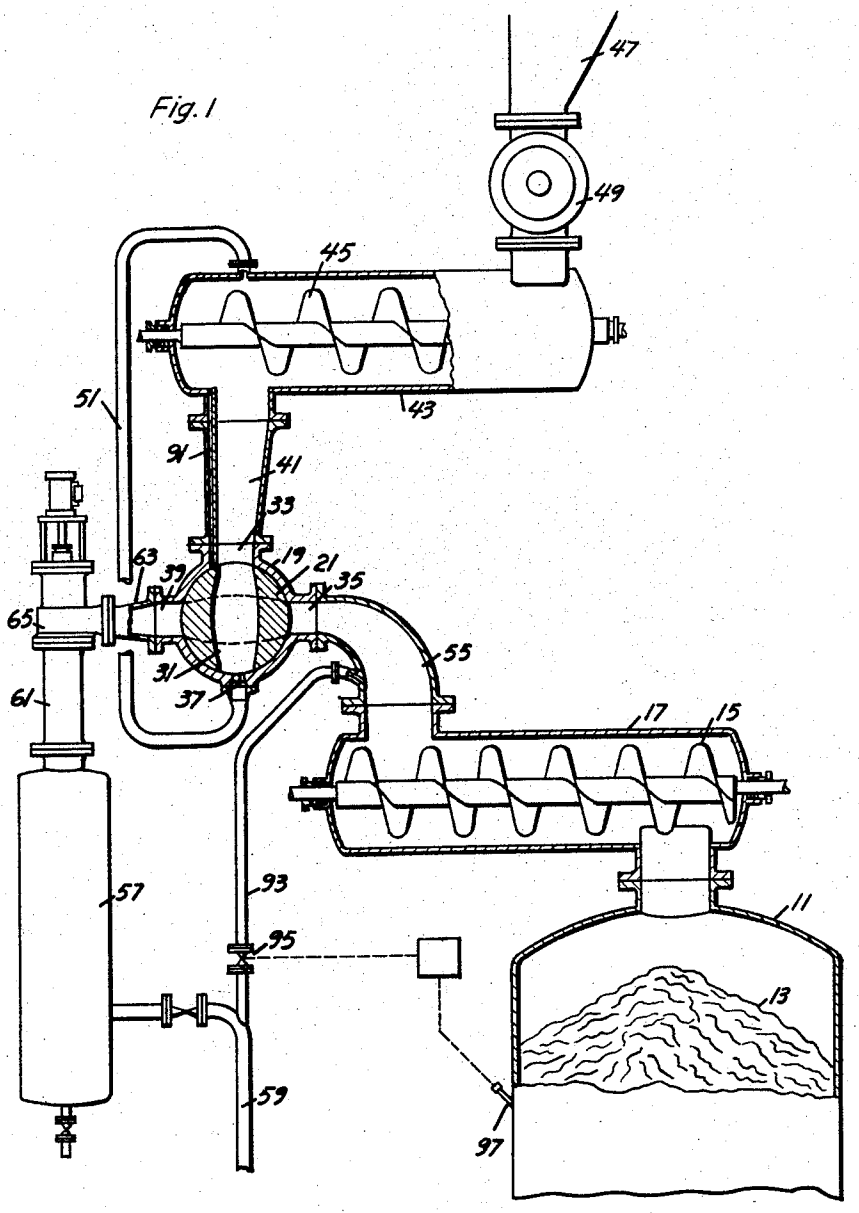
Nov. 24, 1959 O. J. RICHTER 2,914,223

MATERIAL FEEDING APPARATUS

Filed March 10, 1958 3 Sheets-Sheet 1

Fig. 1



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Fig. 2

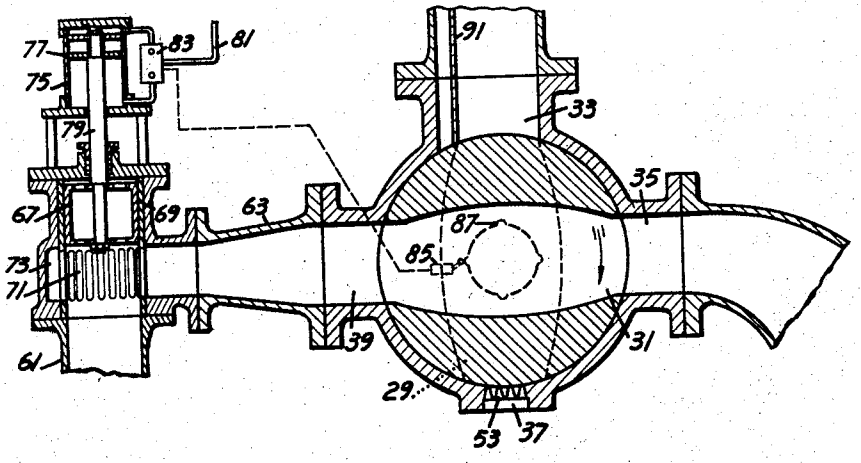
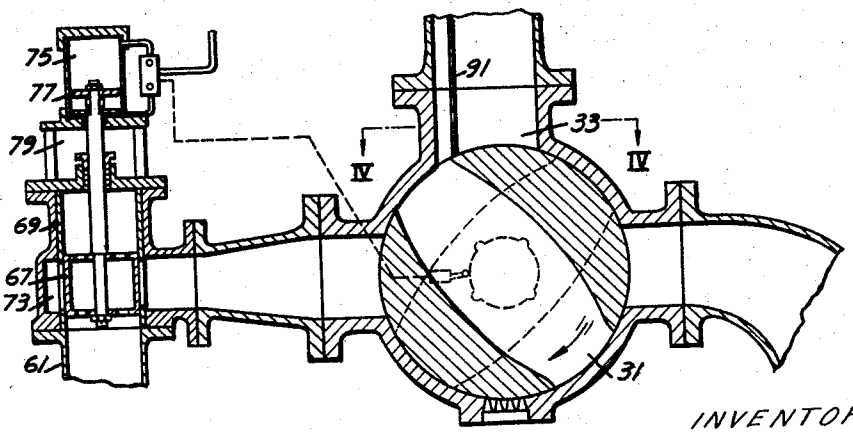


Fig. 3



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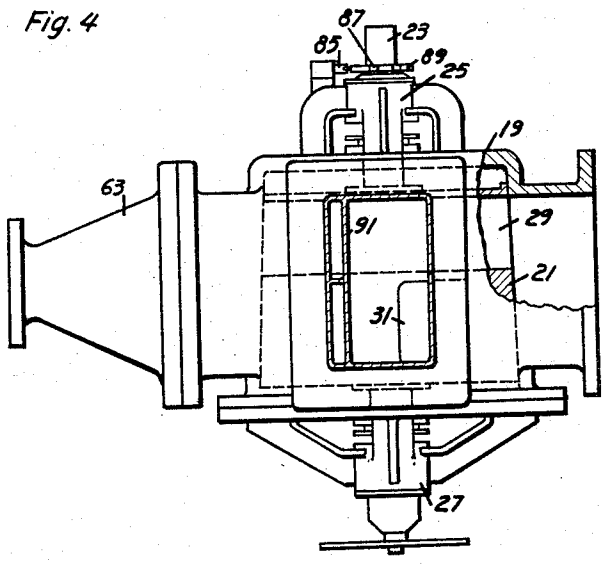
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Fig. 4



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MATERIAL FEEDING APPARATUS

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Claims priority, application Sweden March 11, 1957

3 Claims. (Cl. 222—194)

The present invention relates to material feeding apparatus. More particularly, it relates to a charging valve device for feeding comminuted cellulosic fiber material, such as wood chips, straw, etc., into a pressure vessel, particularly into a continuous cellulose digester.

Known charging valve devices of the above character usually include a housing having ports, and a valve body rotatable in the housing and having one or more passageways, bores or pockets extending transversely therethrough for sequential communication with an inlet port and an outlet port of the housing. Such known devices are usually further characterized in that the housing is provided with a third port adapted to be periodically put in communication with the outlet port through said valve body passageway for periodic flow through said passageway of steam or other suitable hot fluid discharging the material in the valve passageway through said outlet port.

The object of the invention is to improve the emptying of the passageways or pockets of such valve devices so that they can be emptied by means of a comparatively small quantity of high-pressure fluid, such as steam, preferably by means of a quantity less than the steam quantity required for the heating of the material to the digesting temperature. According to the invention, this object is attained by providing that the steam or other suitable hot fluid is brought to flow through the pocket or passageway of the valve device during a short time interval and with a speed as high as possible, i.e., as an explosion-like puff or blast, whereby the carrying force exerted by the steam flow upon the charge of material in the valve passageway is of extremely high magnitude. In this connection, it has been found to be essential to utilize a steam container of considerably larger volume than that of the valve body passageway in the immediate vicinity of and in communication with the aforesaid third port of the charging valve device. The volume of this container should be at least 10 times and preferably 20 to 50 times as large as the volume of a passageway in the charging valve device. Thus, the steam quantity required for emptying the passageways is made conveniently and readily available on the spot, this being a prerequisite for obtaining the desired forceful puff or blast.

It has further been found that if the steam or other hot fluid container is connected to the aforesaid third port of the housing by means of a conduit having a cross sectional area several times as large as that of the inlet feed line through which the hot fluid is supplied to the container, a low flow resistance in the conduit to the charging valve device is created. Such low resistance promotes a quick discharge from the container through said conduit. This latter feature has the advantage that a continuous and even flow will thus be maintained in said conduit and the pressure variations therein, particularly in its far end, will be small, this being significantly important especially when the hot fluid is steam tapped from a steam turbine.

In a preferred embodiment of the invention, there is inserted in the conduit between the steam container and the charging valve device a quick-acting valve, the maximum admission cross sectional area of which is at least equal to one-half of the cross sectional area of the conduit from the container. Preferably, said quick-acting valve is operated by pressure fluid and is controlled in accordance with rotation of the valve body of the charging valve. This quick-acting valve allows a practically unrestricted flow during the whole admission time period, said period being kept very short and correctly timed relatively to the position of the passageway or passageways in the charging valve body so that the dynamic action of a certain or predetermined quantity of the hot fluid or steam will be at a maximum.

Other objects and advantages of the invention will be evident from the following description and accompanying drawings, in which:

Figure 1 is a fragmentary, diagrammatic and partially sectioned elevational view of a continuous cooking plant equipped with a feeding apparatus embodying the invention;

Figures 2 and 3 are corresponding fragmentary and enlarged vertical sectional views of the charging valve device of Figure 1 and showing different operative positions thereof; and

Figure 4 is a sectional view taken along line IV—IV of Figure 3, and with certain parts being omitted for the sake of clarity and convenience of illustration.

Referring now to the drawings, Figure 1 shows a cooking plant provided with an illustrative embodiment of the material feeding apparatus of the invention. Numeral **11** designates an upright cylindrical digester, the upper end of which should be charged continuously with a heated mixture of a comminuted cellulosic fiber material, for example, wood chips, straw, etc., and a suitable digesting liquor, for example, sodium lye. From the bottom of the digester (not shown) the material is discharged continuously at such a rate that a level **13** is maintained somewhat below the upper end of the digester, the rest of the digester being filled with steam. Connected to the upper end of the digester is a heating vessel **17** having a feeding screw **15** therein, as shown, and in which vessel the material, while being stirred, is heated by steam to the temperature required for the digesting cook, before the material is delivered into the digester. A raised pressure which can be of the order of 8 atmospheres gauge may be present in the digester **11** and the vessel **17**. Additionally, the temperature in the digester may be around 150° to 200° C.

The fiber material preferably is charged against the pressure in the vessel **17** by means of a charging valve device constructed in accordance with the invention. Said valve device, as shown, includes a housing **19** and a cylindrical or somewhat frusto-conical rotor or valve body **21** turnable or rotatable therein (see Figures 1 and 4). A horizontal shaft **23** projects from the rotor **21** and is journalled in bearings **25, 27** suitably mounted on either side of the housing **19** as by spider frames, as shown in Figure 4.

In the illustrated form, the valve body **21** is formed with two axially-spaced passageways or pockets **29, 31** therein. These passageways preferably are disposed at right angles to each other and extend diametrically through the valve body. Each passageway forms a straight passage which is somewhat widened at the middle (see Figures 2 and 3) and preferably is of a generally rectangular cross section. The housing **19**, as illustrated, has four ports **33, 35, 37** and **39** which, in the axial direction of the valve body **21**, extend across the two passageways **29, 31** (see Figure 4). The ports preferably are arranged in pairs, opposite each other,

and adjacent ports are displaced approximately 90 degrees in the peripheral or circumferential direction relatively to each other. Port 33 is an inlet port and is placed in communication with the bottom of a low-pressure steaming vessel 43 via a vertical passage 41. A feeding screw 45 may be provided in vessel 43, as indicated.

The mixture of comminuted fibrous material and the digesting liquor is charged into the hopper 47 from which it is introduced into vessel 43 by any suitable means, such as the rotary charging device 49. The material is heated in vessel 43, preferably by steam, after which it flows through the passage 41 and into the inlet 33. When the valve body passage 31 takes the position shown in Figure 1, the material collected in the inlet 33 drops down and fills this passageway. Connected to the port 37 is a conduit 51 leading to the upper part of the vessel 43 and serving the purpose of equalizing the pressure on the valve body 21. A screen 53 (see Figure 2) covers port 37 and prevents the solid material in passageway 31 from entering the conduit 51.

The port 35 forms the outlet port of the charging valve device and is connected by the elbow conduit section 55 to the heating vessel 17, as shown. When the valve body 21 is turned from its Figure 1 position and in the direction of the arrow in Figures 2 and 3, the filled passageway 31 will be sequentially shut off from the inlet 33 and then put into communication with the outlet port 35 under high pressure. When this passageway reaches the position shown in Figure 2, it will be emptied in a manner to be described in more detail by steam supplied through the port 39.

The invention contemplates that a container 57 be arranged in the immediate vicinity of the charging valve device. This container is constructed and arranged to be filled with high-pressure steam supplied through a conduit 59 (Figure 1). The far end of said conduit preferably is connected either to a boiler or some other steam generator or to a steam turbine (none of which is shown), from which steam of a suitable pressure is tapped off for flow to container 57. In the container 57 a pressure is maintained which is somewhat higher than the pressure of the digester 11, for example, such pressure in container 57 may be around 10 to 12 atmospheres gauge. Preferably, the conduit 59 is made relatively narrow, so that a considerable pressure drop will be produced therein. The container 57 is connected to the port 39 of the charging valve device by means of a comparatively short and wide conduit means 61, 63. Inserted in this conduit means is a valve 65, the maximum admission cross-sectional area of which is approximately of the same size as the cross-sectional area of the conduit part 61, or in any case at least greater than half of the cross-sectional area of conduit 61. In this regard, the conduit 63 widens in the direction toward the port 39, and when the passageway 31 is in the position shown in Figure 2 and the valve 65 is fully opened, a fluid flow path having an extremely low resistance to flow will thereby be provided between the steam container 57 and the vessel 17 through conduit means 61, 63, valve 65, passageway 31 and conduit 55.

The illustrative embodiment of valve 65, as best seen in Figures 2 and 3, preferably is provided with a valve body in the shape of a hollow cylindrical slide 67 reciprocably arranged in a cylindrical lining 69 inserted in the valve housing and having admission or flow slits 71 therein. The slide, as shown, has upper and lower openings therein and is displaceable between an upper, opened position (Figure 2), in which the slits 71 are wholly uncovered, and a lower, closed position (Figure 3), in which the slits are covered by the slide. The lining 69 forms a flush extension of the conduit 61, said conduit opening out into one end of the lining. Between the valve housing wall and the slitted part of the lining there is an annular space 73 communicating with the conduit part 63, as indicated.

The slide 67 preferably is operated by a pneumatic cylinder 75 (Figure 2) and a piston 77 movable therein. A piston rod 79 connects the piston 77 to the slide. Pressure fluid is supplied to cylinder 75 through a conduit 81 and is directed by an appropriate reversing valve 83 alternately to one end of the cylinder 75 and then the other. Actuation of valve 83 preferably is controlled by a suitable impulse means 85 which, in turn, is actuated by cam lobes 87 on a cam disc 89 attached to the shaft 23 projecting from valve body 21 (see Figures 2 and 4).

Immediately before the valve body 21 arrives at the position shown in Figure 2, the impulse means 85 is actuated by a cam lobe 87, as indicated, thereby reversing the valve 83 and admitting pressure fluid to the lower end of the cylinder 75. The piston 77 is then rapidly moved by such pressure fluid to the upper end position thereof shown in Figure 2, carrying with it the valve slide 67, so that the slits 71 are wholly uncovered. After a turning movement of the valve body of merely a few degrees, the cam lobe 87 in question will have passed out of contact with the impulse means 85, and this means then will return to its normal rest position causing reversal of the valve 83 and a consequent flow of pressure fluid into the upper end of cylinder 75. This results in rapid movement of the piston 77 downwardly to the position shown in Figure 3, thereby effecting closure of valve slide 67. At a normal angular velocity of the valve body 21 of about 3 to 10 revolutions per minute, the valve 65 will be held open during an interval of 0.25 to 0.5 second. During this short interval, a powerful and fast moving volume of steam is admitted from the container 57 through conduit 61, valve 65, conduit 63, pocket 31 and passage 55. This steam flow meets with no appreciable resistance until it reaches passageway 31, where the steam penetrates the spaces between the particles of the charge in the passageway, exerting a force of great magnitude thereon, so that the charge is rapidly and completely driven out of the passageway and through the conduit 55 for discharge into the vessel 17.

After the charged valve passageway 31 has been thusly emptied of its charge of fibrous material, further rotation of the valve body 21 causes passageway 31, now filled with high-pressure steam, to be initially shut off at both ends and then to be brought to the position thereof shown in Figure 3, in which the passageway is opened towards the inlet port 33. The steam captured in the passageway now expands to the lower pressure of the steaming vessel 43, the steam being conveyed to this steaming vessel by means of a partition arrangement 91 inserted in the port 33 and passage 41, and extending upwardly into the steaming vessel. By virtue of this arrangement, the steam will flow from passageway 31 to the vessel 43 without dispersing the fibrous material collected in the inlet 33 on the opposite side of partition 91. Finally, the passageway 31 will be returned to the charging position thereof shown in Figure 1, whereafter the aforedescribed cycle will be repeated. It will be appreciated that passageway 29 will be charged and emptied in the same manner as that described for passageway 31, but with a time lag corresponding to a rotary movement of the valve body 21 of 90°. Thus, the sequential charging and discharging operations for the passageway 29 will be 90° out of phase with respect to those for passageway 31. The short steam blasts or puffs coming from the steam container 57 pass alternately or sequentially through the passageway 29 and passageway 31 and, as is evident, during each revolution of the valve body 21 four separate charges will be transferred from the low to the high pressure side through passageways 29, 31.

In order to completely empty the valve passageways 29, 31, each steam puff or blast passing therethrough must be of a volume of at least about twice as large as

the volume of each passageway, preferably 5 to 10 times larger than the volume of the passageway. It is advantageous to maintain an over-pressure in the container **57** as compared to the digester pressure, and therefore, the volume of the container is made a few times, for example, 2 to 5 times, larger than the volume of each blast of steam.

Branching off from the steam supply tube **59** is a tube **93** leading into the side of the passage **55**, as shown in Figure 1. Inserted in tube **93** is a valve **95** controlled by a suitable temperature-sensitive means **97** arranged in the digester wall and operatively connected to the valve **95**. Of the steam required for heating the fibrous material in the vessel **17**, a large and almost constant part passes through the body **21** of the charging valve device. However, the desired temperature of the digester **11** can be maintained by controlling that part of the steam passing through the tube **93**. Thus, even when the steam consumption is as low as 0.5 kgs. per ton of dry pulp produced, only a part of the total quantity of steam need be used for emptying the passageways **29**, **31** of the charging valve device.

It will thus be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of the invention and are subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the appended claims.

I claim:

1. Apparatus for feeding fibrous materials or the like into a pressure vessel, said apparatus comprising: a valve housing having spaced material inlet and outlet ports; a valve body rotatably mounted in said housing being provided with at least one passageway extending transversely therethrough; means for rotating said valve body for sequentially disposing said passageway in communication with said spaced inlet and outlet ports; said housing also having a third port arranged for communication with said outlet port through said passageway of said valve body; a container for hot fluid under pressure; said container being arranged in the immediate vicinity of said third port and having a volume considerably greater than the volume of said passageway of said valve body; conduit means connecting said container to said third port; a quick-acting valve arranged in said conduit means between said container and said third port, the maximum admission cross-sectional area of said latter valve being at least equal to one-half the cross-sectional area of said conduit means between said container and said latter valve; fluid pressure actuated means operatively connected to said quick-acting valve and said rotatable valve body, said fluid pressure means being operable in response to rotation of said valve body to periodically actuate said quick-acting valve.

2. Apparatus as defined in claim 1 wherein said fluid pressure actuated means operates to periodically open said quick-acting valve for approximately 0.25 to 0.50 second.

3. Apparatus for feeding fibrous materials or the like into a pressure vessel, said apparatus comprising: a valve housing having spaced material inlet and outlet ports; a valve body rotatably mounted in said housing being provided with at least one passageway extending transversely therethrough; means for rotating said valve body for sequentially disposing said passageway in communication with said spaced inlet and outlet ports; said housing also having a third port arranged for communication with said outlet port through said passageway of said valve body; a container for hot fluid under pressure; said container being arranged in the immediate vicinity of said third port and having a volume considerably greater than the volume of said passageway of said valve body; conduit means connecting said container to said third port; a quick-acting valve arranged in said conduit means between said container and said third port, the maximum admission cross-sectional area of said latter valve being at least equal to one-half the cross-sectional area of said conduit means between said container and said latter valve; means for effecting a periodic discharge of a blast or puff of fluid from said container through said quick-acting valve and said conduit means, said blast of fluid having a volume approximately 5 to 10 times as large as the volume of said passageway in said valve body.

References Cited in the file of this patent

UNITED STATES PATENTS

2,151,511	Hagen	Mar. 21, 1939
2,299,565	Colburn	Oct. 20, 1942
2,356,737	Bland	Aug. 29, 1944
2,644,724	Kronstad	July 7, 1953