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Description

This invention relates to an apparatus for transferring powder from a bulk supply to containers of smaller size, for example, boxes and bags etc.

The transfer of powders from a bulk supply to smaller containers for marketing or storage is complicated by the fact that the flow characteristics of powders are very different from those of liquids. For example some powders tend to be sticky and flow only with difficulty whilst others may be of a very light and flocculent nature so that when they are poured into a container air which is displaced carries with it substantial quantities of entrained powder. This can cause fire hazards if the powder is flammable or financial loss and danger to health if the powder is expensive or toxic.

The filling of a large number of containers with powder from a bulk supply must for practical reasons be carried out rapidly and under conditions so that preferably the escape of powder is prevented or if this is not possible then efficient methods of powder recovery are employed. Various measures have been taken for the purposes of achieving this objective. For example one of these involves fitting the delivery end of a conduit extending from the bulk supply of powder to be transferred to the container to be filled with an inflatable annulus which can be inflated and made to grip and form an air-tight seal with the mouth of the container. A second conduit is then provided between external wall of the inlet conduit and the inflatable annulus through which displaced air containing entrained powder can pass on its way to a powder recovery station where powder can be recovered. In order to assist the process a draught created by an exhaust fan assists the removal of displaced air. However in order to avoid any excessive reduction in pressure within the container air from outside the container is allowed to enter the container through a third conduit and merge with the effluent stream of air leaving the container. In this way an improvement has been effected.

Such an apparatus is disclosed in EP-A-0 257 683. The preamble of claim 1 is based on this prior art. However even with existing well designed machines there is a tendency for small quantities of powder to escape. The present invention is directed to an improved packaging apparatus which avoid to a major extent the disadvantages of existing machines as well as providing other benefits.

Accordingly this invention provides apparatus for filling a flexible container from a bulk supply, comprising; a weighing base providing a support for a container during filling thereof; a filling head adapted to be disposed in sealing engagement with an upper part of said container to be filled; a powder conduit in said filling head adapted to con-

duct powder from said bulk supply to an interior space of said container; a vent conduit providing a gas flow path from said space to atmosphere; an extraction conduit with one end connected to said interior space and with another end connectable to an extraction fan, and a purge conduit, connected at one end to a supply of purge gas, the purge conduit having an other end arranged for supplying purge gas into the container interior characterised in that the vent conduit provides such gas flow path to atmosphere in a first direction through a first part of a filter; in that said extraction conduit has a second part of said filter in a path of gas flow from the space into the extraction conduit; in that during purging said other end of said purge conduit discharges purge gas into the extraction conduit which gas thereafter flows into the space in the container through the second part of the filter in a direction opposite to that of extracted gas; and in that the said extraction and vent conduits are so arranged relative to each other that extraction of gas via said extraction conduit causes ingress of ambient gas via said vent conduit through the first part of the filter in a direction contrary to the flow of gas expelled from the space in container during filling.

The invention is illustrated but not restricted by the following drawings;

Figure 1 is a side view taken in vertical section of one preferred form of the apparatus made according to the invention.

Figure 2 is an enlarged view of part of the apparatus shown as A in figure 1.

With reference to the drawings the apparatus comprises a dryer base valve (1) which controls a supply of powder (2) by means of screw feeder (3) along a powder conduit (4). Passage of powder along powder conduit (4) is further controlled by valve (5) and the end of the powder conduit (4) extends down into a bag (25) made of substantially air-tight material for example polythene.

A pipe (6) supplies nitrogen gas under control of valve (7) to a purge conduit (8) which is disposed concentrically round the powder conduit (4). The end of purge conduit (8) is blocked. However the wall of the conduit is provided with apertures (10) which communicate with the interior of an extraction conduit (11) to which is clamped a filter (13) which has an annular first part (13a) and cylindrical second part (13b). The filter (13) comprises a flexible sheet made of fibres or filaments which preferably prevent the build-up of electrostatic electricity. Especially good results have been obtained by using a filter made of fibres of polytetrafluoroethylene (P.T.F.E) available under the trade mark GORE-TEX. The purpose of part 13a is to permit gas to vent from the container via vent conduit (28) but at the same time to prevent the escape of any powder.

Extraction conduit (11) is connected through ducting (15) to air extraction valve (16) which acts in conjunction with an exhaust fan (17). Ducting (15) also communicates with a ventilation system consisting of a perforated plenum (18) through a control flap valve (19).

The arrangement of conduits (4), (8), (11) and (28) is located within a metal frame (20) which is secured to the base (21) of a weighing machine. The frame incorporates a return member (21) which supports a supply (22) of plastics lay-flat tubing which during the operation of the machine will be converted into filled bags. The frame also supports filter (13) and an inflatable annulus (23) made of resilient material, preferably rubber. A keg (24) containing a bag (25) filled with powder rests in the frame of the base (21) of the weighing machine. The whole of the frame together with discharge ends of the conduits are enclosed partly by a compartment (26) made conveniently of any suitable construction material for example a plastics coated wood laminate. The weight of the compartment is supported from above rather than being carried by the weigh base (21) and the side of the compartment opposite the perforated plenum (18) is open so that an operative can carry out certain operations described below.

Each part of the machine for example the screw feeder and various valves operate in timed relationship under the control of a control system (not shown) which requires to be programmed for each powder that has to be packaged. The operation of the machine can be described conveniently as being divided into three phases.

Pre-Filling Phase

The exhaust fan (17) is switched off and initially the annulus (23) is in a deflated state. Valves (1), (5), (7) and (16) are all closed. A supply (22) of lay-flat plastics tubing for making bags is fed on to support (20) and a keg (24) with a pre-fitted liner of plastics material is placed on the base (21) beneath the outlet of powder feed conduit (4). The end of the lay-flat tube is then pulled down from support (20) and tied so as to effect closure. The closed end of the tube is then pulled down further until it rests on the bottom of the keg (24). The exhaust fan (17) is then switched on and valve (1) is opened. Powder now flows from dryer base valve (1) to screw feeder (3) to form a choke feed. The annulus (23) is then inflated until it engages with the inner wall of the lay-flat tube which has now been converted by the tying operation into a bag and forms a seal. Valve (16) is then opened and since the exhaust fan is operating already air is sucked out of the bag via conduit (11) thereby causing the walls of the bag to collapse and some

air to enter flowing down conduit (28) and down via filter part (13A). Valve (16) is then closed and valve (7) opened to allow nitrogen, under pressure, from a supply (not shown) to enter conduit (8) from pipe (6). Since the end of the conduit (8) is blocked the gas passes through apertures (10) and then through the vertical porous wall of filter (13), part (13b) (in a direction contrary to the direction in which the gas flowed through filter part (13b) during extraction) into the space (27) between the annulus which has been inflated already and the conduits and inflates and fills the container (25).

Filling Phase

The start button of the sequencer on the weighing machine (not shown) is then operated to commence the filling operation. The weighing system is set to net weighing mode after which powder feed valve (5) is opened. This has the effect of starting the screw feeder (3) which supplies powder at a rate which is determined by a setting on the control system. Since the walls of the container are made of impermeable plastics material displaced gas passes through the filter part (13a) during which process any powder caught up in the stream of gas is held back by the filtering action of the member. The filtered gas continues up through the space (28) between the support (20) and the conduits and discharges finally into the compartment (26). After a period the feeder is slowed until powder is being supplied at a dribble. Finally a cut-out is operated which stops the screw feeder when the required weight of powder has been delivered to the bag (25). The feed valve (5) is then closed thereby isolating the feeding system from the rest of the machine.

Final Phase

The annulus is then deflated by operating a switch on the control system and valve (16) is then opened. As a result the contents of the bag (25) is subjected to negative pressure due to flow of air up the extraction conduit (11), passing inwardly through filter part (13b). This causes the wall of the bag to collapse. The neck of the bag is then tied at two positions (29) and (30) one above the other above the surface (31) of the powder. The keg (24) containing the filled bag is then removed from the base (21) and a new keg is placed in position. The end of the lay-flat tubing (22) closed at (29) is then pulled down and positioned on the bottom of the replacement keg so as to enable the cycle of operations to be repeated.

During the various stages of operation of the machine and particularly when an operative is handling the kegs and tying the bags a draught is

being created by exhaust fan (17) through the perforated plenum (18). As a consequence any powder which may inadvertently have escaped from the machine is removed both rapidly and effectively.

The machine can be modified in different ways. For example any conventional feeding system can be used to replace the screw feeder (3). However the latter is preferred on account of the precision with which it enables the powder to be delivered. In the event of the powder being incombustible air can be used as a purge gas and closing of the bags can be effected by heat sealing rather than with ties. The machine can also be used for filling individual bags in which case storage facilities for continuous lay-flat tubing can also be dispensed with.

Claims

1. Apparatus for filling a flexible container from a bulk supply (2), comprising; a weighing base (21) providing a support for a container (25) during filling thereof; a filling head adapted to be disposed in sealing engagement (23) with an upper part of said container (25) to be filled; a powder conduit (4) in said filling head adapted to conduct powder from said bulk supply to an interior space of said container (25); a vent conduit (28) providing a gas flow path from said interior space to atmosphere; an extraction conduit (11) with one end connected to said interior space and with another end connectable to an extraction fan (17), and a purge conduit (8), connected at one end to a supply of purge gas, the purge conduit (8) having an other end arranged for supplying purge gas into the interior space of the container (25) characterised in that a filter (13) is provided between the interior space of the container and respectively the vent conduit (28) and the extraction conduit (11); in that the vent conduit (28) provides such gas flow path to atmosphere in a first direction through a first part (13a) of the filter (13); in that said extraction conduit (11) has a second part (13b) of said filter (13) in a path of gas flow from the space into the extraction conduit (11); in that during purging said other end of said purge conduit (8) discharges purge gas into the extraction conduit (11) which gas thereafter flows into the interior space in the container through the second part (13b) of the filter (13) in a direction opposite to that of extracted gas; and in that the said extraction and vent conduits (11, 28) are so arranged relative to each other that extraction of gas via said extraction conduit (11) causes ingress of ambient gas via said

vent conduit (28) through the first part (13a) of the filter (13) in a direction contrary to the flow of gas expelled from the space in container (25) during filling.

2. An apparatus according to claim 1 wherein the second conduit is disposed concentrically with respect to the first conduit.
3. An apparatus according to either of claims 1 and 2 wherein the filter is annular shaped and is disposed concentrically with respect to the first and second conduits.
4. An apparatus according to claim 3 wherein the filter is made of flexible sheet material.
5. An apparatus according to claim 4 wherein the sheet material comprises filaments made from polytetrafluoroethylene.

Patentansprüche

1. Apparat zur Füllung eines Faltbehälters von einer Schüttgutversorgung (2), bestehend aus einer Wägebasis (21), die eine Halterung für einen Behälter (25) während der Füllung des besagten Behälters (25) bietet; einem Füllkopf, der einen dichten Verschluss (23) mit dem Oberteil des besagten, zu füllenden Behälters (25) bietet; einer Pulverleitung (4) im besagten Füllkopf, der entsprechend ausgeführt ist, um Pulver von der besagten Schüttgutversorgung in einen Innenraum des besagten Behälters (25) zu führen; einer Lüftungsleitung (28), die einen Luftfluß vom besagten Innenraum zur Atmosphäre ermöglicht; einer Absaugleitung (11), mit einem am besagten Innenraum verbundenen Ende und mit einem anderen, an einem Absauggebläse (17) anschließbaren Ende, sowie einer Ausblasleitung (8), die an einem Ende an einer Ausblasluftversorgung angeschlossen ist, wobei die Ausblasleitung (8) ein anderes Ende hat, das entsprechend angeordnet ist, um Ausblasluft in den Innenraum des Behälters (25) zu liefern, gekennzeichnet dadurch, daß die Lüftungsleitung (28) Luftfluß zur Atmosphäre in einer ersten Richtung durch einen ersten Teil (13a) des Filters (13) liefert; daß besagte Absaugleitung (11) in einem Luftfluß vom Innenraum zur Absaugleitung (11) einen zweiten Teil (13b) des besagten Filters (13) beinhaltet; daß beim Ausblasen das besagte andere Ende der besagten Ausblasleitung (8) Ausblasluft in die Absaugleitung (11) einfließen läßt, diese Luft fließt danach durch den zweiten Teil (13b) des Filters (30) in den Innenraum des Behälters, und zwar in einer

entgegengesetzten Richtung zur abgesaugten Luft; und daß die besagten Absaug- und Lüftungsleitungen (11, 28) relativ zueinander so angeordnet sind, daß die Absaugung von Luft über besagte Absaugleitung (11) zum Eintritt von Umgebungsluft über besagte Lüftungsleitung (28) durch den ersten Teil (13a) des Filters (13) führt, und zwar in einer entgegengesetzten Richtung zu dem Fluß des vom Innenraum des Behälters (25) während des Füllens verdrängten Gases.

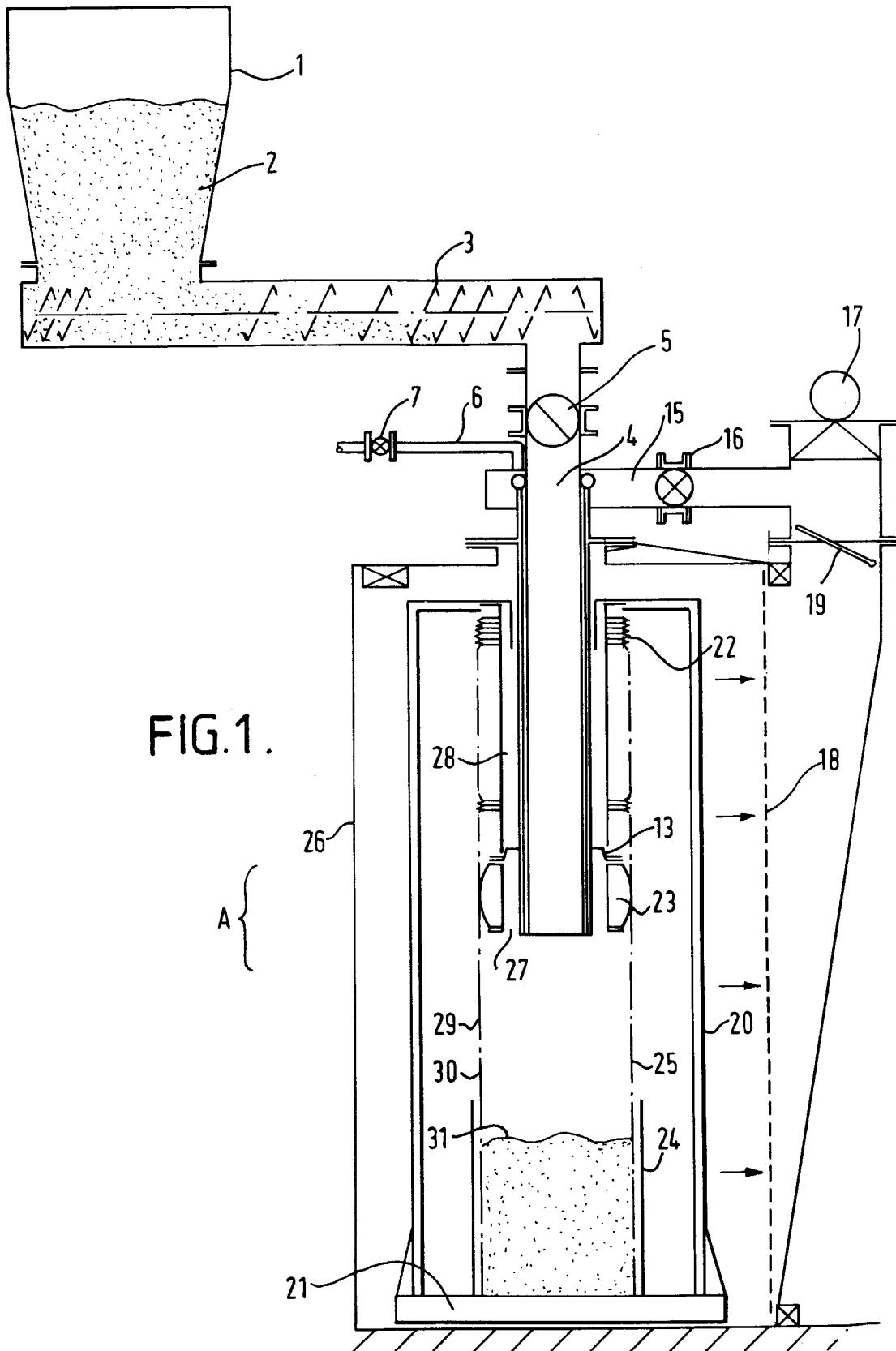
2. Ein Apparat gemäß Anspruch 1, wobei die zweite Leitung in bezug auf die erste Leitung konzentrisch angeordnet ist.
3. Ein Apparat gemäß Anspruch 1 bzw. 2, wobei der Filter ringförmig ist und in bezug auf die erste und zweite Leitung konzentrisch angeordnet ist.
4. Ein Apparat gemäß Anspruch 3, wobei der Filter aus flexiblem Plattenmaterial gefertigt ist.
5. Ein Apparat gemäß Anspruch 4, wobei das Plattenmaterial aus von Polytetrafluorethylen bestehenden Spinnfäden besteht.

Revendications

1. Un appareil destiné à remplir un conteneur flexible à partir d'un dispositif d'alimentation en vrac (2), comprenant: une base de pesage (21) servant de support à un conteneur (25) au cours du remplissage de ce dernier; une tête de remplissage adaptée, engagée dans un joint hermétique (23) communiquant avec la partie supérieure du conteneur susdit (25) devant être rempli; un conduit (4) situé dans la tête de remplissage et permettant le passage de la poudre depuis le dispositif d'alimentation en vrac jusqu'à l'espace intérieur du conteneur susdit (25); un conduit de ventilation (28) permettant le passage du gaz depuis l'espace intérieur du conteneur susdit vers l'atmosphère extérieure; un conduit d'extraction (11) dont l'une des extrémités est raccordée à l'espace intérieur susdit et l'autre à un ventilateur d'extraction (17), et un conduit de purge (8) dont l'une des extrémités est raccordée à une alimentation en gaz de purge, son autre extrémité permettant d'alimenter l'espace intérieur du conteneur (25) en gaz de purge et étant caractérisée par le fait que le conduit de ventilation (28) permet la circulation du gaz vers l'atmosphère dans une première direction par une première section (13a) du filtre (13); par le fait que le conduit d'extraction susdit (11) contient

une seconde section (13b) du filtre susdit (13), placée sur la trajectoire du flux de gaz entre l'espace intérieur et le conduit d'extraction (11); par le fait que, au cours de la purge, l'autre extrémité susdite du conduit de purge susdit (8) décharge le gaz de purge dans le conduit d'extraction (11), lequel gaz passe ensuite dans l'espace intérieur du conteneur à travers la seconde section (13b) du filtre (30) dans une direction opposée à celle du gaz extrait; et par le fait que les conduits d'extraction et de ventilation susdits sont disposés de telle manière l'un par rapport à l'autre que l'extraction du gaz par le conduit d'extraction susdit (11) provoque la pénétration de gaz ambiant par le conduit de ventilation susdit (28) à travers la première section (13a) du filtre (13) dans une direction opposée à celle du flux de gaz expulsé de l'espace intérieur du conteneur (25) au cours de son remplissage.

2. Un dispositif correspondant à la revendication 1, où le deuxième conduit est disposé de manière concentrique par rapport au premier conduit.
3. Un dispositif correspondant aux revendications 1 ou 2, où le filtre est de forme annulaire et disposé de manière concentrique par rapport au premier et au deuxième conduits.
4. Un dispositif correspondant à la revendication 3, où le filtre est constitué de feuilles de matériau flexible.
5. Un dispositif correspondant à la revendication 4, où les feuilles de matériau comportent des filaments de polytétrafluoroéthylène.



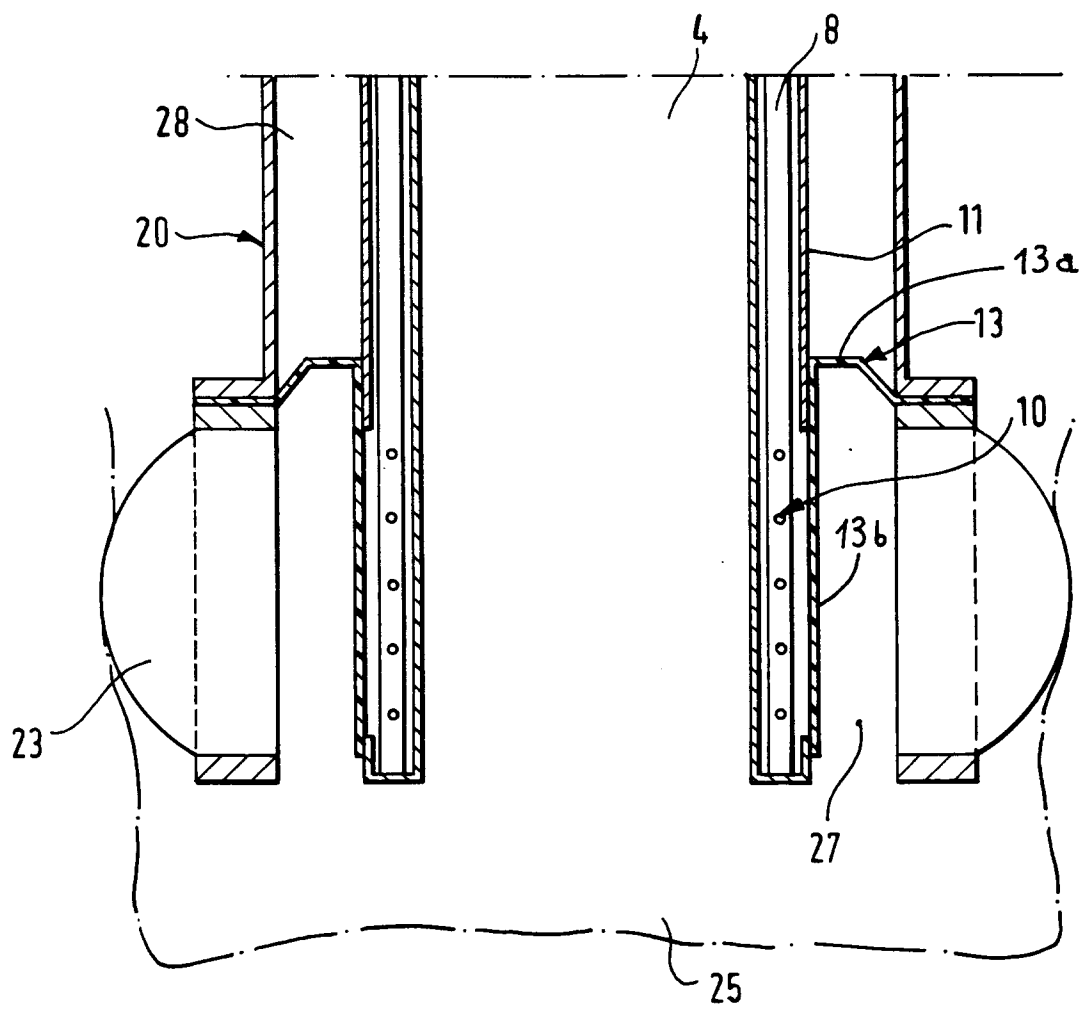


FIG. 2.