

July 22, 1952

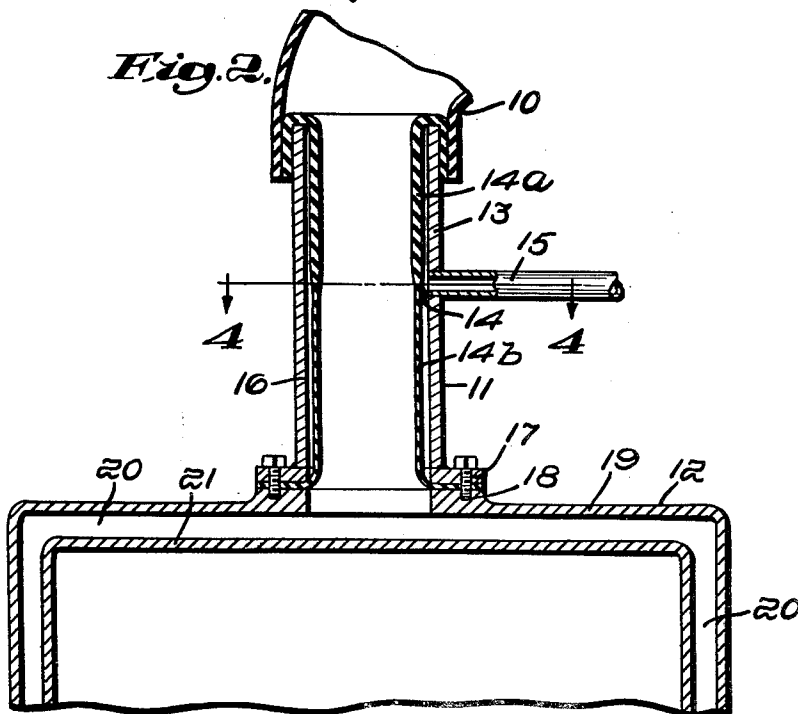
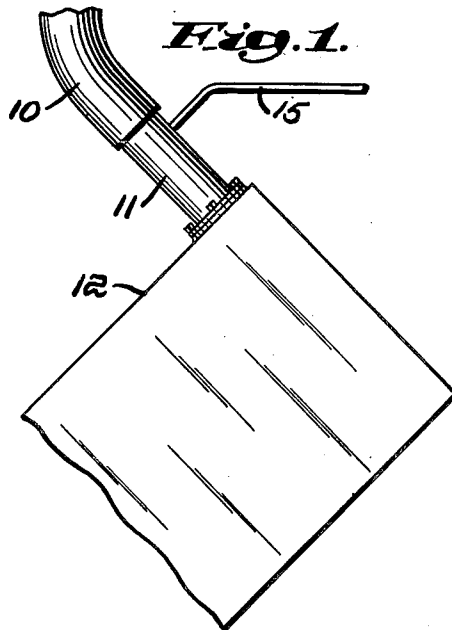
R. S. HOOD

2,604,246

FEEDING APPARATUS

Filed Nov. 27, 1948

2 SHEETS—SHEET 1



Inventor:
Ralph S. Hood,
by K. E. Folkers
Attorney

July 22, 1952

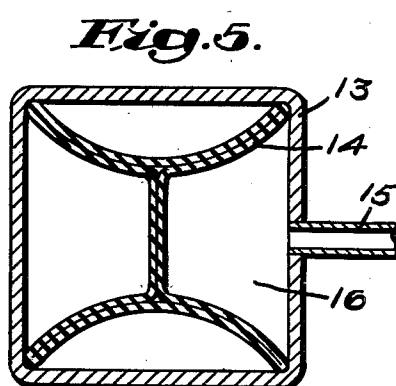
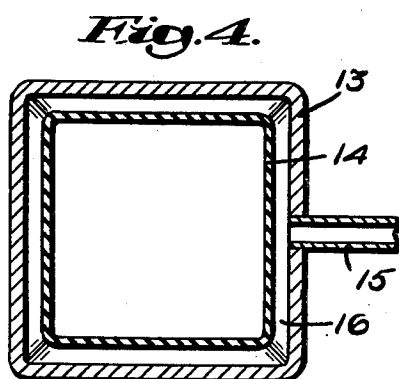
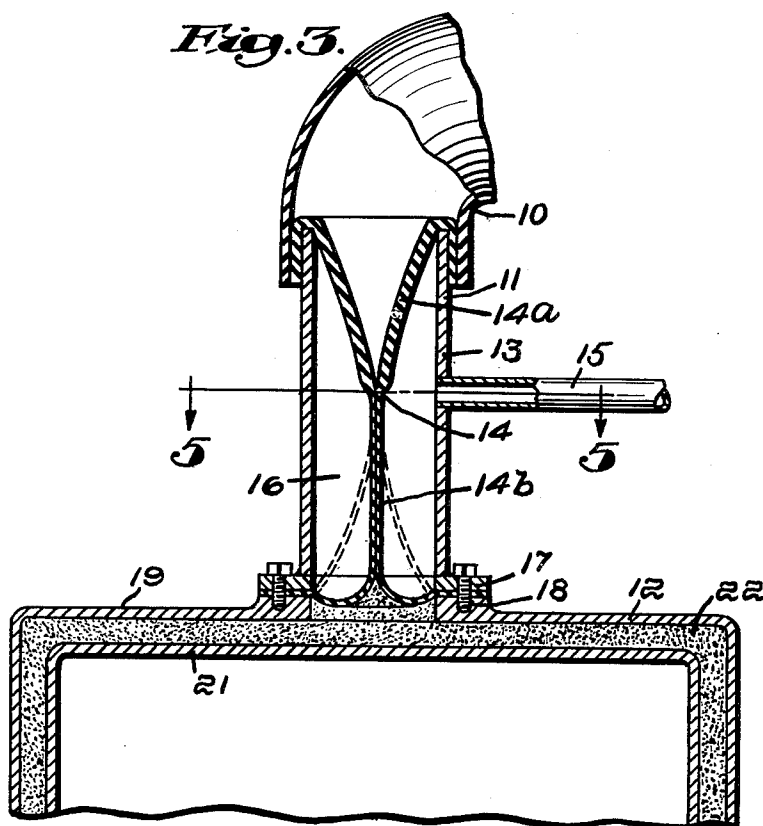
R. S. HOOD

2,604,246

FEEDING APPARATUS

Filed Nov. 27, 1948

2 SHEETS—SHEET 2



Inventor:
Ralph S. Hood,
by Kern E. Follens
Attorney

UNITED STATES PATENT OFFICE

2,604,246

FEEDING APPARATUS

Ralph S. Hood, Marblehead, Mass., assignor to
Monsanto Chemical Company, St. Louis, Mo., a
corporation of Delaware

Application November 27, 1948, Serial No. 62,267

2 Claims. (Cl. 226—19)

1

The present invention relates to an improved valve which is particularly adapted for use in controlling the flow of finely divided, free-flowing materials, as when packaging such materials or filling containers or like spaces therewith.

In filling containers with finely divided, free-flowing materials of the nature of aerogels, bentonite, diatomaceous earth, sawdust and the like, it is often difficult to stop the flow of material quickly, especially when filling a container continuously through an open port therein which is connected by a pipe to a source of supply. Moreover, it is frequently difficult to pack the material satisfactorily during the filling operation with the result that settling occurs when the container is subsequently jostled or vibrated, as during shipping or while otherwise being used. Thus in conventional filling operations it is generally necessary to pack the powdered material by a separate operation after the filling is completed, then to add additional material, pack down the added increment, and then repeat the operation until no further settling of the material is possible. This has been an especially cumbersome procedure when filling the hollow walls of refrigerator cabinets and like spaces with finely divided insulating material.

It is accordingly one object of the present invention to provide a quick acting valve which is not only capable of controlling the flow of powdered or other finely divided material during filling operations, but is also adapted simultaneously to pack the material in the container or other space to be filled.

A further object of the invention is the provision of a valve of the type described which can be readily inserted in the feed line from a storage vessel or other source of supply and is also adapted for quick mounting over the filling port of a container or hollow wall which is to be filled with finely divided material.

Still further objects and advantages of the present invention will appear from the following description when taken in connection with the accompanying drawings and the appended claims.

The improved valve of this invention in general comprises a rigid outer wall or casing, within which is inserted a thin elastic lining, which is normally positioned adjacent to the rigid outer wall, but which may be laterally distended or stretched as by air pressure to a position in which its inner surfaces contact each other over a substantial area, thereby closing off the passageway normally existing centrally thereof. The air

2

pressure is exerted against the outer surfaces of the inner lining, and is applied in such a way as to cause the central portion of the elastic walls to contact first, after which the walls contact progressively downward. Moreover, the lower half of the walls of the inner lining are made thinner than the upper half with the result that the bottom portion of the lining tends to balloon downwardly on applying the air pressure, thereby exerting a pushing action on any material present centrally of the tube and near the bottom thereof.

A further understanding of the invention will be obtained from the accompanying drawings, in which like parts are designated by the same numbers, and in which Figure 1 illustrates a preferred embodiment of the valve claimed herein in combination with a conveyor pipe and a refrigerator cabinet to be filled with powdered insulating material;

Figure 2 represents an enlarged vertical sectional view of the valve shown in Figure 1 showing the valve in open position and fragmentary portions of the conveyor pipe and refrigerator cabinet to be filled;

Figure 3 is a further representation of Figure 2, but illustrating the valve in an initially closed position (dotted lines) and finally closed position (solid lines);

Figure 4 is a cross-sectional view of the valve in open position taken along the line 4—4 of Figure 2;

Figure 5 is a cross-sectional view of the valve in closed position taken along the line 5—5 of Figure 3.

Figures 1, 2 and 3 of the drawings illustrate the combination of a conveyor pipe 10, the valve constituting the present invention, which is generally designated by the numeral 11, and a conventional refrigerator cabinet 12 which is to be filled with finely divided insulating material. The valve 11 comprises an outer wall or casing 13 which is constructed of any suitable rigid supporting material such as wood, metal, hard rubber, plastic and the like, a thin elastic membrane or lining 14 inserted therein and tightly fastened or sealed at each end by suitable means, such as clamps, cement or the like, and a pipe 15 for supplying air under pressure from a supply source (not shown) to the substantially air tight chamber or space 16 formed between the inner surface of casing 13 and the outer surface of lining 14.

The feed end of valve 11 is connected to the conveyor pipe 10 in any suitable manner. In

Figures 1, 2 and 3 conveyor pipe 10 which is of rubber bellows construction is merely inserted over a portion of lining 14 and casing 13. However, clamps or other suitable joining means may be employed depending upon the materials of construction employed in pipe 10 and casing 13. In the same figures the valve 11 is shown as fastened to the cabinet 12 by screws. However, this is by way of illustration only. Since valve 11 is only temporarily connected to cabinet 12 during the filling operation, any suitable fastening means such as clips, clamps and the like may be used to hold the valve 11 to cabinet 12.

Casing 13 of valve 11 is illustrated in Figures 4 and 5 as having a square cross section. However, this is not necessary for the proper functioning of the valve, and it may have any suitable cross sectional form or configuration such as a circle, triangle, rectangle, polygon and the like. The only requisite is that the size of the cross sectional opening be sufficiently large to permit the flow of finely divided materials. Moreover, it is not essential that casing 13 be straight as illustrated in Figures 1-3 since it may change in direction by as much as 90° between the feed end at conveyor pipe 10 and the exit end at refrigerator cabinet 12.

As illustrated in Figures 2 and 4, the elastic membrane 14 provides a lining for the inner surface of casing 13. The membrane 14 is clamped as illustrated in Figures 2 and 3 at the feed end of valve 11 between casing 13 and pipe 10 and at the exit end of valve 11 between the integral flange 17 at the lower end of wall 13 and the raised portion 18 surrounding the open port in the outer wall 19 of cabinet 12. However, the upper and lower edges of membrane 14 may be cemented directly to the top and bottom portions of casing 13 or to the internal or external surfaces thereof. Moreover, it is not essential, although it is preferred, that membrane 14 be so constructed as to line the entire inner surface of casing 13 as illustrated in Figures 2 and 4. For example, it is possible to use a lining which covers only a portion of the inner surface of the outer casing. Thus, the lining need not extend over the entire length of the casing and it is possible to employ a lining which normally covers only two sides of the casing in the case of a square construction. In such instances pipe 15 should be so located that it can supply compressed air into the space 16 between lining 14 and casing 13.

Furthermore lining 14 need not fit snugly against the casing 13 when the valve is in the open position. The open position of valve 11 is illustrated in Figures 2 and 4. Lining 14 may be spaced from casing 13 in such instances to any desired extent providing, of course, that there is sufficient space between the walls of the lining to permit the flow of finely divided material through the valve when it is in the open position. In addition, lining 14 need not have the same cross-sectional form or configuration as casing 13.

Lining 14 as illustrated in Figures 2-5 is composed of a thin, seamless rubber tubing of square cross-section. However, it is not essential that this lining be constructed of rubber or that it be seamless. It may be made of any elastic material such as synthetic elastomers, that is copolymers of styrene and butadiene, polyisobutylene and the like, or any other material which is adapted to expand or distend when subjected to air pressure and return to its original configuration or

form when the air pressure is released. The lining may be satisfactorily constructed from films or sheets of such material by shaping such films or sheets into a tube of the desired cross-sectional configuration and then cementing or otherwise joining the edges thereof to form a closed, substantially air tight seam or joint. It is essential, however, that the membrane be thin in cross-section so that it will inflate easily and quickly at a relatively low air pressure to form a substantially air tight closure. In general, the membrane 14 and particularly its lower half should be sufficiently thin to require external support, and to give a substantially air tight closure when inflated or distended as illustrated in Figure 5. The criterion is rapid inflation of the membrane or distention inwardly at air pressures of about 2 to 10 pounds per square inch (gauge), that is, rapid and substantially complete closure of the valve followed by a ballooning action parallel to the axis of flow of materials passing through the valve.

The thickness of the membrane or lining 14 may be varied depending upon the size of the valve. When the cross-sectional dimensions of the valve as illustrated in Figure 4 range between 3 inches by 3 inches and 6 inches by 6 inches and the length or height of the valve illustrated in Figure 2 is between 6 inches and 10 inches, a membrane having a cross-sectional thickness varying between about 0.03 inch and 0.18 inch has been found to give satisfactory results, while a membrane having a cross-sectional thickness between about 0.03 inch and 0.09 inch is preferred. Even thinner membranes may be employed in small valves. In larger sized valves the membrane may have a thickness approaching about 0.20 inch, although thinner membranes having the cross-sectional thickness described above are still preferred.

In Figures 2 and 3 the lining 14 is illustrated in vertical section with an upper portion 14a of greater thickness than the lower portion 14b. It is essential that the lower portion 14b of lining 14 be thin-walled, that is, have a thinness of the order hereinbefore referred to. The upper portion 14a of lining 14 may be of any convenient thickness, but for best results should always be thicker than lower portion 14b. Of the total length of lining employed, it is preferred to have the lower portion 14b comprise at least 50% of such length although this is not essential for the satisfactory operation of the valve. If desired, the entire length of the lining 14 may consist of rubber or other elastic material of the same thickness, although this is not as satisfactory since the lining will balloon upwardly and downwardly when inflated or distended whereas, as will be seen later, it is preferred to have the ballooning action take place primarily in a downward direction as illustrated in Figure 3.

It is not essential that lining 14 extend throughout the entire length or height of casing 13 as illustrated in Figures 2 and 3 since the upper and lower edges of the lining may be fastened or cemented to casing 13 at any suitable point above and below pipe 15. It is only essential that the inflation or distention of the lining under air pressure effect a substantially complete air tight closure of the valve 11 and the ballooning action hereinbefore referred to (as illustrated in Figure 3).

The operation of the valve is as follows:

Finely powdered insulating material 22 is al-

5

lowed to flow by gravity through conveyor pipe 10 from a supply source (not shown) through valve 11 while it is in open position (Figures 2 and 4) and thence into the empty space 20 between walls 19 and 21 of refrigerator cabinet 12. The valve is closed after the filling is completed by supplying compressed air through pipe 15 to space 16 thus distending the walls of lining 14. The lining 14 is initially distended in this manner to the position illustrated by the dotted lines in Figure 3. In this position the space between the membrane, which is represented by dotted lines, is filled with the insulating material. As the air pressure is increased the exit or lower portion 14b of lining 14 balloons downwardly forcing or packing the material between the dotted lines into space 20. In addition, some of the material 22 directly below the valve 11 is also acted on or packed down by the ballooning action of the lining as illustrated in Figure 3. A suitable vent may be provided in the top of the cabinet to allow air entrapped in the material to escape thereby facilitating the packing action exerted by the membrane. The valve is opened by releasing the air pressure and additional quantities of insulating material may be packed into the refrigerator walls by repeating the procedure one or more times. The packing action exerted depends upon the nature of the material, the quantum of air pressure supplied to the space 16 between the lining and casing and the thickness of the lining.

What is claimed is:

1. A valve for controlling the flow of finely divided solids, consisting of an outer rigid casing, a thin elastic lining substantially adjacent to the entire inner surface of said casing when the valve is in the normal open position, the edges of said lining being sealed against said casing to provide a substantially air-tight region between the outer surface of the lining in the casing and the inner surface of the casing, said lining having a lower portion which is thinner in cross-section than the upper portion of said lining, the lower portion of said lining being sufficiently thin to require external support and to balloon inwardly and downwardly when air under pressure is applied to the outer periphery

6

of said lining, and means for supplying air under pressure against the outer periphery of said lining.

2. In combination, a container having an opening in its uppermost surface, a valve positioned above said container and fastened to said container in communicative relationship with said opening in the container, a storage container for finely divided solids positioned above said valve and a conduit connecting the upper portion of said valve and the storage container, said valve consisting of an outer rigid casing, a thin elastic lining substantially adjacent to the entire inner surface of said casing when the valve is in the normal open position, the edges of said lining being sealed against said casing to provide a substantially air-tight region between the outer surface of the lining in the casing and the inner surface of the casing, said lining having a lower portion closest to said first mentioned container, which portion is thinner in cross-section than the upper portion of the lining, the lower portion of said lining being sufficiently thin to require the external support of said casing during the passage of finely divided solids between the walls of said lining and also being sufficiently thin to balloon inwardly and downwardly when air under pressure is applied to the outer periphery of said lining, and means for supplying air under pressure against the outer periphery of said lining.

RALPH S. HOOD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,026,916	Smith	Jan. 7, 1936
2,059,079	Beldin	Oct. 27, 1936
2,069,261	Monnet	Feb. 2, 1937
2,470,744	Korn	May 17, 1949

FOREIGN PATENTS

Number	Country	Date
37,681	Italy	June 1, 1939