

Oct. 16, 1956

F. G. GREAVES ET AL  
MATERIAL HANDLING VALVE

2,766,911

Filed Nov. 26, 1951

2 Sheets-Sheet 1

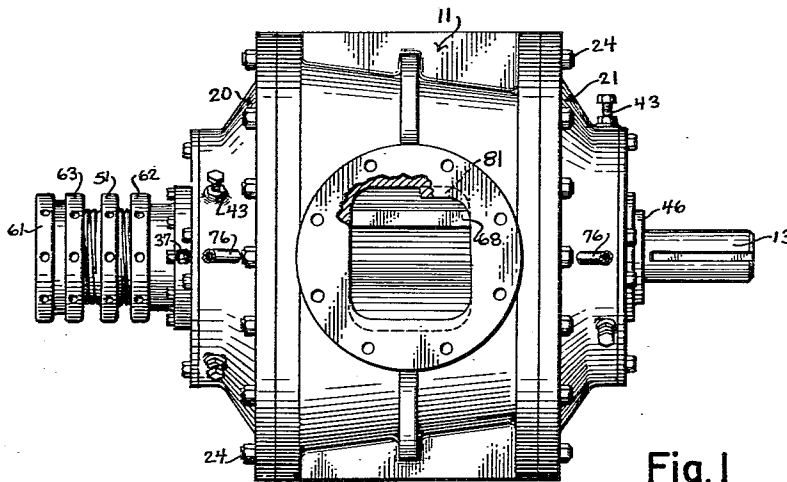


Fig. 1

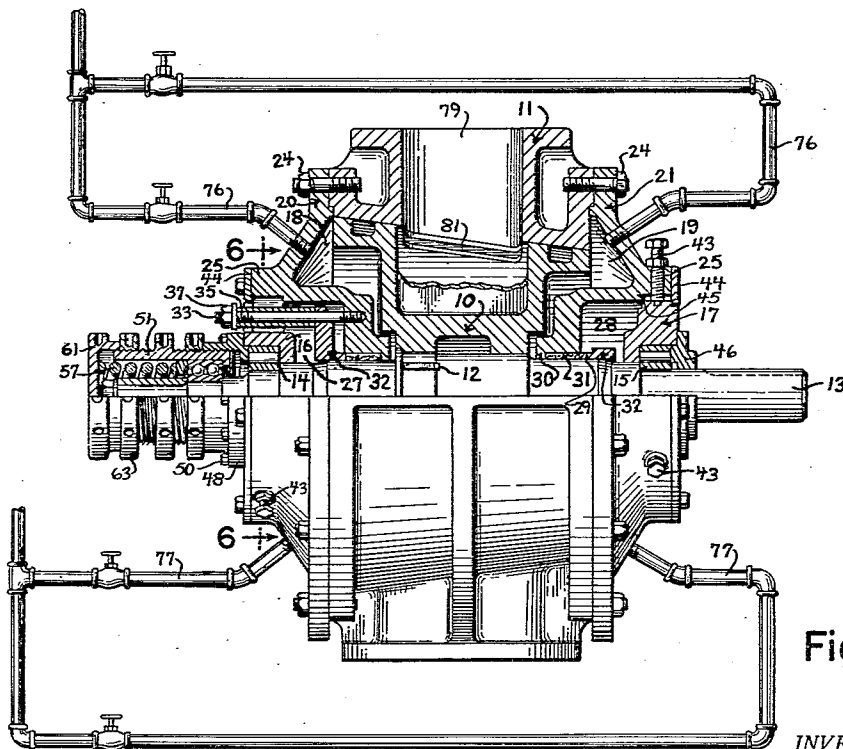


Fig. 2

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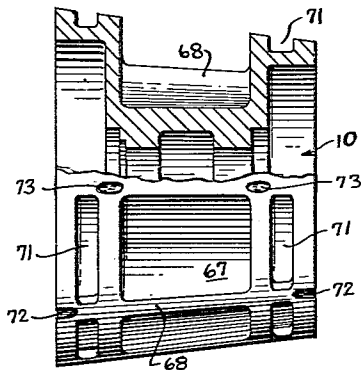


Fig. 3

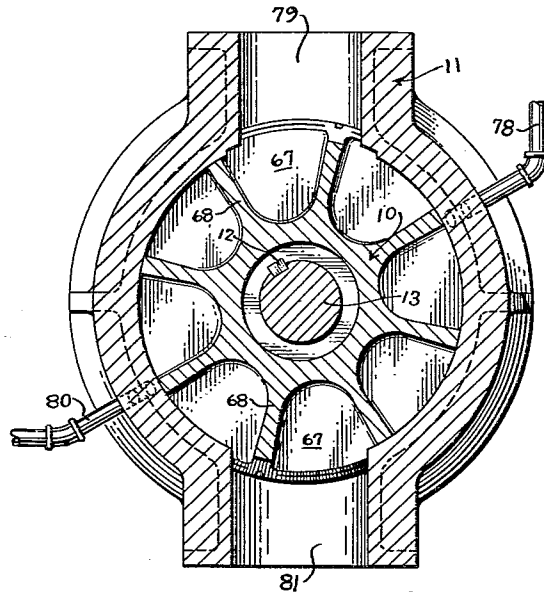


Fig. 4

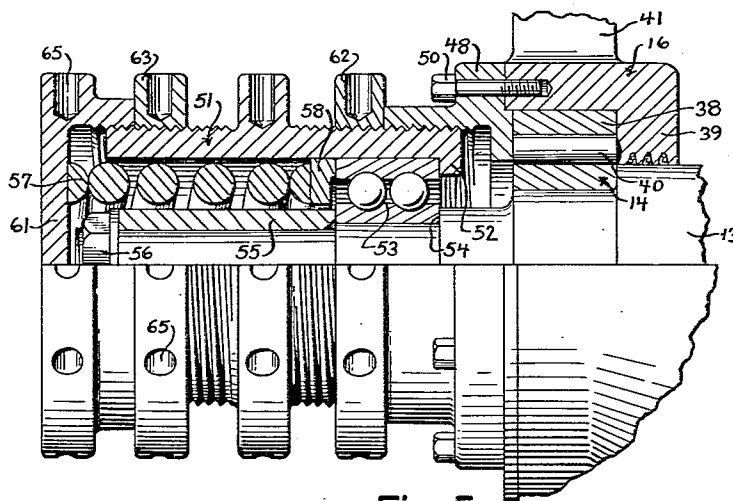


Fig. 5

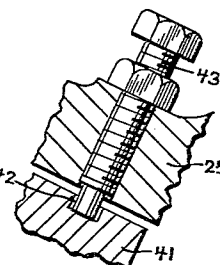


Fig. 8

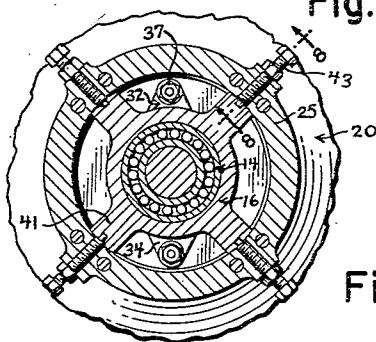


Fig. 6

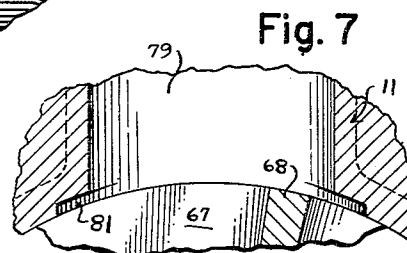


Fig. 7

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2,766,911

## MATERIAL HANDLING VALVE

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11 Claims. (Cl. 222-148)

The present invention relates to an improved material-handling valve and has as its principal object the providing of a valve which can be used to continuously feed material to or from a pressure cooker without causing an objectionable loss of pressure in the latter. The valve is particularly designed for handling wood chips in the continuous pressure cooking system disclosed in U. S. Patent No. 2,706,148, issued April 12, 1955. It is important to note, however, that the valve of the present invention can also be used to handle a variety of materials other than wood chips and hence, although the following detailed explanation makes particular reference to wood chips for purposes of example, no limitation in the use of the invention is intended thereby.

Another object of the invention is to provide a material-handling valve which will feed wood chips without causing a wedging and shearing of the chips between the relatively moving valve and valve body.

When the valve is used with a cooker as aforesaid, the present invention has the further important object of preventing the formation of a coating on the working surfaces of the valve.

Still another object is the providing of a rotary tapered valve which will not bind in its seat and a novel arrangement whereby such a valve can be yieldingly urged toward its seat with the amount of seating force and the degree of seating both being readily adjustable independently of another and while the valve is in operation.

With the foregoing and still more particular objects and advantages in view, the invention consists in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Fig. 1 is a top plan view of the valve assembly with parts broken away.

Fig. 2 is a side elevational view of the valve with the upper half thereof shown in section.

Fig. 3 is a side elevational view of the valve rotor partly in section.

Fig. 4 is a transverse sectional view taken along the line 4-4 of Fig. 1.

Fig. 5 is an enlarged fragmentary view taken from Fig. 2 and showing the arrangement for adjustably spring-loading the nondriven end of the shaft.

Fig. 6 is a transverse sectional view taken along the line 6-6 of Fig. 2.

Fig. 7 is an enlarged fragmentary view looking down the ends of the undercuts in the inlet opening as shown in Fig. 4 with the line of sight being tilted from the horizontal in a degree corresponding to the amount of the rotor taper; and

Fig. 8 is an enlarged fragmentary sectional view taken along the line 8-8 of Fig. 6.

Referring to the drawings it is seen that the valve of the present invention comprises a frustro-conical pocketed rotor 10 journaled in the tapered bore of a valve body 11. The rotor is keyed, as at 12, to a drive shaft 13 and this shaft is journaled in a pair of axially spaced

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bearings 14 and 15. These bearings are carried in identical bearing housings 16 and 17 which are in turn supported by a pair of headers 20 and 21 in a manner to be hereinafter detailed. The headers are detachably secured by bolts 24 to the valve body, the headers together with the valve body serving as a housing for the rotor. From their bolt connection to the valve body the headers taper oppositely toward the shaft thus providing annular end cavities 18 and 19 between the headers and the rotor. At their endwise extremities the headers present circumscribing flanges 25 which are concentric to the drive shaft. From these flanges the end bells double back toward one another and then radially toward the shaft to provide external annular concavities 27 and 28 between the headers and the shaft. At their extreme inner ends the headers present annular lips 30 directed toward the shaft and serving as the floor for packing wells defined between the headers and the shaft. The packing 31 in these wells is held in position by packing glands 32, each presenting an inturned lip 29 engaging the packing and a pair of radially extending anchoring arms 34 each slidably receiving an elongated stud 33 threaded at both ends. These studs are anchored in the headers as shown in Fig. 2 and extend beyond the bearing housings so that ready access can be had to the head end thereof. A sleeve 35 is received over each stud externally of the respective gland arm and is brought to bear on the arm for urging the inturned lip 29 against the packing by the act of turning a nut 37 screwed onto the free end of the stud.

The bearing housings 16 and 17 are each composed of a central body portion into which the outer bearing race 38 of the respective Hyatt bearing is fitted and an inturned annular stop 39 serving to limit inward movement of such race and the associated rollers 40. Centering arms 41 project radially from the bearing housings and terminate short of the flanges 25 of the headers. As best shown in Fig. 8 the outer end of each arm 41 is grooved as at 42 and received in the groove and bearing against the arm is the end of a dog-pointed set screw 43 the main body of which is screwed through the respective header. This arrangement permits the shaft to be offset from the center axis of the tapered bore of the valve body should load or wear conditions make this desirable. The bearing housings are retained in position in the concavities 27 and 28 by clamp rings 44 bolted to the ends of the flanges and engageable by the outer free ends of the arms 41. Inward movement of the housings is limited by circumscribing shoulders 45 presented by the headers.

The outer race and rollers of the bearing 15 are retained by a cap 46. The corresponding parts of the other bearing 14 are held in position against the stop 39 by a hollow bearing closure 48 secured by bolts 50 to the bearing housing 16. This closure 48 has an internally threaded bore which receives one end of an externally threaded thrust-adjusting sleeve 51. In turn, this sleeve presents an inturned bearing stop 52 for limiting inward axial movement of a roller bearing 53 whose inner race is retained in position about the shaft by a shaft step 54 at one end and a shaft sleeve 55 at the other end. The latter said sleeve is held in position by a nut 56 screwed onto the outer end of the shaft. Occupying the space between the sleeve 55 and the thrust-adjusting sleeve 51 is a compression spring 57 bearing at its inner end upon a thrust collar 58 and retained at its outer end by an end plate 61 threadably received on the outer end of the thrust-adjusting sleeve. The thrust collar 58 in turn bears against the outer race of the roller bearing 53 so that the effect of the compression spring 57 is to yieldingly hold the bearing against the stop 52. Lock-nuts 62 and 63 are provided to hold the thrust-adjusting

sleeve 51 and end plate 61, respectively, against turning movement. The thrust-adjusting sleeve is provided with a wrench-receiving flange 64 intermediate its ends and this flange, the lock-nuts, and the end plate each present circumferentially spaced holes 65 for receiving a spanner wrench so that they can easily be turned when adjustment is to be made.

At this point it will appear obvious that the thrust adjusting sleeve 51, by means of its stop 52, serves to positively limit inward movement of the shaft, and hence limits the degree of seating of the rotor. The adjustable end plate 61 permits ready adjustment of the force of the spring 57 which acts through the shaft to yieldingly seat the valve. It should be noted particularly that these adjustments of the sleeve 51 and end plate 61 can be readily made independently of one another and while the valve is in operation.

The tapered rotor 10 itself, as best shown in Fig. 3, is provided with a plurality of fully contained material-handling pockets 67 extending radially to the outer periphery of the rotor and separated by vanes 68. The particular shape of the mouth of these pockets is not critical but it is preferred to have the vanes of substantially uniform width in which case the pocket mouth is generally trapezoidal with the ends being the parallel sides. The end walls of each pocket are substantially parallel whereas the side walls converge and are joined by a curved bottom wall.

It is important that the taper of the rotor and the bore of the valve body be sufficient to negative any natural tendency for the rotor to bind in the bore. In this regard an eight degree taper relative to the axis of rotation gives excellent performance.

In order to minimize any tendency for matter from the cooker to find its way between the rotor and valve housing and build up a coating thereon, the rotor is provided with relatively shallow recesses or auxiliary pockets disposed endwise of the material-handling pockets 67 to collect such matter. The pattern of these auxiliary pockets is not particularly important as long as they, collectively with the material-handling pockets, span the entire length of the valve. To elaborate, in the embodiment illustrated in the drawings elongated auxiliary pockets 71 are provided between the ends of the pockets 67 and the ends of the rotor. These auxiliary pockets are supplemented by smaller pockets 72 each open to an end of the valve and extending in a slight degree inwardly beyond and between respective pairs of the elongated pockets. Another group of small auxiliary pockets 73 slightly lap the pockets 61 and 67. With this arrangement there is no uninterrupted band around the valve because the pockets collectively span the length thereof. Accordingly, any matter which should happen to pass between the valve and valve body, as by the action of steam from the cooker, will be wiped into one of the auxiliary pockets instead of contributing to the forming of a residual coating on the bearing surfaces of the rotor and valve housing. To elaborate, if material should adhere to the tapered seat of the valve body it will cause the valve to unseat slightly until such material reaches one of the auxiliary pockets whereupon the valve will reseat causing the material to protrude into the auxiliary pocket and the trailing edge of the latter to thereafter wipe the material from the seat into the pocket.

The function of the auxiliary pockets can be supplemented by charging the end cavities 18 and 19 between the headers and the rotor with a fluid, such as steam, under a regulated pressure exceeding that in the cooker to which the valve is connected. For this purpose supply and exhaust lines 76 and 77 (Fig. 2) can be brought into communication with the end cavities. Also of importance is the fact that a force differential can be established on the ends of the valve by individually controlling the pressure in these end cavities and this differential can be used in conjunction with or, in some instances, in place of the spring 57 to load the rotor.

As shown in Fig. 4 the pockets 67 can be vented consecutively by a pipe 78 as they approach the inlet port 79 so that a pressure condition in a pocket will not deter the filling thereof. Likewise, the pockets can be pressurized consecutively after being filled, as by a pipe 80 placed in advance of the discharge port 81 and connected to a pressure source. It will be noted that the length of the inlet port is less than the width of the material-handling pockets 67 and that the reverse is true in the case of the outlet port.

As in the feed and discharge valves disclosed in the aforesaid prior application, the leading edge of the inlet opening is undercut to prevent wedging and shearing of the material to be handled between the valve vanes and the valve body. This undercut, denoted by the numeral 81, extends at least the entire width of the inlet opening as shown by the dotted representation of the undercut in Fig. 1. The depth of the undercut is preferably uniform as illustrated in Fig. 7 and is made somewhat greater than the thickness of the chips or other material to be handled so that the same will not wedge between a vane 68 and the roof of the undercut.

The above described valve can be used successfully to continuously feed material to or from a vessel kept under a less than atmospheric pressure as well as to or from a pressure cooker. It is thought that the present invention and the manner of its usage will be apparent from the above description of the illustrated embodiment, and it is self-evident that changes from this embodiment may be resorted to without departing from the spirit of the invention. Accordingly it is our intention that no limitations be implied and that the hereto annexed claims be given a scope fully commensurate with the broadest interpretation to which the employed language admits.

What we claim is:

1. In a continuous feeder, a housing presenting a tapered seat, a tapered valve mounted in the seat for rotary and axial movement, means located at the smaller end of the valve for turning the valve, adjustable means for selectively limiting axial movement of the valve toward the seat and short of a full seating of the valve in the seat, and means for yieldingly urging the valve into the seat, the last two said means both being located at the larger end of the tapered valve.

2. In a continuous feeder, a housing presenting a tapered seat a tapered valve mounted in the seat, for rotary and axial movement, means located at the smaller end of the valve for turning the valve, means located at the larger end of the valve for limiting axial movement of the valve toward the seat and short of a full seating of the valve in the seat, a compression spring arranged to yieldingly urge the valve into the seat, and adjustable means for selectively varying the compression of the spring.

3. In a continuous feeder, a housing presenting a tapered seat, a tapered valve mounted in the seat for rotary and axial movement, means for turning the valve adjustable means for selectively limiting axial movement of the valve toward the seat and short of a full seating of the valve in the seat, pressure means arranged to yieldingly urge the valve into the seat, and adjustable means for selectively varying the force of the pressure means independently of the seating of the first said adjustable means.

4. In a continuous feeder, a housing presenting a tapered seat, a tapered valve mounted in the seat for rotary and axial movement and presenting a stub shaft at each end, one serving to drive the valve and the other having a compression spring around the free end thereof arranged to yieldingly seat the valve, a thrust adjusting sleeve surrounding the spring and threadably received in the housing, said sleeve presenting a stop arranged to limit axial movement of the valve toward the seat, and an adjustable end plate threadably received on the free end of the sleeve for selectively varying the compression of the spring.

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5. The structure of claim 4 in which the said thrust adjusting sleeve is adapted to receive a tool for turning the sleeve and threadably receives a pair of lock nuts for locking the adjustments of the sleeve in the housing and the end plate on the sleeve.

6. A continuous feeder comprising a housing presenting a tapered seat and circumferentially spaced ingress and egress openings in the tapered working face of the seat, a tapered valve mounted in the seat for rotary and axial movements and presenting a plurality of circumferentially spaced fully contained pockets exposed at one end to the tapered working face of the valve and arranged to successively communicate with the said ingress and egress openings, stub shafts at the ends of the valve and extending through and slidably journaled in the ends of the housing, packing glands between the stub shafts and the housing and inwardly of the journals, said valve and housing being shaped to provide circumscribing closed chambers between the ends thereof and inwardly of said packing glands, means for turning one of the stub shafts to turn the valve, and pressure means for yieldingly seating the valve.

7. The feeder of claim 6 in which the said pressure means comprises spring pressure exerting an end thrust on one of the stub shafts externally of the housing.

8. The feeder of claim 6 in which the said pressure means comprises a fluid under controlled pressure in the said end chamber at the larger end of the valve.

9. The feeder of claim 6 in which means are provided for supplying fluid under individually controlled pressures to the said end chambers.

10. A continuous feeder comprising a housing presenting a tapered seat and circumferentially spaced ingress and egress openings in the tapered working face of the seat, a tapered valve mounted in the seat for both rotary and endwise movements and having a plurality of circumferentially spaced pockets spaced from the ends of the valve and exposed to the tapered working face of the

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valve, said pockets being arranged to successively communicate with the said ingress and egress openings, said valve also having recesses located in the end portions of the valve lying endwise of said pockets, means for turning the valve, and means yieldingly urging said valve toward its said seat, whereby material adhering to said seat in areas thereof overlying said end portions of the valve will slightly unseat the valve until such material reaches a said recess in the valve whereupon the valve will reseat causing the material to protrude into the recess and the trailing edge of such recess to thereafter wipe the material from the seat into the recess.

11. In a material handling valve, two tapered mating surfaces normally seated together and mounted for both rotary and endwise relative movements with reference to a rotary axis, one of said surfaces having a recess therein, means for imparting said rotary relative movement to said surfaces, and means acting endwise of said axis and yieldingly urging said surfaces toward one another whereby material adhering to the surface not having said recess and in the path of the latter will slightly unseat the surfaces until such material reaches the recess whereupon said surfaces will reseat causing the material to protrude into the recess and the edge of the recess to thereafter wipe the material into the recess.

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