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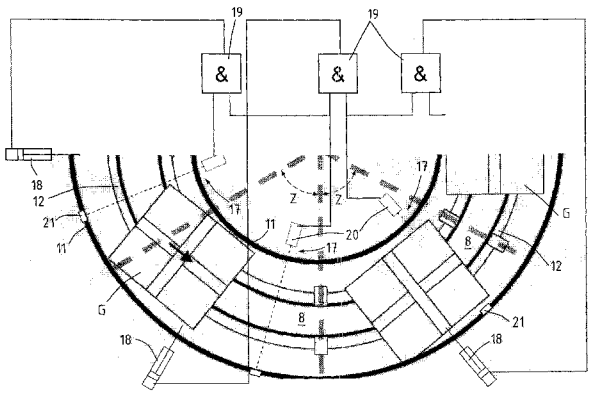
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(54) **Title:** A CONVEYOR FOR CONVEYING AND BUFFERING ARTICLES



(57) **Abstract:** The invention relates to a conveyor for conveying and buffering articles (G) and the like along a vertically extending, substantially helical path. A conveyor belt (8) or conveyor rollers (13) supported by a frame (1) and driven by a drive unit (9; 16) extend along said helical path and convey articles along said path. The substantially helical path is divided into zones (Z), each zone being provided with switch means (18), in such a manner that the conveyor can be switched in each zone between a conveying position, in which the conveying means convey the articles, and a buffering position, in which the articles present in said zone are stationary. Buffering members (12; 14,15) distributed over the length of the conveyor and being present in each zone support the articles in the buffering position. The drive unit (9; 16) and/or the conveyor belt/rollers (8; 13) on the one hand and the buffering members (12; 14, 15) on the other hand are vertically movable with respect to each other in each zone (Z), in such a manner that the articles (G) in question are in contact with the drive unit (9; 16) in the conveying position and with the buffering members (12; 14, 15) in the buffering position in said zone. In this way a simple and reliable buffering system can be realised.

WO 2008/044926 A1

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A conveyor for conveying and buffering articles

The invention relates to a conveyor according to the preamble of claim 1.

An embodiment of such a conveyor is known, for example from US 6,935,485. The conveying means of said known conveyor consist of a roller track with so-called "powered rollers", which rollers are provided with an internal motor, which can be turned on and off via switch means. Thus, articles can be buffered in the zones by stopping the drive motors and be transported further again by activating the drive motors. Although such a system functions satisfactorily, the "powered rollers" are comparatively costly and require a high level of maintenance.

The object of the invention is to provide a novel conveyor.

In order to accomplish that object, the invention proposes a conveyor that exhibits the features of claim 1.

By using separate conveying means and buffering means, said means can be specifically selected for their respective purposes and the conveying means can be driven continuously, which has a positive effect both as regards reliability and as regards wear.

The buffering means are preferably vertically adjustable with respect to the frame in the conveying means, as in most cases this is the easiest way to realise this.

In a special embodiment the buffering means are disposed on either side of the conveying element. In such an embodiment, the width of the conveying means in relation to that of the articles to be conveyed must be so small that the articles project from the conveying means and that the projecting parts thereof can be supported by the buffering means. This functions best with articles which are relatively stiff, of course, in particular the bottom surface thereof, and which preferably have a regular shape, most preferably having the same dimensions. Articles that can certainly be

considered with such an embodiment are crates, cases, boxes and the like.

It is advantageous in that connection if the buffering means are configured as rail sections that extend along part of the helical path. Such buffering means can support the articles in a reliable manner and deliver them to the conveying means again. The rail sections may extend over the entire zone or only over a part thereof, whilst each zone may furthermore comprise several rail sections.

In one embodiment the conveying means are configured as an endless conveyor belt, for example a slat conveyor belt. Such conveying means can be of comparatively low-cost construction and contribute to a smooth transportation of the articles at a low noise level.

In this embodiment it is advantageous if the conveyor belt comprises a support surface having a convex cross-section. In such an embodiment the articles to be conveyed will be supported in a stable manner on the conveyor belt because the articles are supported along a curved line of contact in the centre thereof. When the conveyor belt has a flat upper side, the articles will be supported on two corners with their flat bottom side because of the helical shape, as a result of which the articles may start to wobble. The articles will not exhibit such a tendency when a convex support surface is used.

An alternative embodiment of the conveyor according to the invention is characterised in that the conveying means comprise a number of driveable rollers evenly distributed along the length of the substantially helical path for forming a roller track extending along the substantially helical path. Such a conveyor can be of relatively low-cost construction, since the rollers can be driven in a simple manner, possibly continuously. The buffering means may be disposed on either side of the roller conveyor, as is the case with the conveyor belt, but they may also be disposed between the rollers, for example in the form of fingers or cross ribs. In this way the conveyor is suitable for use with several kinds of articles of varying shape.

Further alternatives of the conveyor according to the invention are defined in the independent claims 15 and 16.

The invention will be explained in more detail hereinafter with reference to the drawings, which are very schematic views of embodiments of the conveyor according to the invention.

Fig. 1 is a schematic, perspective view of a first embodiment of the conveyor according to the invention.

Fig. 2 is a sectional view along the line II-II in Fig. 1.

Figs. 3 and 4 are simplified sectional views along the lines III-III and IV-IV, respectively, in figure 2, which illustrate the buffering function of the conveyor of Figs. 1 and 2.

Figs. 5, 6 and 7 are sectional views corresponding to Figs. 2-4 of a second embodiment of the conveyor according to the invention.

Figs. 8, 9 and 10 are sectional views corresponding to Figs. 2-4 of a third embodiment of the conveyor according to the invention.

Figs. 11-13 are sectional views corresponding to Figs. 2-4 of a fourth embodiment of the conveyor according to the invention.

Fig. 14 is a sectional view corresponding to Fig. 2 of the first embodiment of the conveyor, in which the sensor arrangement is illustrated.

Fig. 15 is a sectional view along the line XV-XV in Fig. 14.

Fig. 16 is a sectional view corresponding to Fig. 15, in which no articles are present in the zone in question, however.

Fig. 17 a part of the sectional view of Fig. 14, illustrating the manner in which the switch means are controlled in the zones.

The drawing shows a conveyor which is capable of conveying products, in particular articles G, in vertical direction along a helical path. In practice such conveyors

are also known as spiral conveyors or winding conveyors. Said conveyors are suitable for conveying products in a continuous flow, which product flow may be intended for vertical transport, but in particular for buffering products in a process line. Possible applications are, for example, the foodstuffs industry, distribution centres, the graphics industry and the like. Articles which are very suitable for being conveyed by means of such conveyors are, for example, boxes, crates, cases and other articles exhibiting a reasonable degree of shape-stability, in particular the bottom surface thereof, and which cannot fall over.

The illustrated conveyor comprises a frame 1, in this case having a central column 2 with bases 3 and a helical guide chute 4, which extends around the column 2 and which is attached thereto. All kinds of other frame constructions are conceivable, of course. An end pulley 5, 6 is mounted to the upper end and the lower end, respectively, of the guide chute 4, and a return chute 7 of the frame 1 extends between said ends of the helical guide chute 4. In this embodiment the conveyor belt 8 supported by the frame 1 travels along different paths in the conveying portion and the return portion, therefore. It is also conceivable, however, to use embodiments in which the conveying belt is returned along the underside of the guide chute 4.

In the illustrated embodiment the helical guide chute 4 comprises three windings, but this number may be increased or decreased, depending on the application in question. The conveyor belt 8 can be driven through a large number of windings without any problem. In the illustrated embodiment, a drive motor 9 engages the end pulley 6 at the upper end of the conveyor track. If desired, auxiliary drive units may be used at different locations along the conveyor track. The conveyor belt 8 may also be driven linearly. The conveyor may be connected to further conveyors at the lower and upper end pulleys 5, 6.

The illustrated conveyor belt 8 comprises a large number of slats 10, which are interconnected either directly or via an endless connecting element. Each slat 10 has an

upper, flat support surface, and the slats abut each other so closely in their conveying path that products can be supported by a number of adjacent slats 10. As already said before, the slats 10 are pivotally interconnected either directly, or in this embodiment, via an endless connecting element, such as a side-bow chain, in such a manner that the slats 10 can pivot relative to each other, both about a first axis parallel to their conveying surface and perpendicular to the conveying direction, and about the second axis perpendicular to the conveying surface and perpendicular to the conveying direction. Said latter pivoting motion enables transport in a helical path, whilst the former pivoting motion enables the conveyor belt 8 to pass over the end pulleys 5 and 6.

Since the slats 10 taper off slightly from their central axis towards the ends, the slats 10 do not obstruct each other in bends. Other shapes, such as a diamond shape, a V-shape, a toothed shape and also overlaps or a combination thereof are possible. In a special embodiment the slats 10 may be segmented, in which case the conveyor belt can only travel along a fully curved path, however, but on the other hand a fully closed surface of the conveyor belt 8 is effected in that case.

Other belt conveyors, such as conveyors comprising links and the like, are conceivable. Examples of belt conveyors that may be used are disclosed in more detail in WO 99/11547 and WO 03/024846, the content of which is incorporated herein by reference. The frame of said belt conveyors is provided with a helical frame, and the endless conveyor belt is guided in at least substantially radial direction with respect to the guide by means of guide rollers.

Fig. 1 furthermore shows that the guide chute of the frame is provided with a railing 11 at least on the outer side, but preferably on both sides (see Figs. 3 and 4), which railing prevents articles falling off the conveyor on the outer side of the helical path and which furthermore provides

an at least substantially symmetric support for the articles relative to the conveyor belt.

In order to perform a buffering function, the helical conveying path of the conveyor according to the invention is divided into zones Z (see Fig. 2), which are each provided with switch means, in such a manner that in each zone the conveyor can be switched between a conveying position, in which the conveyor belt conveys the articles, and a buffering position, in which the articles present in the zone in question are stationary. A zone may extend through an arc angle of 30, 60 or 90 degrees, for example, but any other arc angle is conceivable, depending on the application in question. In the embodiment of Fig. 2 each zone Z_1-Z_6 extends through an arc angle of 60 degrees.

Figs. 1-5 show that buffering means in the form of rail sections 12 are disposed on either side of the conveyor belt so as to provide the buffering function. Said rail sections extend through an arc angle that corresponds to the arc angle of a zone Z, and in fact said rails sections determine the zones (Z_1-Z_6). The rail sections of each zone can be moved up and down with the aid of the switch means. In the lower position of the rail sections 12, said rail sections are positioned below the level of the upper surface of the conveyor belt 8 (Fig. 3), as a result of which the article G is moved ahead by the conveyor belt. The width of the conveyor belt 8 is so small in comparison with the articles G to be conveyed that said articles project laterally from the conveyor belt. When the rail sections 12 are moved upwards to their buffering position, they will extend above the upper surface of the conveyor belt 8 (Fig. 4), and an article present in the zone in question will come to be supported on the rail sections with the parts that project laterally from the conveyor belt, thus enabling the conveyor belt to move under the lifted article. When the rail sections move down, the articlein question will be lowered onto the conveyor belt again and be conveyed further. In Fig. 2 the articles G are being buffered in zones Z_1-Z_3, whilst the articles are still being conveyed in zones Z_4-Z_6.

In order to have the articles stop quickly upon being lifted off the moving conveyor belt 8, the upper surface of the rail sections 12 on which the articles will be supported is provided with an antiskid coating or the like. The articles cannot slide down under the influence of the slope of the rail sections in that case.

As Figs. 14-17 show, a PLC control unit may be provided for controlling switch means in the zones Z of the conveying path, which control unit is connected to a number of sensors 17, with at least one sensor 17 being present in each of the zones Z. Said sensor 17 may be combined with a controllable air valve for actuating a pneumatic cylinder 18 (Fig. 17) for raising or lowering the rail sections 12. The sensor may furthermore be provided with logic elements 19 to enable communication between the successive sensors 17. To that end the sensors 17 will generally be connected in series, so that, if buffering is taking place in a zone Z, a sensor 17 in a next zone can be informed that buffering must take place in said next zone as well upon detection of the presence of a article by said sensor 17. Conversely, when a article leaves a zone Z, the sensors 17 in all the next zones must be informed that buffering is not necessary upon passage of an article. A sensor unit 17 that might be used is for example a photoelectric cell 20 with a reflector 21, as for example the reflection (infrared) light sensor for roller conveyors type WTR1 from SICK. Other sensors-detectors, such as probes, approach switches and the like are conceivable.

Obviously, other possibilities are available for controlling the switch means. Thus it is for example possible to count articles at the start and at the end of the conveyor and activate and deactivate zones on the basis thereof. Furthermore a system is conceivable in which buffering takes place directly at the start of the conveyor by moving up or indexing one zone each time and releasing a product at the delivery end of the conveyor. Furthermore it is possible to have random buffer zones occupied, and in some processes it is even conceivable not to operate according to the first-in-first-out (FIFO) principle but according to the first-in-

last-out principle, in which case a reversal of the conveying direction may be effected.

Figs. 5-7 show a second embodiment of the conveyor according to the invention, in which the conveying means do not consist of a conveyor belt or the like but of a roller track. Said roller track includes a plurality of rollers distributed over the length of the helical path, in this case conical rollers 13, which jointly form a helical conveying surface. In principle the rollers are driven continuously, in which case all rollers will in principle be driven, but in principle it is also possible to drive fewer rollers and to configure some rollers as freely rotatable rollers, as long as it can be effected that the articles G can be conveyed in all positions. The rollers 13 may be provided with internal drive units, so-called motorised rollers or "powered rollers", but it is also conceivable to position a driving conveyor belt under the rollers, which conveyor belt is in engagement with all the rollers and thus drives said rollers. The rollers 13 may be interconnected, so that the drive unit engages one roller 13, which in turn drives one or more other rollers 13 via the connections.

In this embodiment the buffering means are comparable to those used in the first embodiment, viz. consisting of arcuate rail sections 12, the arc angle substantially corresponds to that of the associated zone Z. Accordingly, the operation of the device is the same as that of the first embodiment.

Figs. 8-10 show a third embodiment, in which the conveying means again consist of driveable rollers 13. In this case wider rollers 13 are used, however, so that said rollers can support the articles G to be transported and buffered over the entire width thereof. In order to be able to release the articles G from the conveying means in this case as well for the purpose of buffering the same, the buffering means are disposed between the rollers 13 in this embodiment and are configured as fingers or cross ribs 14, which can be individually controlled for each zone Z in this embodiment as well. In the illustrated embodiment, each zone

Z extends through an angle of 90°. The cross ribs 14 of each zone are interconnected by arcuate members 15, so that the cross ribs 14 can be adjusted for height by a single drive unit in each zone Z.

The operation is again comparable to that of the preceding embodiment, with this difference that the articles G are now supported over their entire width at a number of spaced-apart locations in their buffered position.

Figs. 11-14 show a fourth variant of an embodiment of the conveyor according to the invention. In this variant, rollers 13 are used as the conveying means again. Said rollers 13 can be driven by drive means, in this embodiment in the form of a driving belt 16 disposed under the rollers 13. The buffering means are again configured as rail sections 12, which are vertically adjustable under the control of the switch means with respect to the drive means and with respect to the support surface of the rollers 13 that function as conveying means. The vertical adjustment of the buffering means makes it possible to lift the rollers 13, which are in contact with the driving belt 16 in the conveying position, and the articles G from the driving belt 16 and thus release the driving engagement. The rollers 13 and thus the articles G are supported by the buffering means 12 in the buffering position. The rail sections of the buffering means or separate brakes that may be provided effect a rapid deceleration of the rotation of the rollers 13, so that the articles will quickly come to a standstill. When the buffering means are lowered, the rollers are brought into contact with the drive means again and will transport the article in question further again. Of course it would also be possible to adjust the drive means for height and thus either drive the rollers or lower the rollers onto the buffering means. In both cases a vertical adjustment between the support surface of the conveying means and the buffering means will take place, which is also the case in the other embodiments.

The rollers may also be differently configured, for example as straight cylindrical rollers or as a plurality of

wheels (roller skater wheels) evenly distributed over a shaft or an axis. In the embodiments comprising rollers it is not necessary to drive the rollers by means of a motor in a situation in which products are only transported in downward direction. In that case the articles are driven by the force of gravity in combination with the freely rotating rollers.

The invention is not limited to the embodiments as described above and illustrated in the drawings, which can be varied in various ways within the scope of the invention as defined in the claims. Thus it is possible to exchange the rail sections and the conveyor belts for one another, so that single rail sections are provided between conveyor belts extending on either side thereof. When rail sections or other buffering means are provided on either side of the conveyor belt, it is furthermore possible to move only the buffering means disposed on one side of the conveyor belt, so that the articles are supported at a slight angle above the conveyor belt or other conveying means. Furthermore it is possible to make the conveyor belts or other conveying means vertically adjustable rather than the buffering means. Instead of using rail sections as the buffering means, other supports may be used, such as a plurality of fingers or differently configured lifting means distributed over the zone.

If a roller track is used, all kinds of driving arrangements may be used for the rollers, such as one or more or drive units connected to one or more rollers, whilst the rollers are interconnected. Also motorised rollers might be used.

The conveyor track will preferably be spiral-shaped, but it may also have an at least partially different shape, if this is more advantageous for the application in question. It is also possible to couple spirals, so that the articles move up in one spiral and move down again in the other spiral. The articles will land at the same level again or at a different level in that case. The spiral shape makes it possible to realise a large buffering capacity on a small surface area.

In the case of three-dimensionally curved conveyor tracks it is advantageous to configure a supporting conveyor belt or a driving conveyor belt with a support surface/driving surface having a convex cross-section, because this makes it possible to realise a better and more stable engagement of the articles or the rollers.

In the illustrated embodiments the vertical adjustment of the buffering means and the conveying means takes place by pneumatic means, but it is also possible to use electric means for this purpose. It is also conceivable, however, to have said raising and lowering take place mechanically via the conveying means, in which case a temporary connection with the conveying means effects the movement in vertical direction, for example via an eccentric or the like.

CLAIMS

1. A conveyor for conveying and buffering articles and the like along a vertically extending, substantially helical path, comprising a frame, conveying means supported by the frame, which extend along said helical path and which are capable of conveying the articles along said path, which substantially helical path is at least partially divided into zones, each zone being provided with switch members, in such a manner that the conveyor can be switched in each zone between a conveying position, in which the conveying means convey the articles, and a buffering position, in which the articles present in said zone are stationary, **characterised by** buffering means distributed over the length of the conveying means and being present in each zone, which function to support the articles in the buffering position, said conveying means and said buffering means being vertically movable with respect to each other in each zone, in such a manner that the articles in question will be supported by the conveying means in the conveying position and by the buffering means in the buffering position in said zone.

2. A conveyor according to claim 1, wherein the buffering means are vertically adjustable with respect to the frame in the conveying means.

3. A conveyor according to claim 1 or 2, wherein the buffering means are disposed on either side of the conveying element.

4. A conveyor according to any one of the preceding claims, wherein the buffering means are configured as rail sections that extend along part of the helical path.

5. A conveyor according to any one of the preceding claims, wherein the conveying means are configured as an endless conveyor belt, for example a slat conveyor belt.

6. A conveyor according to claim 5, wherein the conveyor belt comprises a support surface having a convex cross-section.

7. A conveyor according to claim 5 or 6, wherein the frame is provided with a helical guide and wherein rollers guide the endless conveyor belt in at least substantially radial direction with respect to said guide.

8. A conveyor according to any one of the claims 1-4, wherein the conveying means comprise a number of driveable rollers evenly distributed along the length of the substantially helical path for forming a roller track extending along the substantially helical path.

9. A conveyor according to claim 8, wherein the buffering means are disposed between the rollers.

10. A conveyor according to claim 9, wherein the buffering means are configured as fingers.

11. A conveyor according to any one of the preceding claims, wherein the buffering means are provided with antiskid surfaces that support the articles.

12. A conveyor according to any one of the preceding claims, wherein a sensor device is provided in each zone, which sensor device cooperates with said switch means, and wherein the switch means of the various zones are connected in series.

13. A conveyor according to any one of the preceding claims, wherein the buffering means and the conveying means can be moved in vertical direction with respect to each other by pneumatically or electrically operated lifting means.

14. A conveyor according to any one of the preceding claims, wherein the buffering means and the conveying means can be moved in vertical direction with respect to each other by lifting means which can be mechanically operated by the moving conveying means.

15. A conveyor for conveying and buffering articles and the like along a vertically extending, substantially helical path, comprising a frame, conveying means supported by the frame and driven by drive means, which extend along said helical path and which are capable of conveying the articles along said path, which substantially helical path is at least partially divided into zones, each

zone being provided with switch means, in such a manner that the conveyor can be switched in each zone between a conveying position, in which the conveying means convey the articles, and a buffering position, in which the articles present in said zone are stationary, **characterised by** buffering means distributed over the length of the conveying means and being present in each zone, which function to support the articles in the buffering position, said drive means and said buffering means being vertically movable with respect to each other in each zone, in such a manner that the articles in question are in contact with the drive means in the conveying position and with the buffering means in the buffering position in said zone.

16. A conveyor for conveying and buffering articles and the like along a vertically extending, substantially helical path, comprising a frame, conveying means supported by the frame, which extend along said helical path and which are capable of conveying the articles along said path via their support surface, which substantially helical path is at least partially divided into zones, each zone being provided with switch means, in such a manner that the conveyor can be switched in each zone between a conveying position, in which the conveying means convey the articles, and a buffering position, in which the articles present in said zone are stationary, **characterised by** buffering means distributed over the length of the conveying means and being present in each zone, which function to support the articles in the buffering position, said buffering means and said support surface being vertically movable with respect to each other in each zone, in such a manner that the articles are in contact with the drive means in the conveying position and that the contact between the drive means and the articles is broken in the buffering position and the buffering means will support the articles in question in said zone.

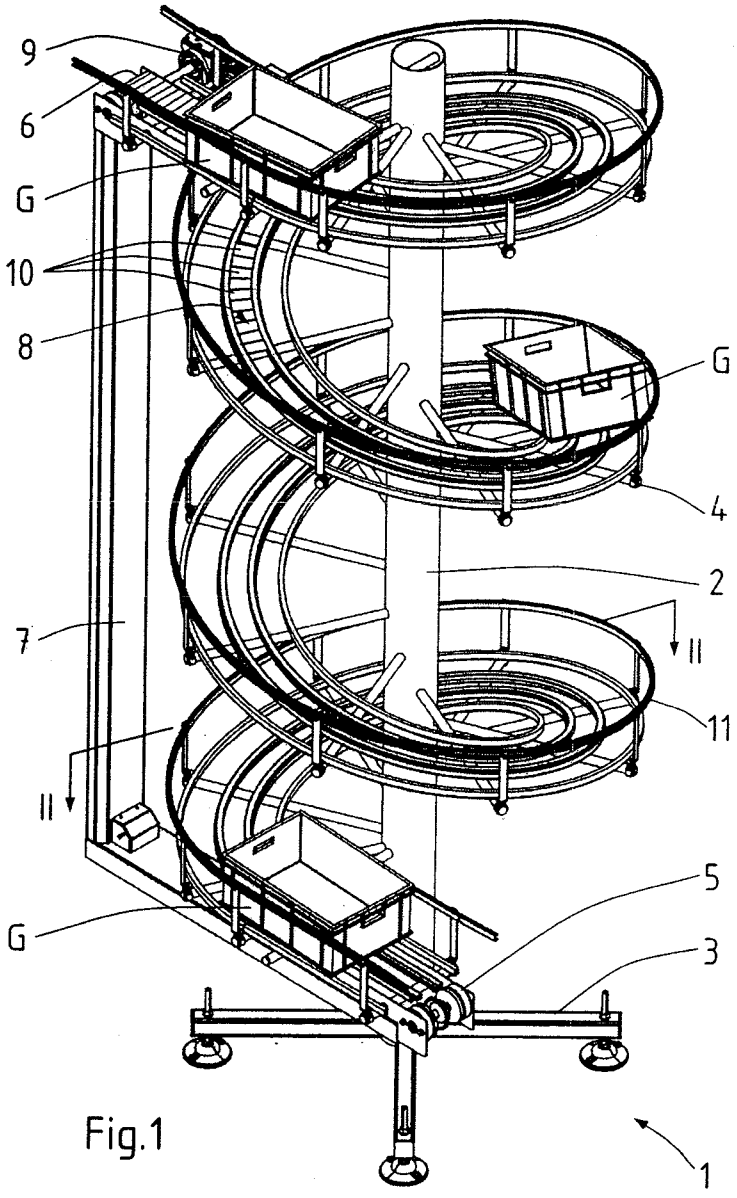


Fig.1

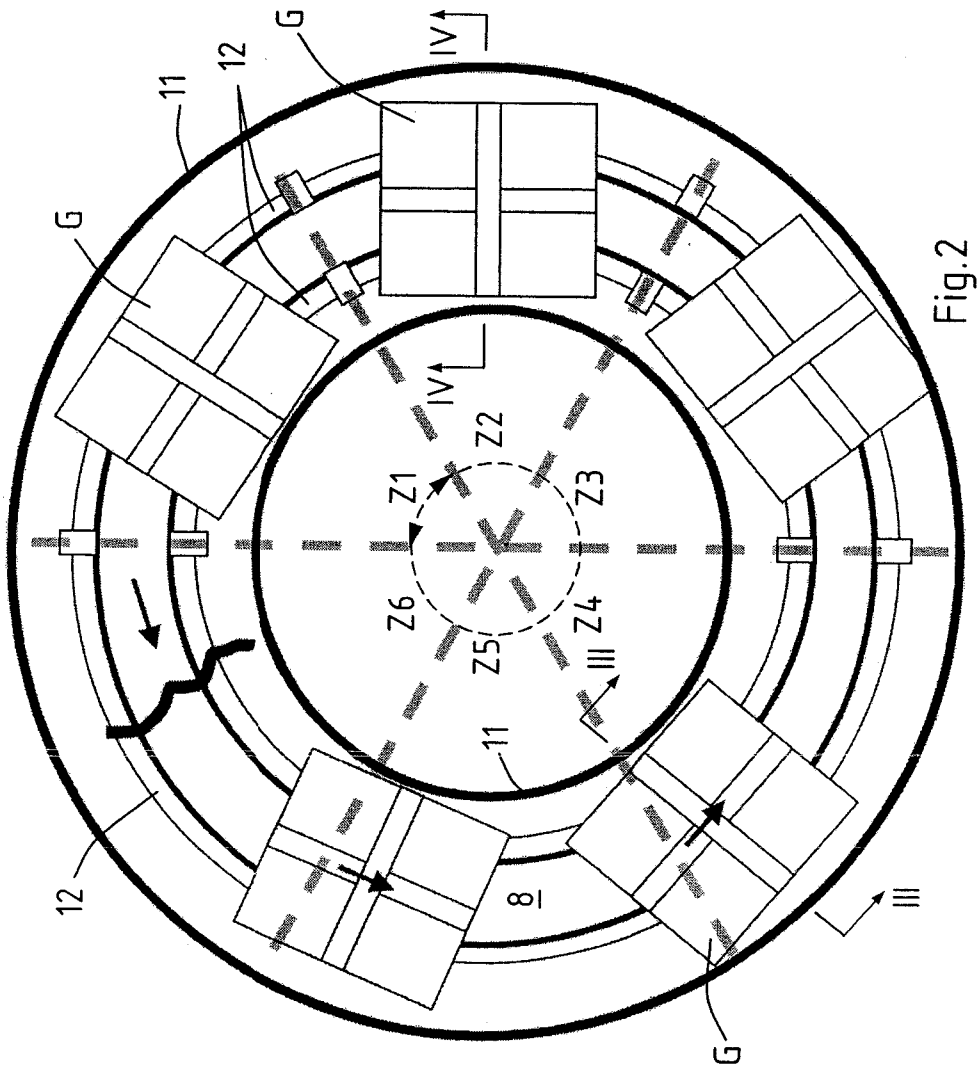


Fig.2

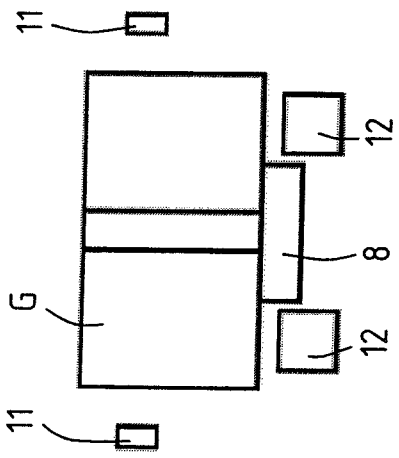


Fig.3

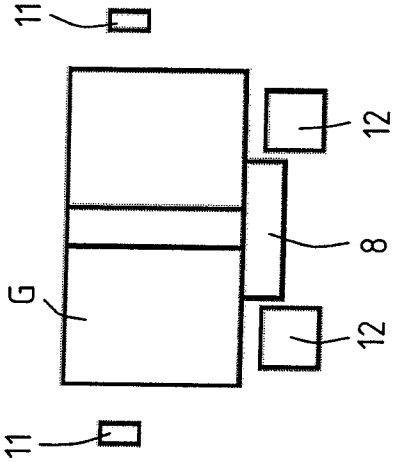


Fig.4

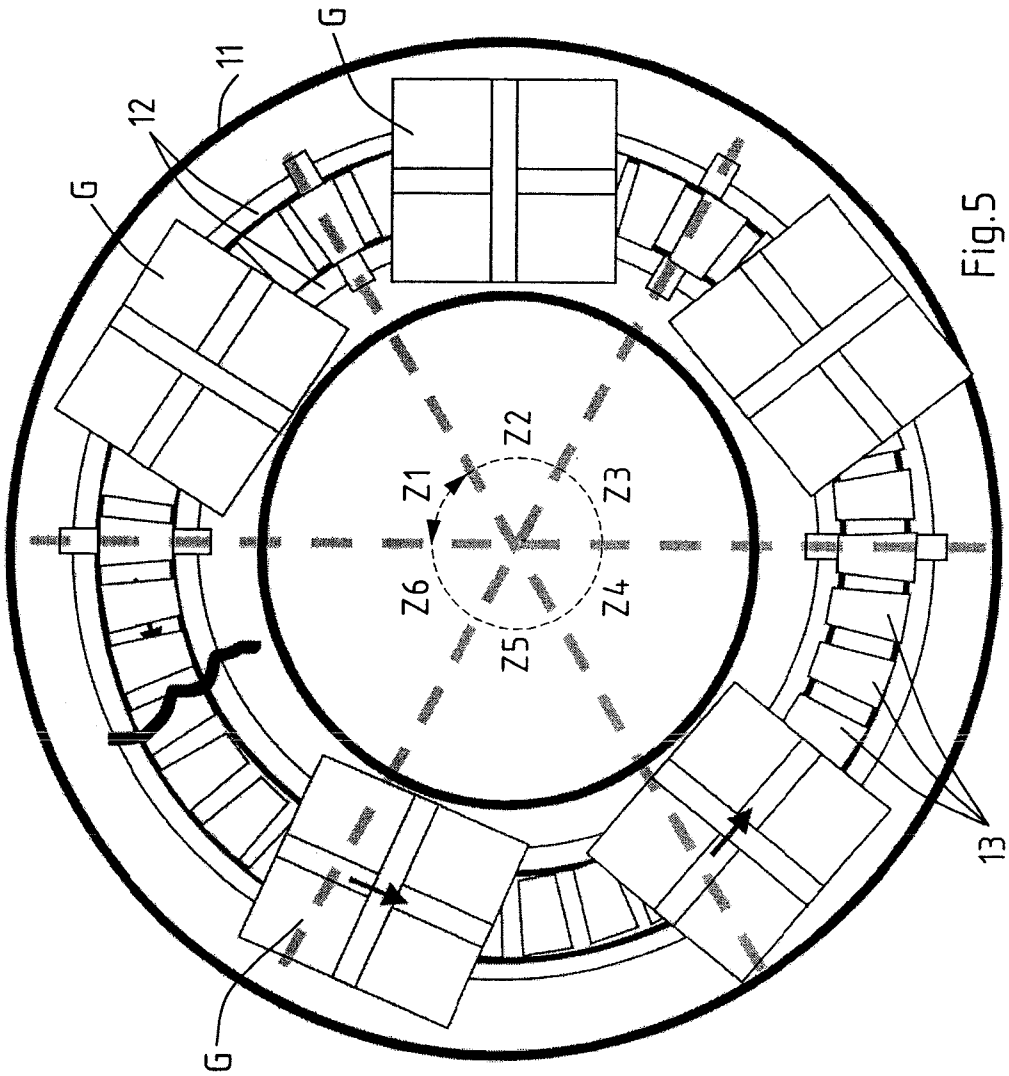


Fig.5

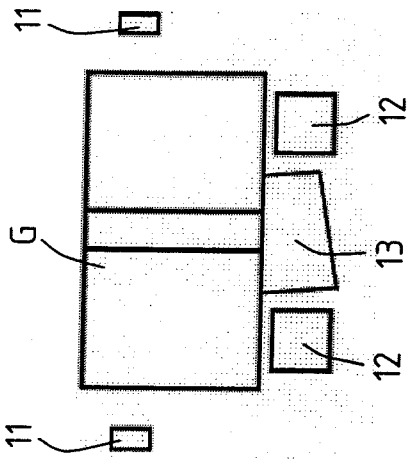


Fig.6

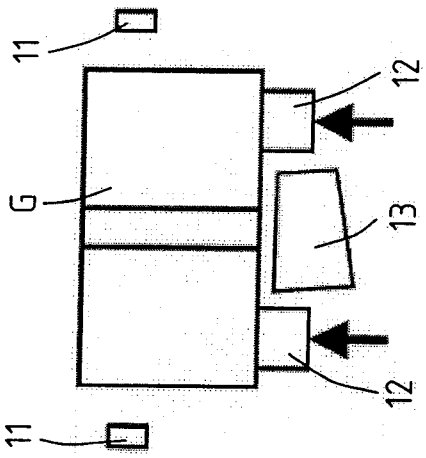


Fig.7

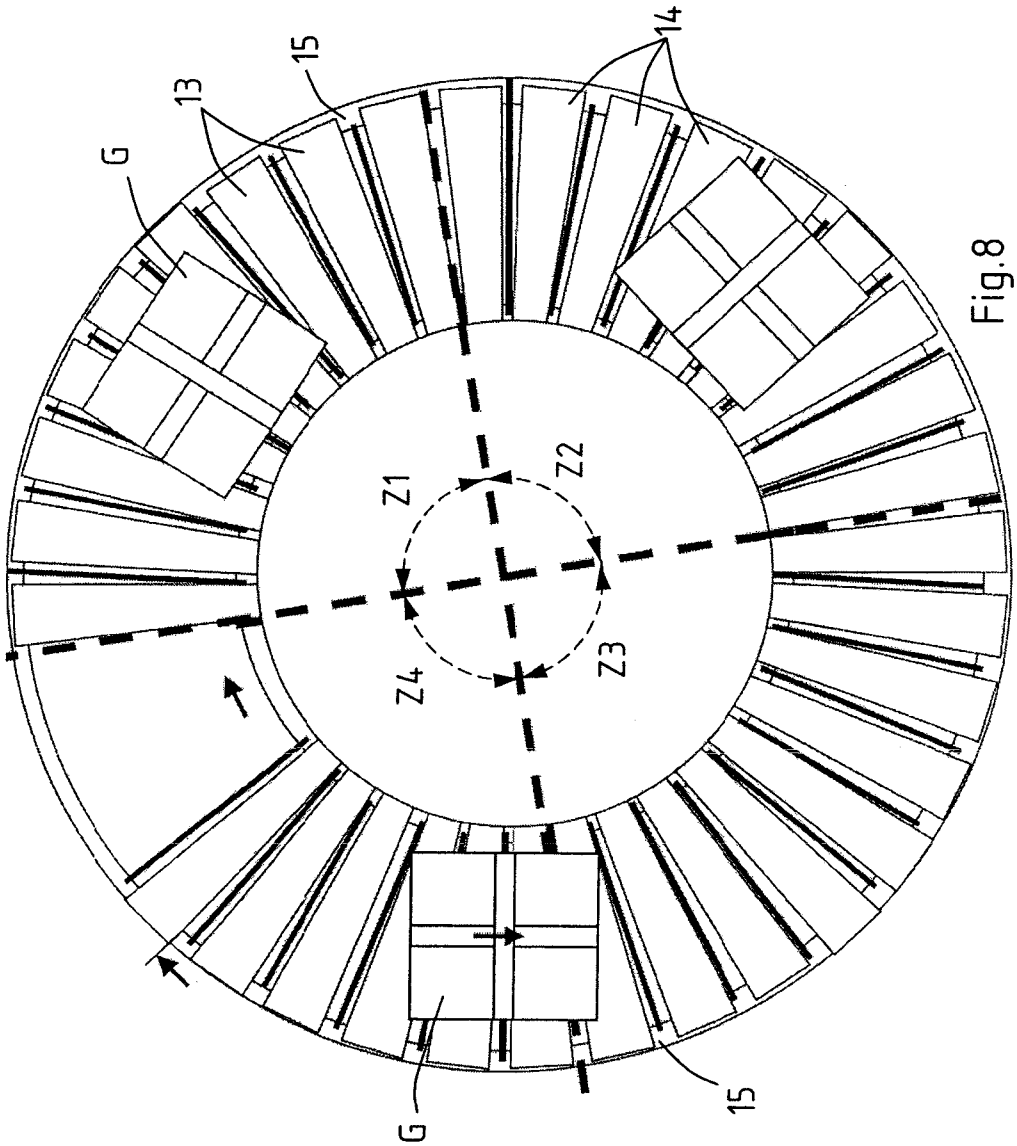


Fig.8

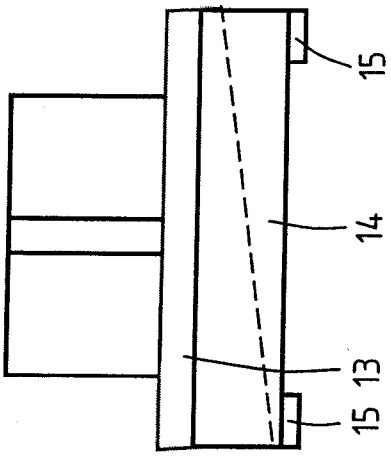


Fig.9

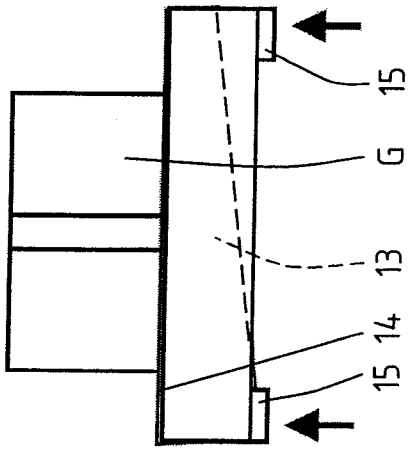


Fig.10

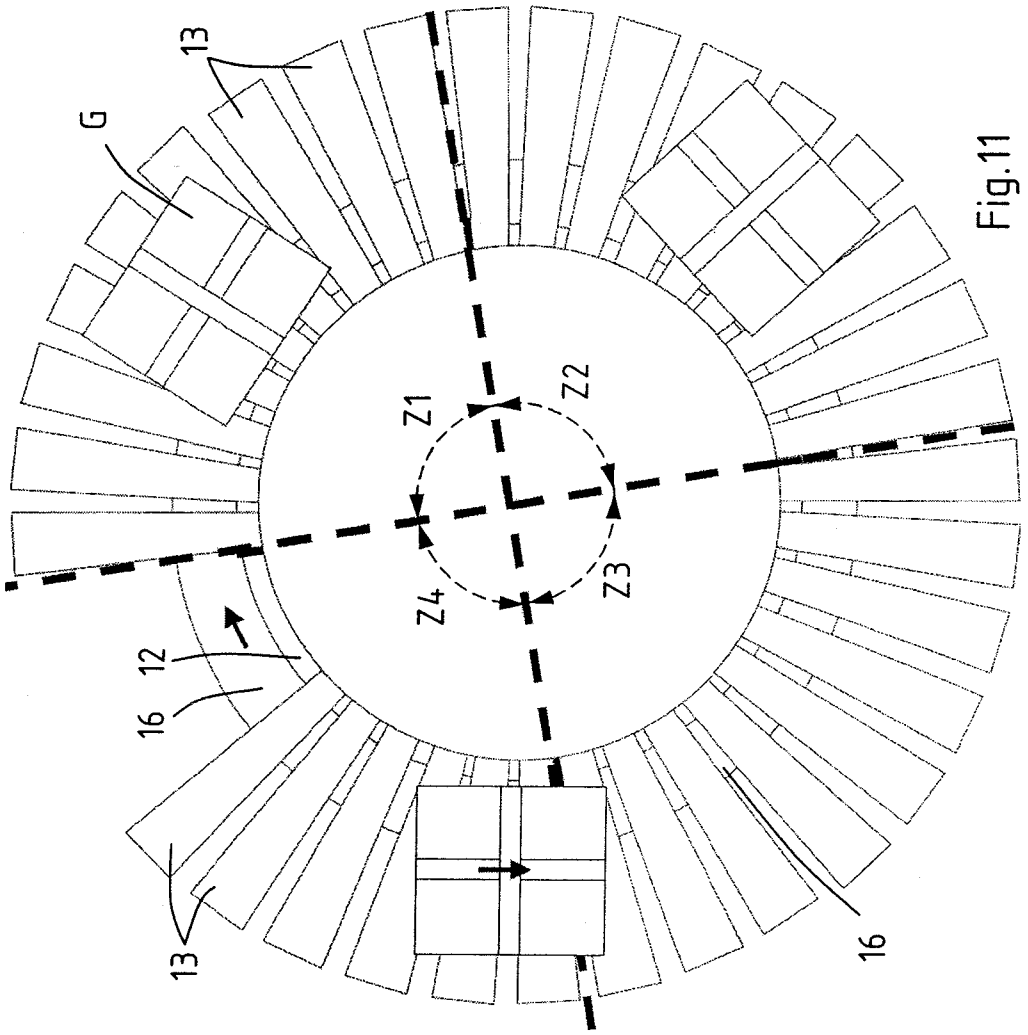


Fig.11

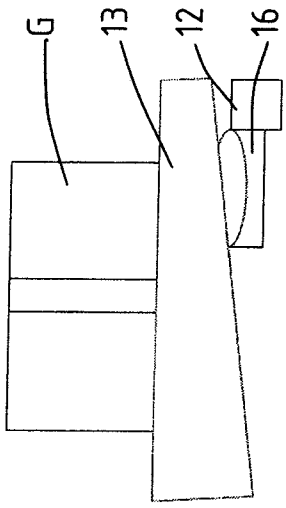


Fig.12

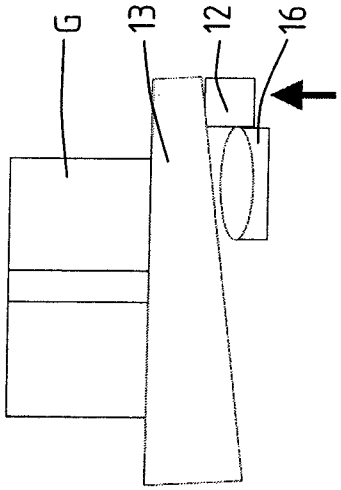


Fig.13

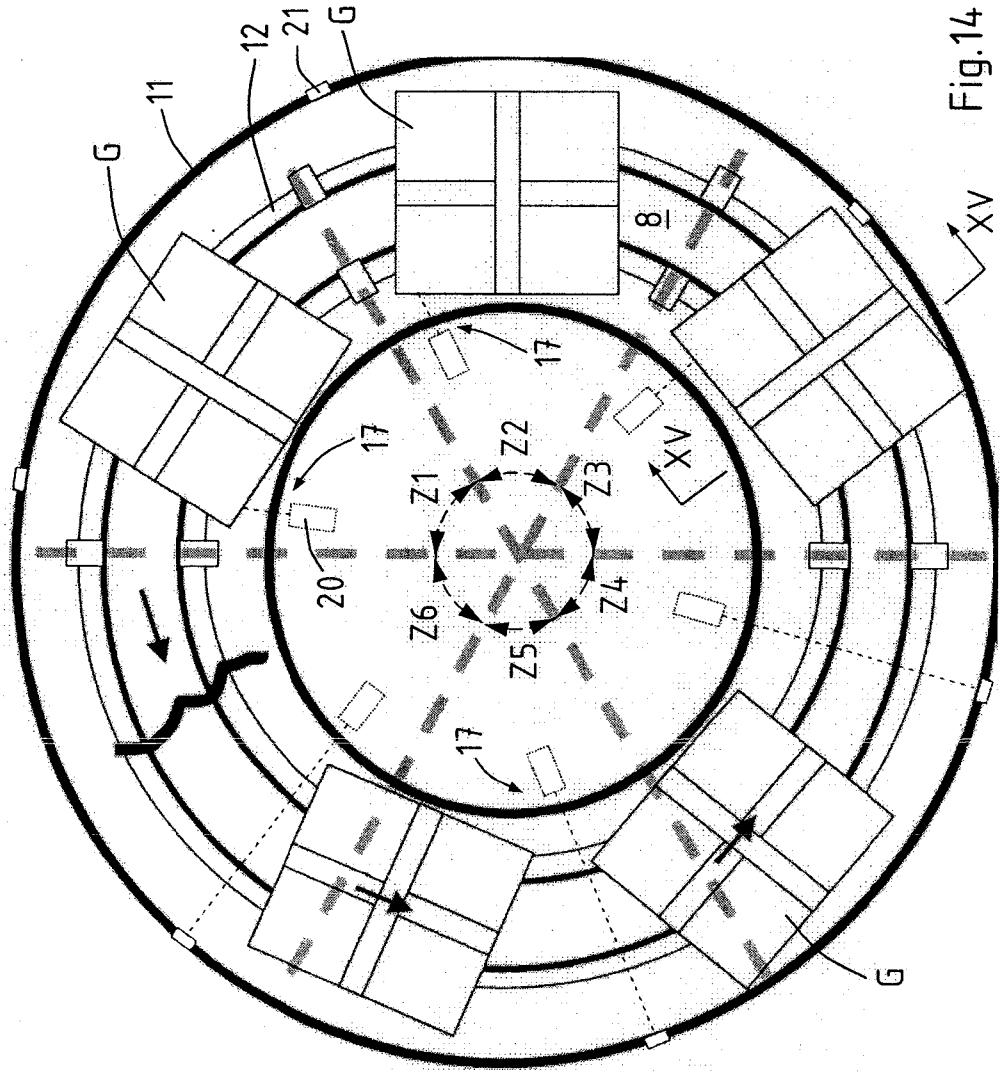


Fig.14

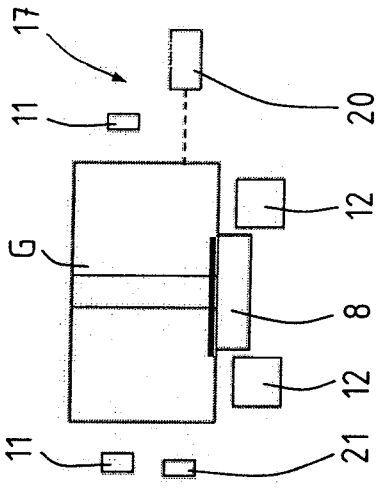


Fig.15

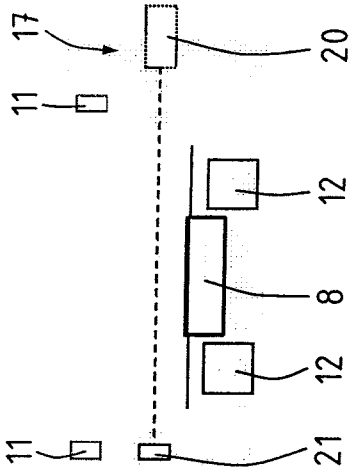


Fig.16

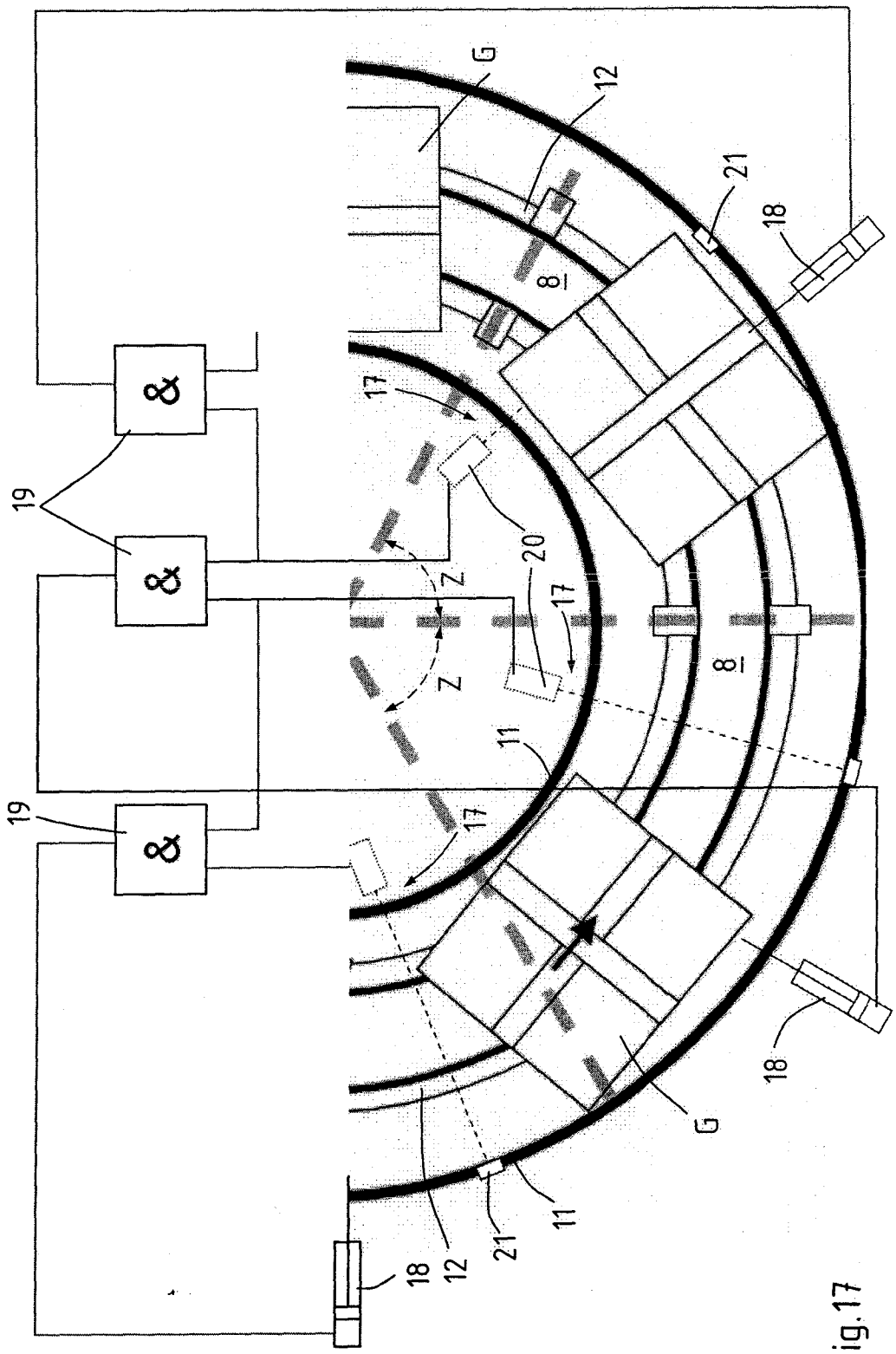


Fig.17

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2007/050485

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G47/26
ADD. B65G17/00

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)
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)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 935 485 B2 (BELZ DONALD F [US] ET AL) 30 August 2005 (2005-08-30) cited in the application	1,15,16
A	WO 02/064463 A (MAIL SYSTEMS INC [US]) 22 August 2002 (2002-08-22)	1,15,16
A	US 2003/192769 A1 (COTTER DAVID H [US] ET AL COTTER DAVID H [US] ET AL) 16 October 2003 (2003-10-16)	1,15,16
A	US 4 361 225 A (SAUR CHARLES W) 30 November 1982 (1982-11-30)	1,15,16

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

☒ See patent family annex.

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"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

Date of the actual completion of the international search	Date of mailing of the international search report
21 November 2007	28/11/2007

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	Roberts, Peter

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/NL2007/050485

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6935485 B2	30-08-2005	US 2004262129 A1	30-12-2004
WO 02064463 A	22-08-2002	NONE	
US 2003192769 A1	16-10-2003	US 2005263376 A1	01-12-2005
US 4361225 A	30-11-1982	NONE	