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Method and plant for deaerating, gas-charging and closing metal cans containing food products.

The method for closing food product-containing cans in an inert environment comprises inserting the container in a hermetically sealed environment, creating within said environment a vacuum of at least 70 cm of mercury, then feeding inert gas into said hermetically sealed vacuum environment to a pressure of at least 0.1 bar gauge and then seam-joining the lid. The plant for implementing the method is of the turntable type and comprises a rotating plate having a circular rim structure consisting of a succession of platforms 5 in the form of blocks which can move vertically in hermetically sealed relationship with each other and are retained under hermetically sealed engagement between two parallel cylindrical walls 8, 9, there lying above each block a bell-cap 10 which also slides under hermetically sealed engagement between said cylindrical walls 8, 9.

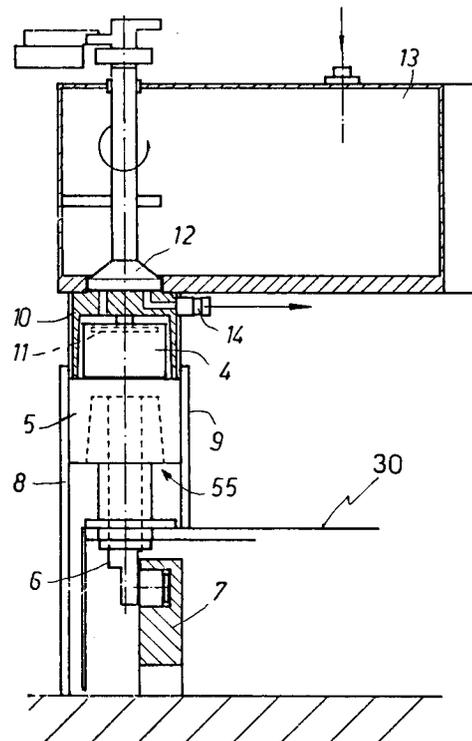


FIG. 5

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The modern systems for filling and seam-closing metal cans containing food products put the interior of the can under vacuum before closing it. The reason for this is to remove the oxygen contained in the can in order to preserve its contents.

However, the seaming methods have the serious drawback that if the level of vacuum created within the can is to be sufficient to reduce the oxygen content to below that which would be damaging to the preservation of the product, the walls of the can must be sufficiently robust not to deform under the action of the vacuum.

A vacuum level of 72-73 cm of mercury is the ideal for proper product treatment, but cannot be currently adopted for strictly economical reasons concerning the cost of the can.

The present invention proposes to obviate this drawback by providing means which enable cans containing food products to be hermetically sealed after extracting their contained oxygen to a level safe for their preservation, without subjecting the cans to compressive forces which could damage their walls. This means that cans with extremely thin walls can be used, resulting in substantial cost reduction.

According to the method of the invention, the can is placed in a hermetically sealed bell-shaped chamber communicating with a vacuum chamber, so that said hermetically sealed chamber and hence the interior of the can can be put under vacuum without generating any force on the can walls. According to the invention the hermetically sealed chamber containing the can is then saturated with an inert gas at a pressure slightly greater than atmospheric, a pressure of 0.1-0.2 bar gauge being considered sufficient, the inert gas hence occupying the space previously occupied by the air.

The can is then conveyed to a usual seaming machine within an environment saturated with the said inert gas, so that seaming can take place before the can is exposed to the atmosphere.

According to a particularly convenient embodiment of the method, immediately before seaming the lid, effected by usual means, a squirt of water vapour is fed into the can and condensed after seaming, to put the interior of the can under very slight vacuum in order to prevent undesirable deformation of the lid and further reduce the oxygen content of the can.

In addition to the method, the invention also relates to the particular means for its implementation, these being described hereinafter with reference to the accompanying drawings, which illustrate a preferred embodiment thereof by way of non-limiting example.

Figure 1 is a plan view of a first embodiment of a deaerating/gas-charging/closing plant con-

structed in accordance with the invention;

Figure 2 is an enlarged partial plan view of the rotating plate of the plant shown in Figure 1;

Figure 3 is a side view of the component segments or platforms of that portion of the rotating circular rim structure in which the platform carrying the can descends;

Figure 4 is a section on the plane IV-IV of Figure 1;

Figure 5 is a section on the plane V-V of Figure 1;

Figure 6 is a section on the plane VI-VI of Figure 1;

Figure 7 is a section on the horizontal plane VII-VII of Figure 10, showing a part of the plant in the form of a second embodiment of the invention;

Figure 8 is a section on the plane VIII-VIII of Figure 7;

Figure 9 is a section on the plane IX-IX of Figure 7;

Figure 10 is a section on the plane X-X of Figure 7;

Figure 11 is a section on the plane XI-XI of Figure 7;

Figure 12 is a section on the plane XII-XII of Figure 7;

Figure 13 is a section on the plane XIII-XIII of Figure 12.

Figures 1-6 show a common conveyor belt 1 which with the aid of a spacing screw 2 and a star-shaped insertion wheel 3 loads the cans 4 containing the food product onto the platforms or segments 5 of a plate 30 rotating about a vertical central axis A.

Said platforms 5, arranged one following another, form a circular rim structure 55, each of them being supported by an underlying rod 6 which rests via a follower roller on a shaped cam 7 fixed to the machine base.

In a position above the circular rim structure formed by the platforms 5 and rotating together with this latter there is a series of bell caps 10 of a number equal to the number of underlying platforms. At the centre of each bell cap 10 there is a pad 11 the purpose of which is to rest on the product contained in the can 4 while this moves into the interior of each bell cap 10, to prevent any unsettling and spilling of the product during deaeration.

The bell caps 10 are supported by an annular vessel 13 containing the inert gas to be fed into the can 4 when the platform 5 has inserted it into one of the bell caps 10.

The inert gas is fed via a usual rotary valve 12 positioned at the top of each bell cap 10, the axis of which coincides with the axis of the container 4.

The bell cap 10 is connected alternately, by the valve 12, to the vessel 13 and to a duct 14 connected to a vacuum vessel 25, preferably in two stages: firstly to 45-50 cm of mercury and then to 72-73 cm of mercury.

The means which connect the bell cap to the vessels 13 and 25 are not shown.

During the rotation of the circular rim structure 55 which supports the containers or cans 4, the various platforms 5 are progressively raised until they rest below the bell cap to form, in cooperation with a suitable gasket, a sealed chamber which by means of the relative valve 12 is connected alternately firstly to the vacuum vessel 25 and then to the feed line for the inert gas contained in the vessel 13.

By this means, along a first portion of the path a strong vacuum is created within the bell cap, by which the air contained in the container 4 and in the relative product is completely removed without the container walls being stressed in any way. On command, the valve 12 then shuts off the vacuum and allows inert gas to be fed into the relative bell cap 10. A further command to the valve 12 isolates the bell cap both from the vacuum and from the gas.

Figure 5 shows a container contained within said bell cap, with the supporting circular rim structure in an angular position in which the relative platform 5 is completely raised.

It should be noted that the platforms 5 slide vertically in sealed relationship both with each other and with two side walls 8 and 9.

The wall 9 has a constant height along the entire machine periphery, whereas the wall 8 has an upper outline which comprises a reduced-height portion (Figure 4) for the insertion of the container 4. In this manner, with particular reference to Figure 3, it can be seen that during the progressive lowering of the platforms 5 due to the corresponding fall of the cam 7, the inert gas which has been fed into the bell caps 10 cannot escape in the opposite direction to the direction of rotation of the machine, because in this direction the environment in which the containers lie is sealed by the engagement between each platform and the preceding platform, by the engagement between the inner and outer sides of each platform and the walls 8 and 9, and by the engagement between the bell caps 10 and the walls 8 and 9.

After the gas feed to the interior of the bell cap 10 is complete and this latter has been opened, the container 4 lies in an environment saturated with inert gas. It has terminated its travel along the circular rim structure formed by the platforms 5, and is withdrawn from the deaeration and gas-charging turntable by a conveyor, shown in Figures 1, 2 and 6, which is enclosed in a tunnel 15

hermetically connected to the walls 8 and 9 between which the platforms 5 rise and fall, hermetically connected to the plane of the circular rim structure formed by the platforms 5, and hermetically connected to an upper plane defined by the lower mouth of the bell caps 10.

The containers 4 are withdrawn from the circular rim structure formed by the platforms 5, by a deviator 16 which forces the containers 4 into said tunnel 15, where they are collected and pushed forwards by a series of equidistant appendices 17. The appendices 17 are positioned at equidistant points on a chain 18 which travels as an endless vertical loop adjacent to one side of the tunnel 15, as shown in Figure 6, whereas on the opposite side to the chain 18 there is a horizontally adjustable guide 19 which compels the containers 4 to maintain a straight path.

The tunnel 15 leads to a housing 20 of completely hermetically sealed construction containing usual lid seam-joining means. The lids are fed via an entry 21 and after the lids have been seam-joined the cans leave from an exit 22. The ports providing communication with the outside of the housing 20 are very small and practically the same size as the cans, so that the loss to the outside of the inert gas contained in the housing 20 is amply compensated by the feed into the housing 20 of the inert gas contained in the bell caps 10, as these open.

Steam feeding means 23 are provided inside the housing 20 and are adjusted to direct a squirt of steam onto the mouth of the container 4 just prior to seam-joining the lid. This squirt of steam is such that, after seaming and once the can has cooled, it condenses to put the interior of the can under slight vacuum, to ensure that the lids always remain slightly convex towards the interior of the can so that annoying noisy deformation does not take place. In addition, in condensing, the steam fed on closure ensures further rarefying of the small quantity of oxygen which has remained in the can.

Taking account of the level of vacuum applied to the bell caps 10, which as stated is 72-73 cm of mercury, and the slight gauge pressure of the inert gas fed therein, which as stated is of the order of 0.1-0.2 bar gauge, it can be seen that up to 95-96% of the can internal volume is occupied by inert gas.

The second embodiment, shown in Figures 7-12, differs from the preceding in terms of those elements described hereinafter. The other elements remain substantially the same and are given the reference numerals used in the first embodiment.

The main difference lies in the connection between the bell caps 10 and the vacuum creation and inert gas supply means.

In the second embodiment the annular vessel 13 containing inert gas and the various valves 12 are dispensed with. Instead, each bell cap 10 is connected via a respective pipe 61 to a central distributor 62 fixed above the rotary turntable. The distributor 62 is formed from a fixed part 63 and a movable part 64, which rotates relative to the fixed part, in hermetically sealed relationship therewith, about the turntable axis A. The movable part 64 is connected to the bell caps 10 by the pipes 61 and rotates rigidly with the plate 30 and hence with the bell caps 10.

The fixed part 63 lies on the movable part 64 and comprises a first chamber 65 shaped as an arc of increasing width, and a second chamber 66 also arc-shaped. Downstream of the chamber 66 there is a third chamber 66' shaped as an arc but shorter than the chamber 66 (see Figure 12).

The chamber 65 is connected by a pipe 75 to vacuum creation means. The chamber 66 is connected by a pipe 76 to inert gas supply means. The chamber 66' is also connected to inert gas supply means. Each of the mouths 61' via which the pipes 61 open into the movable part 64 becomes connected in succession to each chamber 65, 66, 66' by the rotation of the movable part 64.

During the rotation of the plate 30, each mouth 61' encounters firstly the chamber 65 so that vacuum is created in the respective bell cap 10, this being gradual (because of the increasing width of the chamber 65) in order not to damage the product. The mouth 61' then encounters the second chamber 66 which feeds inert gas to the bell cap 10. This also happens when it encounters the chamber 66'.

Along those sections in which they do not encounter said chambers 65, 66 and 66', the mouths 61' are closed by the solid continuous surface 63; via which the fixed part 63 is in contact with the movable part 64.

The manner and the angular position in which the mouths 61' of the pipes 61 communicate with the chambers 65, 66 are the same as for the vacuum creation and inert gas feed stages already described in relation to the first embodiment. The chamber 66' is used to feed further inert gas to the bell caps 10 in the region in which the containers 4 enter the tunnel 15.

Figures 9, 10 and 11 show the region in which the containers 4 pass from the deaeration and gas charging turntable to the tunnel 15. This region is substantially identical in both embodiments.

In this region the tunnel 15 meets the turntable via two opposite fixed lateral walls 31 and 32 at such a distance apart as to allow the containers 4 to pass. The initial part of the outer lateral wall 31 has a cylindrical surface 31' which matches and is in sliding contact with the outer lateral wall of the

platforms 5 and with the outer lateral wall of the lower part 10' of the bell caps 10.

The initial part of the inner lateral wall 32 matches and slides in sliding contact along the upper surface of the platform 5; said initial part defines the deviator 16 which urges the containers 4 towards the tunnel entrance by gradually removing them from their contact with the platforms 5.

In the second embodiment, abutment elements 33 are fixed on the platforms 5 to retain the containers 4 in a central position on the platforms 5. Said elements 33 slide within a channel 32a provided in the lower face of the deviator 16.

In the second embodiment there is no outer side wall 8 (Figure 8).

In this case after the platforms 5 have been raised into contact against the bell caps 10, they remain in this position until they reach the region comprising the outer wall 31. On reaching this position the platforms 5 are lowered and the space containing the containers 4 is closed laterally by the wall 31 and the wall 9 and then by the wall 31 and the wall 32.

The tunnel 15 also possesses a horizontal lower wall 34 which blends into and sealedly engages the turntable, in that its upper surface for supporting the containers 4 is at the same level as the upper face of the platforms 5 when these reach the entrance to the tunnel 15. Finally there is a horizontal upper wall 35 which upperly closes the tunnel 15 and blends into and sealedly engages the lateral outer face of the parts 10' of the bell caps 10.

In the second embodiment the tunnel 15 has a cross-section which is just larger than the containers 4, and in it there travels only the upper branch of the chain 18, the appendices of which urge the containers 4 forward by firstly extracting them from the deaeration and gas charging turntable in cooperation with the deviator 16, and then advancing them along the tunnel 15 as far as the lid seaming means located within the housing 20.

The lower branch of the chain 18 travels within a lower longitudinal chamber 37 parallel to the tunnel 15.

Claims

1. A method for closing containers or cans containing food products, characterised by comprising the following steps:
 - inserting the container in a hermetically sealed environment;
 - creating within said environment a vacuum of at least 70 cm of mercury;
 - feeding inert gas into said hermetically sealed vacuum environment to a pressure of at least 0.1 bar gauge;
 - seam-joining the lid;

- withdrawing the container from said hermetically sealed environment.
2. A plant for deaerating, gas-charging and closing containers or cans containing food products in accordance with the method of claim 1, of the turntable type comprising a rotating plate 30, container support platforms 5 vertically movable on said plate 30, and means for feeding lids to a turntable-type seaming machine connected to the deaeration turntable, characterised in that the rotating plate 30 has a circular rim structure 55 consisting of a succession of platforms 5 in the form of blocks which can move vertically in hermetically sealed relationship with each other and are retained under hermetically sealed engagement between two coaxial cylindrical walls 8, 9, 3 fixed to the base, there lying above each block a bell-cap 10, against the underside of which the underlying platform 5 rests in hermetically sealed relationship when in its raised position, said bell cap 10 being slidingly engaged in hermetically sealed relationship between said cylindrical walls 8, 9, 3 and being alternately connected to vacuum creation means and to inert gas feed means.

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 3. A plant as claimed in claim 2, characterised by comprising an inert gas-containing vessel 13 rotating with the plate 30 and with the bell caps 10, and a plurality of rotary valves 12, one for each bell cap 10, said valve 12 being arranged to connect the respective bell cap 10 alternately to said inert gas-containing vessel 13 and to said vacuum creation means.

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 4. A plant as claimed in claim 2, characterised by comprising a distributor device 62 having two parts, namely a fixed part 63 and a movable part 64, which rotates relative to the fixed part, in sealed relationship therewith, about the turntable axis A, said movable part 64 rotating rigidly with the bell caps 10 and being connected to each bell cap 10, said fixed part 63 having at least two chambers communicating respectively with vacuum creation means and with inert gas supply means, each bell cap 10 being connected in succession to each chamber 65, 66 following the rotation of the movable part 64 relative to the fixed part 63..

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 5. A plant as claimed in claim 1, characterised by comprising a hermetically sealed housing 20 connected to the station 15 in which the containers 4 are discharged from the deaeration turntable and containing usual means for seam-joining a lid to the container 4.

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 6. A plant as claimed in claim 2, characterised in that within each bell cap 10 there is provided a small reaction pad 11 which holds the product still during the deaeration stage.
 7. A plant as claimed in claim 2 characterised in that inside the hermetically sealed housing 20 in a position immediately upstream of the lid feed station there are provided means 23 for feeding a squirt of steam onto the container mouth.

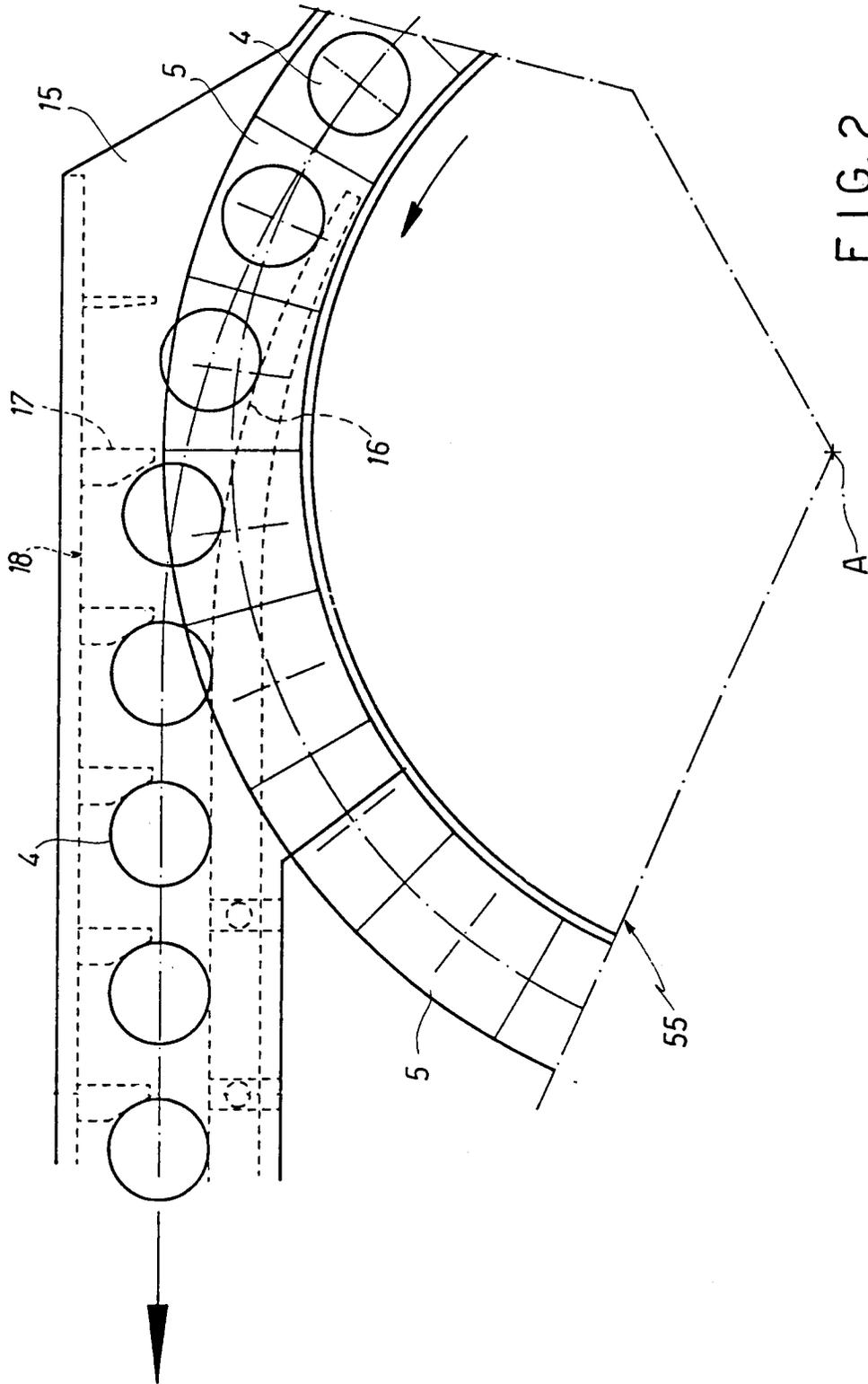


FIG. 2

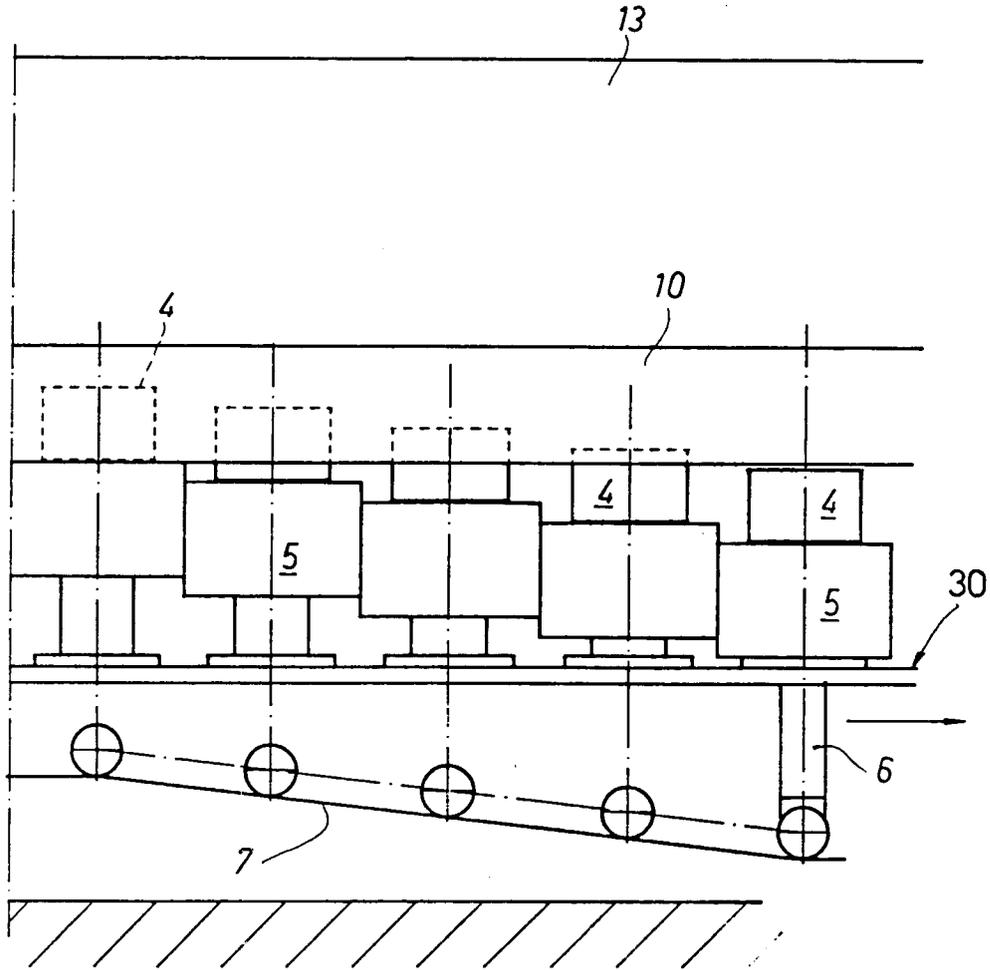


FIG. 3

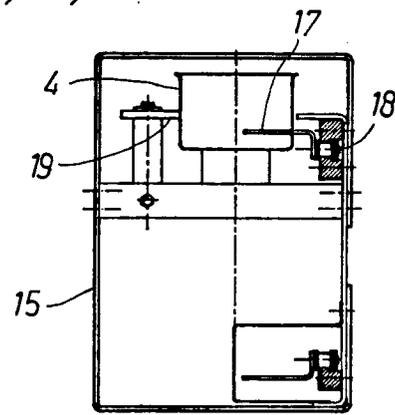


FIG. 6

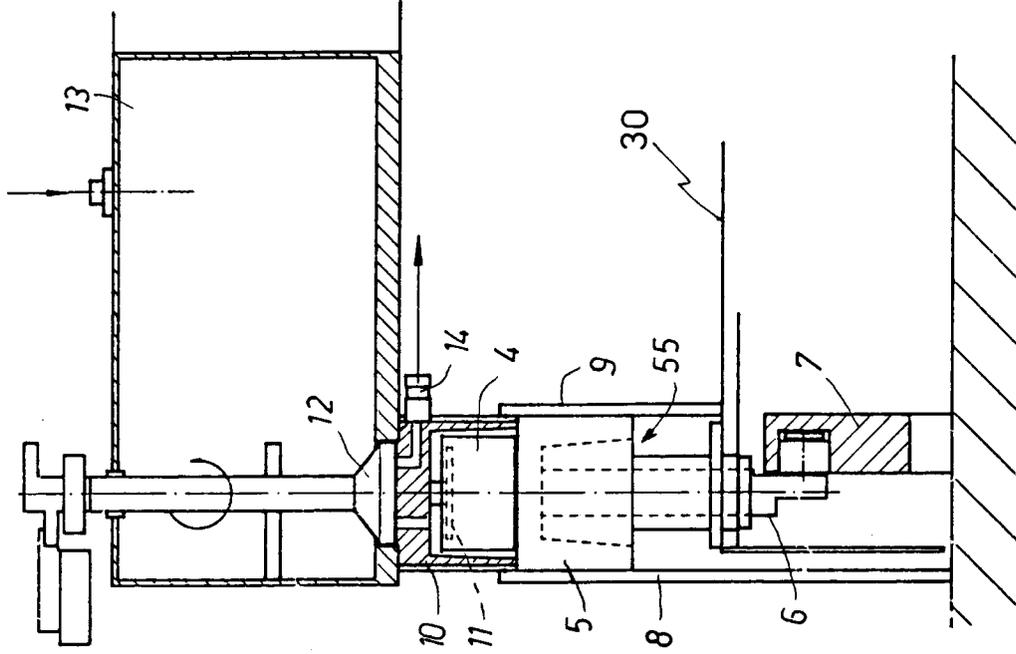


FIG. 5

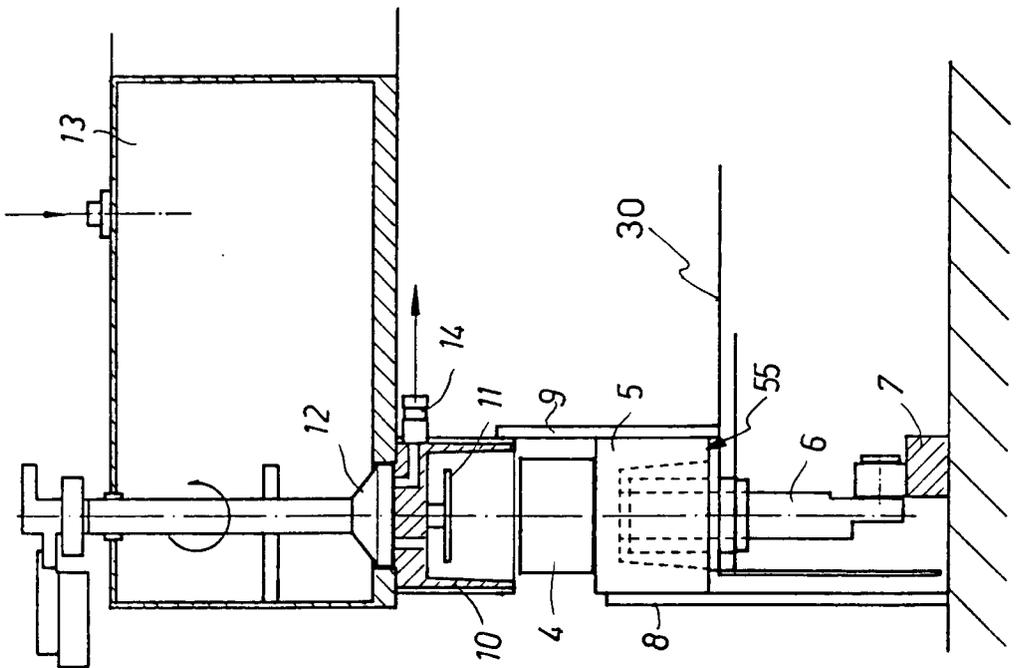


FIG. 4

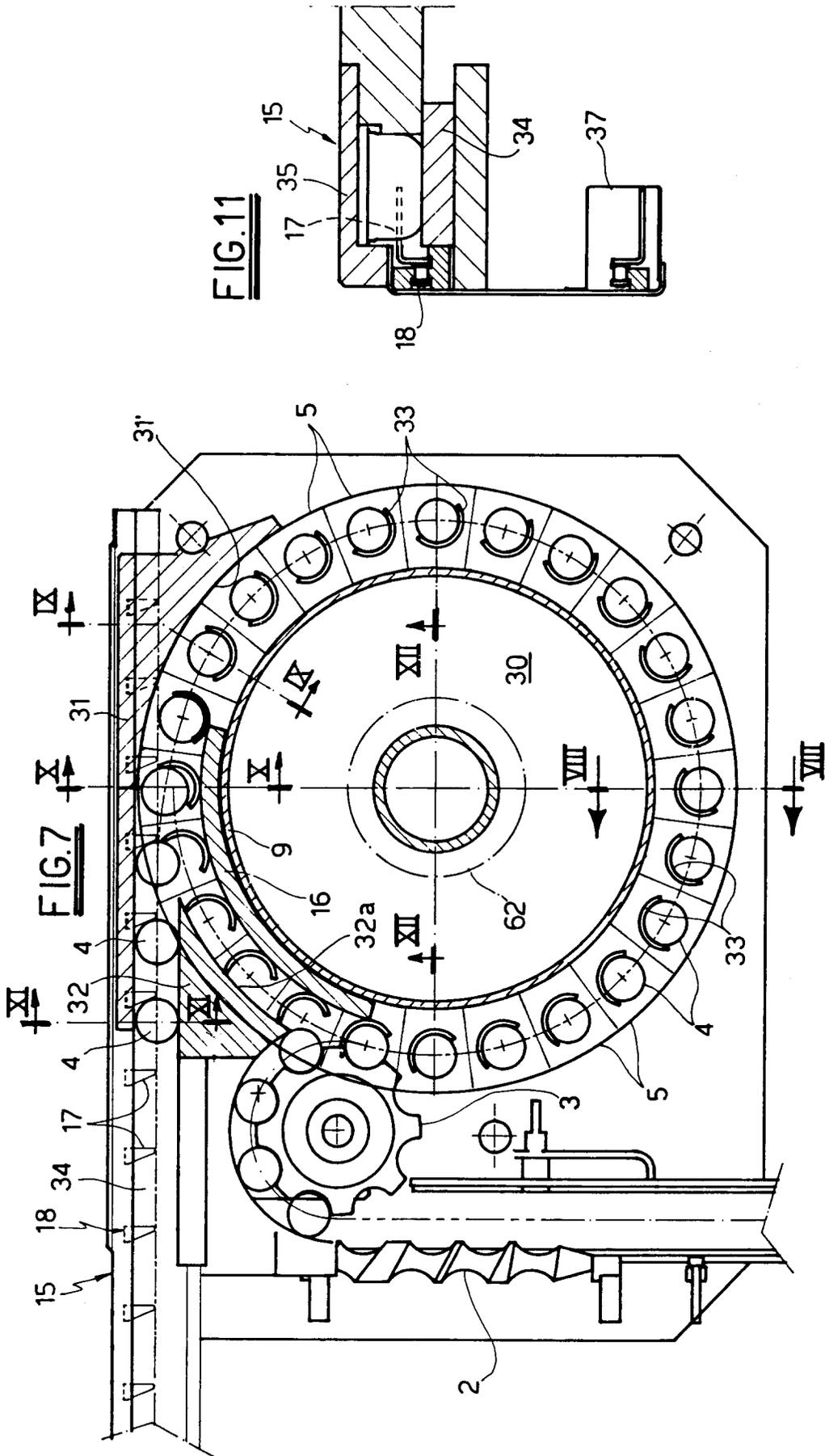
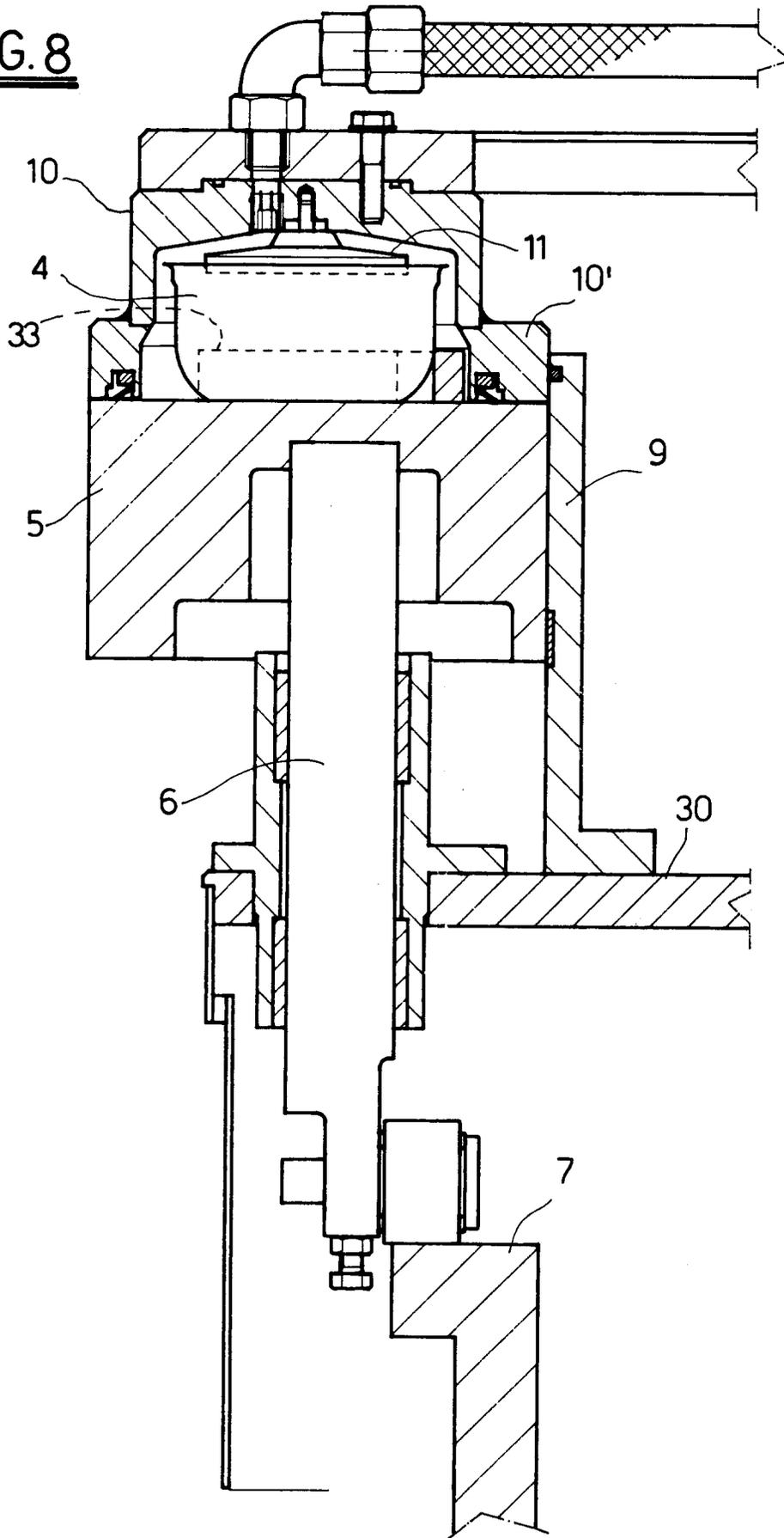


FIG. 8



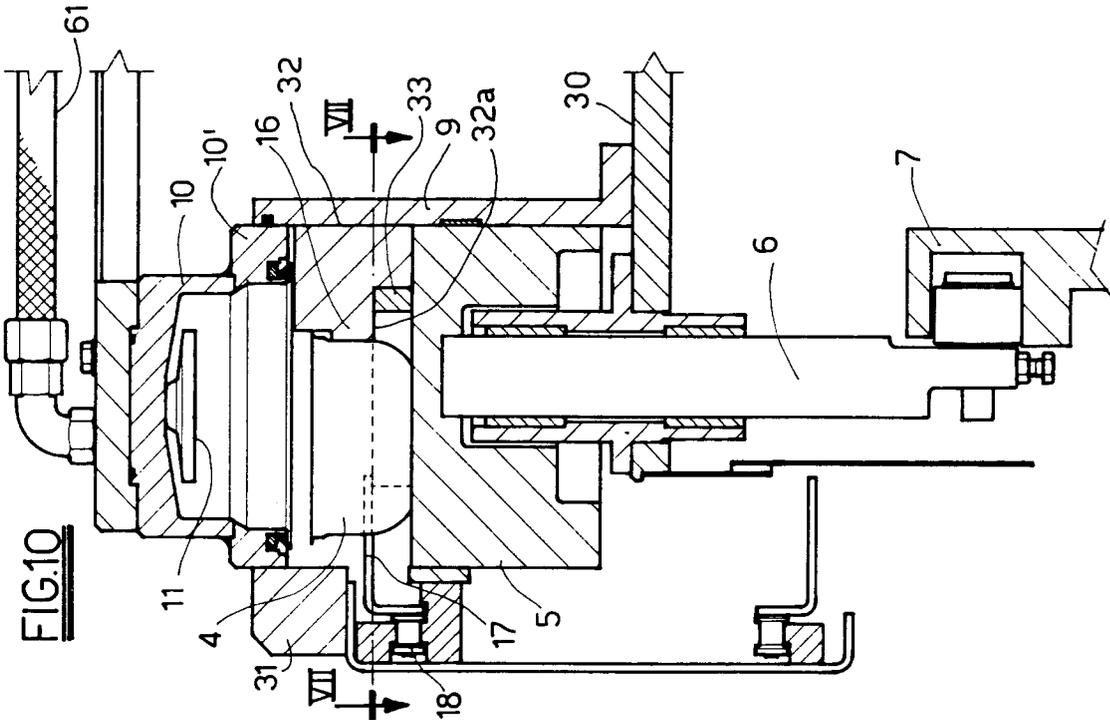
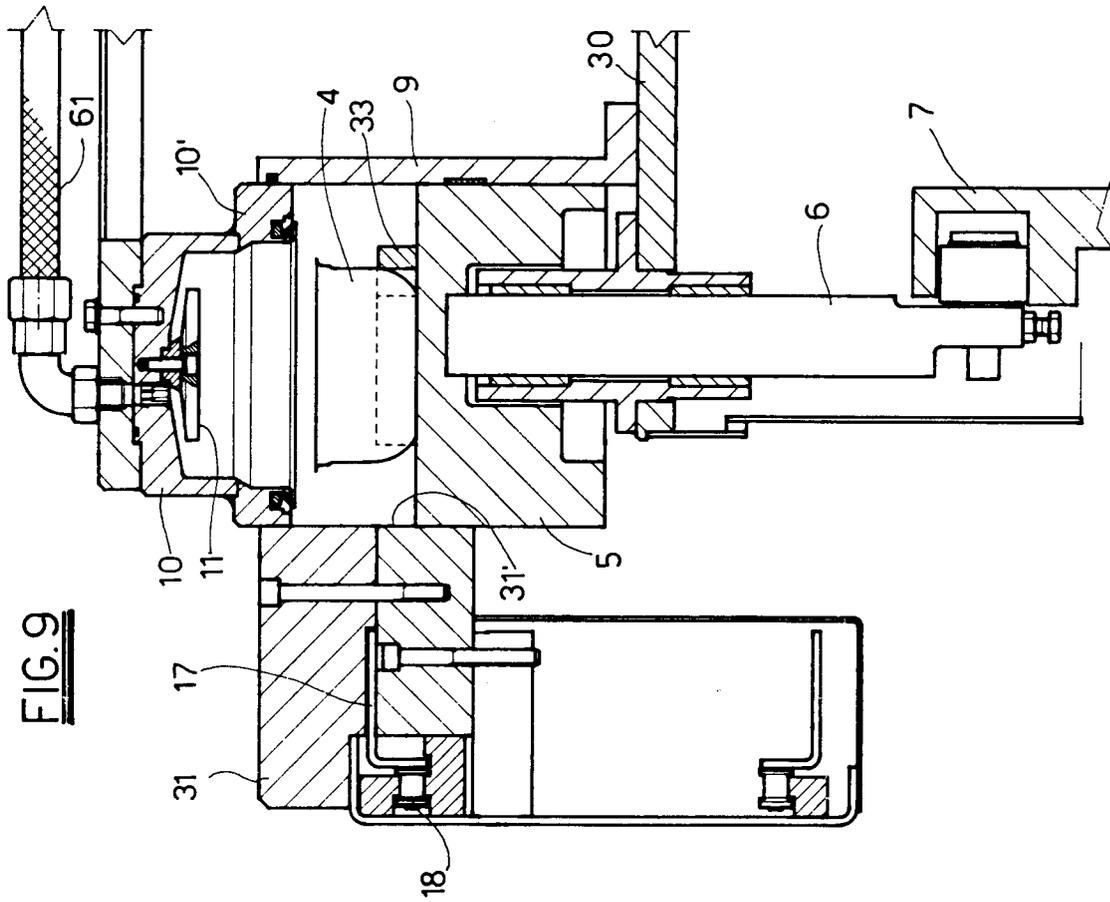


FIG. 12

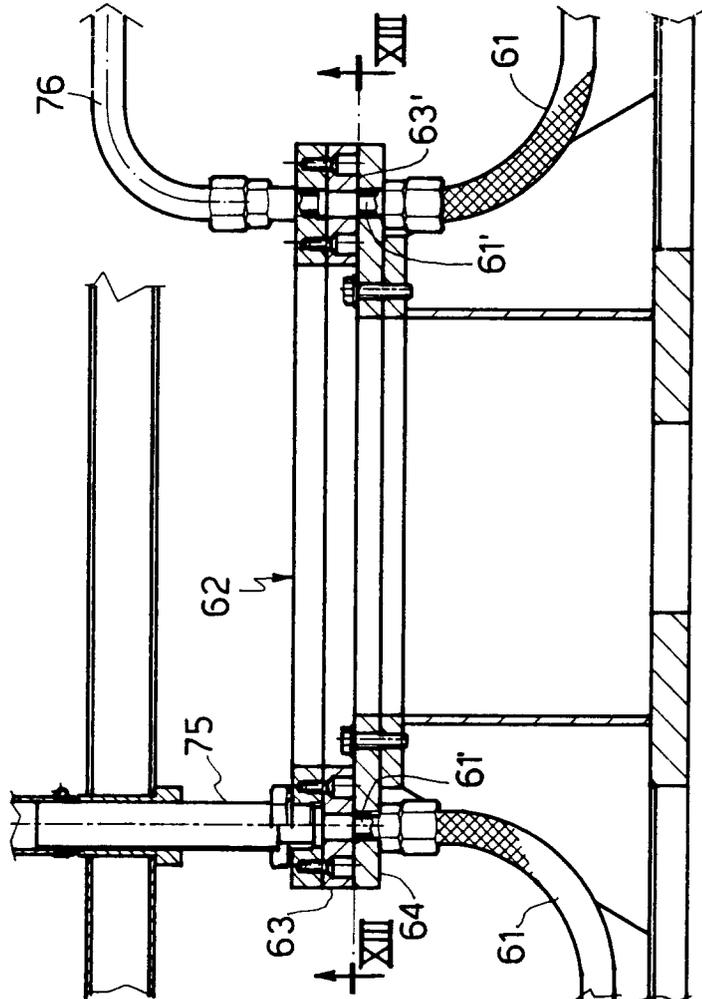
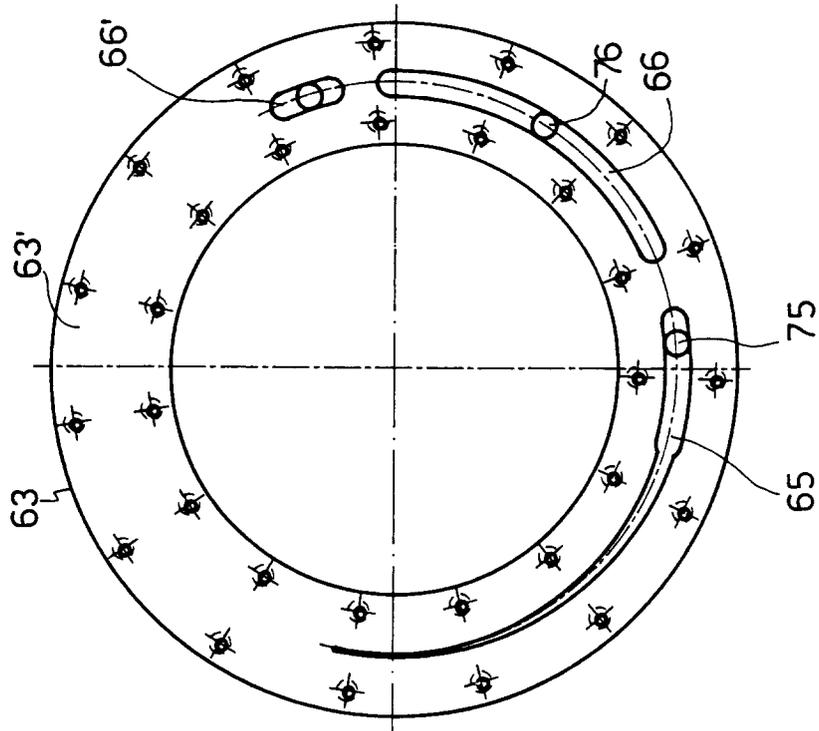


FIG. 13





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EUROPEAN SEARCH REPORT

Application Number

EP 93 20 0768

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	US-A-2 578 815 (CONTINENTAL CAN) * column 12, line 53 - column 13, line 65; figures 1,3,4,8 * * column 8, line 67 - column 9, line 41 * ---	1 2,4	B65B31/02
A	GB-A-625 903 (TRUFOOD) * the whole document * -----	1,2,4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 JULY 1993	Examiner CLAEYS H.C.M.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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