower frame comprising, in combination, a driven unit carrying a wheel and having a coupler portion for one of the posts, a driving unit carrying a wheel and having a coupler portion for the other post and a coupler portion for a horizontal drive mechanism, and an intermediate unit located between the first mentioned two units.

2. A handling apparatus as set forth in claim 1, further comprising a mounting seat removably provided relative to the lower frame, and a vertical drive mechanism mounted on the mounting seat and geared to the vertically movable member.

3. A handling apparatus as set forth in claim 1, wherein the intermediate unit of the lower frame comprises a pair of channel section-shaped members, right and left, each channel section-shaped member comprising a vertically extending longitudinal plate portion, a pair of transverse plate portions extending inwardly laterally of the intermediate unit from upper and lower ends of the longitudinal plate portion, a pair of locking plate portions extending from respective inner ends of the transverse plate portions in vertically opposed directions, and a bulged portion formed in a vertically

midposition of the longitudinal plate portion and bulging inwardly of the intermediate unit.

**4.** A handling apparatus as set forth in claim 3, further comprising

a bolt hole formed in at least the upper transverse plate portion of the pair of transverse plate portions,

a bolt passing through the bolt hole,

a recess formed by being surrounded by the transverse plate portion which is formed with said bolt hole, the locking plate portion, and an upper bulge start point of the bulged portion of the longitudinal plate portion,

said recess being capable of housing a nut to be brought in thread wngagement with the head of said bolt or said bolt itself, and

a whirl stop member for said bolt head or nut which is insertable from one end of the channel section member located in the longitudinal direction of the intermediate unit.

FIG.1

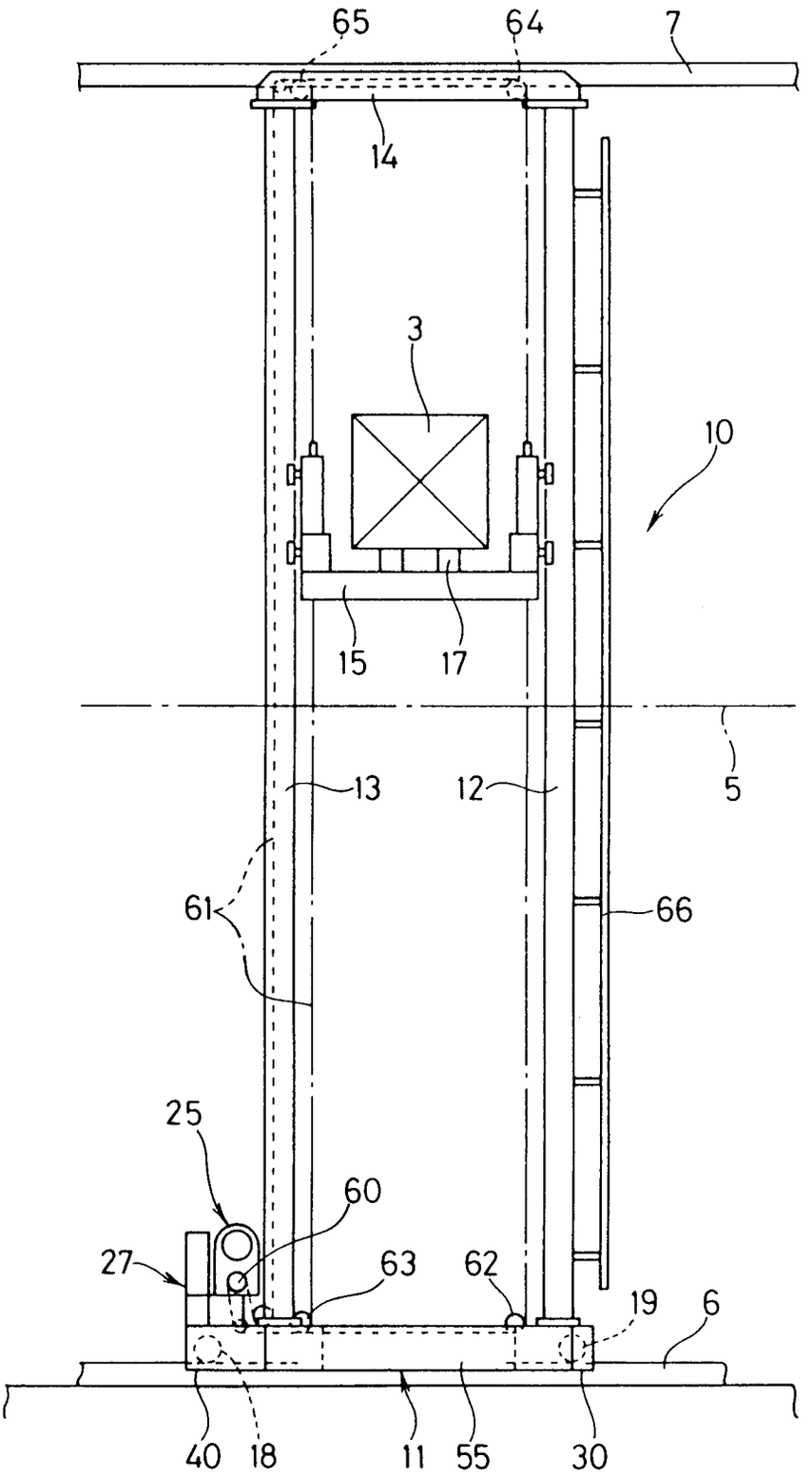

FIG.2

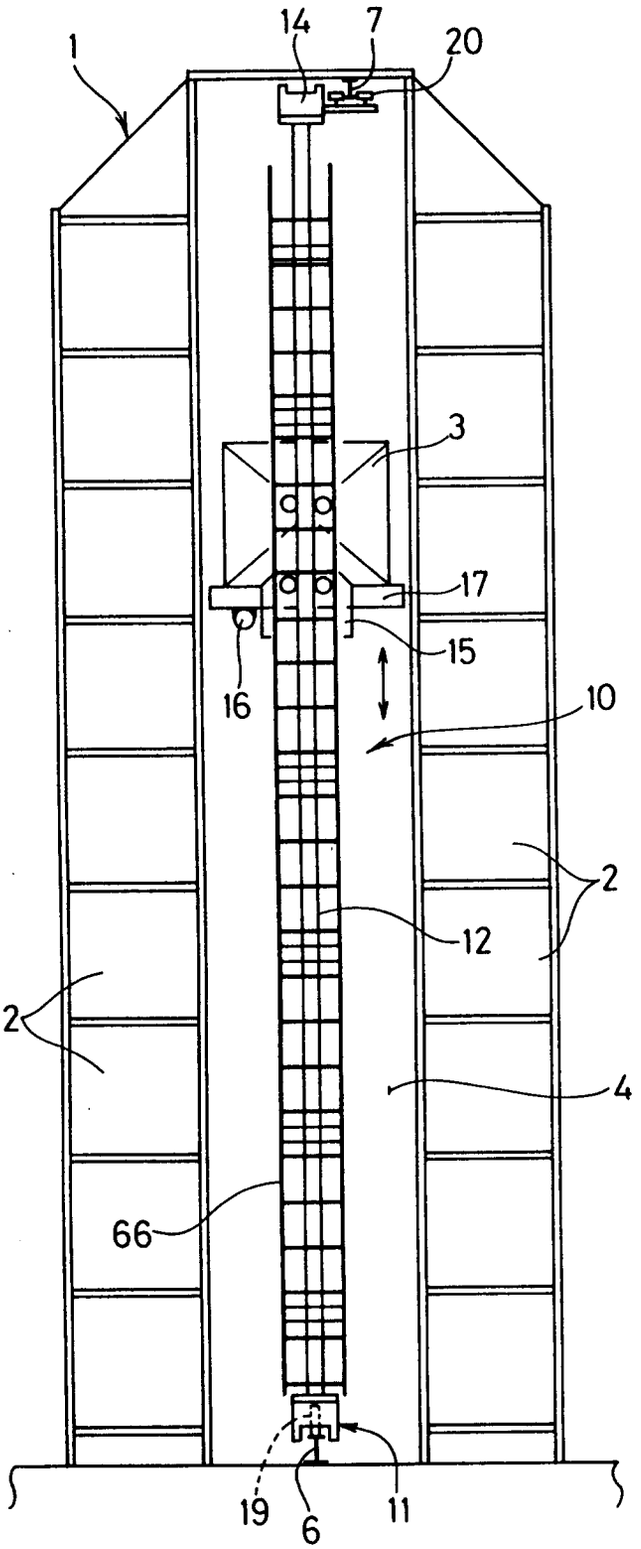

FIG.3

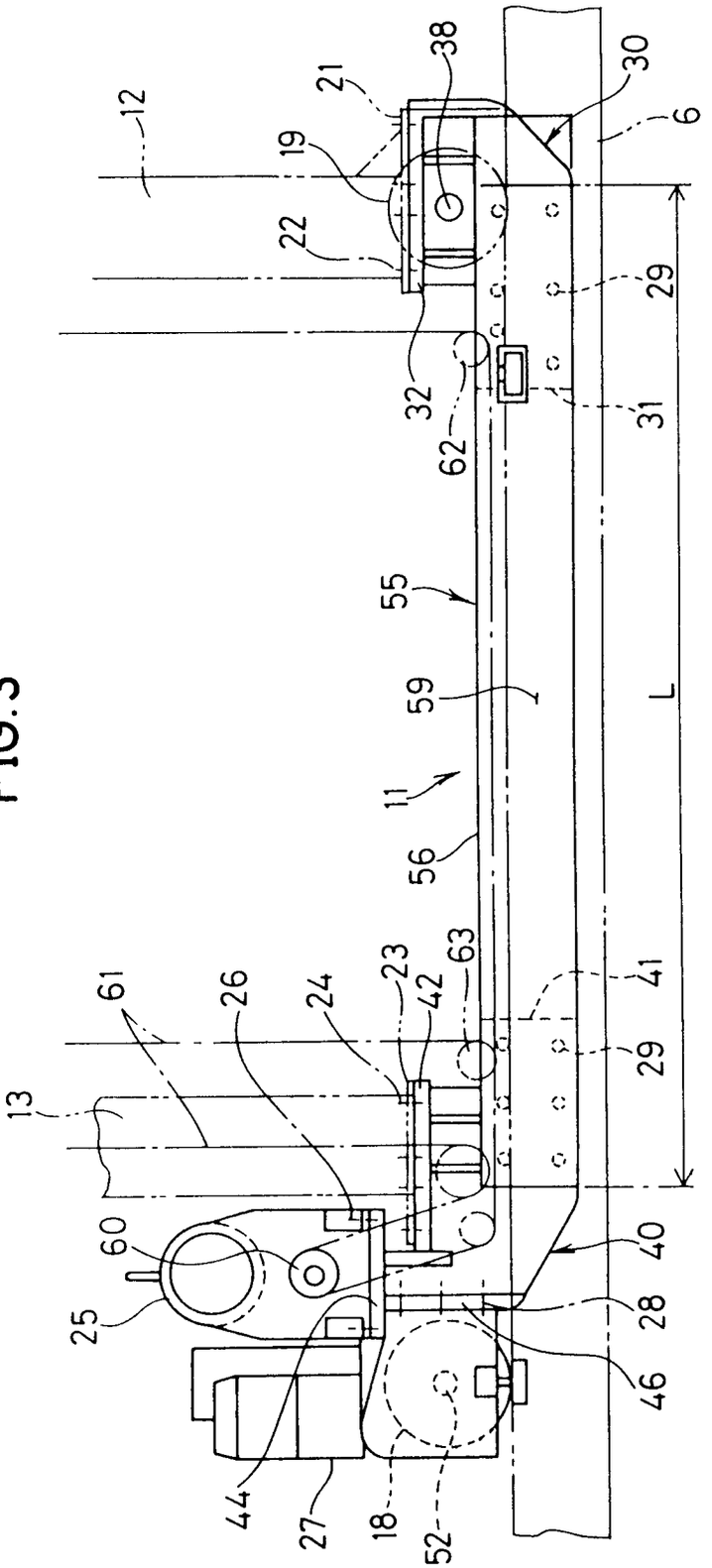
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FIG.4

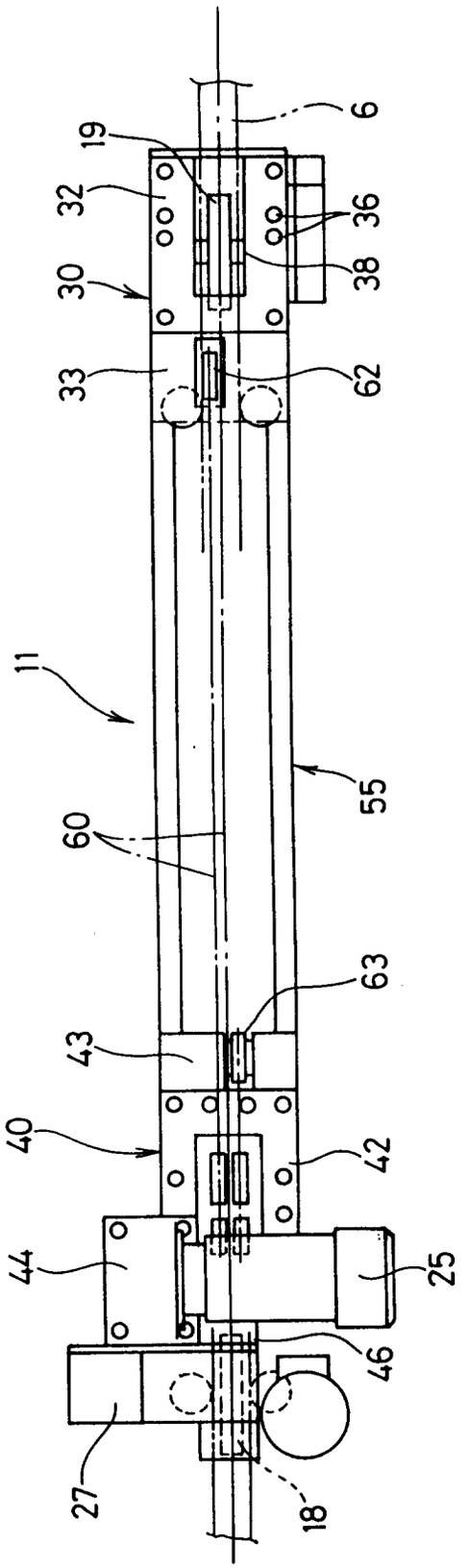

FIG.5

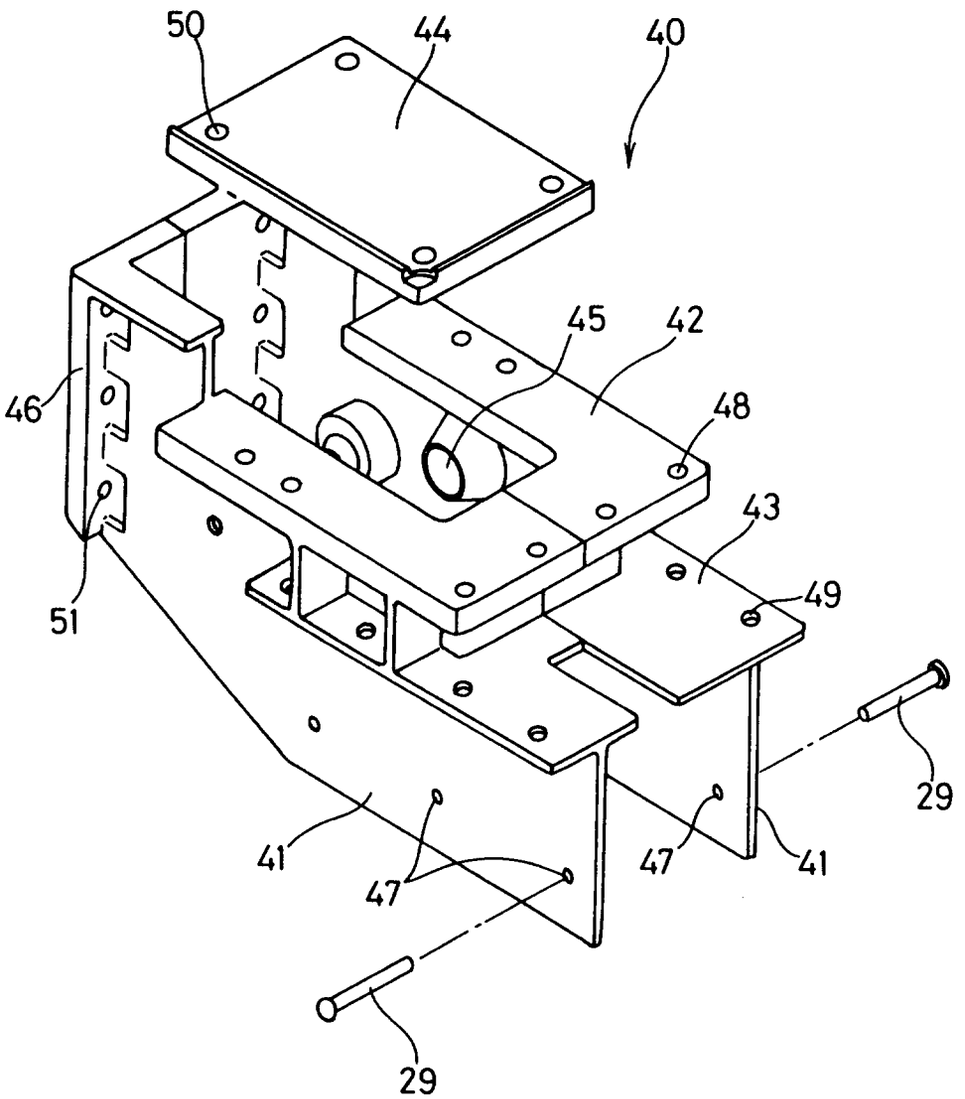

FIG.6

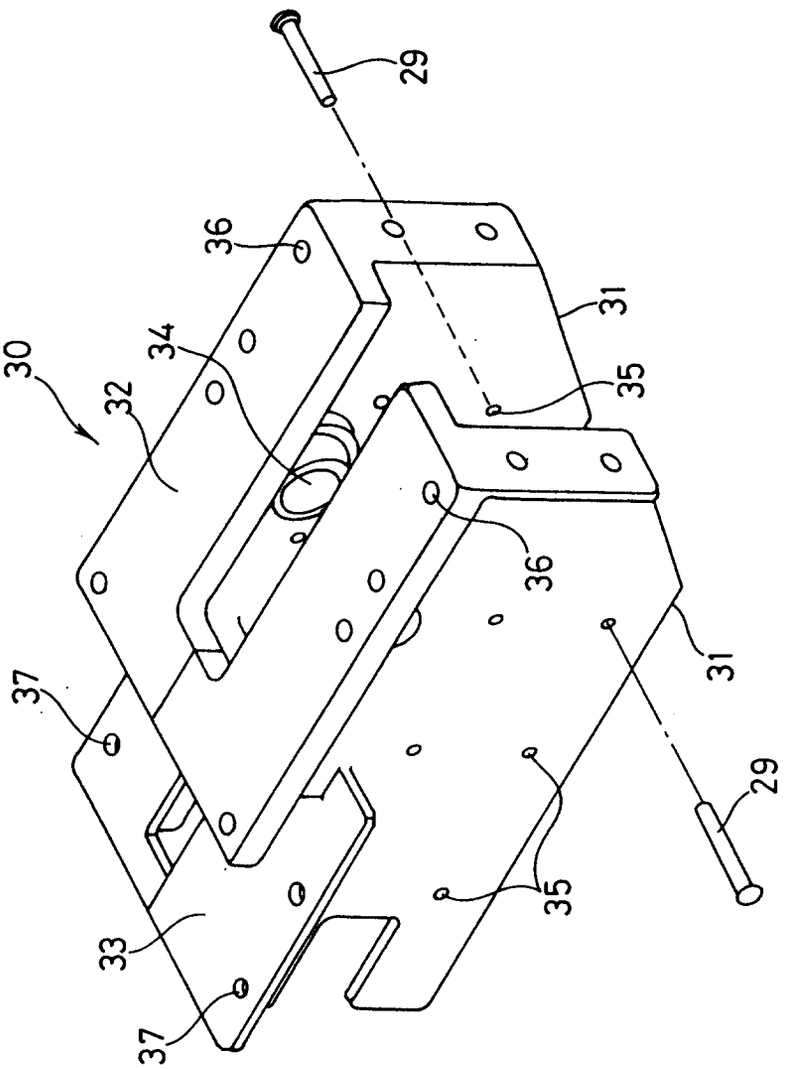

FIG.7

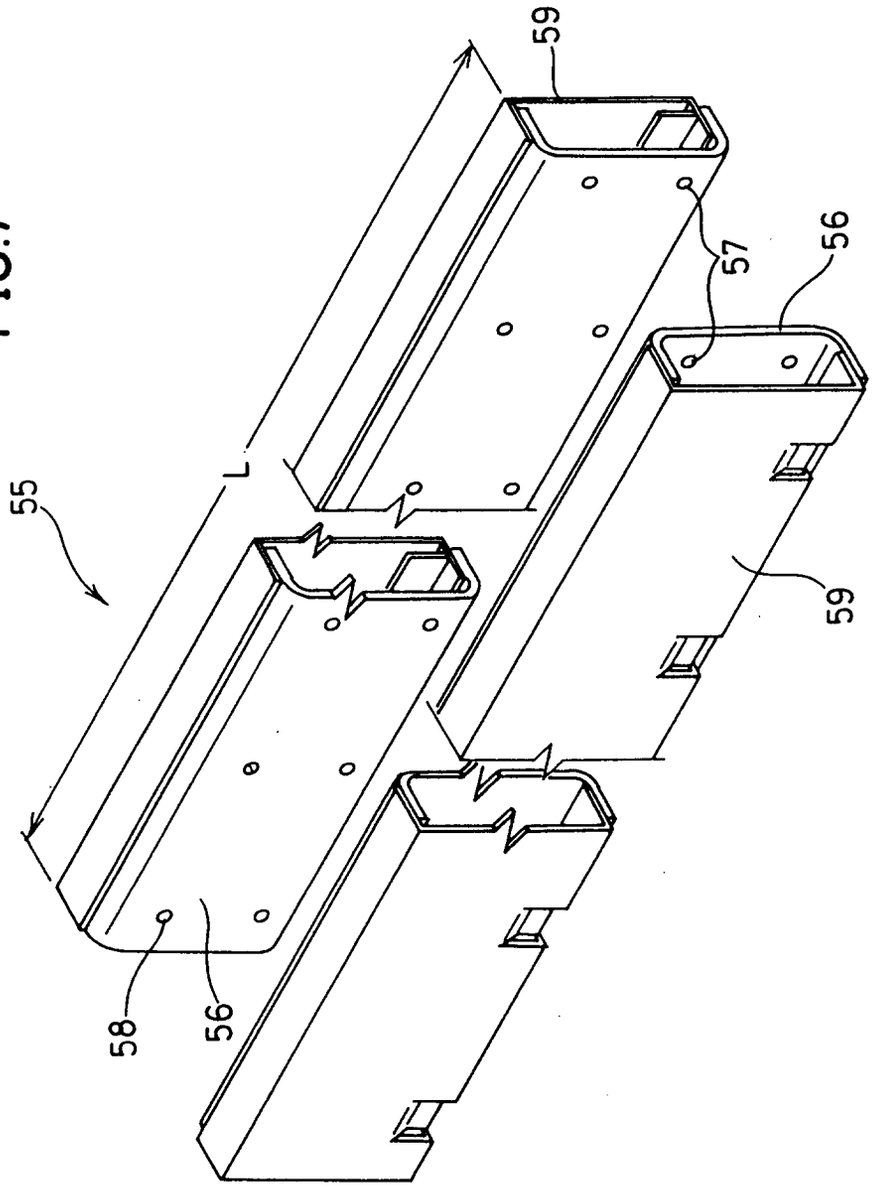

FIG.8

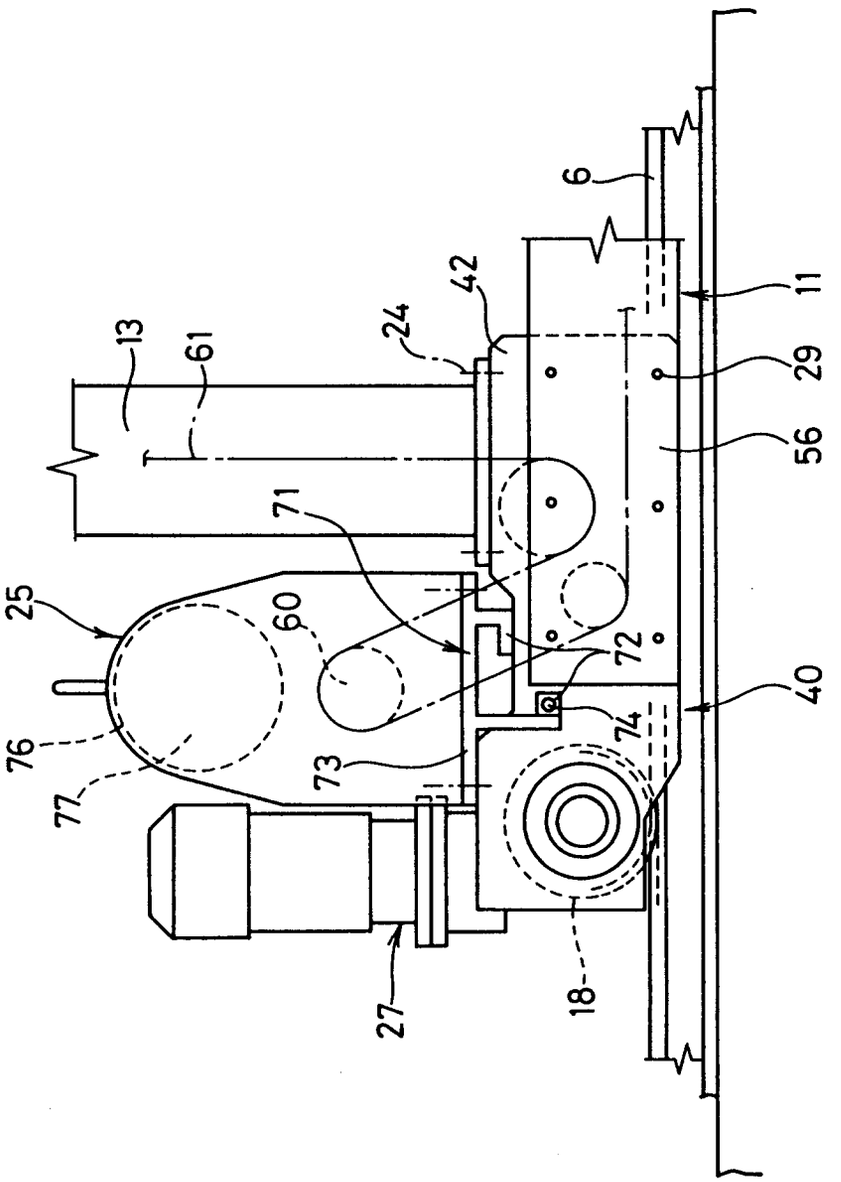

FIG.9

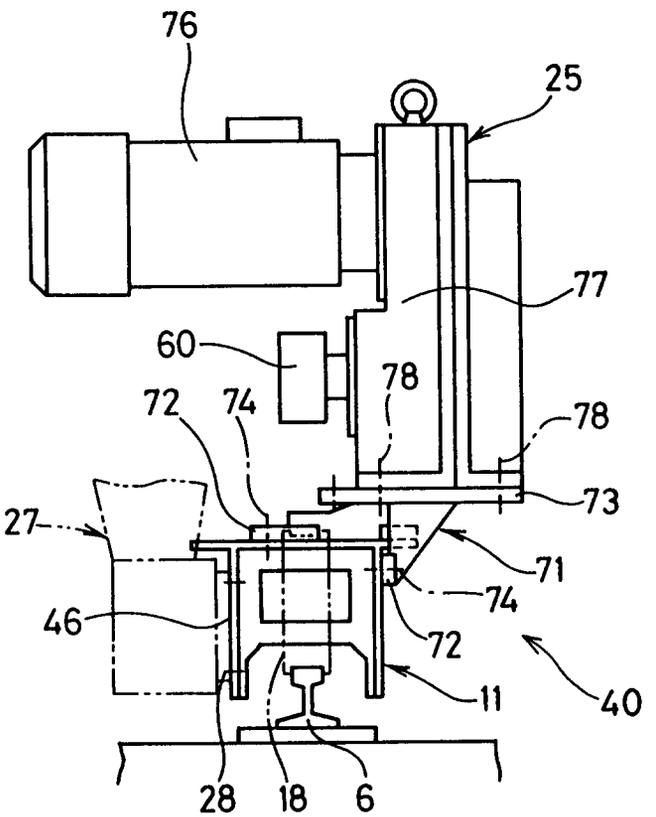

FIG.10

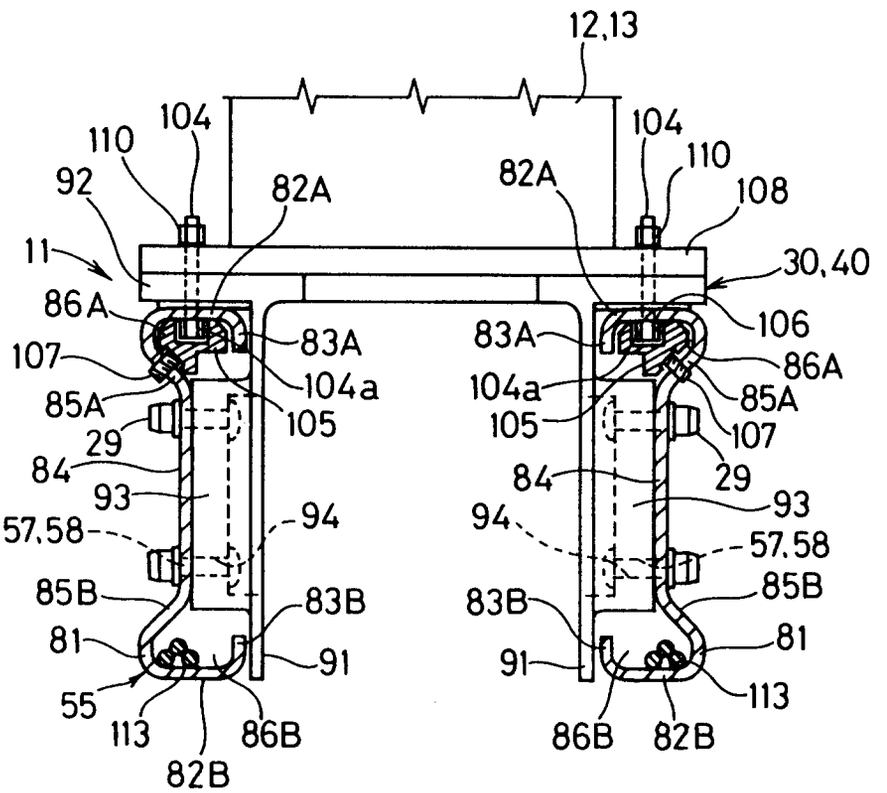
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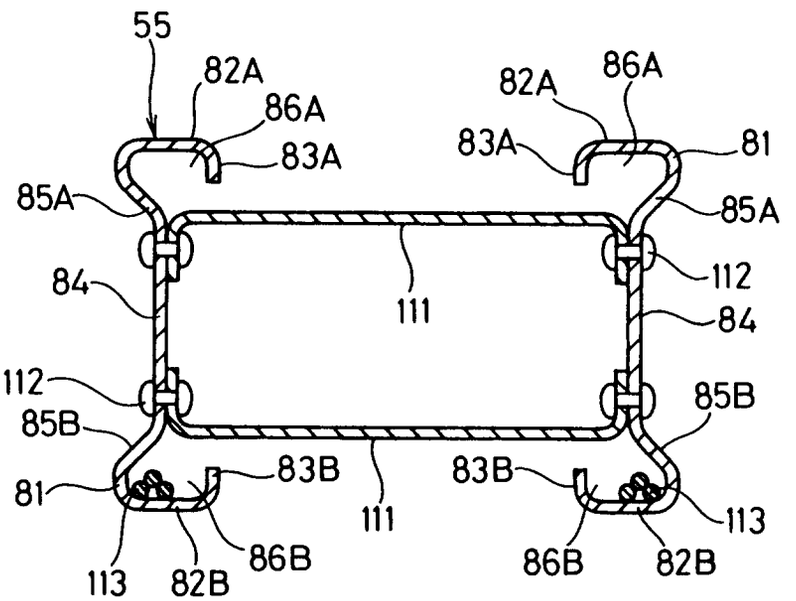
FIG.11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82B

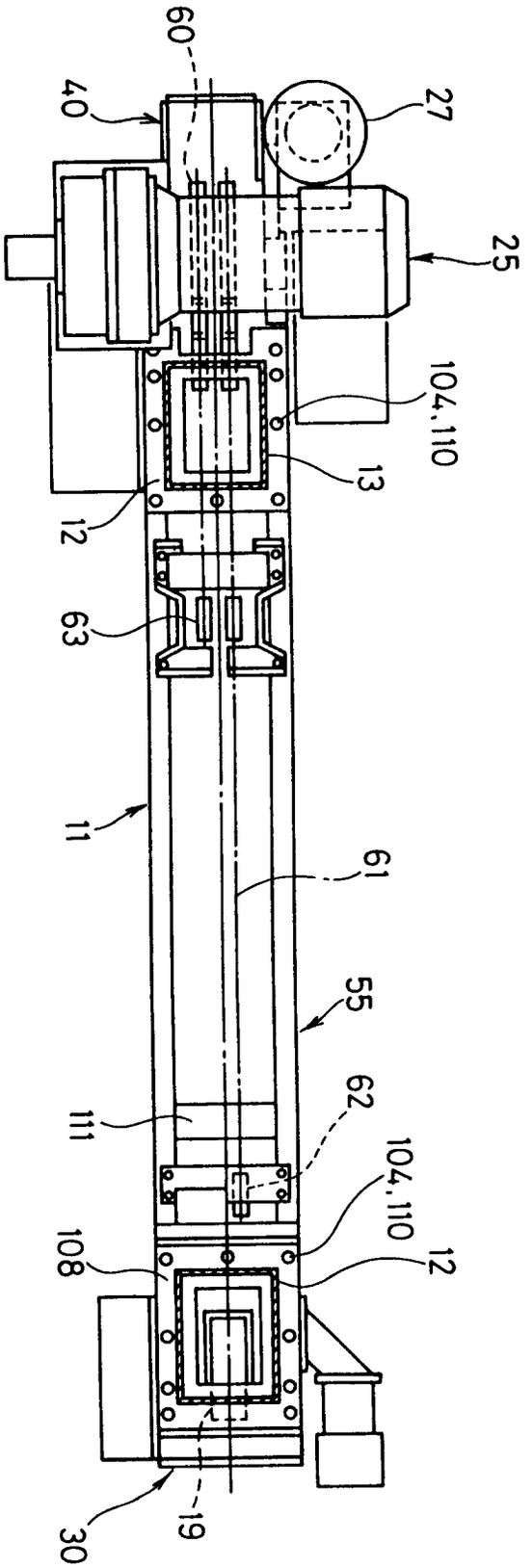
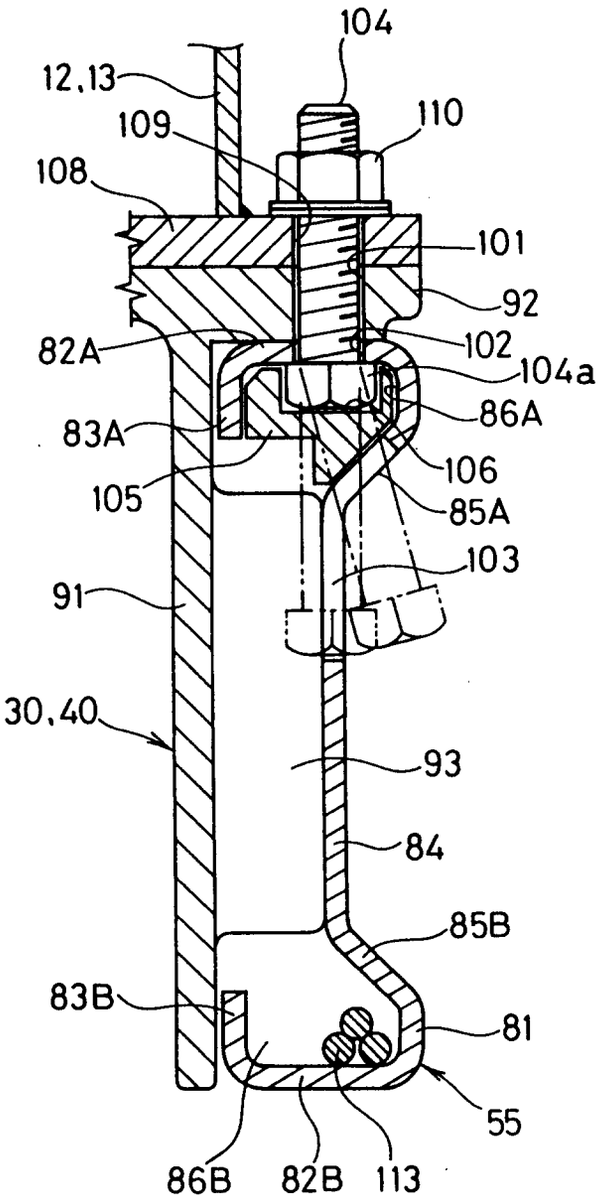



FIG.12

FIG.13


104
12,13
110
109
108
101
92
82A
102
104a
86A
83A
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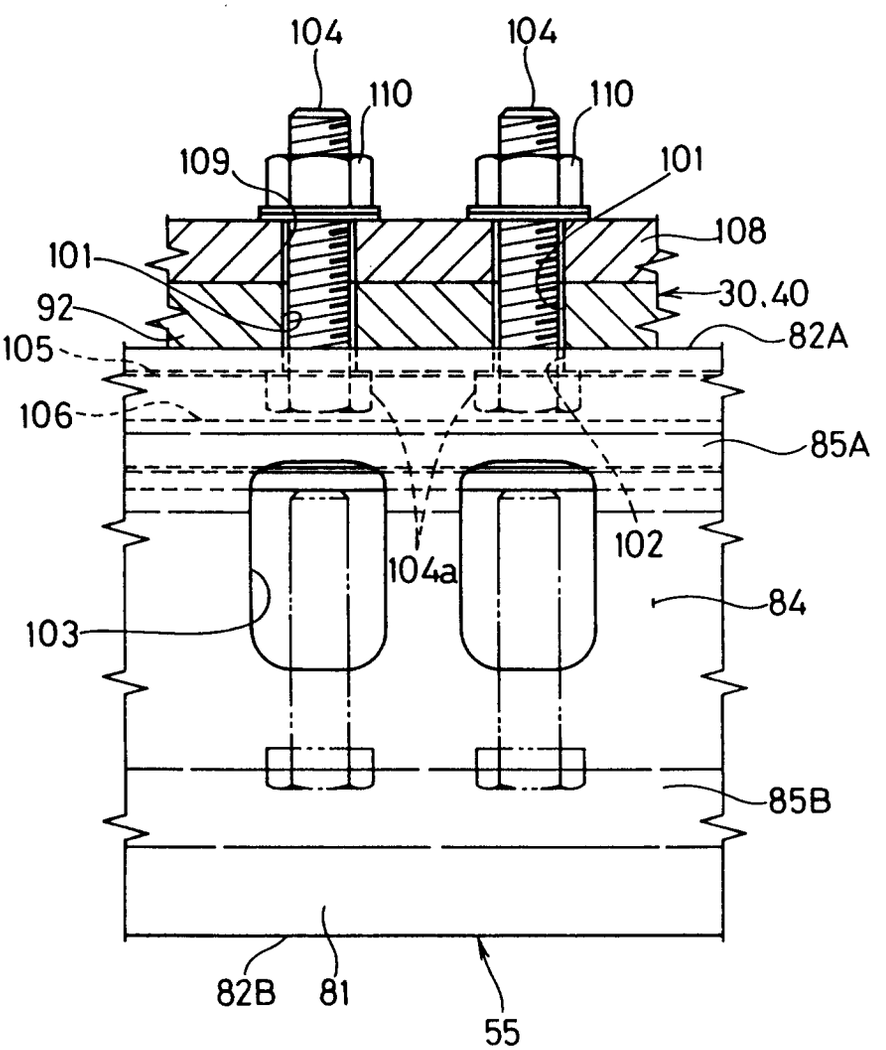
103
91
30,40
93
84
85B
83B
81
55
86B
82B
113

FIG.14


104
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101
101
108
30,40
92
82A
105
106
85A
102
104a
84
103
85B
82B
81
55

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number EP 93109235.7

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| A | US - A - 4 331 418<br>(KLEBE)<br>* Abstract; fig. 1 * | 1 | B 65 G 1/04<br>B 66 F 9/07 |
| A | DE - A - 2 758 226<br>(MITSUBISHI JUKOGYO K.K.)<br>* Pages 5-13; fig. 1,7a * | 1 | |
| A | US - A - 5 170 863<br>(DEVROY)<br>* Abstract; fig. 1 * | 1 | |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 G
B 66 F

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| VIENNA | 14-12-1993 | PISSENBERGER |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

& : member of the same patent family, corresponding document

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