

(19)



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(11)

EP 0 692 449 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.01.1996 Bulletin 1996/03

(51) Int Cl.⁶: **B66F 9/14**

(21) Application number: **95304899.8**

(22) Date of filing: **13.07.1995**

(84) Designated Contracting States:
BE DE FR GB IT NL

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(30) Priority: **13.07.1994 GB 9414153**
16.09.1994 GB 9418819

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(54) Rotating fork unit for pallet handling

(57) The invention provides a rotating fork mounting suitable for use on a load platform narrow aisle fork lift truck or crane. A carriage (5) is movable from one end to the other of a track (6), and the track itself can be moved laterally of a turntable mounting (10). A pair of pallet forks (4) is carried by a lifting mast (7) on the carriage (5), and can be lowered relative to the carriage only when the carriage is in a position with the forks (4) extending in cantilever beyond an end of the track (6).

The mounting of the invention permits an extremely narrow aisle design to be achieved, and is of particular use in a double deep warehouse environment when it can deliver pallets over warehouse rack beams to a double deep position without fouling the beams in the single deep location.

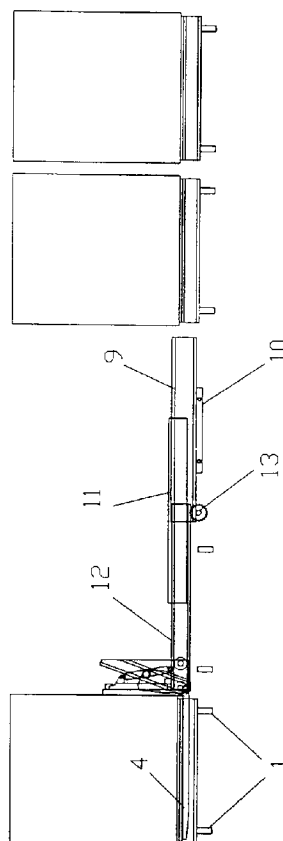


Figure 4

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Description

Field of the Invention

The invention relates to rotating fork units for mounting on the platforms of narrow aisle fork lift trucks or cranes, and to such trucks or cranes having the rotating fork units mounted thereon.

Prior Art

Narrow aisle fork lift trucks or cranes are generally used in warehouses for delivering and retrieving pallets and palletised products from warehouse racking. The truck or crane moves longitudinally along a warehouse aisle, and a load platform can be raised or lowered to access the racking at any desired height. On the platform is a fork extending mechanism carried on a turntable, so that when the turntable is rotated to direct the forks towards the racking on one side or the other of the aisle, the forks can then be extended past beams of the warehouse racking to pick up or deposit a pallet.

The forks are generally carried on a telescopic extending mechanism so that they can be extended in cantilever completely beyond the edge of the platform. If they can extend to only one pallet depth on either side of the aisle the unit is described as a "single deep" fork unit, but if they can extend over the racking beams for two pallets' depth on either side of the aisle then the unit is described as a "double deep" fork unit. Difficulties are always encountered with double deep fork units because it is necessary to ensure that the sections of the telescopic extending mechanism do not foul the racking beams adjacent the aisle when the forks are extended over those beams to pick up a pallet from or deposit it on the more distant racking beams. One means of overcoming those difficulties is to have the racking beams nearer the aisle at a lower level than those more distant, but that is an undesirable expense and inconvenience, and is also wasteful of warehouse space.

It is an object of the invention to overcome the above difficulties and provide a rotating fork mounting that is capable of double deep operation without fouling the racking beams nearer the aisle.

It is a further object of certain embodiments of the invention to provide a rotating fork mounting which permits a reduction in the truck or crane width and thus the aisle width of the warehouse, with concomitant advantages in increased storage capacity.

The Invention

The invention provides a rotating fork mounting for a narrow aisle fork lift truck or crane, comprising:

- a turntable mounting;
- a horizontal track movable laterally relative to the turntable mounting;
- a carriage movable on the track between first and

second positions;

a mast supported on the carriage; and

a pair of pallet forks movable relative to the mast, characterized in that

5 in the first position of the carriage the forks are positioned vertically above or below the track;

in the second position of the carriage the forks extend in cantilever from an end of the track; and

10 in the second position of the carriage the forks can be raised and lowered on the mast.

The mast may be upstanding from the carriage, in which case the forks in the first position of the carriage are vertically above the track; or it may be depending from the carriage, in which case the forks in the first position of the carriage are vertically below the track.

15 Consider first the upstanding mast. In such an arrangement the fork mounting comprises:

a horizontal track movable laterally relative to a turntable mounting; and

20 a pair of pallet forks carried by a lifting mast mounted on a carriage that is movable on the track between a first position in which the forks overlie the track and a second position in which the forks extend in cantilever from an end of the track;

25 characterized in that

in the second position of the carriage the forks can be lowered on the mast to bring the base of a pallet carried thereon to a level below that of the bottom of the track.

30 The track is typically formed or mounted on the distal end of a telescopically extensible mechanism comprising cooperating rails which can be extended or retracted to move the track laterally relative to the turntable. Preferably a pallet is moved out from a central position over a load platform of the truck or crane by first moving the carriage from its first position in which the forks and a loaded pallet carried by the forks is directly over the load platform, to its second position in which the forks and pallet extend in cantilever from a selected side of the load platform. The forks are then lowered on the mast to lower the loaded pallet relative to the mast. Preferably that lowering is accompanied by an automatic simultaneous raising of the load platform by an equal distance, so that in absolute terms the loaded pallet remains at the same

35 height, thereby making it easier for an operator or computer control system to align the pallet forks with the beams of the warehouse racking. The lowering of the pallet forks relative to both the track and the telescopically extensible mechanism of the fork mounting does, furthermore, mean that the pallet can be moved outwardly into the warehouse racking without the elements of the telescopically extensible mechanism fouling the warehouse beams over which those elements pass. The lowering of the forks relative to the track also allows the forks to be extracted from the pallet in a double deep position without the track fouling the beams at the corresponding single deep location.

Retrieving a pallet from either a single deep or dou-

ble deep warehouse location is achieved by a reverse sequence.

The mechanism for raising and lowering the pallet forks on the mast preferably comprises a hydraulic ram or a pair of hydraulic rams. The mast is advantageously inclined at an acute angle to the vertical, so that lowering the forks on the mast (when the carriage is in its second position) also moves them further outboard of the end of the track and of the load platform of the truck or crane on which the fork mounting is to be mounted. Conversely, raising the forks on the mast moves them slightly inboard towards the centre of the load platform which is of benefit when centralizing the load on the platform.

The rotating fork mounting of the invention permits four load positions to be accessed: that is, single deep and double deep load positions in the warehouse racking to the right of the aisle, and single deep and double deep load positions in the warehouse racking to the left of the aisle. It has now been appreciated that the creation of fifth load location is an advantageous possibility according to the invention. The invention accordingly provides such a rotating fork mounting in which a fifth load position is defined, on a load platform of the fork lift truck or crane on which the rotating fork mounting is mounted, displaced outwardly of the turntable mounting in a direction longitudinally of the aisle direction. This fifth load position defines a temporary load storage area on the load platform itself, and permits temporary storage of a palletized load while the pallet forks are used to transfer other loads between work stations.

To transfer a loaded pallet to the fifth position, the pallet should be rotated over the turntable mounting until the pallet forks are directed longitudinally of the aisle towards the fifth load position. With the track remaining centrally or substantially centrally over the turntable mounting, the carriage should then be moved to just beyond its second position in which the forks extend in cantilever from the end of the track, with the load positioned over the fifth load position. Lowering the forks part way down the lifting mast is then sufficient to deposit the pallet at the fifth load position, without bringing the forks into fouling engagement with the track as the carriage is retracted to its central position over the turntable mounting. The height of the fifth load position is preferably slightly higher than that of the top of the track.

A narrow aisle fork lift truck or crane provided with a mounting having such a fifth load position is thus capable of carrying two pallets at any one time: one at the fifth load position and one on the pallet forks. This permits a significant increase in the flexibility of the fork lift truck or crane.

Consider next a rotating fork mounting of the invention with a depending mast, which carries forks which in the first position of the carriage are vertically below the track. When a palletized load is carried by the forks, then with the carriage in its first position the forks must remain fully lowered on the mast to avoid contact between the top of the load and the bottom of the track. When the

carriage is in its second position the forks may be raised and lowered because the load is held in cantilever outwardly from the end of the track. The fork mounting is constructed and operates similarly to that described above with an upstanding mast in all other respects. When the load is held in cantilever outwardly from the end of the track (i.e. in the second position of the carriage), the forks can be moved up the mast to bring the top of the load above the level of the top of the track, or it can be moved down the mast to bring the top of the load below the level of the bottom of the track, for movement of the carriage back to its first position. The overall vertical spacing between the racking beams of the warehouse racking system can therefore be reduced, and there is no fouling of the racking beams adjacent the aisle when the forks are extended past those beams to the double deep position.

Drawings

Figures 1 to 4 are schematic sections through a warehouse racking system, showing a fork mounting according to the invention in four successive stages of delivering a loaded pallet to a double deep warehouse location;

Figure 5 is a section corresponding to that of Figure 2 through the pallet forks and carriage only, drawn to a larger scale;

Figure 6 is a plan view from above of Figure 2;

Figure 7 is an end elevation of the fork mounting of Figure 3, viewed from the left hand side of Figure 3;

Figure 8 is a plan view from above of a pallet on a fork mounting of the invention when the pallet has been retracted as in Figure 1 to lie centrally over a load platform of a fork lift truck or crane (not shown);

Figure 9 is a schematic plan view of the warehouse, illustrating the rotating nature of the fork mounting of the invention;

Figure 10 is a schematic side elevation of another rotating fork mounting according to the invention, with a loaded pallet (shown in phantom) on the pallet forks centrally over the turntable mounting;

Figure 11 is a plan view from above of the unit of Figure 10;

Figure 12 is a side elevation of the unit of Figure 10, but with the loaded pallet extended in cantilever in the longitudinal aisle direction over a fifth load position;

Figure 13 is a plan view from above of the unit of

Figure 12;

Figure 14 is a schematic side elevation of yet another rotating fork mounting according to the invention, with a depending mast and showing the mechanism extended for double deep pallet pick-up or deposit; and

Figure 15 is a schematic side elevation of the rotating fork mounting of Figure 14, except that the pallet forks are lowered on the mast and the carriage is in its first position with a load supported directly beneath the retracted track.

Referring first to Figures 1 to 9 of the drawings, the warehouse comprises a narrow aisle A, on either side of which is a single deep pallet location B and a double deep pallet location C. In Figure 1 pallets are shown at the pallet locations B and C to the right of the central aisle A, but the warehouse beams 1 to the left of the central aisle are empty.

A rotating fork mounting according to the invention is shown in the central aisle A, with a palletized load sitting centrally on the mounting. The palletized load comprises a product or load 2 on a pallet 3, with a pair of forks 4 of the fork mounting of the invention received in the fork pockets of the pallet, taking the weight of the load.

The forks 4 are mounted on a carriage 5 which is movable on a track 6 comprising a pair of side rails one at each side of the fork mounting. Figure 1 shows the forks 4 in a first position overlying the track 6. Figure 2 shows the carriage 5 in its second position in which the forks 4 extend laterally in cantilever from an end of the track 6.

It will be observed that in Figures 1 and 2 the forks 4 are above the height of the warehouse racking beams 1, but the track 6, which forms part of a telescopically extensible mechanism to be described below, is at a level that would foul the warehouse beams 1 if it were extended laterally from the central aisle A.

The forks 4 are mounted on an upstanding mast 7 on the carriage 5, and are movable up and down the mast 7 under the control of a hydraulic ram 8. It will be appreciated that the forks 4 can be lowered on the mast 7 only when the carriage 5 is in its second position, as shown in Figures 2 and 3. Figure 2 shows the forks raised on the mast, whereas Figure 3 shows them lowered. The mast 7 is inclined at an acute angle to the vertical, so that the lowering of the forks 4 also move them slightly outwardly beyond the end of the track 6, as clearly illustrated by reference to Figure 2 and 3.

A careful comparison of Figures 2 and 3 will also show that at the same time as lowering the forks 4 relative to the carriage 5, the body of the fork mounting, including the track 6, has been raised by an equal distance. Therefore in Figure 3 the forks 4 are at the same absolute height as in Figure 2, but in Figure 3 the telescopically

extensible mechanism of the fork mounting is at a height at which it can be extended without fouling the warehouse racking beams 1.

Figure 4 shows the extension of that mechanism. A central platform 9, mounted on a turntable 10, mounts two pairs of telescopic sections 11 and 12 of which the track 6 is associated with the distal sections 12.

Figure 4 shows that the central platform 9 has been lowered slightly by the narrow aisle truck or crane on which the assembly is mounted, to lower the pallet 3 onto the relevant pair of beams 1.

Figure 6 shows more clearly the turntable 10. With the forks fully inboard as illustrated in Figures 1, 8 and 9, the turntable 10 can be rotated so as to permit extension of the forks to either side of the central platform 9. Figure 10 illustrates the turning circle 13 of the forks and of a pallet thereon, from which it will be understood that the fork mounting of the invention is a very compact unit, permitting the use of extremely narrow aisles not significantly wider than the rotation of a loaded pallet around a central vertical axis.

In Figures 10 to 13 of the drawings, the same reference numerals have been used as in Figures 1 to 9 for analogous parts, and further description of those common features will therefore be omitted. In Figures 11 and 13, the longitudinal direction of the central aisle is indicated by an arrow AA, whereas warehouse racking (not shown) would be provided on either side of that longitudinal centre line.

Figures 10 to 13 illustrate very clearly how the turntable 10 can be rotated until the pallet forks 4 extend longitudinally of the aisle in the direction AA, an additional, or fifth, load position 20 is provided on the load platform 21 of the truck or crane along that longitudinal axis, so that by moving a loaded pallet from the position shown in Figure 10 to that shown in Figure 12, the load can be positioned over the additional load position. Then by lowering the forks 4 very slightly on the mast 7 by means of the ram 8, the load can be deposited at the additional load position and the carriage retracted on the track over the central turntable 10.

A careful analysis of Figures 11 and 13 will show that if the loaded pallet is deposited in the position shown in the position shown in Figure 13, and the forks retracted, the unit can pick up a further pallet which can then be rotated from one side of the aisle to the other, passing through the position shown in Figure 11, without fouling the load deposited at the load position 20.

Figures 14 and 15 also use similar reference numerals for similar parts. The mast 7 in Figures 14 and 15 depends from the carriage 5 so that in the first position of the carriage (as shown in Figure 15) the load is supported directly beneath the track 6. In the second position of the carriage (as shown in Figure 14) the load is in cantilever to one side of the carriage 5 and can be raised so as to reduce the overall height of the load and track. Note that dimension H1 in Figure 14 is less than dimension H2 in Figure 15. Thus the track can be extended from

the condition of Figure 15 to that of Figure 14 without fouling the racing rails adjacent the aisle. In this embodiment the racking rails that would be at risk of being fouled would be those defining the racking level above that on which pallet handling is taking place.

Claims

1. A rotating fork mounting for a narrow aisle fork lift truck or crane, comprising:
 - a turntable mounting (10);
 - a horizontal track (6) movable laterally relative to the turntable mounting;
 - a carriage (5) movable on the track (6) between first and second positions;
 - a mast (7) supported on the carriage (5); and
 - a pair of pallet forks (4) movable relative to the mast (7),characterized in that
 - in the first position of the carriage (5) the forks (4) are positioned vertically above or below the track (6);
 - in the second position of the carriage (5) the forks (4) extend in cantilever from an end of the track (6); and
 - in the second position of the carriage (5) the forks (4) can be raised and lowered on the mast (7).
2. A rotating fork mounting for a narrow aisle fork lift truck or crane, comprising
 - a horizontal track (6) movable laterally relative to a turntable mounting (10); and
 - a pair of pallet forks (4) carried by a mast (7) mounted on a carriage (5) that is movable on the track (6) between a first position in which the forks (4) overlie the track (6) and a second position in which the forks (4) extend in cantilever from an end of the track (6);characterized in that in the second position of the carriage (5) the forks (4) can be lowered on the mast (7), relative to the track (6).
3. A fork mounting according to claim 2, wherein the track (4) is mounted on a telescopically extensible mechanism (11,12) comprising rails (11,12) which can be extended or retracted to move the track (4) laterally relative to the turntable mounting (10).
4. A fork mounting according to claim 3, wherein the telescopically extensible mechanism (11,12) comprises intermediate sections (11) and distal sections (12) supported thereon, wherein the intermediate sections (11) are constrained to move only half the distance of the distal sections (12).
5. A fork mounting according to claim 4, further comprising a chain and gear mechanism for extending and retracting the rails (11,12) and the track (6) mounted thereon.
6. A fork mounting according to any of claims 2 to 4, further comprising one or more hydraulic rams (8) or other lifting means for raising and lowering the forks (4) on the mast (7) when the carriage (5) is in its second position.
7. A fork mounting according to any of claims 2 to 5, wherein the mast (7) is inclined at an acute angle to the vertical so that lowering the forks (4) on the mast (7) when the carriage (5) is in its second position also moves them further outboard of the end of the track (6).
8. A narrow aisle fork lift truck or crane including a rotating fork mounting according to any preceding claim.
9. A truck or crane according to claim 8, comprising
 - operator or automatic controls for raising and lowering a platform on which the turntable mounting is mounted,
 - operator or automatic controls for rotating the turntable,
 - operator or automatic controls for extending the track (6) relative to the turntable,
 - and operator or automatic controls for raising and lowering the forks (4) relative to the mast (7) when the carriage (5) is in its second position,
 - wherein the controls for raising and lowering the forks (4) are interlinked to the controls for raising and lowering the platform so that raising or lowering the forks (4) relative to the mast (7) is accompanied by an equal and opposite raising or lowering of the turntable platform or track (6) so that the forks (4) remain at the same absolute height.
10. A truck or crane according to claim 8 or claim 9, wherein a further load position is defined on the load platform of the truck or crane, displaced outwardly of the turntable mounting in a direction longitudinally of the aisle direction, the further load position defining a temporary load storage area on the load platform.

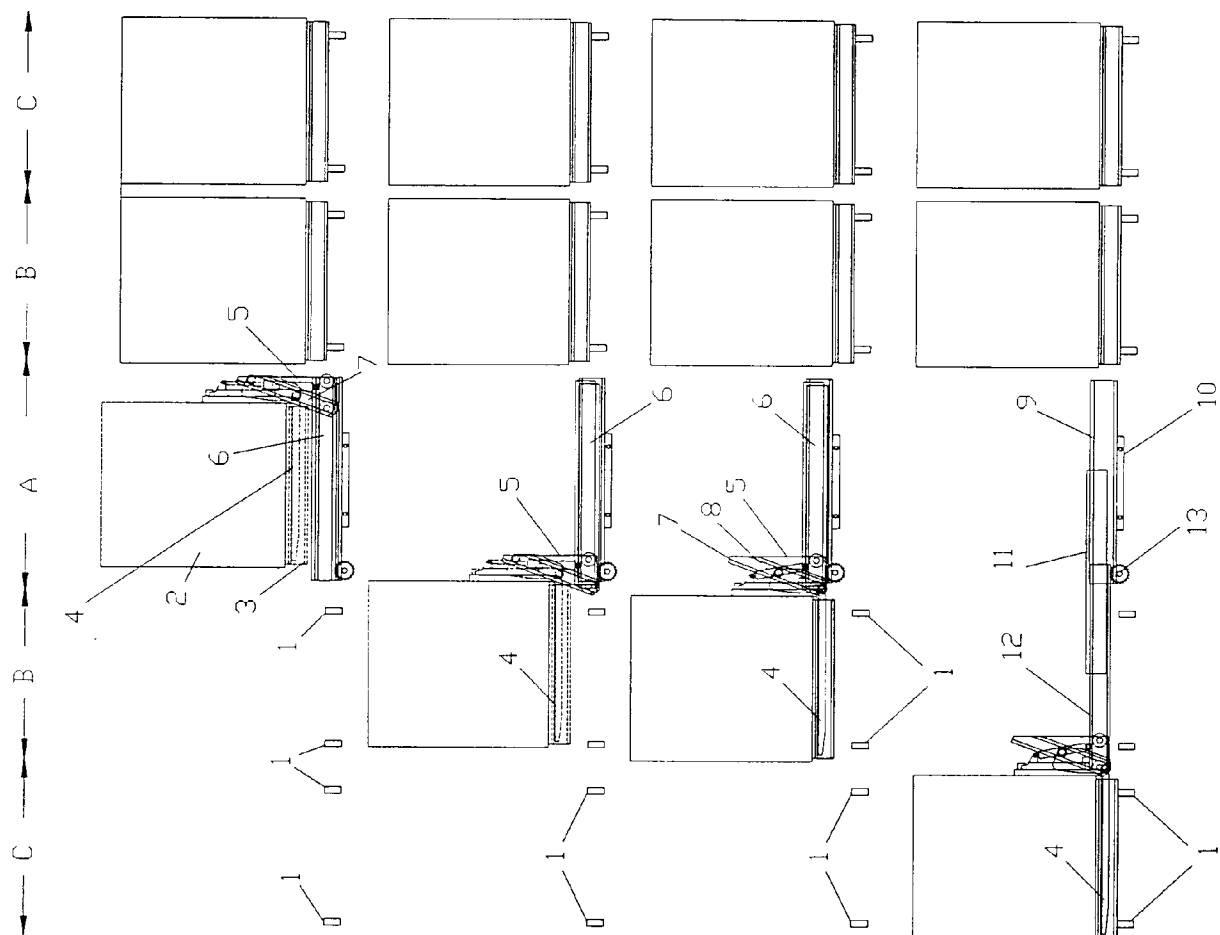


Figure ①

Figure ②

Figure ③

Figure ④

Figure ⑤

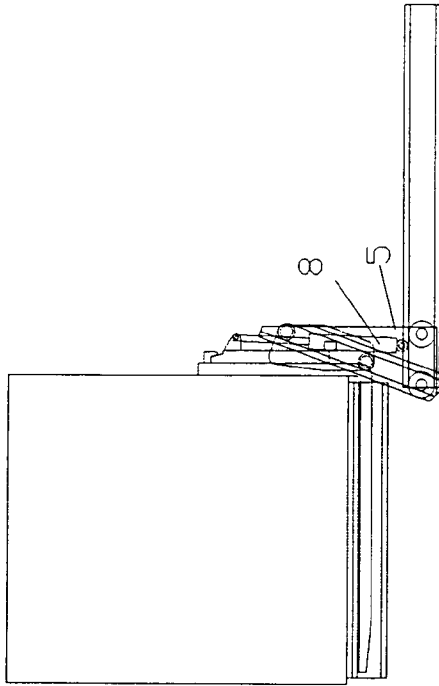


Figure ⑦

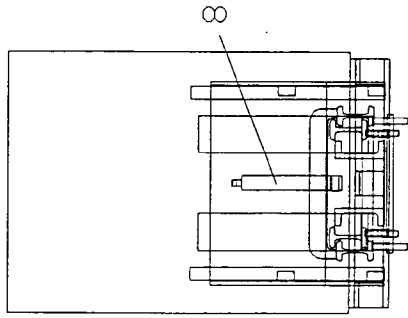


Figure ⑥

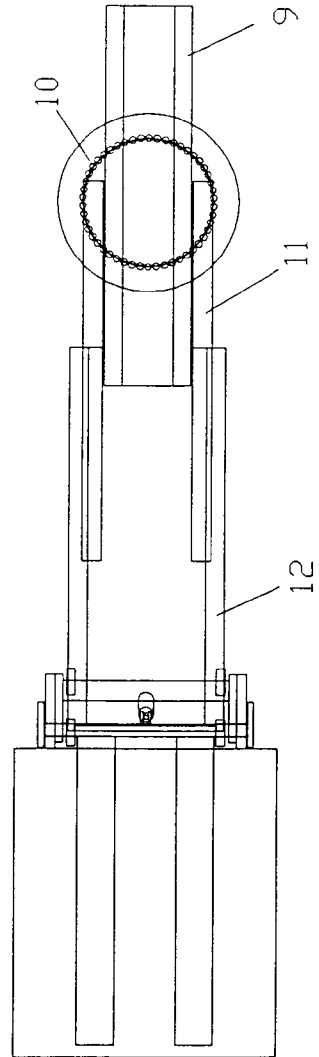
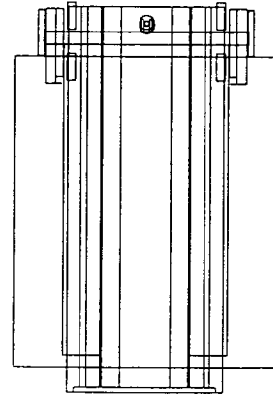


Figure ⑧



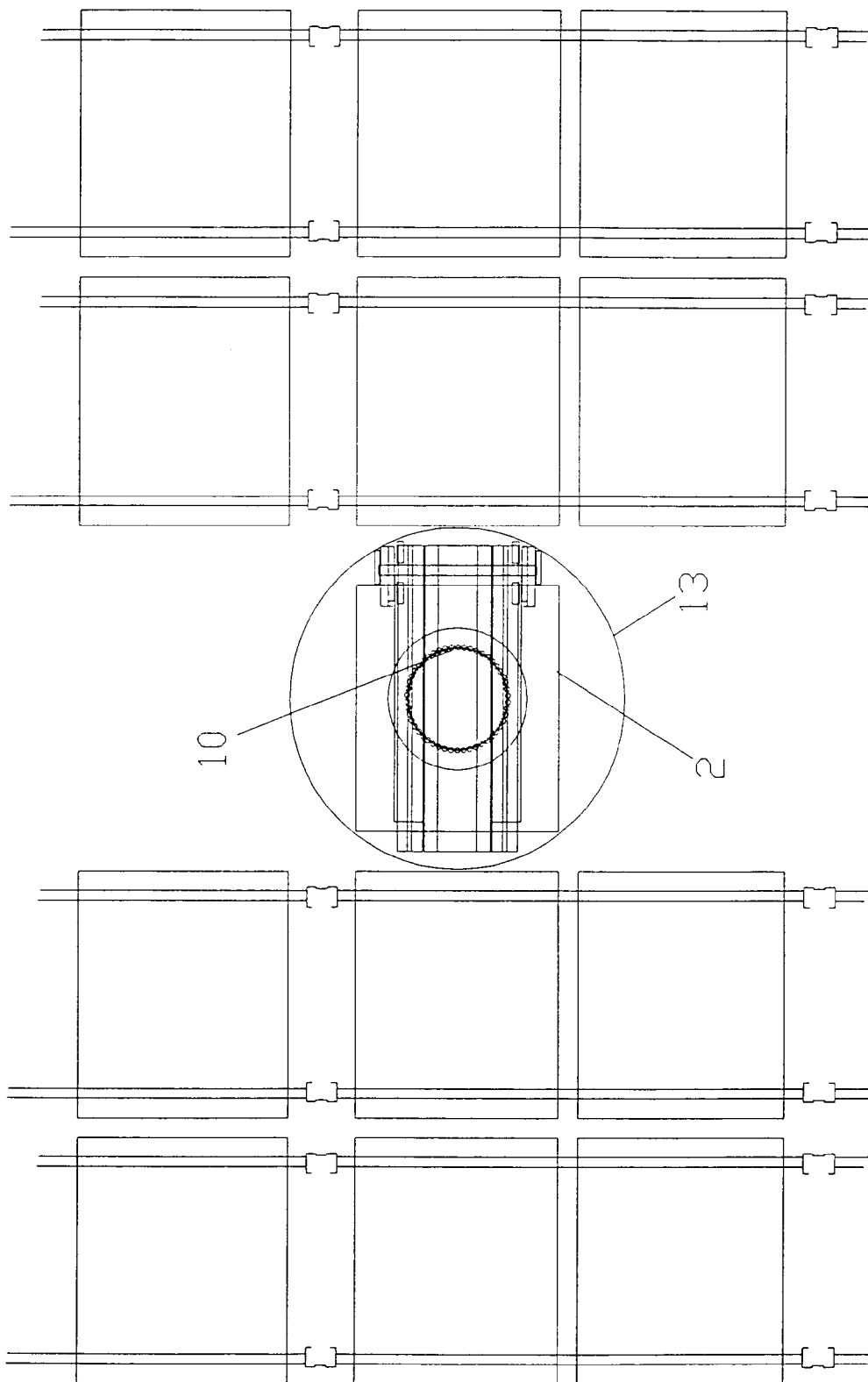


Figure 9

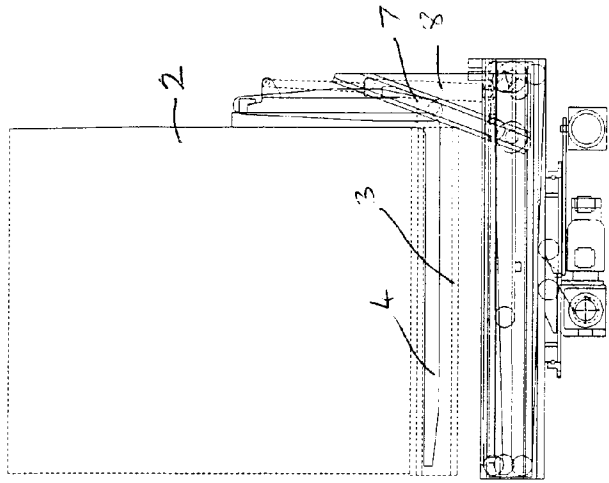


Figure 10

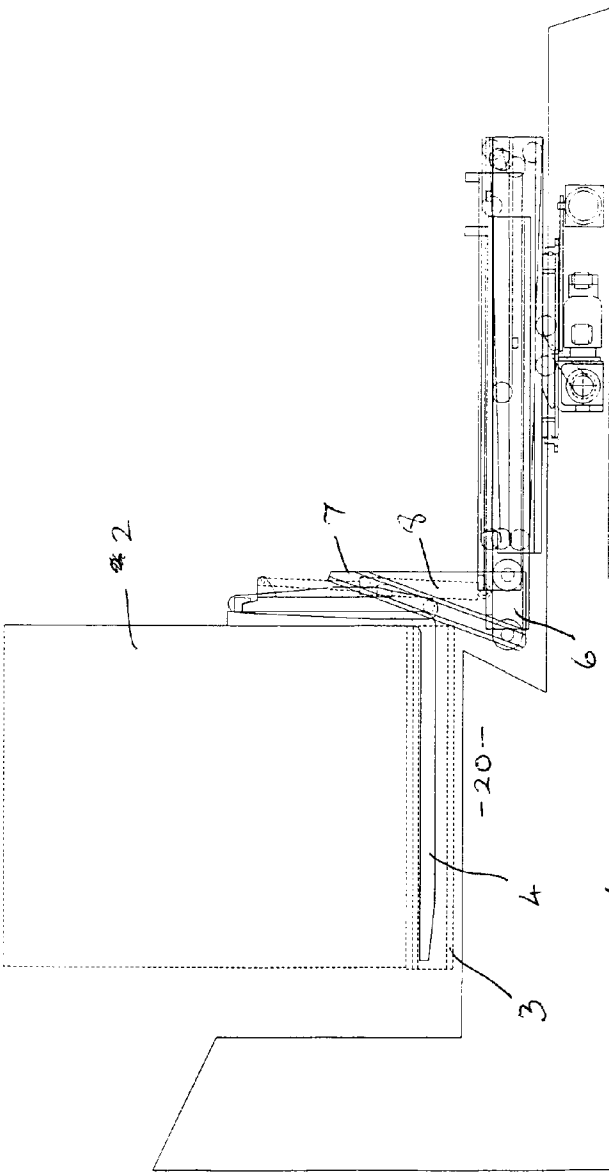


Figure 12

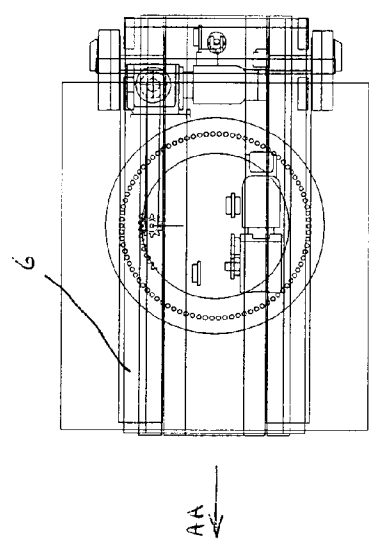


Figure 11

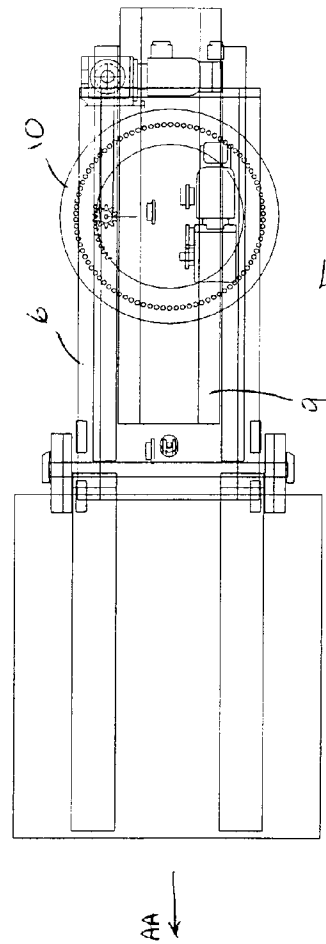


Figure 13

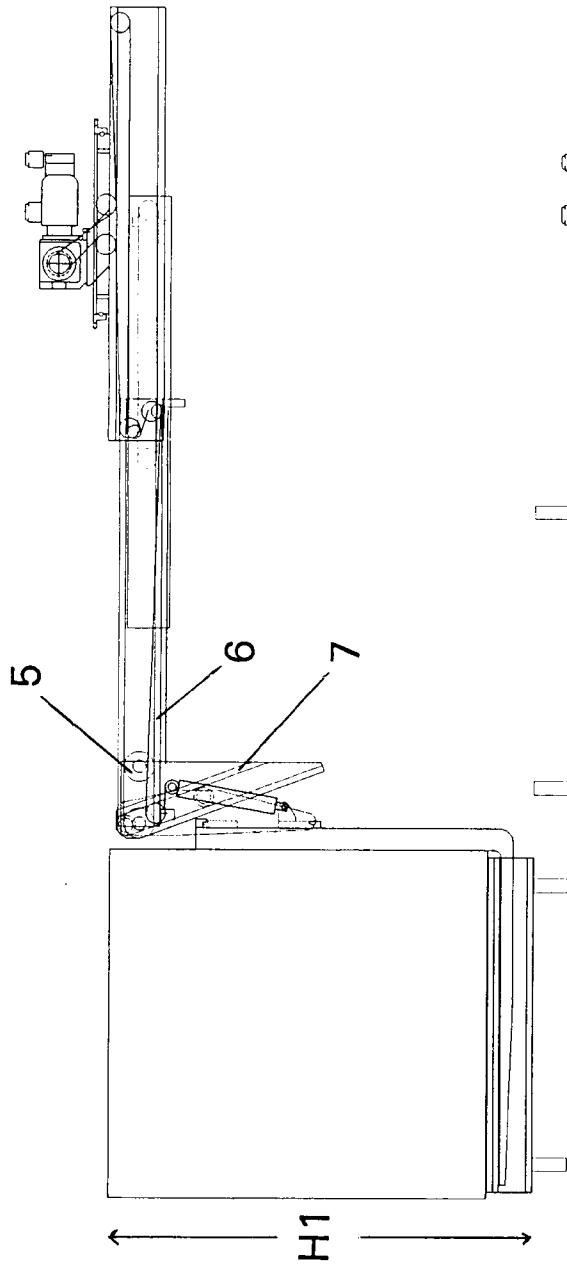


Figure 14

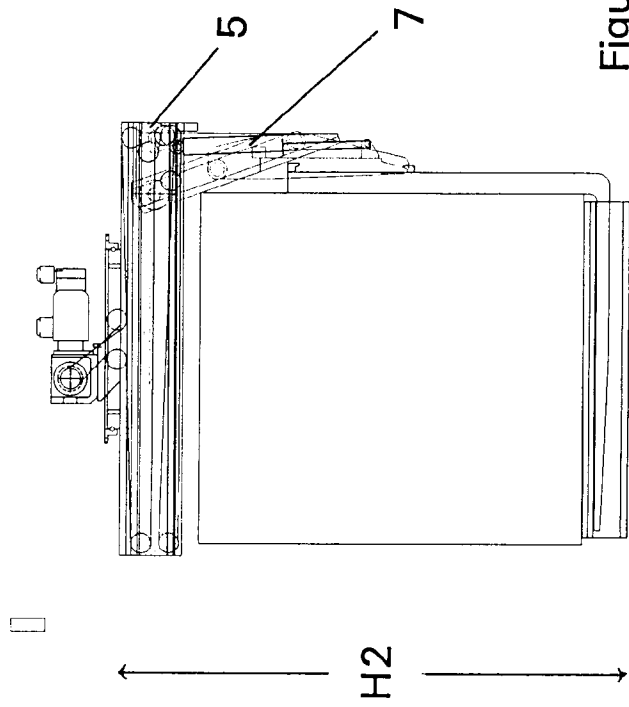


Figure 15



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 4899

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.6)
X	DE-A-30 17 147 (JUNGHEINRICH UNTERNEHMENSVERWALTUNG)	1-3,6	B66F9/14
Y	* page 18, paragraph 2 - page 19, paragraph 3 * * page 22, paragraph 2 * ---	4,5,7	
Y	DE-A-19 10 603 (A.S.E.A.) * page 6, paragraph 2 * ---	4,5	
Y	WO-A-87 02338 (MTH GRUPPEN) * abstract; figure * ---	7	
X	FR-A-1 338 707 (LANSING BAGNALL)	1,2	
A	* the whole document * ---	3	
A	GB-A-2 080 265 (FARR) * figure 6 * ---	10	
A	US-A-3 863 777 (MURATA) ---		
A	WO-A-94 04447 (CLECO) -----		TECHNICAL FIELDS SEARCHED (Int.Cl.6) B66F B65G
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28 September 1995	Examiner Van den Berghe, E
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