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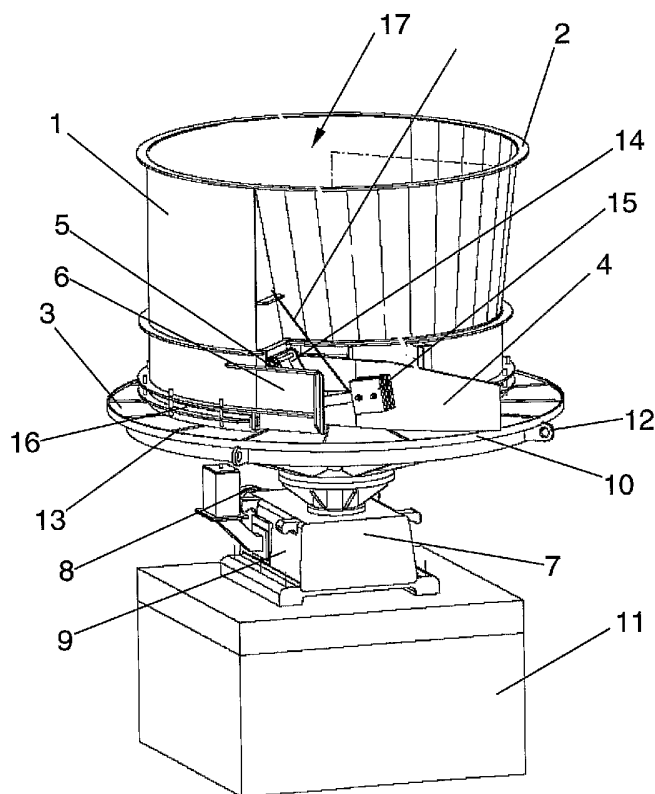
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[Continued on next page]

(54) Title: EQUIPMENT FOR TREATING POWDEROUS OR PULVEROUS MATERIAL



(57) Abstract: The invention relates to equipment for treating powdery or pulverous material (18), said equipment comprising a feed funnel (1) provided with a discharge orifice (5) for the material (18), a table feeder (3) that can be rotated around its center point, an actuator for rotating the table feeder (3), and a scraper blade (4) for guiding the material (18) away from the table feeder (3); in addition, the equipment includes a closing plate (14) for the discharge orifice (5), and a closing mechanism connected to the closing plate (14). In addition, the invention relates to a corresponding method for treating powdery or pulverous material (18).



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## EQUIPMENT FOR TREATING POWDEROUS OR PULVEROUS MATERIAL

The present invention relates to equipment and method for treating powderous or pulverous material. More precisely, the invention relates to equipment placed  
5 underneath the discharge orifice of a silo or a corresponding tank, said equipment being operated in connection with said discharge orifice, including a method for treating powderous or pulverous material stored in a silo or the like.

Table feeders are generally used for feeding various powderous or pulverous  
10 materials from a silo or a corresponding tank. The purpose of table feeders is to ensure an even material flow for the material stored in the silo when taking the material out and transferring it further in the process. A table feeder is installed to rotate underneath the funnel-like discharge orifice located at the bottom end of the silo, so that the material is discharged in an even flow from the silo onto  
15 the table, from where it is removed to be further treated in the process. This kind of prior-art table feeder is known for instance from the publication US 3 369 645.

The publication US 3 369 645 introduces a table feeder that is meant for the  
20 treatment of powderous material. The table feeder is rotated by intermediation of a ring gear located on the circumference of a planar table and by means of an electric motor. Material is fed from a silo onto the planar table feeder through a discharge orifice. The quantity of the material fed onto the table feeder is adjusted by means of a vertically moving collar that adjusts the opening  
25 between the planar surface of the table feeder and the orifice of the silo, and hence the discharge velocity of the material discharged onto the table. The adjusting is carried out by means of bolts located outside the collar, either by tightening or by loosening them. The material is removed from the table by means of a control element onto a belt conveyor proceeding underneath the  
30 table. The control element is moved by a pushbar and an electric motor, and it is pivotally attached at one edge on the outer circumference of the table.

The problem with prior art table feeders is that they are easily blocked in case the material under treatment is cloddy or for some reason contains larger particles among the otherwise homogeneous material. In addition, the material under treatment may be fairly wearing for those table feeder parts that get into  
5 direct contact with the material. Moreover, the sticking of the material onto the surface material of the equipment hinders the operation of the equipment and may cause a blockage in the whole system. The rotation mechanism suggested in the publication US 3 369 645 requires continuous maintenance. In this prior art arrangement, the starting torque is too low, particularly in a start-up after a  
10 stoppage, which means that the wet material is packed against the feeder.

The object of the invention is to provide a new, inventive, maintenance-free and operationally reliable equipment for treating powdery or pulverous material. Another object of the invention is to provide a new and inventive method for the  
15 treatment of powdery or pulverous material.

The above enlisted objects are achieved by the equipment and method according to the independent claims. In addition, the dependent claims describe other preferred embodiments of the invention.  
20

The invention is characterized by what is set forth in the characterizing parts of the independent claims.

The invention is described in more detail below with reference to the appended  
25 drawings, where

figure 1 is a general illustration of the equipment according to the invention,

figure 2 is a side-view illustration of a preferred embodiment of the mechanism  
30 of the discharge orifice,

figure 3 is a side-view illustration of a preferred embodiment of the mechanism of the discharge orifice, and

figure 4 illustrates the adjustable collar of the feed funnel.

5

Figure 1 shows a general illustration of the equipment according to the invention, seen diagonally from the top, for treating powderous or pulverous material. Particularly advantageously the equipment is suited for the feeding difficult substances, such as finely divided chromite, from a silo or a  
10 corresponding storage tank. The equipment comprises a feed funnel 1, which is placed for example underneath the silo funnel discharge orifice (not illustrated). The feed funnel 1 and the silo funnel are advantageously interconnected for instance by a flange joint. The connecting flange 2 of the feed funnel 1 is shown in figure 1. As the silo is filled up, the material under treatment rests  
15 directly against the table feeder 3 arranged underneath the feed funnel 1. In the bottom part of the feed funnel 1, there is attached a scraper 4 that guides the material discharged through the discharge orifice 5 of the feed funnel 1 away from the rotary table feeder 3, for example onto a band conveyor (not illustrated) proceeding along the side of the equipment, which belt conveyor  
20 then conveys the material further in the process. In figure 1, the discharge orifice 5 of the feed funnel 1 is mainly located behind the edge 6. Underneath the table feeder 3, there is arranged its actuating equipment 7, advantageously including an electric motor 8 and a gear system 9. The table feeder 3 is advantageously rotated at the axis connected to the center point thereof. This  
25 ensures a more secure operation than in the arrangements according to the prior art, where the feeder is actuated from the outer edge 10 of the feed plate 3 by means of a gear rim and gears. In addition, the actuation from an axis connected to the center point ensures a sufficient torque, particularly in a start-up after a stoppage, when the wet material is packed against the feeder.

30

The whole equipment is preferably arranged on top of a foundation 11, so that possible maintenance steps are easier to perform. Moreover, the feed table 3

includes lifting lugs 12. The feed table 3 can be suspended from the lifting lugs 12 by means of pulleys, to hang from the bottom part structures of the silo, so that the gear system 9 is easily and quickly replaced, only by pulling it away from underneath the feed table 3, when the gear system is damaged or needs maintenance. Thus the down time can be cut shorter. The number of the lifting lugs 12 is 2 – 8, but preferably there are 4 of them. The existence of the lifting lugs 12 makes it possible to replace the gear system 9 without emptying the silo, which is particularly advantageous.

10 On top of the feed table 3, there are arranged rotary bars 13 that create an autogenous lining on the surface of the feed table 3 as the feed table rotates. The quantity of the material fed by the feed table 3 is controlled, apart from the speed of rotation of the feed table 3, also by the operation of the discharge orifice 5 of the feed funnel 1. A closing plate 14 is fastened, by hinges arranged  
15 at its top edge, to the discharge orifice 5. The closing plate 14 is provided with a connected counterweight 15 that tends to close the closing flap by gravity. By means of the counterweight 15, the quantity of the material discharged through the discharge orifice 5 can be adjusted. The mechanism is described in more detail below, in connection with figure 2.

20

Another preferred embodiment is to use a spring that in similar fashion regulates the opening of the closing plate 14. In that case the spring is mounted for example in the middle of the closing plate 14 in the vertical direction and connected to the respective spot at the edge of the discharge orifice 5 of the  
25 feed funnel. This embodiment is described in more detail in figure 3. Moreover, a discharge orifice 5 operated by either of the methods described above is not blocked, in case the material under treatment includes clods or other larger particles. If a problematic object like this enters the discharge orifice 5, the orifice is capable of adjusting to the situation and letting the object through  
30 automatically, so that the discharge orifice 5 is not blocked, and the clod does not disturb the evenly proceeding material flow.

The quantity of the material flow can also be adjusted by an adjustable bottom skirt 16 attached to the bottom of the stationary top part, i.e. to the bottom of the feed funnel 1. By adjusting the position of the bottom skirt 16 up or down, the slot between the slowly rotating feed table 3 and the bottom skirt 16 of the feed funnel 1 can be controlled, because the material rests directly against the surface of the feed table 3.

For achieving a better transport and lesser adhesion of the material, as well as for reducing wear and corrosion, the inner surface 17 of the feed funnel 1, the scraper blade 4 and the closing plate 14 of the discharge orifice 5 are preferably coated, at least in those parts that get into contact with the material under treatment. This increases the operational reliability of the equipment and improves the evenness of the material flow as well as reduces the need for maintenance. Depending on the material under treatment, the agents used for coating can be different known coating materials, such as Chemflake special paint, Polyglass VEF coating or for example ceramic plates or Hardox wear plates.

The operation of the mechanism of the discharge orifice 5 is described in more detail in figure 2. At the opening of the discharge orifice 5, there is arranged a closing plate 14 hinged at the top edge, which closing plate 14 is opened as the material 18 is pressed against it when the feed table 3 rotates. The quantity of the material 18 discharged through the discharge orifice 5 is adjusted by the rotation speed of the feed table 3 as well as by the opening of the closing plate 14 and by an adjustable bottom skirt (not illustrated in figure 2). The opening of the closing plate 14 is affected by means of replaceable counterweights 15 connected thereto, which counterweights tend to close the discharge orifice 5. The minimum opening of the discharge orifice 5 is adjusted by the length of a wire 20 connected to the support rod 19 of the counterweight 15 or by some corresponding means. The wire 20 can also be connected directly to the counterweight 15.

Figure 3 illustrates another preferred embodiment. There the quantity of the material 18 is adjusted by a similar closing plate 14 as in the mechanism illustrated in figure 2. The opening of the closing plate 14 is affected by means of a spring 21, and the size of the minimum opening is adjusted by means of  
5 the fastening 22 of an adjusting screw attached at the edge of the discharge orifice 5 and by the adjusting screw 23 itself. The counterpiece 24 of the adjusting screw 23 is mounted on the side of the closing plate 14. The adjusting screw 23 can also be mounted so that it rests directly against the closing plate 14 without a separate counterpiece . Here the spring 21 is arranged between  
10 the closing plate 14 and the edge of the discharge orifice 5, but it should be understood that it may also be located somewhere else, for example in connection with the hinges 25 of the closing plate.

The mechanisms of figures 2 and 3 can be combined, and solutions of a similar  
15 type can be achieved. The essential thing is that the mechanism ensures an operation of the equipment without blockages and can be adjusted for a minimum output of the material.

Figure 4 is a more detailed illustration of how the bottom skirt 16 of the feed  
20 funnel 1 is adjusted. At the bottom part of the feed funnel 1, there is constructed, by means of threaded rods 25 and bolts 26, a simple adjusting mechanism, by which the location of the bottom skirt 16 with respect to the surface of the feed table 3 can be adjusted. On the surface of the feed table 3, there also is described a rotary bar 13, and at the outer edge of the feed table,  
25 a lifting lug 12.

In the above specification, the invention is described by way of example only, and the suggested solutions are by no means restrictive. The protected scope of the invention is defined according to the appended claims.

## Claims

1. Equipment for treating powdery or pulverous material (18), said  
5 equipment comprising a feed funnel (1) provided with a discharge orifice (5) for  
the material (18), a table feeder (3) that can be rotated around its center point,  
an actuator for rotating the table feeder (3), a scraper blade (4) for guiding the  
material (18) away from the table feeder (3), **characterized** in that the  
equipment also includes a closing plate (14) for closing the discharge orifice (5),  
10 and a closing mechanism connected to the closing plate (14).
2. Equipment according to claim 1, **characterized** in that the closing  
mechanism comprises a counterweight (15), a counterweight rod (19) and an  
adjusting mechanism.  
15
3. Equipment according to claim 1, **characterized** in that the closing  
mechanism comprises a spring (21) and an adjusting mechanism.
4. Equipment according to claim 2 or 3, **characterized** in that the adjusting  
20 mechanism is a wire (20) or the like, or an adjusting screw (23) provided with  
fastening (22) or the like.
5. Equipment according to any of the preceding claims 1 – 4,  
**characterized** in that rotary bars (13) are provided on the surface of the table  
25 feeder (3).
6. Equipment according to any of the preceding claims 1 – 5,  
**characterized** in that the actuator includes an electric motor (8) and a gear  
system (9).  
30
7. Equipment according to any of the preceding claims 1 – 6,  
**characterized** in that the inner surface (17) of the feed funnel (1) and/or the

feed funnel closing plate (14) are coated by ceramic or corresponding wear plates or by a ceramic coating, paint or other corresponding coating material.

8. Equipment according to any of the preceding claims 1 – 7,  
5 **characterized** in that the scraper blade (4) is coated by ceramic or corresponding wear plates or by a ceramic coating, paint or other corresponding coating.

9. Equipment according to any of the preceding claims 1 – 8,  
10 **characterized** in that the table feeder (3) is connected to the actuator through its center point.

10. Equipment according to any of the preceding claims 1 – 9,  
**characterized** in that the outer circumference of the table feeder (3) is provided  
15 with means, such as lifting lugs (12) or other corresponding means for suspending the table feeder (3) from the structures of the bottom part of the silo.

11. Equipment according to any of the preceding claims 1 – 10,  
20 **characterized** in that the bottom part of the feed funnel (1) is provided with an adjustable bottom skirt (16).

12. A method for treating powderous or pulverous material (18) contained in a silo or a corresponding storage tank, said method comprising the following  
25 steps:

- underneath the discharge orifice of a silo or a corresponding storage tank, there is arranged a feed funnel (1),
- powderous or pulverous material (18) is transported by means of gravity from the silo to the feed funnel (1) and further to the discharge orifice (5)  
30 of the feed funnel (1),
- underneath the discharge orifice (5), there is arranged a table feeder (3),

- the table feeder (3) is rotated around its center point by means of an actuator,
- on top of the table feeder (3), there is placed a scraper blade (4) for moving the material (18) forward, away from the table feeder (3),

5 **characterized** in that the method also includes the following steps:

- in the discharge orifice (5) of the feed funnel (1), there is installed a closing plate (14), which is fastened by hinges at its top edge ,
- the feeding of the material (18) through the discharge orifice (5) onto the  
10 closing plate (14).

13. A method according to claim 12, **characterized** in that the table feeder (3) is rotated from an axis arranged at the center point thereof.

15 14. A method according to any of the preceding claims 12 – 13, **characterized** in that the feeding of the material (18) is controlled by the rotation speed of the feed table (3) and/or by the closing mechanism of the closing plate (14) of the discharge orifice(5).

20 15. A method according to claim 14, **characterized** in that the closing mechanism is adjusted by an adjusting mechanism.

16. A method according to any of the preceding claims 12 – 15, **characterized** in that the inner surface (17) of the feed funnel (1), and/or the  
25 surface of the scraper blade (4), and/or the closing plate (14) of the feed funnel (1) is coated for reducing wear, corrosion and friction.

17. A method according to any of the preceding claims 12 – 16, **characterized** in that the closing plate (14) is adjusted to be sufficiently opened  
30 when necessary, for example when a clod or the like enters the discharge orifice (5), by means of a spring, a counterweight or the like, in order to prevent the equipment from being blocked.

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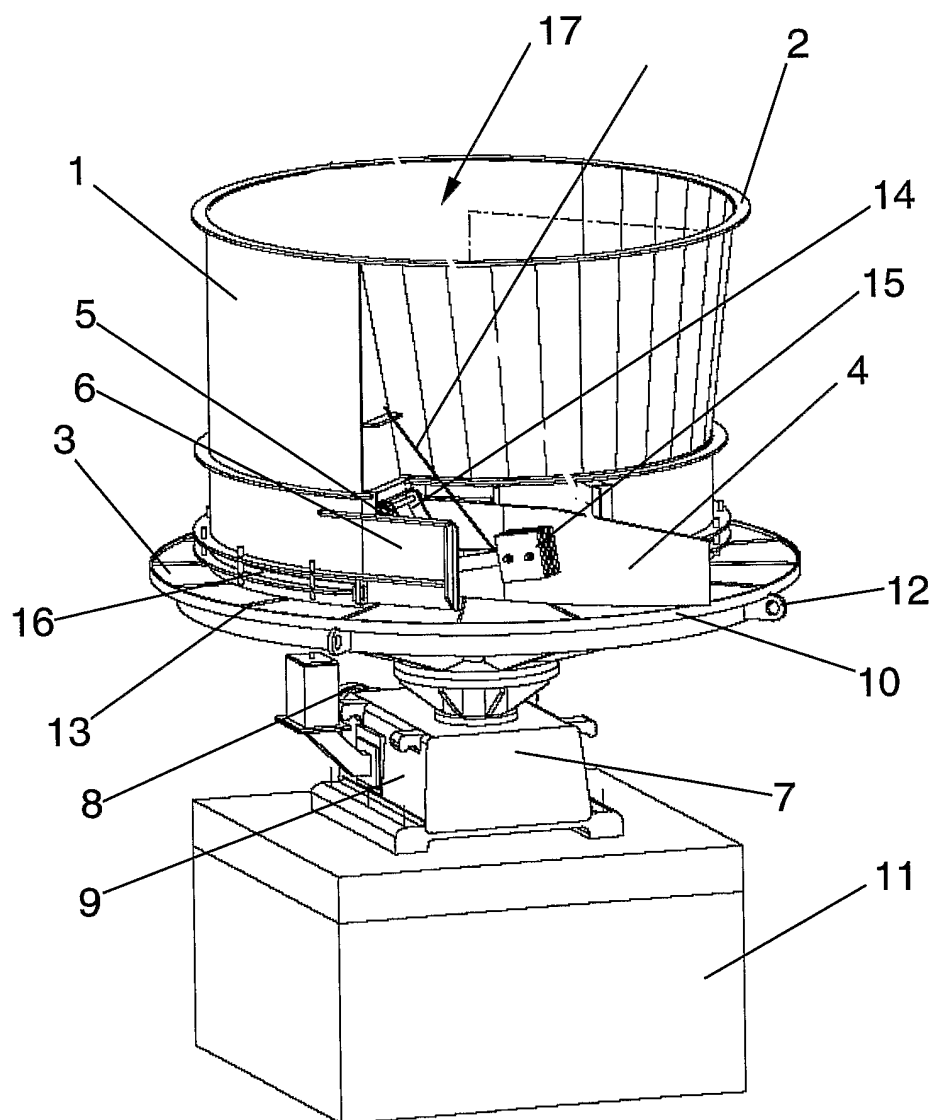


Fig. 1

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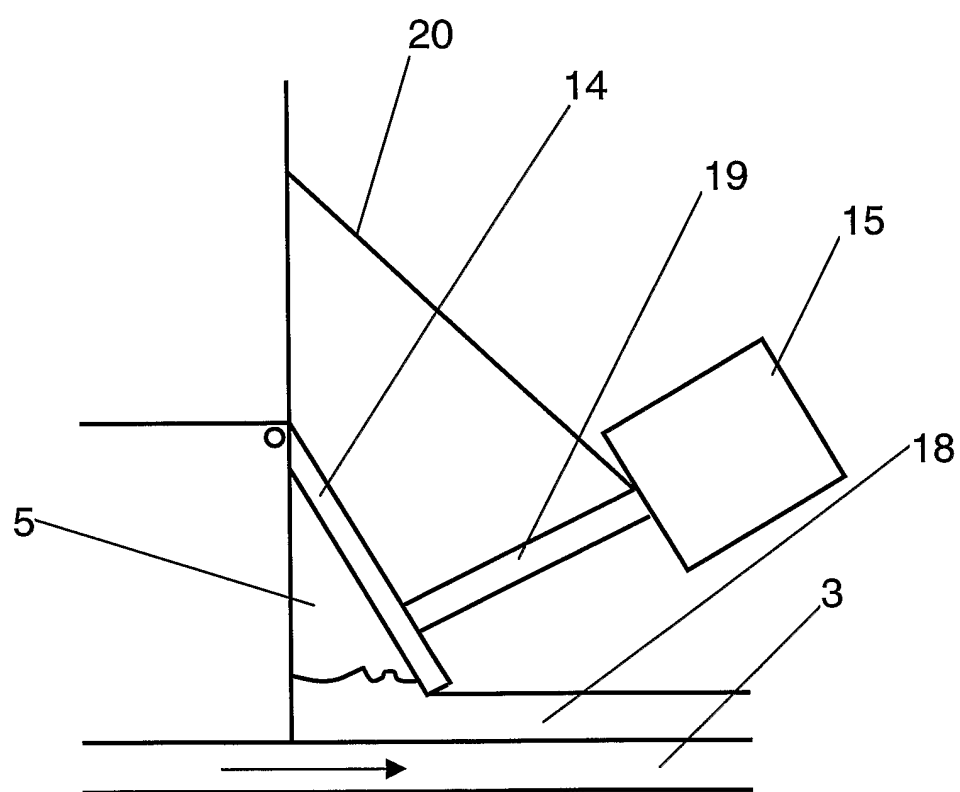


Fig. 2

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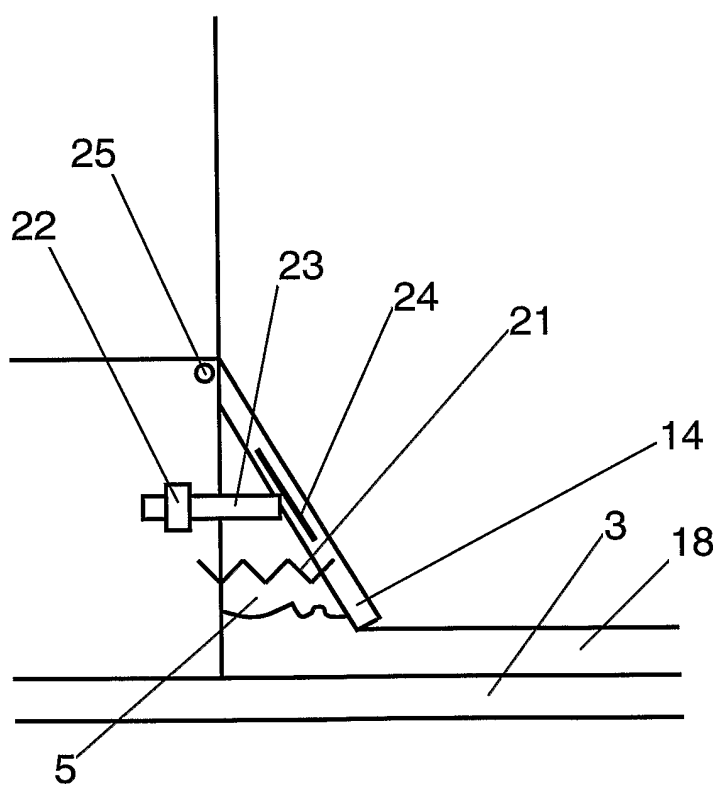


Fig. 3

4/4

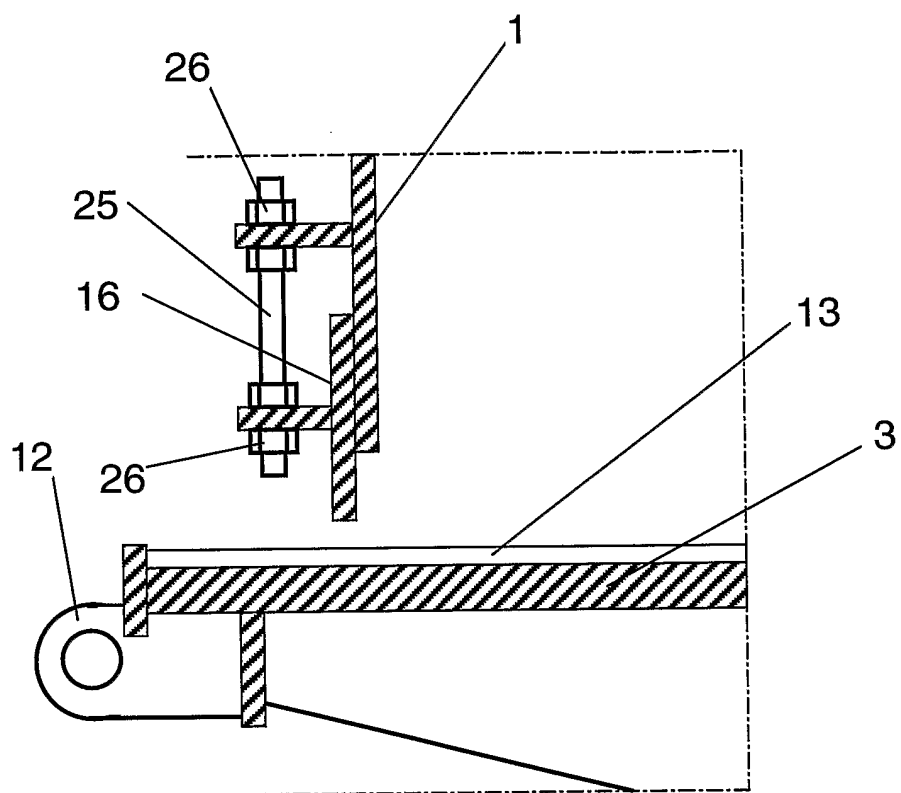


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2005/000556

## A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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: B65G

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                            | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | File EPODOC/EPO, Sumitomo Metal Ind et al:<br>"Table Feeder in Charging Car"<br>JP9048975 A, 19970218<br>abstract<br><br>--   | 1,12                  |
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☒ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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Date of the actual completion of the international search

17 May 2006

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International application No.

PCT/FI2005/000556

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                        | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | File EPODOC/EPO, Sansei Kensetsu KK et al:<br>"Delivery Method and Device of Rotary Table"<br>JP6191645 A, 19990712<br>abstract<br><br>-- | 1,12                  |
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**International patent classification (IPC)****B65G 65/48** (2006.01)**B65G 47/80** (2006.01)**Download your patent documents at [www.prv.se](http://www.prv.se)**

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Paper copies can be ordered at a cost of 50 SEK per copy from PRV InterPat (telephone number 08-782 28 85).

Cited literature, if any, will be enclosed in paper form.

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

04/03/2006

International application No.

PCT/FI2005/000556

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