(12) PATENT **(11)** Application No. **AU 199663655 B2**
(19) AUSTRALIAN PATENT OFFICE **(10)** Patent No. **716643**

(54) Title
Material handling apparatus

(51)[6] International Patent Classification(s)
B65G 069/18

(21) Application No: **199663655** (22) Application Date: **1996.07.05**

(87) WIPO No: **WO97/05050**

(30) Priority Data

(31) Number	(32) Date	(33) Country
9515256	**1995.07.25**	**GB**

(43) Publication Date : **1997.02.26**
(43) Publication Journal Date : **1997.04.24**
(44) Accepted Journal Date : **2000.03.02**

(71) Applicant(s)
Matcon (R and D) Limited

(72) Inventor(s)
Ivan Semenenko

(74) Agent/Attorney
COLLISON and CO,GPO Box 2556,ADELAIDE SA 5001

(56) Related Art
EP 680902
EP 380255

OPI DATE 26/02/97 APPLN. ID 63655/96
AOJP DATE 24/04/97 PCT NUMBER PCT/GB96/01632
AU9663655

INTE

(51) International Patent Classification 6 :
B65G 69/18

A1

(11) International Publication Number: WO 97/05050

(43) International Publication Date: 13 February 1997 (13.02.97)

(21) International Application Number: PCT/GB96/01632

(22) International Filing Date: 5 July 1996 (05.07.96)

(30) Priority Data:
9515256.7 25 July 1995 (25.07.95) GB

(71) Applicant *(for all designated States except US)*: MATCON (R & D) LIMITED [GB/GB]; Matcon House, London Road, Moreton-in-Marsh, Glos GL56 0HJ (GB).

(72) Inventor; and

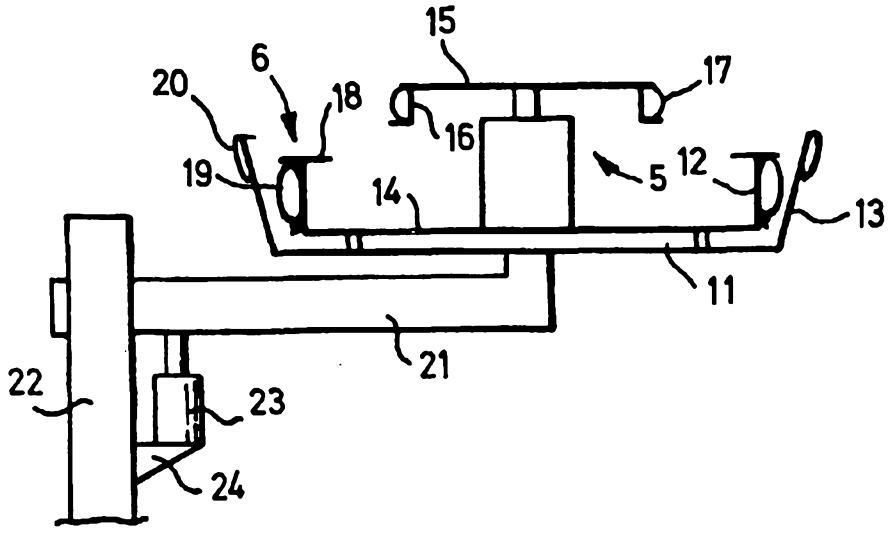
(75) Inventor/Applicant *(for US only)*: SEMENENKO, Ivan [GB/GB]; Harvey House, High Street, Moreton-in-Marsh, Glos GL56 0HJ (GB).

(74) Agent: JOHNSON, Terence, Leslie; Edward Evans & Co., Chancery House, 53-64 Chancery Lane, London WC2A 1SD (GB).

(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: MATERIAL HANDLING APPARATUS



(57) Abstract

The invention relates to apparatus (1) for handling flowable material, particularly particulate material, which is held in a discharge container such as an IBC (2) having an opening (3) normally covered by a transport cap (4), the apparatus (1) comprising a device (5) which is adapted to engage and remove the transport cap (4) and means (6) to cover at least a rim of a cap (4) during such removal. The problem of contamination is overcome using the apparatus (1) which is in the form of an annular metal (in the embodiment) cowl (11) which has two peripheral spaced apart upstanding walls (12, 13), the inner wall rising from an internal base (14) in the embodiment and from which also rises the engaging and removing device (5) which in the embodiment shown comprises a pneumatic piston and cylinder arrangement. The piston carries an extractor means in the form of an annular disc or spider (15) having a depending peripheral wall (16) which carries an inflatable ring or tyre (17). The external surface of the inner wall (12) carries at its rim a lip seal (18) which is mounted over an inflatable ring (19). The outer wall (13) is higher than the inner wall (12), and carries an annular seal (20) too, which extends over the lip seal (18).

MATERIAL HANDLING APPARATUS

The invention relates to material handling apparatus, particularly flowable material such as a powder. It will be understood that the expression particulate material used herein includes powders, grains, granules, dust, tablets, capsules, and the like.

It is often the case that such particulate material - usually held in a container such as an intermediate bulk container (IBC) for transport, storage and general handling - has to be contained in the immediate area of the IBC during discharge through a discharge station to subsequent processing. Such containment is for environmental purposes and/or for the health of operating personnel. Such problems have to a large extent been obviated, for example as shown in U.K. patent specification No. 2084969.

However, required standards for containment are constantly increasing in industries such as those concerned, with pharmaceutical, fine chemicals, or radio-active materials and indeed anywhere where product contamination of atmosphere or personnel is an important factor.

Present day O.E.L. (operator exposure levels) typically are between 1×10^{-3} and 1×10^{-5} grammes per cubic metre of air. These levels are no longer sufficient to meet the needs of industry and O.E.L. levels down to 1×10^{-9} grammes per cubic metre (1 nanogramme per cubic metre) are now required. The only present practical ways to achieve such levels are by use of laboratory scale equipment using glove boxes, full operating protection, breathing apparatus, full environmental air cleaning and conditioning and so on. The problem is that laboratory methods can only process such products in very small quantities whereas industrial process industries require to process and action these toxic

materials in large batch quantities in the hundreds and thousands of Kgs. Such prior processes are expensive, time-consuming and impractical for large volumes, particularly as no prior system today is capable of meeting containment O.E.L. levels of 1×10^{-9} grammes per cubic metre.

The problem is that generally an IBC when removed from a discharge station even with a double lip seal and intermediate cleaning system will still have some amount of product on the bottom exposed edge of a cone valve seal and bin outlet of the system.

There is an item, a transport cap, which is fitted manually or automatically to the outlet to cover these contaminated areas completely and thus to enable the IBC to be moved away with no product exposed, a system incorporating such a cap being now able to achieve higher levels of product containment.

However, between the time that the IBC is lifted up from the discharge station and the transport cap being fitted, product is exposed to the local environment and there is a risk that while the transport cap is being moved horizontally sideways underneath the IBC (between the IBC and the discharge station), and then upwards to engage, some minute particles of product will fall off the edge of the cone valve and bin outlet and contaminate the outer surfaces of the transport cap - (it being accepted that when the transport cap has been moved horizontally into position and lifted upwards the inner surfaces of the transport cap and the exposed surfaces of the cone valve mate and seal together thus protecting these product contaminated surfaces from the outside and vice versa).

It is therefore an object of the invention to seek to mitigate the disadvantages referred to hereinbefore, and to seek to ensure that contamination of the outside of the transport cap is substantially obviated.

According to a first aspect of the invention, there is provided apparatus for handling flowable material for example, particulate material, which is held in a container having a discharge opening normally covered by a transport cap, the apparatus comprising a device which is adapted to engage and remove the transport cap and means to cover at least a rim of the transport cap during such removal.

The apparatus may comprise an annular member, the device being substantially centrally arranged, and the cover means preferably being substantially peripherally arranged. This provides a relatively simple way of covering a transport cap.

The cover means may comprise a substantially annular lip seal. This provides for substantially complete containment over the whole peripheral edge of the cap in use.

The lip seal may have a relaxed sealing mode, and the apparatus may comprise means to actuate the lip seal into a non-sealing mode. This enables ease of operation and installation.

The actuating means of the lip seal may comprise an expansible ring internally of part of the lip seal, the arrangement being such that on expansion of the ring the lip seal may be drawn back to a non-sealing mode. This provides a relatively efficient yet simple operation.

The apparatus may have two spaced peripheral walls, and the lip seal and actuating means may be carried externally of the inner wall. This provides a relatively easily manufactured apparatus.

The outer wall may be higher than the inner wall and may terminate in an

inwardly directed cover part overlying and spaced from the lip seal whereby to provide an annular space. This annular space may comprise a sweep area for gas, e.g. air, cleaning.

The device for engaging and removing the cap may comprise a reciprocable actuating arrangement which may carry an extractor device for engaging the cap. This again provides a relatively simple construction, particularly when the reciprocable actuating arrangement may comprise a piston and cylinder arrangement carried by the apparatus.

The piston and cylinder arrangement may be mounted substantially centrally of the apparatus and may comprise a pneumatically operable piston and cylinder arrangement. This can be actuated by the air system of a discharge station.

The extractor device may be mounted on the piston for reciprocation therewith. This provides adequate control.

The extractor device may comprise an inflatable device which on expansion may contact and grip an internal surface of the transport cap. This provides for positive action.

The inflatable device may comprise a pneumatic device, suitably an inflatable ring.

The apparatus may have a support means. This provides for ease of mounting at a discharge station.

The support means may comprise an arm mounted for rotation whereby the arm is operable to move the apparatus to address a transport cap. This provides for

ease of removal of a transport cap.

The arm may carry service lines of the apparatus. This provides for a saving of space.

The service lines may comprise an air line or lines. These may suitably be air lines of the discharge station.

According to a second aspect of the invention, there is provided a discharge station for discharging flowable particulate material from a container therefor, comprising apparatus as hereinbefore defined.

There may also be a station for cleaning the apparatus.

The cleaning station may comprise an air cleaning station.

According to a third aspect of the invention there is provided a material handling system including a wash station for washing the container, and the said station may include apparatus as hereinbefore defined.

Apparatus and a system incorporating same are hereinafter described, by way of example, with reference to the accompanying drawings.

Fig. 1 shows schematically a discharge station incorporating apparatus according to the invention;

Fig. 2 shows to an enlarged scale apparatus according to the invention, taken on the line X-X of Fig. 3;

Fig. 3 shows a plan view of the apparatus of Fig. 2;

Fig. 4 shows a longitudinal sectional view of the apparatus in combination with a transport cap, the left hand side of the Fig. shows the apparatus and transport cap still in position at an outlet of an IBC with the apparatus addressing same;

Fig. 5 shows a schematic view of part of the left hand side of Fig. 4;

Fig. 6 shows an enlargement of part of Fig. 5;

Fig. 7 shows a schematic view of part of the right hand side of Fig. 4; and

Fig. 8 shows an enlargement of part of Fig. 7.

Referring to the drawings, there is shown apparatus 1 for handling flowable material, particularly particulate material, which is held in a discharge container such as an IBC 2 having an opening 3 normally covered by a transport cap 4, the apparatus 1 comprising a device 5 which is adapted to engage and remove the transport cap 4 and means 6 to cover at least a rim of the cap 4 during such removal.

The particulate material, which may be a pharmaceutical product, fine chemical product, radioactive material or any other material which can contaminate its surroundings, is held in the intermediate bulk container 2 (IBC) for storage, transport and general handling prior to passing to future processing. In order to pass the material to future processing, it is necessary to discharge it from the IBC, through the discharge opening 3 thereof. The discharge opening 3 is usually obturated by a closure device such as a valve 7 of conical or frusto-conical form which, to obturate the opening 3, sits down on the internal hopper

surface of the IBC leading to the outlet 3, and which valve is raised by a lifting device 8 at the discharge station 9 to open an annular gap defined by the valve and hopper surface through which the material can flow. During transport, it is important that the valve does not become dislodged and accordingly the valve is held in place by the transport cap 4 which can be manually or automatically applied to the edge of the hopper surface and which is inserted in the discharge opening to grip the inside of the valve from the inside.

There are various seal arrangements 10 to ensure that as much material as possible is maintained within the IBC or at the outlet and does not contaminate the external surfaces defining the discharge opening 3, the cap 4 or the seals 10 themselves as well as ensuring that the material itself is not contaminated by extraneous material. Such seal systems are disclosed in GB patent specification No. 2084959 or European Patent No. 0380255.

The transport cap 4 is usually moved into (or out of) position substantially horizontally (as viewed), and is then offered up to the discharge opening. In certain circumstances, however, a few particles of material may become adhered to the transport cap 4, and accordingly the problem of such contamination is overcome using the apparatus 1 shown, which is in the form of an annular metal (in the embodiment) cowl 11 which has two peripheral spaced apart upstanding walls 12, 13, the inner wall rising from an internal base 14 in the embodiment and from which also rises the engaging and removing device 5 which in the embodiment shown comprises a pneumatic piston and cylinder arrangement. The piston carries an extractor means in the form of an annular disc or spider 15 having a depending peripheral wall 16 which carries an inflatable ring or tyre 17. The external surface of the inner wall 12 carries at its rim a lip seal 18 which is mounted over an inflatable ring 19. The outer wall 13 is higher than the inner wall 12, and carries an annular seal 20 too, which extends over the lip seal

18.

The cowl 11 is mounted on a swingable or pivotable arm 21 which is pivotably mounted on an upstanding arm or pedestal 22. An actuator in the form of a piston and cylinder 23 for lifting the pivot arm 11 is mounted between that arm and a bracket 24 on the pedestal 22 and there is also an actuator 25 in the form of a piston and cylinder for swinging the cowl 11 between a parked position (shown in dashed lines in Fig. 3) and a position (shown in full lines in Fig. 3) below the IBC 2.

In use, at a discharge station 8, the IBC 2, filled with flowable particulate material, and with a transport cap 4 fitted, is brought by suitable means such as a forklift truck or other mechanical handling means over the discharge station 8, and is held some distance thereabove.

The arm 21, actuated by the piston and cylinder 25, is pivoted horizontally so that the apparatus 1 is brought into position between the discharge outlet or opening of the IBC. During this action, the ring or tyre 19 is inflated. This action draws the lip seal 18 back (Figs. 7, 8) so that its free edge is adjacent the edge of the wall 12 and, moreover, is brought back so that it is clear of the largest diameter of the transport cap 4. In other words, the lip seal 18 clears the transport cap 4. The cowl 11 is then raised by raising the arm 21 via the piston and cylinder 23 until the piston and cylinder arrangement 5 in the centre of the cowl 11 is inside the transport cap 4. The annular ring or tyre 17 carried by the spider 15 is now expanded by air flow down the air service lines in the arm 21 (as indeed was the ring or tyre 19). The tyre 17 has a large surface area on inflation which grips an inner surface of a wall of the transport cap 4. On lowering the piston 5, the transport cap 4 is drawn downwards and is thus released from the edge of the hopper outlet and from the valve. As the piston 5

is lowered by retraction into the cylinder, the transport cap 4 and the ring are lowered down inside the cowl 11.

The piston and cylinder arrangement 23 is now actuated to lower the whole combination of cowl 11 and transport cap 4. At the same time, the tyre 19 is deflated, so that the lip seal 18 relaxes inwards to its natural, extended position and in doing so it covers the top edge and outer surfaces, including the rim thereof, of the transport cap 4. In this position, if there are any released or loose particles of material from the cone valve, they will deposit onto the lip seal 18 and/or they will be drawn into the annulus formed between the lip seal 18 and the seal 20 which annulus is an outer (as viewed) air sweep annulus as there may be provided means such as air inlet nozzles to ensure removal of product from the region of the transport cap. Thus no particulate material can contaminate the outside of the transport cap 4. These sequences of operations are shown in Fig. 2 and 4 to 8, in Fig. 2 the raised position of the piston and cylinder being shown in dashed lines.

The arm 21 is then actuated via the piston and cylinder 25 to swing the combination of cowl 11 and transport cap 4 to a separate enclosure (not shown) where air is admitted as a sweep to ensure that any particles of material on a top contaminated surface do not contaminate the local process environment or personnel.

The IBC is then lowered onto the discharge station 8 and material is discharged in the usual way. It will be understood that there may be a static outer air sweep cowl 26 around the discharge station 8 hopper to ensure that while the IBC 2 is being lowered, any particles of dust are contained within the air sweep area and are not admitted into the outer process area.

The IBC 2 is then raised, and the above-described process is reversed to re-engage the transport cap 4 via the cowl 11, thereby allowing the IBC 2 to be removed with no particulate material contaminating the outer surfaces of the transport cap and with the contaminated inner surfaces of the cone valve, hopper outlet and transport cap locked and sealed together.

The IBC may then be taken to a wash booth (not shown) where apparatus embodying the invention separate the transport cap and IBC, and internal jets wash all the inner and outer surfaces of the IBC before it is refilled, and the cycle repeated.

It will be understood that using apparatus embodying the invention as hereinbefore described in the drawings, it is possible to ensure that no particulate material contaminates the outer surface of the transport cap, contaminated inner surfaces of the valve 7, outlet and transport cap being locked and sealed together to achieve this desirable result.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Apparatus for handling flowable material particularly, particulate material which is held in a container having a discharge opening covered by a transport cap, the apparatus comprising a device which is adapted to engage and remove the transport cap and means to cover at least a rim of the transport cap during such removal.

2. Apparatus according to Claim 1, comprising an annular member, the device being substantially centrally arranged and the cover means being substantially peripherally arranged.

3. Apparatus according to Claim 2, the cover means comprising a substantially annular lip seal.

4. Apparatus according to Claim 3, the lip seal having a relaxed sealing mode, and the apparatus comprising means to actuate the lip seal into a non-sealing mode.

5. Apparatus according to Claim 4, the actuating means of the lip seal comprising an expansible ring internally of part of the lip seal, the arrangement being such that on expansion of the ring the lip seal is drawn back to a non-sealing mode.

6. Apparatus according to Claim 4 or Claim 5, having two spaced peripheral walls, the lip seal and actuating means being carried externally of the inner wall.

7. Apparatus according to Claim 6, the outer wall being higher than the inner wall and terminating in an inwardly directed cover part overlying and spaced from the lip seal whereby to provide an annular space.

8. Apparatus according to Claim 7, the device for engaging and removing the cap comprising a reciprocable actuating arrangement which carries an extractor device for engaging the cap.

9. Apparatus according to Claim 8, the reciprocable actuating arrangement comprising a piston and cylinder arrangement carried by the apparatus.

10. Apparatus according to Claim 9, the piston and cylinder arrangement being mounted substantially centrally of the apparatus and comprising a pneumatically operable piston and cylinder arrangement.

11. Apparatus according to Claim 10, the extractor device being mounted on the piston for reciprocation therewith.

12. Apparatus according to Claim 9, the extractor device comprising an inflatable device which on expansion contacts and grips the internal surface of the transport cap.

13. Apparatus according to Claim 12, the inflatable device comprising a pneumatic device.

14. Apparatus according to Claim 13, the inflatable device comprising an inflatable ring.

15. Apparatus according to any preceding claim, having a support means.

16. Apparatus according to Claim 15, the support means comprising an arm mounted for rotation whereby the arm is operable to move the apparatus to address a transport cap.

17. Apparatus according to Claim 16, the arm carrying service lines of the apparatus.

18. Apparatus according to Claim 17, the service lines comprising an air line or lines.

19. A discharge station for discharging flowable particulate material from a container therefor, comprising apparatus according to any preceding claim.

20. A discharge station according to Claim 19, and a station for cleaning the apparatus.

21. A discharge station according to Claim 20, the cleaning station comprising an air cleaning station.

22. A material handling system, including a discharge station according to any of Claims 19 to 21.

23. A material handling system according to Claim 22, including a wash station for washing the container, said station including apparatus according to any of Claims 1 to 18.

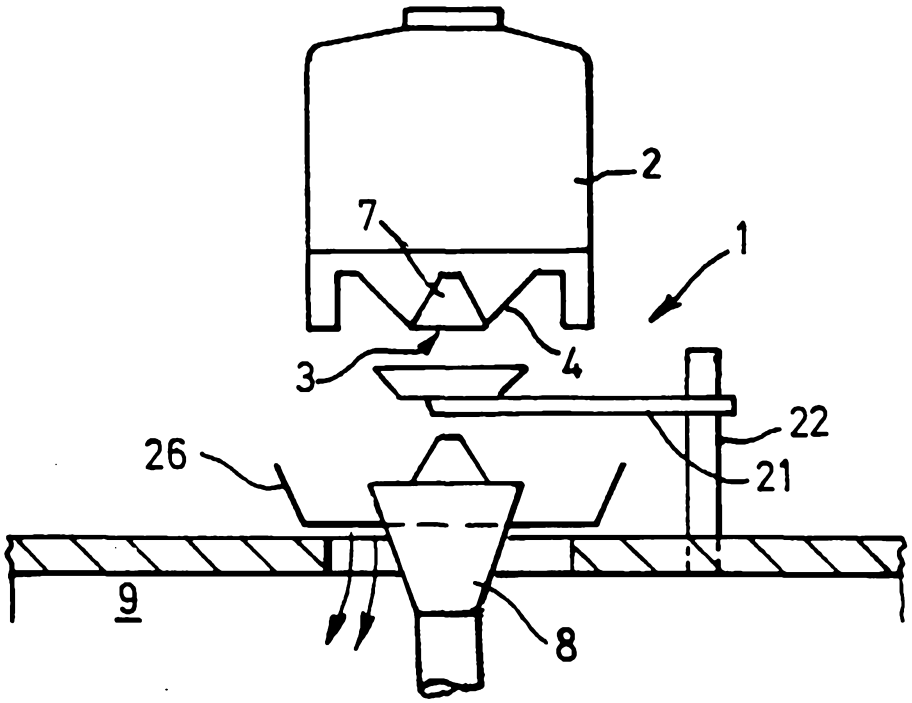


FIG.1

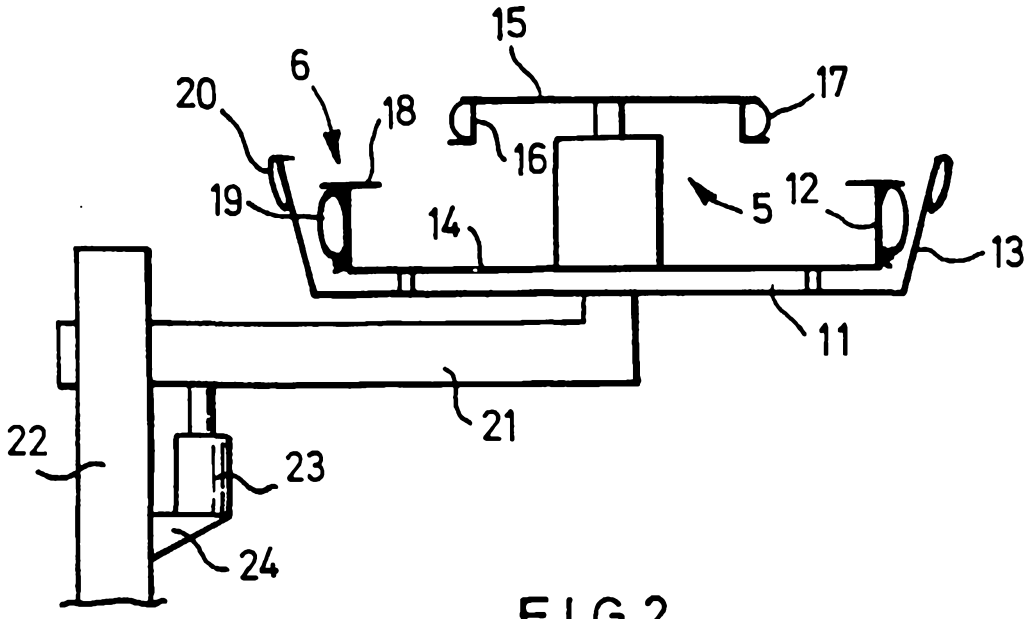


FIG.2

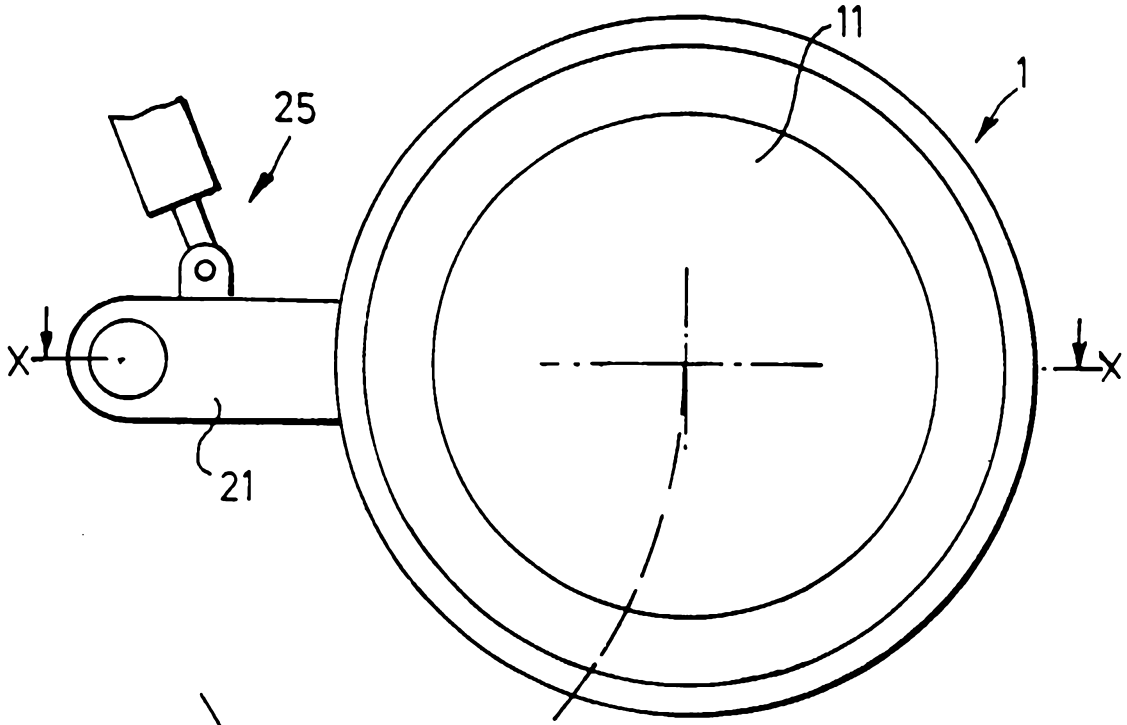


FIG. 3

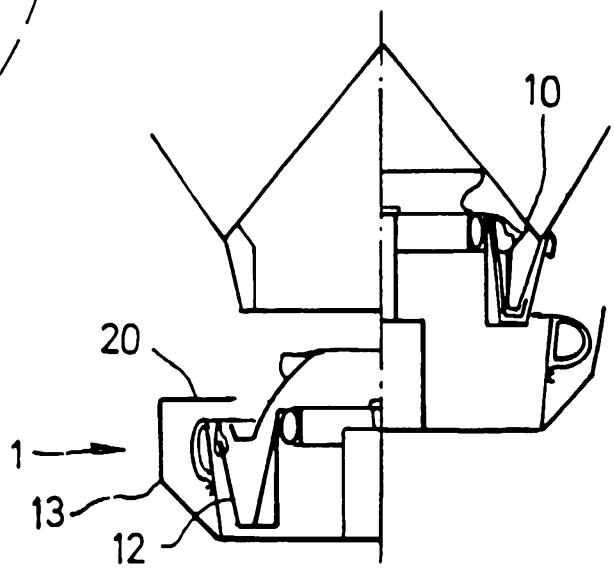


FIG. 4

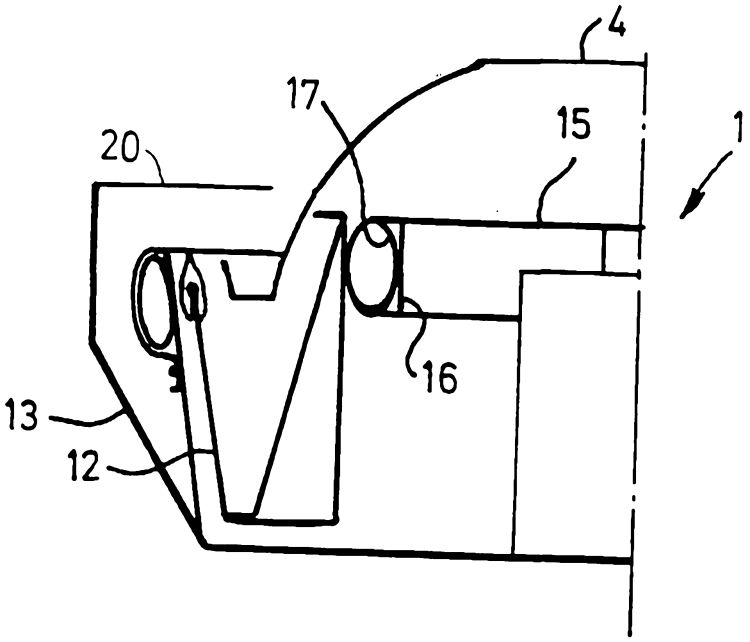


FIG. 5

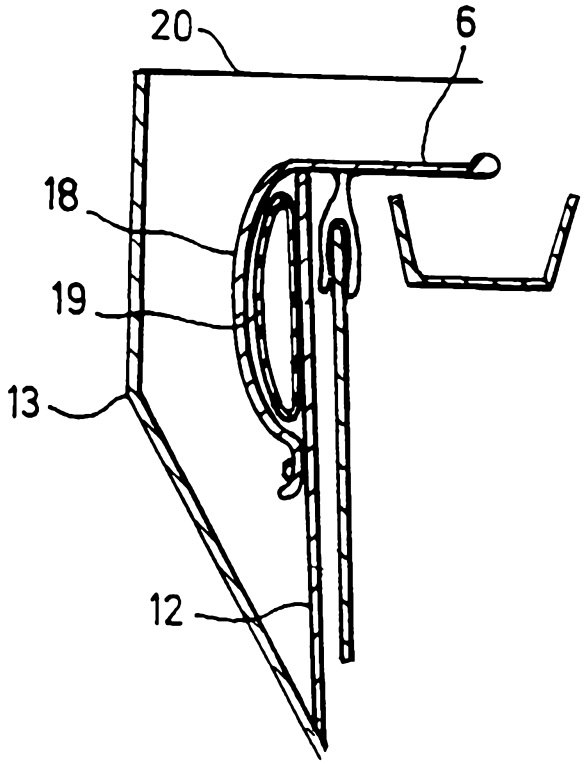


FIG. 6

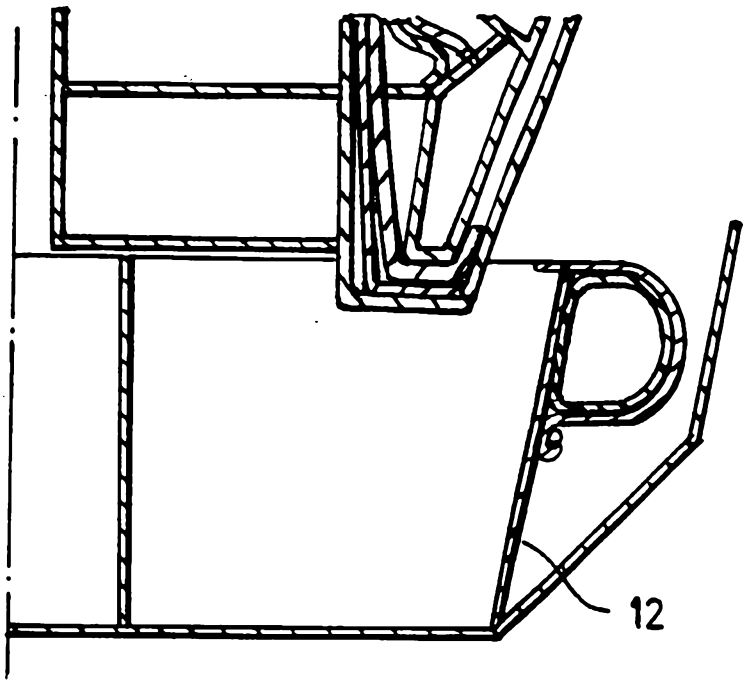


FIG. 7

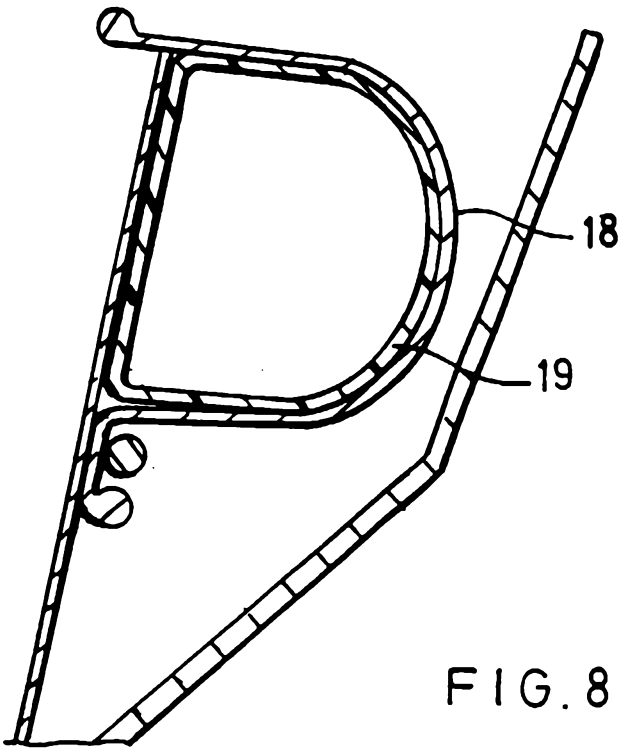


FIG. 8