March 21, 1939. C. HAGEN 2,151,511

VALVE

Original Filed Feb. 6, 1936

Fig. 1.

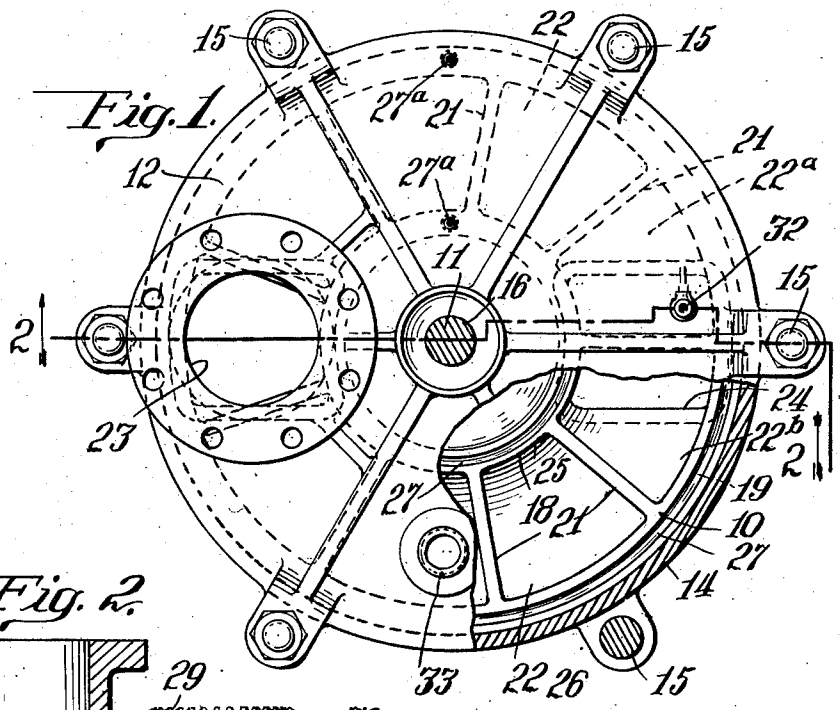
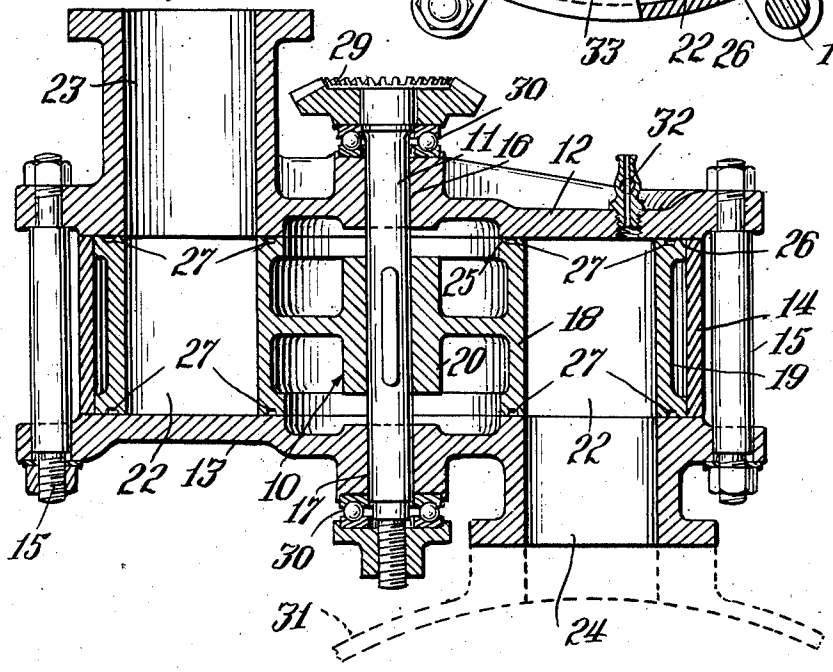


Fig. 2.



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VALVE

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Original application February 6, 1936, Serial No. 62,625. Divided and this application January 26, 1938, Serial No. 186,946

5 Claims. (Cl. 221—108)

This invention relates to improvements in valves adapted for feeding materials into the drying chamber of a continuous vacuum drier and/or for continuously discharging dried material from said drying chamber.

The principal object of the invention is to provide an improved valve of the above character which is particularly suitable for vacuum driers employed for drying starch and other similar materials which are moist and relatively sticky in character at the inlet of the drier and which assumes a finely divided or pulverulent form at the discharge end of the drier.

A specific use of the valve of the present invention is illustrated in my copending application Serial No. 62,625, filed February 6, 1936, of which the present application is a division.

When drying material in a continuous vacuum drier, it is desirable to feed the material into the drier in uniform quantities so as to maintain a relatively uniform flow or movement of the material through the drying chamber. Considerable difficulty has been experienced, heretofore, when drying starch or other similar materials of sticky character, because of the tendency which such material has to adhere to the walls of the feeding valve pockets and thereby partially or wholly interrupt the feeding of the material into the drying chamber.

A further objection to the various feeding and discharge valves heretofore used, in connection with vacuum driers, is that they do not provide suitable seals for preventing the passage of air and/or fine particles of material between the movable contacting surfaces of the valve structure and that they fail to provide for suitable lubrication of said movable contacting surfaces.

It is a specific object of this invention to provide an improved feeding and discharge valve of simplified construction which will overcome the above mentioned and other incidental objections present in valves heretofore used in connection with vacuum driers or similar apparatus. In this connection the invention contemplates the provision of constructions whereby the movable parts of the valve may be clamped in relatively close relation without producing excessive friction and to provide means for insuring quick and complete discharge of the material from the pockets of the revoluble valve member and to provide other means in combination with the specific constructions for effecting complete and rapid filling of the pockets of the valve, either at the inlet or at the discharge end of the drying chamber and at the same time avoid the admission of objectionable quantities of air into the drying chamber and thereby avoid the formation of condensation at locations in the drying chamber which would tend to damage or lower the quality of the material being dried. This feature of the invention contemplates evacuating the air from the valve pockets when the valve is used to discharge pulverulent material from the vacuum chamber of a drying apparatus and thereby avoid any interference to the movement of the dried pulverulent material into the discharge valve and also avoid the formation of dust clouds which would otherwise result if small pockets of air were permitted to suddenly expand in the outlet passage of a chamber containing dry pulverulent material.

Other objects and advantages will be apparent from the detailed description of the embodiment of the invention illustrated in the drawing, wherein:

Fig. 1 is a plan view of the improved valve structure, parts of one head thereof being broken away, so as to show the rotating valve member, and

Fig. 2 is a vertical section taken substantially on line 2—2 of Fig. 1.

The improved valve structure of the present invention preferably comprises a valve member 10 fixed to a shaft 11 and enclosed in a casing so as to rotate therein about a vertical axis. The said casing is composed of three principal parts including upper and lower head members 12 and 13 and a spacing ring 14. The said spacing ring has a width corresponding substantially to the width of the valve member 10 and is clamped between the head members of the casing by means of a plurality of bolts 15. Preferably the bolts extend from head to head of the casing at locations beyond the outer wall of the ring 14 so that the said ring can be accurately centered relative to the revoluble member 10 and the shaft 11 of the revoluble member may be properly aligned in the bearing openings 16—17 of the head members before the parts of the casing are firmly clamped together.

The revoluble valve member 10 comprises an inner ring 18 and an outer ring 19. The inner ring is joined by a web portion to the hub 20 and the outer ring is joined to the inner ring by a plurality of radially extending partition walls 21. The spaces between the partition walls provide the revoluble valve member with a series of pockets 22 which move successively into register with an inlet passage 23 in the top head of the casing to receive a charge of material and then

move into register with a discharge passage 24 in the lower head to discharge the material from the pockets. Preferably the inlet and discharge passages are positioned at remote points to each other so that the bearing surfaces 25—26 of the inner and outer rings 18—19 of the rotating member and also the upper and lower surfaces of the said partitions 21 will serve as sealing members to prevent the passage of atmosphere through the casing from one of said passages 23 or 24 to the other. In order to insure a thorough sealing effect, the upper and lower surfaces of the ring portions 18—19 of the revoluble valve member are provided with circular grooves, as indicated at 27. The said grooves reduce the area of the bearing surfaces 25—26 which engage the upper and lower heads of the casing and thereby make it practical to provide a relatively close fit between the movable valve member and the casing without excessive friction. The spaced apart surfaces 25—26 provide, in effect, double seals to prevent the passage of air or material between them and the close fitting relation of the parts makes it practical to employ suitable lubricant in the said grooves to lubricate and further seal the movably engaged surfaces without danger of the lubricant coming into contact and thereby contaminating the material passing through the valve. The lubricant above referred to may be introduced into the said grooves 27 through lubricant ducts 27a.

The valve is constructed so as to operate by means of a continuous movement. Any suitable operating means may be employed. For example, a driving connection (not shown) with the bevel gear 29 which is secured to the upper end of the shaft 11. The opposite end of the said shaft is preferably provided with anti-friction thrust bearings 30—30.

When the valve is used to introduce wet starch or other similar material of sticky character into a vacuum drier, for example, the drying chamber 31, indicated in dotted lines in Fig. 2, the inlet passage is connected to a suitable supply of material and the discharge passage is connected to the vacuum chamber 31 of the drier. An air valve 32 is positioned in the upper head of the casing at a location above the discharge passage thereof. The said air valve normally remains open so that when a pocket 22, charged with material moves across the openings of the discharge passage 24 to the position 22a (Fig. 1), the atmospheric pressure enters the pocket above the material therein and forces the material out of the pocket and into the drying chamber. The small amount of air which enters the vacuum chamber along with the charge of wet material is not objectionable since it enters the chamber in the zone of greatest evaporation and would not come into contact with the dry material in the chamber. Movement of the pocket, from the position indicated at 22a to the position indicated at 22b, cuts off communication between the pocket and the said air valve 32. In the latter position of the pocket, however, it remains in communication with the vacuum chamber of the drier so that the air is exhausted from the pocket by reason of its direct communication with the vacuum chamber. The low pressure condition thus established in the pocket insures that the wet or sticky material will flow into the pocket quickly so as to completely fill the same when the pocket moves across the supply passage 23.

When the valve structure is employed to discharge material, for example, dried pulverulent material, from the drying chamber 31, the inlet passage portion of the valve casing is connected to the discharge opening of the drier and the outlet portion 24 of the valve casing is open to the atmosphere. In order to evacuate the atmosphere from the pockets of the valve in advance of their communication with the inlet opening 23 so as to receive a charge of dry pulverulent material, I preferably provide a separate suction line 33 which leads into the valve casing and communicates with the pockets before the said pockets reach their filling position. By withdrawing the air from the pockets in the manner thus described, there is no interference to the discharging movement of the dry starch or other dry pulverulent material in the discharge passage. The low pressure maintained in the pockets prevents the formation of dust clouds within the drying chamber, such as would take place by sudden expansion of air if the air were not exhausted from the valve pocket.

When employing the valve structure as a discharge valve for discharging dry material, for example, pulverulent starch, it is important that the valve and casing be maintained at substantially the same temperature as the interior of the drying chamber so as to avoid any condensation of vapor within the valve. In order to accomlish this result, in an economical manner, the said casing may be provided with a jacket of any suitable insulating material.

From the above description of the structure and the operation of the improved valve of this invention, it will be observed that the construction and assembly of the parts are extremely simple but are of such character as to insure relatively tight working engagement of the parts without excessive friction and that these features of construction together with the other elements of the valve for introducing into the valve pockets and for withdrawing the air therefrom cooperate to accomplish the several objects of the invention set forth at the outset of this specification.

I claim:

1. A valve structure comprising a sectional casing including an upper head member formed with an inlet passage for communicating with a supply of material, a lower head member formed with a discharge passage, a cylindrical spacing ring interposed between the upper and lower head members, and a plurality of bolts extending from head to head of the casing for holding the heads and said ring in clamped engagement; and a revoluble valve member enclosed in said casing, there being a plurality of openings through the valve member to provide pockets adapted to receive a charge of material from said inlet passage and discharge it through said discharge passage.

2. A valve structure comprising a sectional casing including an upper head member formed with an inlet passage for communicating with a supply of material, a lower head member formed with a discharge passage, a cylindrical spacing ring interposed between the upper and lower head members, and a plurality of bolts for holding the heads and said ring in clamped engagement; and a revoluble valve member enclosed in said casing, there being a plurality of openings through the valve member to provide pockets adapted to receive a charge of material from said inlet passage and discharge it through said discharge passage; the said bolts extending from head to head of the casing at locations outside of the spacing ring, whereby the said ring

member may be accurately centered relative to the rotating member before the sections of the casing are firmly clamped together.

3. A valve structure comprising a sectional casing including an upper head member formed with an inlet passage for communicating with a supply of material, a lower head member formed with a discharge passage therein, a cylindrical spacing ring interposed between the upper and lower head members, and a plurality of bolts extending from head to head to clamp the said heads and ring together; a revoluble valve in the casing formed with a plurality of pockets which extend through the valve member from top to bottom thereof and adapted to receive material from the inlet passage and discharge it through said discharge passage; an air vent passage in the upper head adapted to admit atmospheric pressure into each pocket above the material therein when the pocket is in communication with the discharge passage; and a vacuum duct in the casing adapted to communicate with each pocket through an open end of said pocket to exhaust the air therefrom in advance of its position beneath said inlet passage.

4. A valve structure comprising a circular casing having an inlet passage through the top thereof at one side of the vertical axis and having a discharge passage leading from the bottom at a location remote from the inlet and adapted to communicate with the vacuum chamber of a drying apparatus, a revoluble valve member enclosed in said casing to rotate about said vertical axis and having close fitting engagement with the top and bottom walls of the casing to prevent the flow of air through the casing into said vacuum chamber, there being a plurality of openings through the valve member to provide pockets for receiving material from the inlet passage and discharging it through the discharge passage, an air vent valve for admitting atmospheric pressure into the pockets above the material therein, to force the material into the vacuum chamber; the said vent valve being so positioned that the movement of the revoluble valve member closes communication between the vent valve and a pocket while the said pocket remains in communication with the vacuum chamber, whereby the air is exhausted from said pocket in advance of its position for receiving another charge of material.

5. A valve structure comprising a sectional casing including an upper head member formed with an inlet passage for communicating with a supply of material, a lower head member formed with a discharge passage, a cylindrical spacing ring interposed between the upper and lower head members, and a plurality of bolts extending from head to head of the casing for holding the heads and said ring in clamped engagement; and a revoluble valve member enclosed in said casing and comprising inner and outer ring members, a plurality of partition walls positioned between the said inner and outer rings and dividing the space therebetween into a plurality of pockets extending through the valve member; the said inner and outer ring members of the valve being of substantially the same width as the said spacing ring and the upper and lower edge portions of said rings being formed with lubricant grooves whereby the edges of said inner and outer ring portions may be clamped into relatively close movable contact with the top and bottom heads of the casing without excessive friction, there being a relatively wide channel extending around the outer wall of the outer ring of said valve to reduce the frictional engagement thereof with the spacing ring of the casing.

CARL HAGEN.