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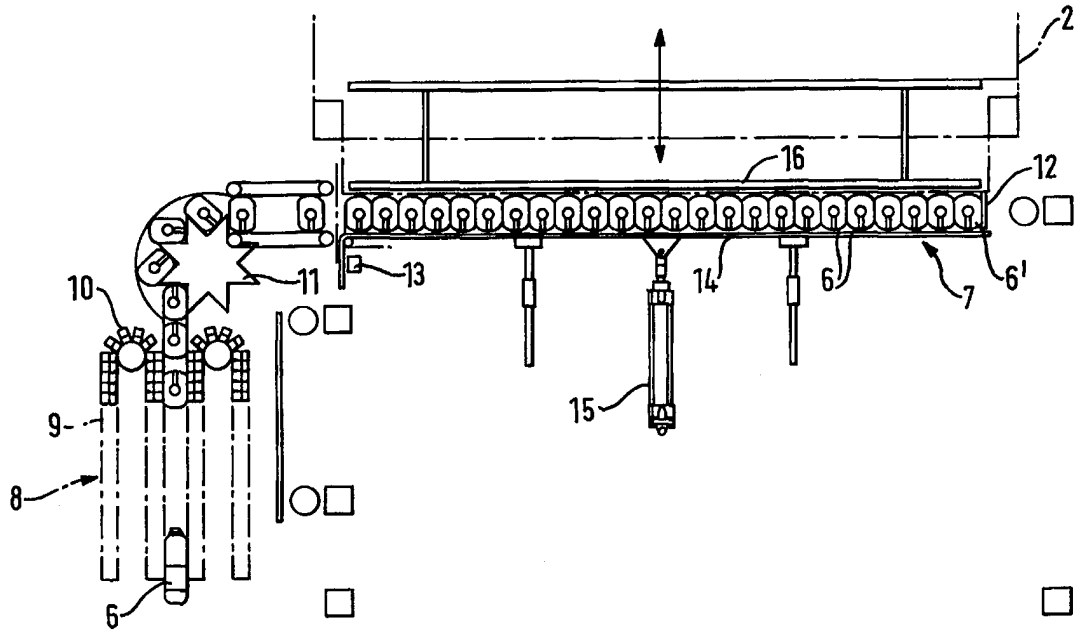
(54) Title: STORAGE APPARATUS



(57) Abstract

Storage apparatus (1) for storing a plurality of empty lightweight plastics containers (6) includes a storage bin (2) and a loading/unloading station (3). Containers (6) can be stored in layers in the storage bin (2). The loading/unloading station (3) is used for loading containers (6) into the storage bin (2) and receiving containers (6) unloaded from the storage bin (2). The storage bin (2) includes a movable support (16) which is movable with a leading row of containers (6) moved into the storage bin (2) by the loading/unloading station (3) to support said leading row of containers (6) as containers (6) are loaded into the storage bin (2).

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STORAGE APPARATUS

The present invention relates to storage apparatus for storing a plurality of containers.

Plastics containers, for milk for example, are extrusion blow-moulded conventionally in one of two types of factory. One is a central plant factory and the other is an in-plant factory.

In a central plant factory, the containers are moulded and then packaged in bags which are loaded manually into a lorry. The bags are delivered to a dairy or other liquid drink producer where the bags are manually unloaded from the lorry. The bags of containers are then placed on a debagging machine where the bag is removed and from which the containers are sent to a filling plant where they are automatically filled with the product such as milk. The need to bag the containers and manually load the bags at the central plant factory and then manually unload the bags and debag the containers at the liquid drink producer all adds to the expense of the containers. Manual loading and unloading of the lorry is also labour intensive and time consuming. There is also a limit of about 2.5 m on the height to which a person can manually stack the bags of containers.

In an in-plant factory, at a dairy for example, the containers are moulded on site usually in a building next to the dairy and immediately conveyed on a conveyor to the dairy filling hall. Occasionally, excess containers are produced and these are often transported to other nearby dairies in the same way as for a central plant mentioned above. However, there is a major problem with the in-plant factories in that the blow-moulding machines produce containers much more slowly than the milk fillers can fill the containers. Thus, the blow-moulding machine usually

operates for 24 hours a day whereas the milk filling hall operates normally for about 16 hours a day. During the 8 hours when the filling plant is not operating, containers are again stored in plastics bags which have to be debagged the next day in order to match the container moulding and dairy filling capacities again increasing costs and inconvenience.

Furthermore, the bags used for the containers are expensive and are troublesome to handle. Containers often fall over within the bags. Bagging and debagging machines are of course also expensive to purchase, operate and maintain. It is therefore desirable to provide a system for storing containers which does not use bags for the containers.

Several prior art systems for storing, loading and unloading articles are known. However, many of these prior art systems are concerned with storing, loading and unloading relatively dense or heavy articles such as containers filled with drinking water and do not address the problem of dealing with lightweight, empty plastics containers which can very easily fall over during handling.

According to the present invention, there is provided storage apparatus for storing a plurality of containers, the apparatus comprising: a storage bin in which a plurality of containers can be stored in a layer; and, a loading/unloading station for loading containers into the storage bin and receiving containers unloaded from the storage bin; the storage bin including a movable support which is movable with a leading row of containers moved into the storage bin by the loading/unloading station to support said leading row of containers as containers are loaded into the storage bin.

Thus, as a layer of containers is loaded row by row into the storage bin, the movable support can be moved with the leading row of containers to support and steady the containers in the leading row and prevent the containers falling over. This is especially advantageous for the preferred application of the present invention in which the containers are empty lightweight plastics containers. When a layer of containers is to be unloaded, the movable support can be driven to push the layer of containers out of the storage bin to the loading/unloading station.

The storage bin can be used as a "buffer" to temporarily store containers delivered from a container manufacturing plant. The containers can then be unloaded as demand requires. The storage bin may additionally or alternatively be used to transport containers from the container manufacturing plant to a filling plant where the containers are filled and/or from a filling plant to distribution points. The loading/unloading station can be dedicated to load or unload containers. Alternatively, the loading/unloading station may be capable of carrying out both functions.

The storage bin preferably has a plurality of shelves each for receiving a respective layer of containers. The storage bin preferably has a movable support for each shelf in the storage bin, each movable support being movable with a leading row of containers to support said leading row of containers as containers are loaded onto a shelf.

The apparatus may include support driving means for driving the or each movable support with a row of containers.

The or each storage bin support may comprise an elongate bar extending across substantially the whole width of a layer in the storage bin.

The loading/unloading station preferably comprises a station support for receiving and supporting a row of containers, the loading/unloading station having moving means for moving the station support to a position adjacent a layer in the storage bin such that containers can be loaded from the station support into the storage bin or unloaded from the storage bin to the station support. Thus, during loading of the storage bin, a row of containers can be supported by the station support which is then moved as necessary so that the row of containers can be moved to a respective layer in the storage bin. During unloading, the station support can be moved to a position adjacent a layer of containers to be unloaded from the storage bin so that a row of containers can be moved from said layer to the station support.

The station may have a station detector for detecting when the station support is full of containers. The station detector may include a counter which counts the number of containers loaded onto or unloaded from the station support.

The moving means may include means for selectively raising and lowering the station support so that the station support is brought to a height adjacent a layer in the storage bin.

The loading/unloading station may have a plurality of station supports for supporting respective rows of containers, the station having driving means for driving the plurality of station supports so that the station supports can be successively moved to be adjacent a layer in the storage bin. Each of the station supports may be supported by an endless belt which is driven by the driving means to drive the plurality of supports.

The loading/unloading station preferably comprises a pusher for pushing a row of containers into the storage bin. The pusher may be used to steady a row of containers as it is unloaded from the storage bin to the loading/unloading station.

The movable support and the pusher are preferably arranged to move synchronously such that the movable support continuously supports a leading row of containers as further rows of containers are successively pushed into the storage bin by the pusher. Similarly, the pusher can continuously steady a lead row of containers as containers are unloaded from the storage bin to the loading/unloading station.

A storage bin detector may be provided for detecting when a complete layer of containers has been loaded into or unloaded from the storage bin. The storage bin detector may include a counter for counting the number of rows of containers loaded into or unloaded from the storage bin.

A conveyor may be provided for conveying containers to and from the loading/unloading station.

The storage bin may be mounted on a vehicle or a vehicle trailer. A portable storage bin of this type can be used to transport containers between a factory where the containers are manufactured and a filling plant where the containers are filled, for example.

The loading/unloading station may have means for adjusting the height and roll of the station. This allows storage bins of different heights and which are not strictly horizontal to be accommodated.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a view from one side of a first example of apparatus according to the present invention;

Fig. 2 is a view from one end of the apparatus of Fig. 1;

Fig. 3 is a view from above of the apparatus of Figs. 1 and 2;

Fig. 4 is a perspective view of a portion of a storage bin;

Fig. 5 is a perspective view of an example of a stationary storage bin; and,

Fig. 6 is a perspective view of an example of a portable storage bin and a further example of a loading/ unloading station.

Storage apparatus 1 for storing a plurality of containers comprises two main components, a storage bin 2 and a loading/unloading station 3. In the example shown in Figures 1 to 3 and 6, the storage bin 2 is portable and is built into the trailer 4 of a lorry, though the storage bin 2 could alternatively be built into the rear cargo portion of a lorry itself for example. In the example shown in Figure 5, the storage bin 2 is stationary and intended to be permanently installed at a site.

In either case, the storage bin 2 has plural shelves 5 each of which can support a layer of containers 6. In the examples shown in the drawings, there are seven shelves 5 and they are open along their length and across their width

so that adjacent containers 6 touch each other both along the length and across the width of the storage bin 2. Pull-down doors (not shown) can be provided to allow the open ends of the shelves 5 to be closed. The shelves 5 may be glass-reinforced plastics with a food grade gel coating and the other parts of the storage bin 2 may be stainless steel for reasons of hygiene.

The loading/unloading station 3 has a station support 7 for receiving and supporting a row of containers 6. In the example shown, the station support 7 is a shelf 7 on which the row of containers 6 stand vertically. Alternatively, the station support 7 may be a single endless belt on which the containers 6 stand. The station support 7 can be moved up and down in the loading station 3 under the action of an electric motor (not shown) so that the station support 7 can be brought to a position adjacent a shelf 5 in the storage bin 2.

A conveyor 8 is provided to convey containers 6 to and from the station support 7. In the example shown, the conveyor 8 has two opposed belts 9 which have rubber fingers 10 between which the containers 6 are gripped. The conveyor 8 may be used to transport containers 6 directly from a moulding machine (not shown) to the station support 7. The containers 6 are transferred in single file to and from the station support 7 by the conveyor 8 with the containers 6 entering and leaving the station support 7 from one end of the station support 7 as shown. In the example shown in the drawings, a star wheel 11 is provided, as shown particularly clearly in Figure 3, so as to rotate the incoming containers 6 to be in the desired orientation to be received on the station support 7. However, such a star wheel may not be required and may be omitted.

In use, to load the storage bin 2, empty plastics containers 6 are conveyed by the conveyor 8 in single file

from a moulding machine onto the station support 7. The station support 7 has a stop 12 which is driven to follow the lead container 6' as the lead container 6' is moved onto the station support 7 in order to prevent the lead container 6' falling over. The containers 6 may simply slide along the support 7 as they are loaded onto the support 7. Alternatively, where the station support 7 is a belt 7 for example, the support belt 7 may be moved synchronously with the containers 6 as the containers 6 are loaded onto the support belt 7. In this case, the stop 12 may be fixed to the belt 7 to move therewith.

A photocell 13 at the end of the station support 7 nearest the star wheel 11 counts the number of containers 6 which have been moved onto the station support 7. Alternatively, a photocell may be provided at the end of the station support 7 furthest from the star wheel 11 to determine when a container 6 has reached that end of the station support 7. When it is determined that a complete row of containers 6 has been loaded onto the station support 7, that row of containers 6 can be moved forwards onto an adjacent shelf 5 of the storage bin 2. To enable this, the loading/unloading station 3 has a pusher bar 14 which is actuated by an electric motor 15 and which extends across the full width of the row of containers 6 on the station support 7. When it is detected that the station support 7 is full with a row of containers 6, the pusher bar 14 is moved forwards to push the complete row of containers 6 onto a shelf 5 in the storage bin 2. The pusher bar 14 can then be withdrawn and a further row of containers 6 conveyed onto the station support 7. Further rows of containers 6 can then be pushed onto the adjacent shelf 5 of the storage bin 2 row by row, each row of containers 6 pushing forwards the rows of containers 6 ahead of them on the storage bin shelf 5, until the particular shelf 5 is full. Whether or not the shelf 5 is full can be determined by counting the number of rows of

containers 6 pushed onto that shelf 5 or by detecting when the lead row of containers 6 has reached the end of the shelf 5 remote from the loading station 7 by use of a photocell, for example.

After a shelf 5 has been filled with containers 6, the station support 7 can be moved to the next free shelf 5 in the storage bin 2 and the loading process repeated. This can be repeated for all of the shelves 5 in the storage bin 2 until the storage bin 2 is full.

In order to prevent the empty plastics containers 6 falling over in the storage bin 2 during loading, each shelf 5 of the storage bin 2 has a support 16 in the form of an elongate bar 16 which preferably extends across the whole width of the shelf 5. Each bar 16 is carried by an endless belt 17 provided at each end of the bar 16, the belt 17 being driven by an electric motor (not shown) in synchronized movement with the loading station pusher bar 14 to move the bar 16 backwards into the storage bin 2 each time the loading station pusher bar 14 pushes a row of containers 6 forwards into the storage bin 2. Thus, the lead row of containers 6 on a shelf 5 in the storage bin 2 is continuously supported by the bar 16 as the lead row of containers 6 is moved along the shelf 5 by loading of further rows of containers 6 onto that shelf 5.

Unloading of the storage bin 2 is basically a reverse procedure of loading. The station support 7 is raised or lowered to be level with a shelf 5 in the storage bin 2 to be unloaded. The storage bin support bar 16 for that shelf 5 is driven towards the station 3 so as to push the containers 6 on that shelf 5 out of the storage bin 2 row by row. The storage bin support bar 16 is initially driven by a distance sufficient to push a first row of containers 6 off the shelf 5 onto the station support 7 and then stopped. In the example shown in the drawings, the row of

containers 6 on the station support 7 is then pushed towards the star wheel 11 by movement of the station support stop 12 towards the star wheel 11. The star wheel 11 rotates the containers 6 so that they can be picked up by the conveyor 8 which transports the containers 6 to the dairy filling station or some other destination point. Instead of the containers 6 being passed back along the station support 7 in the direction opposite the infeed direction, the containers 6 may be passed along the station support 7 in the other direction, i.e. in a continuation of the infeed direction.

When a row of containers 6 has been cleared from the station support 7, the support bar 16 for the shelf 5 being unloaded is again pushed towards the station 3 by a distance sufficient to move a further row of containers onto the station support 7. The process is repeated until that shelf 5 is cleared of containers 6. The station support 7 can then be moved to the next shelf 5 to enable that shelf 5 to be unloaded. The station pusher bar 14 can be moved back and forth synchronously with the forward movement of the storage bin support bar 16 so that the row of empty plastics containers 6 being pushed onto the station support 7 is prevented from falling over by the station pusher bar 14 continuously supporting that row of containers 6 as that row of containers 6 is pushed forwards out of the storage bin 2.

It will be appreciated that a station 3 can be set up so that it only loads containers 6 onto the storage bin 2. Such a loading station 3 may be situated at the moulding plant at which the containers 6 are moulded for example. A dedicated unloading station 3 may be provided at the site (for example, the dairy filling plant) where the containers 6 are to be unloaded. However, a station 3 can readily be configured so that it can optionally load and unload containers 6 so that substantially identical loading/

unloading stations 3 can be provided at each site where containers 6 are to be loaded onto or unloaded from a storage bin 2.

A stationary storage bin 2 which is intended to be permanently fixed on-site is shown in Figure 5. The shelves 5 are contained within a housing 20. Access doors 21 are provided so that access to the shelves 5 is possible. This may be necessary so that any containers 6 on the shelves 5 which have fallen over can be righted. Access can also be had to the support bar 16 and associated driving mechanism for each shelf for maintenance purposes. The loading/unloading station 3 can be permanently fixed adjacent the stationary storage bin 2.

A portable storage bin 2 is shown in Figure 6 built into the trailer 25 of a lorry. The shelves 5 fill the trailer 25. Access doors 26 are provided on the sides of the trailer 25 so that access to the shelves 5 can be had in order to right any containers 6 which have fallen over. Again, access can also be had to the support bar 16 and driving mechanisms for the support bar 16 for each shelf 5 for maintenance purposes. Rather than building the storage bin 2 into a trailer of a lorry, the storage bin 2 can be built into the cargo area of a lorry itself. Power for the portable storage bin 2 can be by a suitable cable connection with a power outlet provided on the loading/unloading station 3.

Where a loading/unloading station 3 is to be used to load containers 6 onto or unload containers 6 from a portable storage bin 2 such as one mounted on the trailer 25 of a lorry, or where the storage bin 2 is built into a lorry itself, the arrangement is preferably such that each side 30,31 of the station 3 can be independently moved vertically up and down. Similarly, preferably, the station support 7 can be shifted laterally to the left and right.

This allows the station support 7 to be brought into complete alignment with the shelves 5 in the portable storage bin 2 even if the lorry trailer 25 has not been perfectly aligned with the loading/unloading station 3 and to allow for the fact that the shelves 5 may not be horizontal because one of the tyres 27 of the trailer 25 or lorry may be flat or because the ground is uneven for example.

Another example of a loading/unloading station 3 is shown in Figure 6. Instead of the station support 7 which is moved up and down in the example shown in Figures 1 to 3, the example shown in Figure 6 has a carousel or so-called "paternoster" system 32. This paternoster system 32 has plural parallel horizontal shelves 33 which are supported at their respective ends by two endless belts 34. The shelves 33 are each respectively filled with empty plastics containers 6 from the conveyor 8 and are then moved to a shelf 5 in the storage bin 2 to be loaded. A pusher bar then pushes that row of containers 6 onto the shelf 5 as described for the first example of a station 3 mentioned above. Successive filled shelves 33 of the paternoster system 32 are moved into alignment with a shelf 5 to be filled and containers 6 moved from those station shelves 33 onto the storage bin shelf 5. The storage bin shelves 5 are each loaded in turn from the paternoster system 32. Unloading is a reverse procedure.

The present invention provides apparatus which can effectively buffer plastics containers produced by a moulding plant. This means that a container filling plant, such as a dairy, will always have containers available which are ready to be filled. Temporary interruptions in filling can be accommodated by the apparatus of the invention in that it is not necessary to halt manufacture of the containers since an excess of containers can be stored by the apparatus of the present invention.

Similarly, temporary interruptions in moulding of the containers do not interrupt filling of the containers as containers are available from the storage bin. This is particularly useful in the case of an in-plant facility where containers are manufactured on-site at the filling plant.

The present invention also allows the loading of containers into and unloading of containers from a vehicle used to transport the containers to be expedited, allowing a much faster throughput of containers out of a manufacturing plant and to a filling station.

In principle, the storage bin 2 can be any reasonable height, allowing more containers 6 to be stored per unit area of floor space. The height is not limited by the height of a person, for example.

An embodiment of the present invention has been described with particular reference to the examples illustrated. However, it will be appreciated that variations and modifications may be made to the examples described within the scope of the present invention. For example, a loading/unloading station 3 can service more than one storage bin 2. The storage bin 2 may have adjustable sides so that containers 6 of different dimensions can be accommodated by the storage bin 2.

CLAIMS

1. Storage apparatus (1) for storing a plurality of containers (6), the apparatus (1) comprising:

a storage bin (2) in which a plurality of containers (6) can be stored in a layer; and,

a loading/unloading station (3) for loading containers (6) into the storage bin (2) and receiving containers (6) unloaded from the storage bin (2);

the storage bin (2) including a movable support (16) which is movable with a leading row of containers (6) moved into the storage bin (2) by the loading/unloading station (3) to support said leading row of containers (6) as containers (6) are loaded into the storage bin (2).

2. Apparatus according to claim 1, wherein the storage bin (2) has a plurality of shelves (5) each for receiving a respective layer of containers (6).

3. Apparatus according to claim 2, wherein the storage bin (2) has a movable support (16) for each shelf (5) in the storage bin (2), each movable support (16) being movable with a leading row of containers (6) to support said leading row of containers (6) as containers (6) are loaded onto a shelf (5).

4. Apparatus according to any of claims 1 to 3, comprising support driving means for driving the or each movable support (16) with a row of containers (6).

5. Apparatus according to any of claims 1 to 4, wherein the or each storage bin support comprises an elongate bar (16) extending across substantially the whole width of a layer in the storage bin (2).

6. Apparatus according to any of claims 1 to 5, wherein the loading/unloading station (3) comprises a station

support (7) for receiving and supporting a row of containers (6), the loading/unloading station (3) having moving means for moving the station support (7) to a position adjacent a layer in the storage bin (2) such that containers (6) can be loaded from the station support (7) into the storage bin (2) or unloaded from the storage bin (2) to the station support (7).

7. Apparatus according to claim 6, including a station detector for detecting when the station support (7) is full of containers (6).

8. Apparatus according to claim 7, wherein the station detector comprises a counter which counts the number of containers (6) loaded to or unloaded from the station support (7).

9. Apparatus according to any of claims 6 to 10, wherein the moving means includes means for selectively raising and lowering the station support (7) so that the station support (7) is brought to a height adjacent a layer in the storage bin (2).

10. Apparatus according to any of claims 1 to 8, wherein the loading/unloading station (3) has a plurality of station supports (33) for supporting respective rows of containers (6), the loading/unloading station (3) having driving means for driving the plurality of station supports (33) so that the supports (33) can be successively moved to be adjacent a layer in the storage bin (2).

11. Apparatus according to claim 10, wherein each of the station supports (33) is supported by an endless belt (34) which is driven by the driving means to drive the plurality of station supports (33).

12. Apparatus according to any of claims 1 to 11, wherein the loading/unloading station (3) comprises a pusher (14) for pushing a row of containers (6) into the storage bin (2).

13. Apparatus according to any of claims 1 to 12, wherein the movable support (16) and the pusher (14) are arranged to move synchronously such that the movable support (16) continuously supports a leading row of containers (6) as further rows of containers (6) are successively pushed into the storage bin (2) by the pusher (14).

14. Apparatus according to any of claims 1 to 13, comprising a storage bin detector for detecting when a complete layer of containers (6) has been loaded into or unloaded from the storage bin (2).

15. Apparatus according to claim 14, wherein the storage bin detector comprises a counter for counting the number of rows of containers (6) loaded into or unloaded from the storage bin (2).

16. Apparatus according to any of claims 1 to 15, comprising a conveyor (8) for conveying containers (6) to and from the loading/unloading station (3).

17. Apparatus according to any of claims 1 to 16, wherein the storage bin (2) is mounted on a vehicle or a vehicle trailer.

18. Apparatus according to any of claims 1 to 17, wherein the loading/unloading station (3) comprises means for adjusting the height and roll of the loading/unloading station (3).

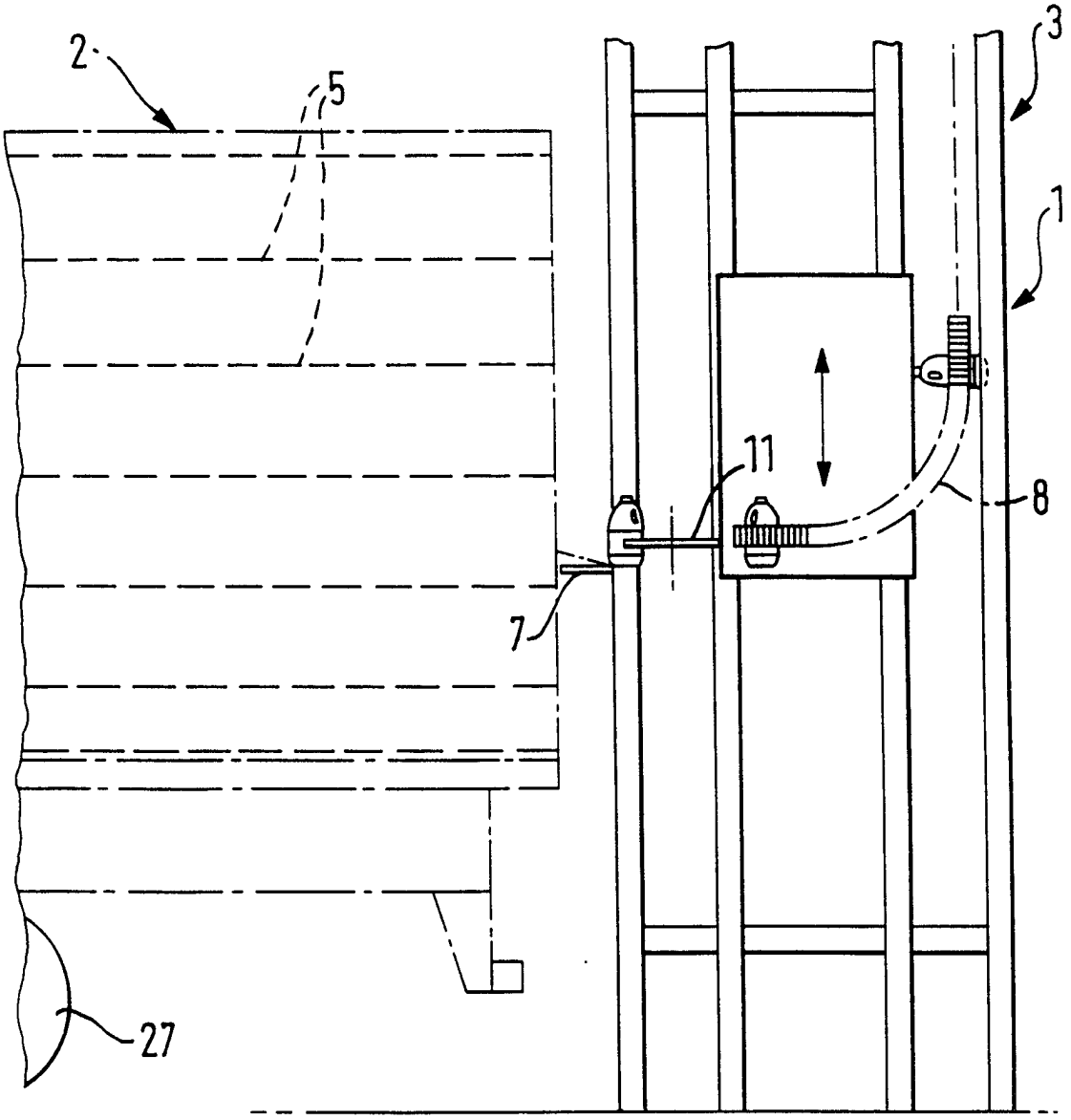


FIG. 1

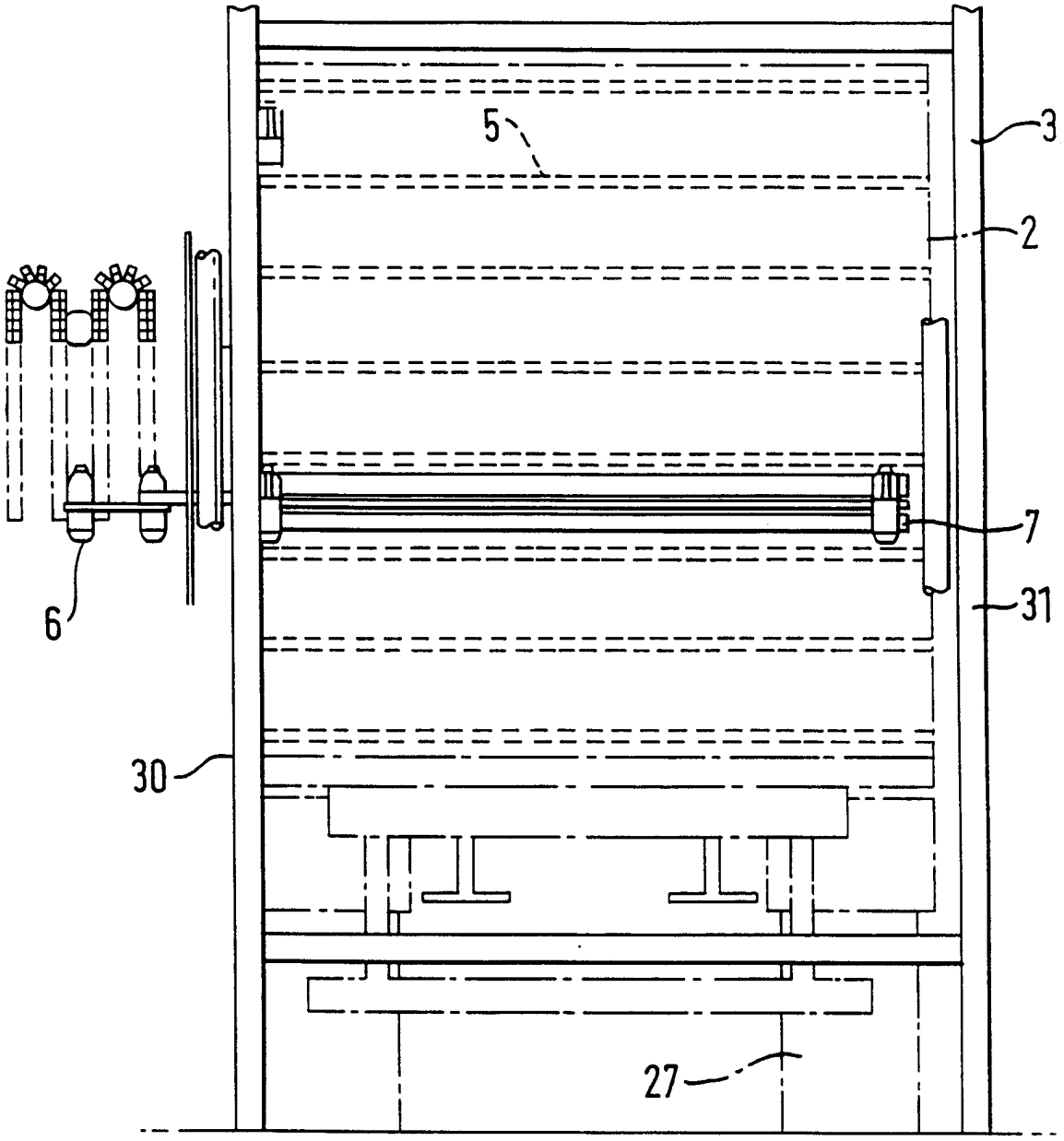


FIG. 2

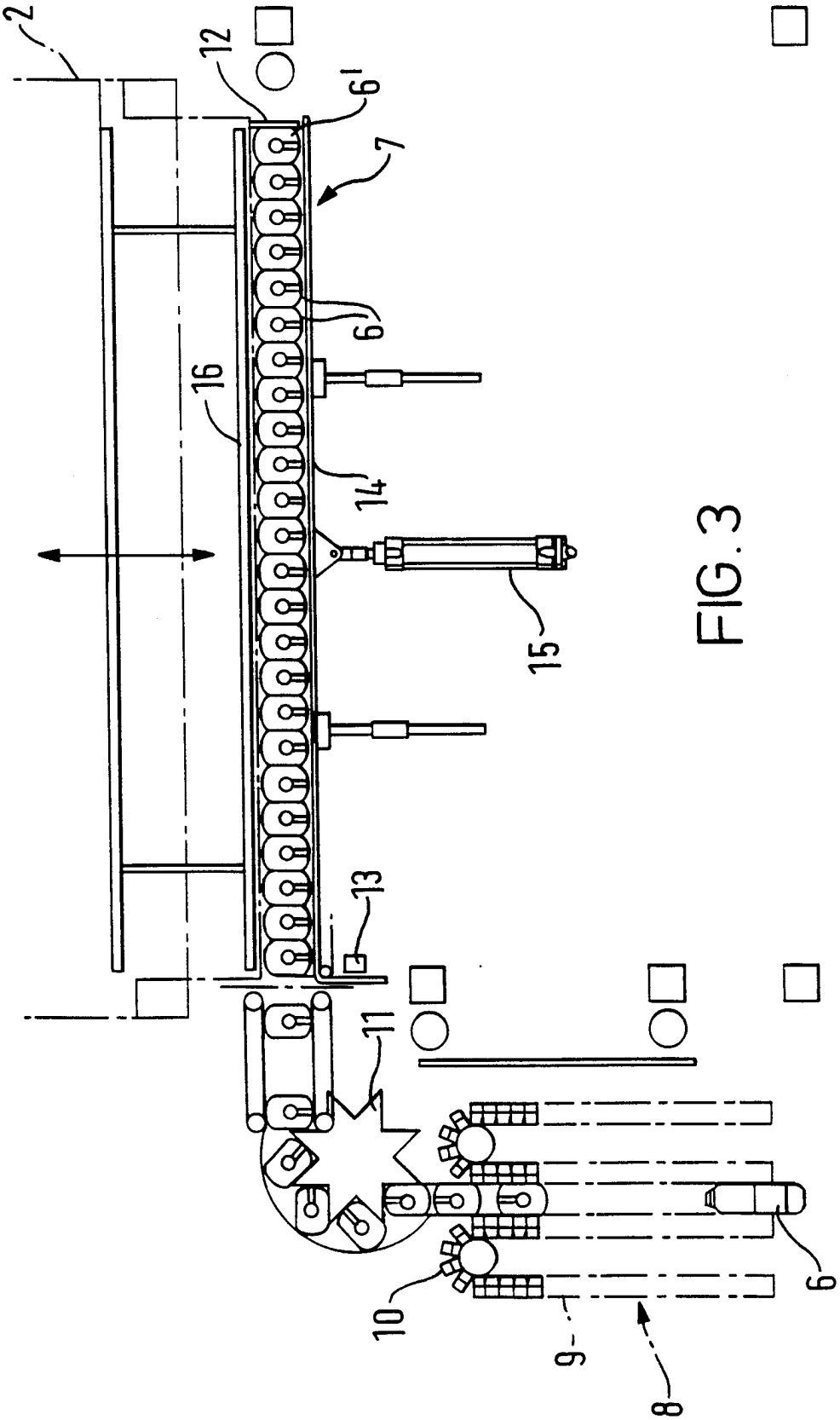


FIG. 3

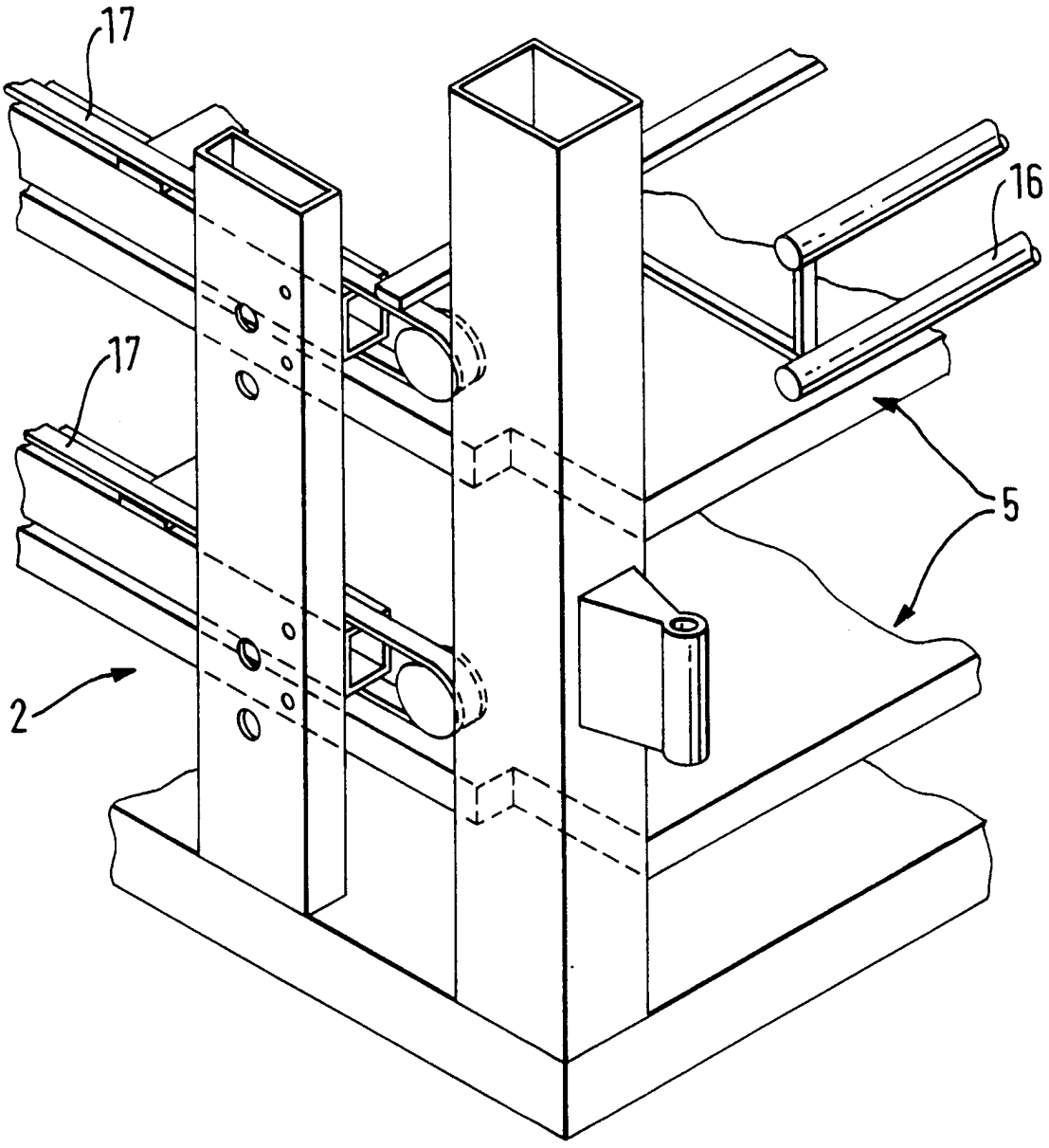


FIG. 4

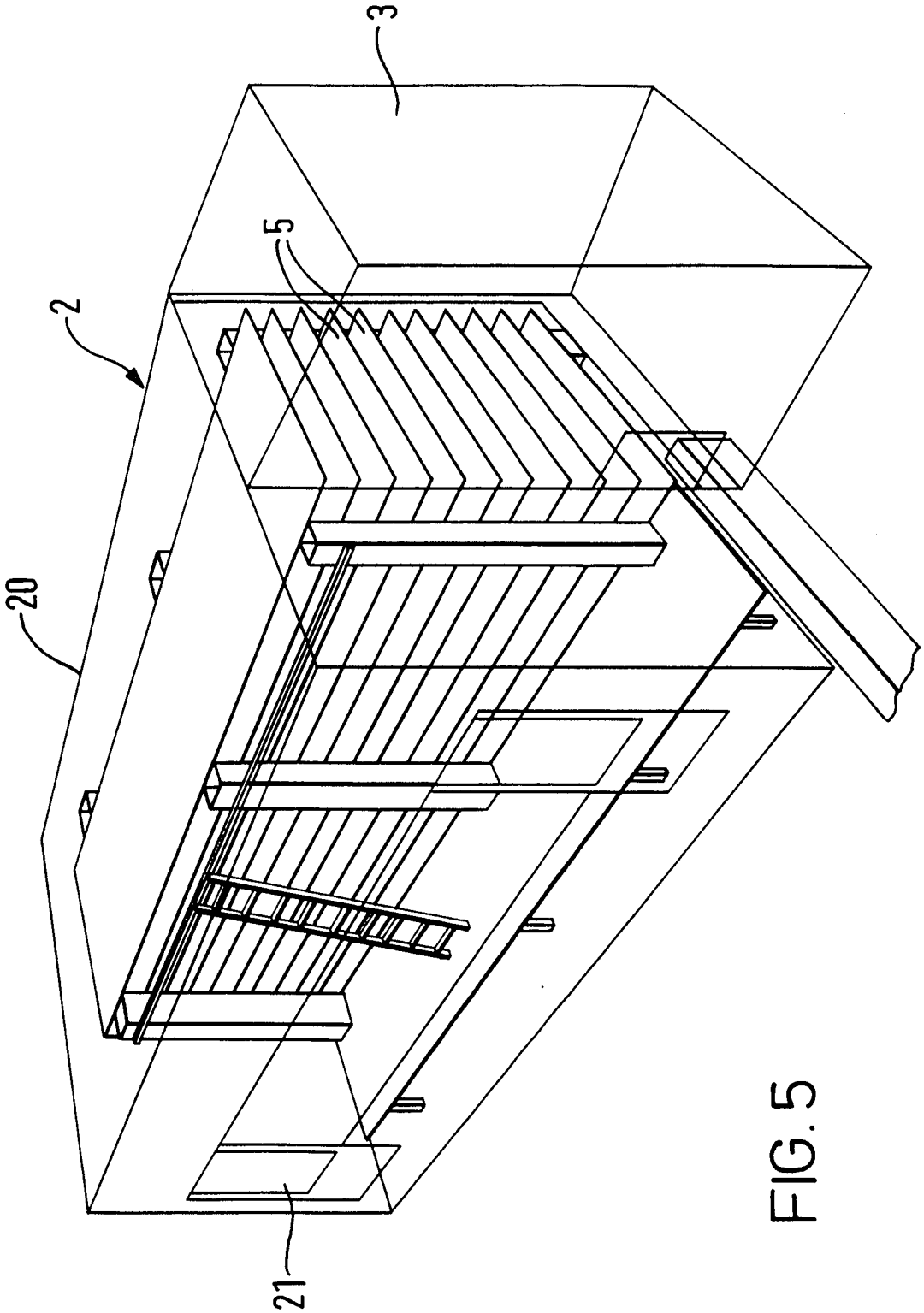
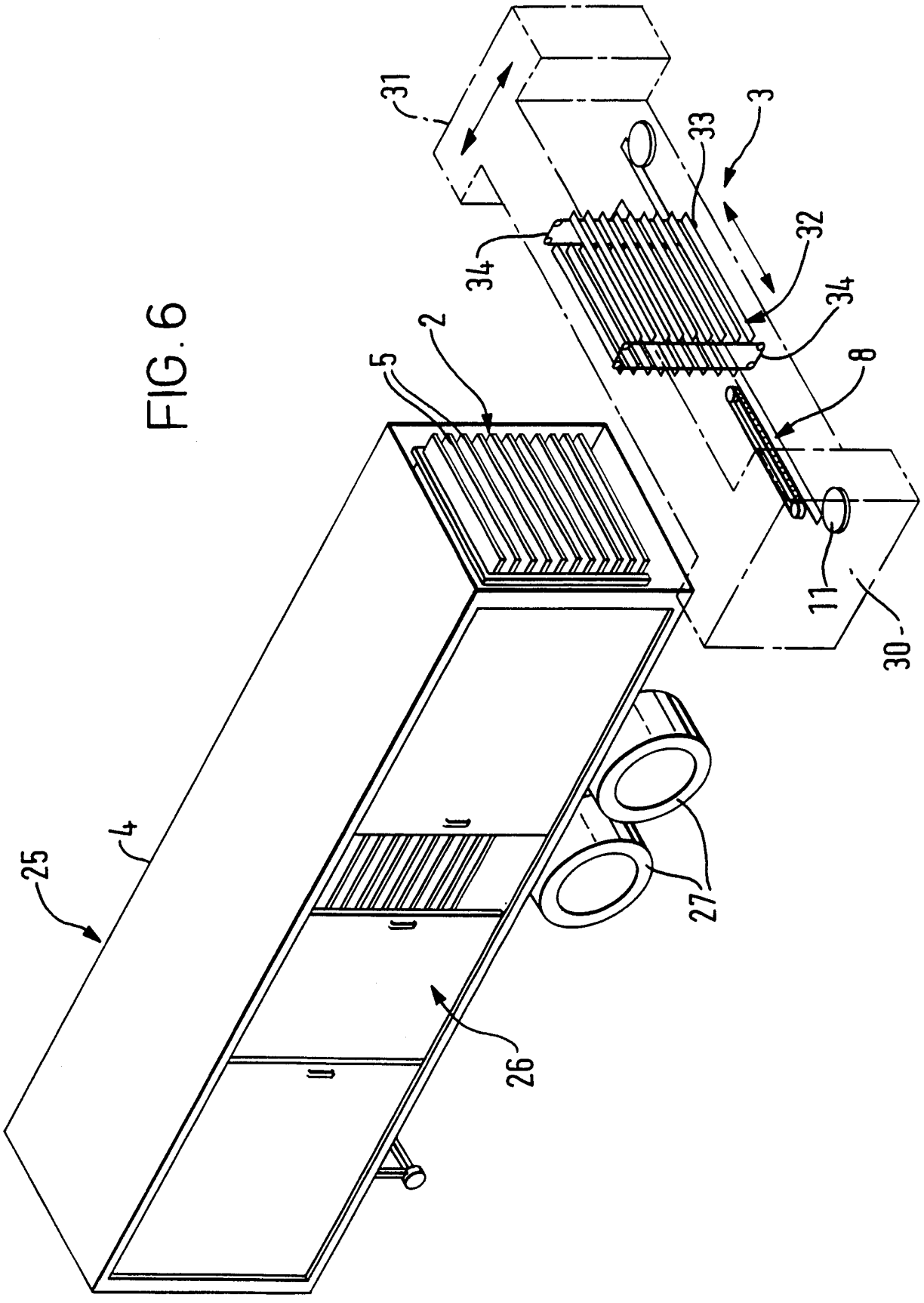


FIG. 5

FIG. 6



INTERNATIONAL SEARCH REPORT

national Application No
PCT/GB 98/00346

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65G47/51 B65G65/00 B65G67/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 35090 A (KELLY DOUGLAS ;SELTMANN BERND (DE); WITTE NIKOLAI (DE)) 7 November 1996	1,2,4,6, 12,13,16
A	see the whole document	5,9
A	EP 0 391 208 A (LEYBOLD AG) 10 October 1990 see the whole document	1
A	DE 86 24 182 U (TRAPP) 24 January 1991 see the whole document	1
A	GB 1 572 340 A (DENHOLM A LTD) 30 July 1980 see the whole document	1,10,11, 16
A	US 3 040 867 A (POSTEN) 26 June 1962 see the whole document	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

1

Date of the actual completion of the international search	Date of mailing of the international search report
12 May 1998	19/05/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ostyn, T

INTERNATIONAL SEARCH REPORT

Information on patent family members

Ir ational Application No
PCT/GB 98/00346

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9635090 A	07-11-96	DE 29507589 U	13-07-95
		EP 0782686 A	09-07-97
EP 0391208 A	10-10-90	DE 9001612 U	19-04-90
		JP 2067772 C	10-07-96
		JP 3067985 A	22-03-91
		JP 7101146 B	01-11-95
		US 5129162 A	14-07-92
DE 8624182 U	24-01-91	NONE	
GB 1572340 A	30-07-80	NONE	
US 3040867 A	26-06-62	NONE	