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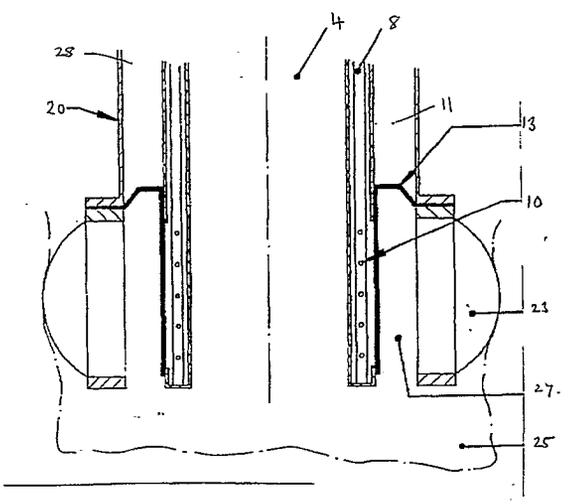
## (54) Powder dispensing apparatus.

(57) An apparatus for transferring powder from a bulk supply to a container comprising a first conduit 4 extending from a bulk supply 2 to the container 25, a second conduit 8 enabling the introduction of a purge gas into the container, a third conduit 28 enabling displaced gas to discharge from the container, a source of suction 17 communicating with the third conduit, a filter 13 through which passes the displaced gas, and an inflatable annulus 23 made of flexible material disposed round the conduits and adapted to enter into engagement with the wall of the container.

Fig 2




EP 0 443 349 A1

# POWDER DISPENSING APPARATUS

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. 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 avoids to a major extent the disadvantages of existing machines as well as providing other benefits.

Accordingly this invention provides an apparatus for transferring powder from a bulk supply to a container comprising a first conduit extending from the bulk supply to the container, a second conduit enabling the introduction of a purge gas into the container, a third conduit communicating with both the container and a source of suction, a filter through which the purge gas passes on leaving the container and an inflatable annulus made from resilient material disposed round the ends of the conduits and adapted to enter into air-tight engagement with the wall of the container. For the purposes of this invention the term 'powder' is taken to include other forms of solid matter eg granules which has been sub-divided.

This 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 Fig.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 conduit 4. Passage of powder along conduit 4 is further controlled by valve 5 and the end of the conduit extends down into a bag 25 made of substantiallly air-tight material for example polythene.

A pipe 6 supplies nitrogen gas under control of valve 7 to a second conduit 8 which is disposed concentrically round the powder feed conduit 4. The end of conduit 8 is blocked. However the wall of the conduit is provided with appertures 10 which communicate with a filter tube 11 to which is clamped an annular shaped filter 13. The latter 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 polytetrafluoethylene (P.T.F.E.) available under the trade mark GORE-TEX. The purpose of this filter is to permit nitrogen or other purge gas to vent from the container but at the same time to prevent the escape of any powder.

Filter tube 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 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 on the base 21 of the weighing machine. The whole of the frame together with discharge ends of 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 on 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 layt-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 thereby causing the walls of the bag to collapse. Valve 16 is then closed and valve 7 opened and allows nitrogen, under pressure, from a supply (not shown) to enter conduit 8 from pipe 6. Since the end of the conduit is blocked the gas passes through appertures 10 and then through the vertical porous wall of filter 13 into the space 27 between the annulus which has been inflated already and the conduits. Since the walls of the container are made of impermeable plastics material the gas passes through the top of the filter 13 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.

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. 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 causing the wall of the bag to collapse and gas borne particles of powder are drawn on to the inner surface of the filter 13. 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 by tie 28 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 inadvertantly 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. An apparatus for transferring a powder from a bulk supply to a container comprising a first conduit extending from the bulk supply to the container, a second conduit enabling the introduction of a purge gas into the container, a third conduit enabling displaced gas to dis-

charge from the container, a source of suction communicating with the third conduit, a filter through which passes the displaced gas leaving the container and an inflatable annulus made of flexible material disposed round the conduits and adapted to enter into engagement with the wall of the container.

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.

6. An apparatus according to any one of the preceding claims incorporating means whereby the flow of purge gas through the filter can be reversed.

7. An apparatus according to any one of the preceding claims wherein the purge gas is inert.

8. An apparatus according to any one of the preceding claims wherein material for forming an air tight liner for a container comprises a continuous length of lay flat tube made of plastics material, the tube being positioned concentrically of the first conduit.

9. An apparatus according to any one of the preceding claims in combination with a compartment provided with a draught to prevent the escape of powder.

10. An apparatus according to claim 9 wherein the draught is provided by an extraction fan which communicates also with the container.

11. An apparatus according to any one of the preceding claims incorporating a plurality of control valves wherein the valves are connected operatively to a sequencer.

12. Any apparatus for transferring a powder as herein before described with particular reference to the drawings.

Fig 1

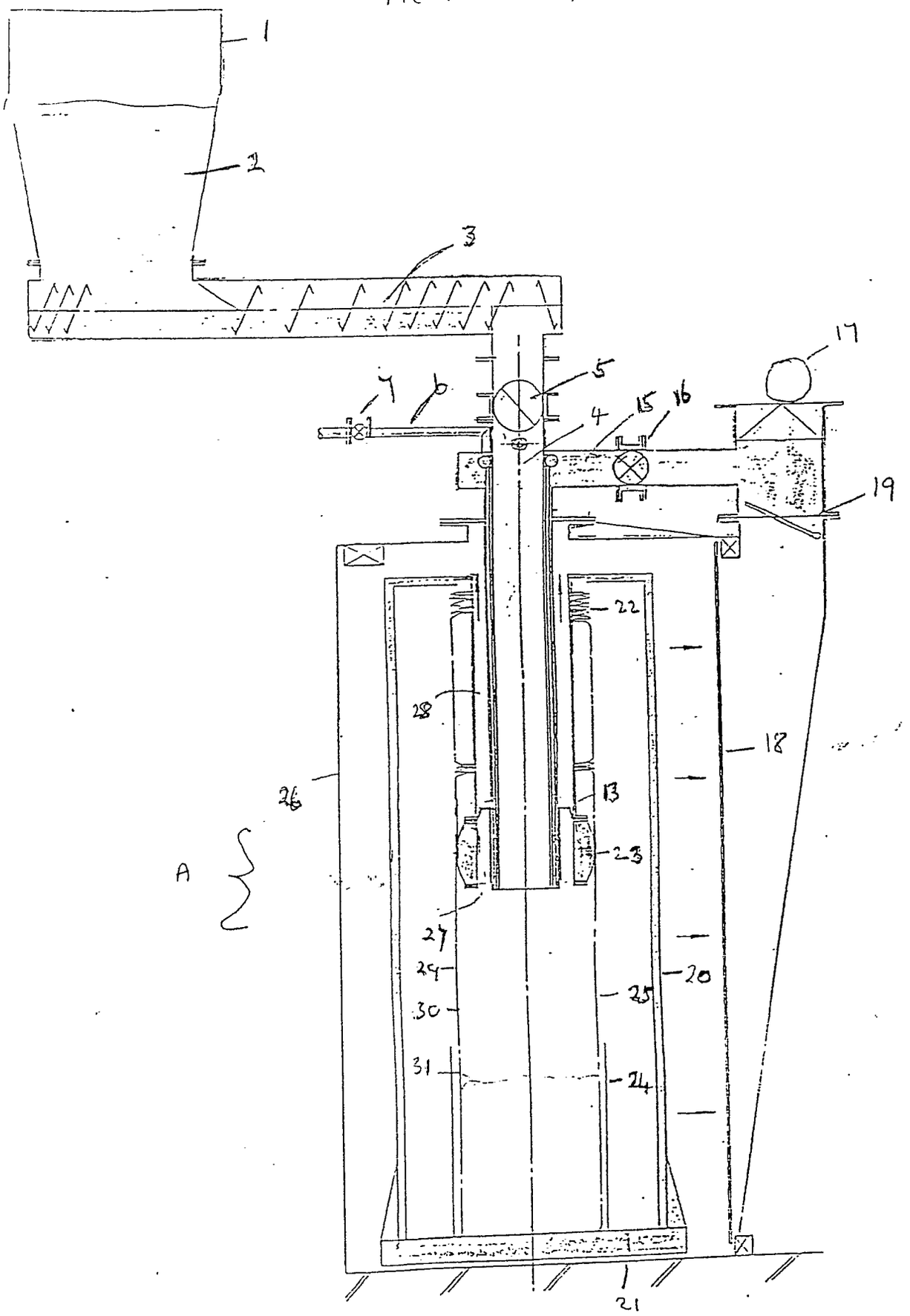
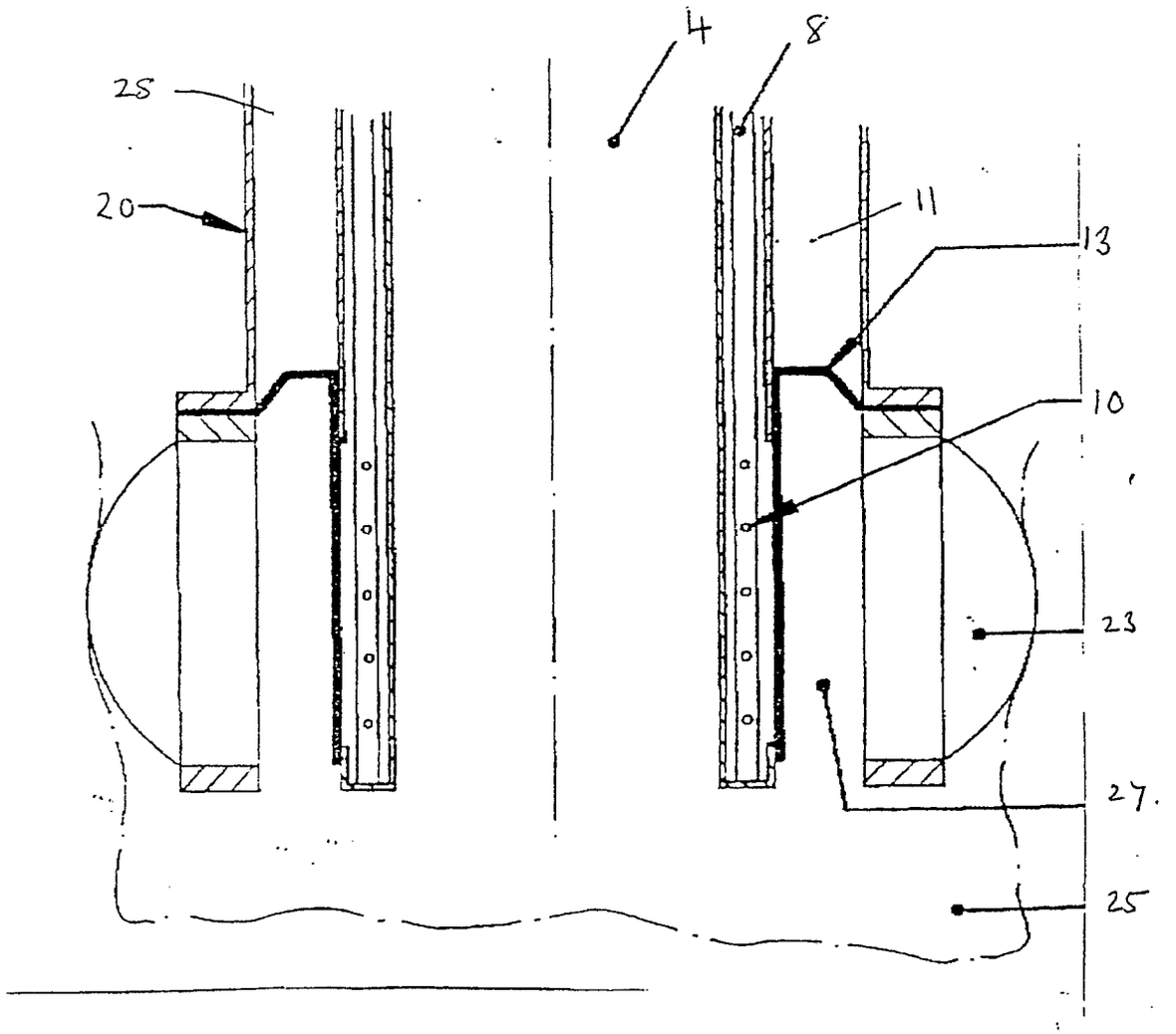


Fig 2.



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# PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application number: EP 91 10 1245

## 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.4) |
|---|---|---|---|
| Y | EP-A-0 257 683 (STOTT)<br>* Column 3, line 15 - column 4, line 43; figure 1 * | 1,2,7, 9,10 | B 65 B 1/28 |
| A | | 11 | |
| | -- | | |
| Y | US-A-3 693 672 (HILAND)<br>* Column 3, lines 43-67; figure 1 * | 1,2,7, 9,10 | |
| | -- | | |
| Y | EP-A-0 058 805 (GENERALE DES ENGRAIS)<br>* Page 5, line 25 - page 6, line 6; figures 1,2 * | 2 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| | -- | | B 65 B |
| | ./. | | |

## INCOMPLETE SEARCH

The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely:

Claims searched incompletely:

Claims not searched: 12

Reason for the limitation of the search:

Rule 29 (6) EPC

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 26-04-1991 | CLAEYS |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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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| DOCUMENTS CONSIDERED TO BE RELEVANT | | | CLASSIFICATION OF THE APPLICATION (Int. Cl.4) |
|---|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | |
| Y | FR-A-2 194 607 (HESSER)<br>* Page 2, line 36 - page 3, line 3; figure * | 7 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |