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APPARATUS FOR FEEDING SOLIDS INTO PRESSURE VESSELS

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FIG. 1

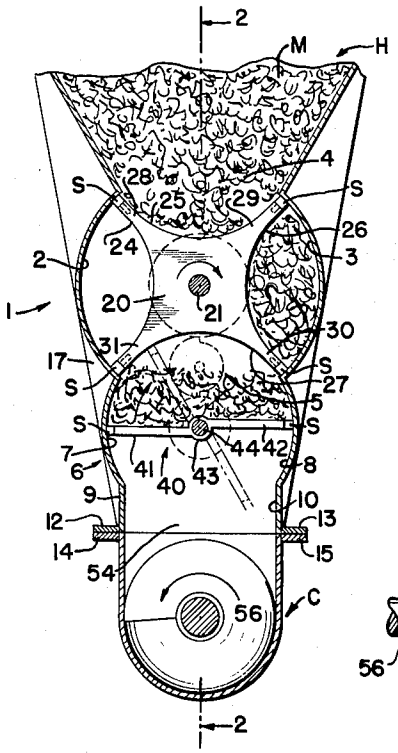


FIG. 2

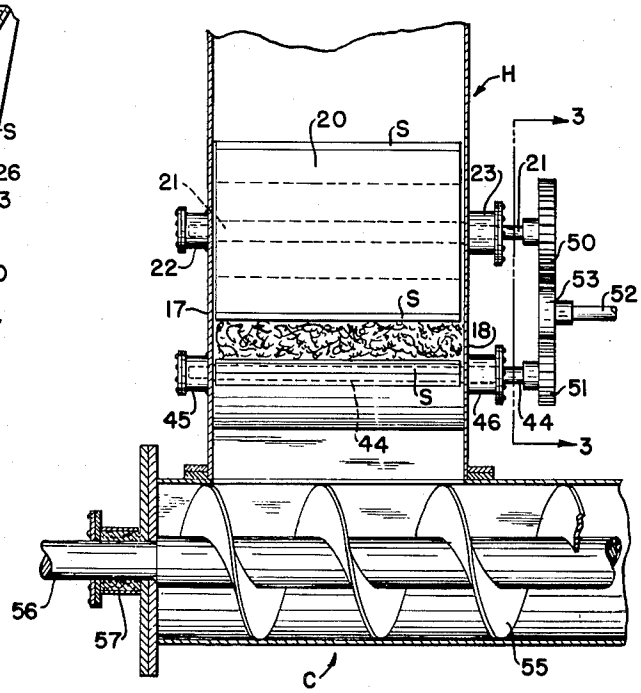
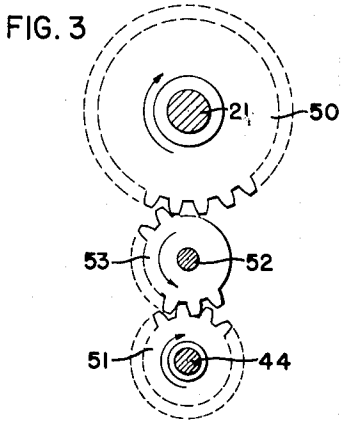


FIG. 3



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APPARATUS FOR FEEDING SOLIDS INTO PRESSURE VESSELS

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4 Claims. (Cl. 214—17)

This invention relates to apparatus for feeding granular, bulky or free-flowing materials into a pressure vessel, and has for its object the provision of an improved apparatus for this purpose. The improved apparatus of the invention comprises tandem feed valves for transferring the material at one pressure, for example at atmospheric pressure, through feed chambers from a source of material, for example a hopper, into a vessel under a higher pressure. The apparatus of the invention is advantageously applicable to the feeding of bulky material into and out of processing apparatus, such as wood chips into a wood-pulp digester containing high-pressure aqueous digestion liquors, without appreciable loss of the medium under pressure and provides an important means for use in apparatus for the continuous treatment of the material.

In its preferred embodiment the apparatus of the invention comprises two coacting valves, one being a bilateral valve and the other a quadrant-sector valve, each valve being rotatable intermittently in its own transfer chamber, the bilateral valve being rotatable at twice the speed of the quadrant-sector valve. I prefer to mount the two valves on parallel shafts and to drive them both through gears connected to a common gear having half-teeth whereby the bilateral valve makes one-half turn for each one-half turn of the drive gear while the quadrant-sector valve is still, and the quadrant-sector valve makes one-quarter turn while the bilateral valve is still. The quadrant-sector valve rotates in a transfer chamber having diametrically opposite concave cylindrically curved walls, an opening above into the hopper and an opening below which is contiguous with an opening into the transfer chamber of the bilateral valve. The chamber of the bilateral valve also has diametrically opposite concave cylindrically curved walls and an opening below connecting with a pressure vessel or a conveyor leading to a pressure vessel.

The longitudinal edges of the valves are provided with sealing members to effect a tight contact with the surfaces of the cylindrical walls and to wipe off the material being fed. The quadrant-sector valve has four blades with the sealing members on the edges and convex cylindrically curved sector surfaces between the blades. The bilateral valve has two blades with the sealing members on the edges, and the radii of the sector surfaces and the bilateral valve blades are substantially equal. The shafts of the two valves are so spaced and the sectors of the quadrant-sector valve are so spaced and proportioned that, when the quadrant-sector valve is still, the sealing members of the bilateral valve sweep the curved quadrant-sector surfaces and remove any adhering material that may adhere thereto.

The apparatus of my invention can be operated advantageously to transfer material, such as wood chips, from a hopper located above the upper chamber by gravity into a conveyor under a steam pressure of, say, 160 pounds per square inch which leads directly into a processing vessel, for example a digester. Aside from

a possible slight leakage of steam, there is a measured transfer of steam moving in the opposite direction of the chips in a reverse transfer, but this is not a disadvantage because the steam preheats the chips.

It will be apparent that my feeding apparatus can be used to remove treated material from a pressure vessel and deliver it to a low-pressure receiver, in which case the quadrant-sector valve is connected beneath the pressure vessel or the conveyor leading from it.

These and other features of the invention will be more fully understood by reference to the accompanying drawings, in which

Fig. 1 is a vertical sectional view of apparatus embodying my invention;

Fig. 2 is a sectional view at 2—2 of Fig. 1; and

Fig. 3 is a sectional view at 3—3 of Fig. 2.

The apparatus of my invention illustrated in the drawings is mounted over a conveyor C for receiving the material and under a hopper H for supplying the material, and comprises an upper transfer chamber 1 having diametrically opposite concave cylindrically curved walls 2 and 3, an opening 4 contiguous with the hopper H and an opening 5 contiguous with an opening in the lower transfer chamber 6. The transfer chamber 6 also has two diametrically opposite concave cylindrically curved walls 7 and 8 connected to depending upright walls 9 and 10 having flanges 12 and 13 connected to the flanges 14 and 15 of the conveyor C. The ends of the transfer chambers are closed by upright end walls 17 and 18.

The aforementioned members are preferably formed of steel plate or other suitable material and all the connecting joints are pressure-tight, preferably welded, except the flange connections 12, 14 and 13, 15 which are sealed with a gasket and bolted together.

The quadrant-sector valve 20 is mounted on the shaft 21 concentrically within the walls 2 and 3, which shaft is mounted in the sealed bearings 22 and 23 attached to the end walls 17 and 18 respectively. This valve has four cylindrically concave sector surfaces 24, 25, 26, and 27 which form with the walls 2 and 3 pockets for receiving the material M, for example wood chips. The sector members form four blades 28, 29, 30, and 31, each edge of which is provided with an elastic or resilient seal S, formed, for example, of rubber, neoprene, or a suitable plastic which makes a close bearing engagement with the inner surfaces of the walls 2 and 3 to effect a pressure seal and also to wipe off the surfaces during rotation. It will be noted that openings 4 and 5 are substantially the same width as the span between adjacent blades.

The bilateral valve 40 comprises two blades 41 and 42 attached to a hub 43 mounted on the shaft 44 concentrically within the walls 7 and 8, which shaft is mounted in sealed bearings 45 and 46 attached to the end walls 17 and 18 respectively. The blades have edge seals S similar to those just described and the blades are displaced with respect to the center of the shaft as shown in Fig. 1 in order to provide some lag with respect to valve 20. It will be noted that the blades 41 and 42 form a receiving pocket defined by walls 7 and 8 and one of the sector elements 24 to 27 of valve 20.

Shaft 21 is keyed to gear 50 and shaft 44 is keyed to gear 51 which has the same kind of teeth but is one half the diameter of gear 50. The drive shaft 52 connected to any suitable source of power (not shown) is keyed to gear 53, which, as best shown in Fig. 3, has teeth on only half its circumference.

The conveyor C has an opening above which is coincident with the opening 54 defined by walls 9, 10, 17, and 18. The conveyor has a feed worm 55 on shaft 56 which is mounted at one end in the sealed bearing 57.

The conveyor and worm enter any suitable pressure vessel for processing the material M such as a continuous pulp digester. The outlet of the digester may be provided with a tandem seal device of my invention to effect removal of the treated material to a low-pressure receiver.

When the apparatus of my invention is operated in combination with a hopper and conveyor as illustrated, the material M in the hopper falls into one of the sector pockets as shown in Fig. 1. When the teeth of gear **53** are in engagement with the teeth of gear **50**, valve **20** is given one-quarter turn after which the teeth become disengaged. The filled pocket is moved to the position shown on the right (Fig. 1). The teeth of gear **53** then engage the teeth of gear **51**, and while valve **20** is thus still, valve **40** is given one-half turn. Assuming valve **40** to have been in the position shown in full lines, Fig. 1, and its pocket filled with material, as it turns over with its seal S bearing against the sector surface **27**, the material is dropped through the hole **54** and into the conveyor. As the operation is repeated the valves are intermittently opened and closed but whenever one valve is in an open position the other is in a closed position. During this transfer there has been no time during which an opening has existed for the escape of steam from the conveyor to the hopper. Some steam is transferred from the conveyor to the hopper in the reverse procedure of the feeding of the solid material M, but this is not considered to be an appreciable loss because it preheats the material.

I claim:

1. Apparatus for transferring material from one pressure zone to a different pressure zone and without appreciable loss of pressure medium from the high-pressure zone to the low-pressure zone which comprises an upper transfer chamber connected to a lower transfer chamber and a common transfer opening therebetween, each of said chambers having two diametrically opposite concave cylindrically curved walls, an opening into the upper chamber for introducing material to be transferred and an opening in the lower chamber for discharging the material, a quadrant-sector valve rotatably mounted on a horizontal shaft in the upper chamber, said sector valve having four sectors with concave cylindrically curved surfaces and four blades each having a sealing edge means for making sealing contact with the inner surfaces of the curved walls of the upper chamber during rotation, a bilateral valve rotatably mounted on a horizontal shaft parallel to the aforementioned shaft and having two blades each having sealing edge means for making sealing contact with the inner surfaces of the curved walls of the lower chamber during rotation, means for turning the quadrant-sector valve one-quarter turn intermittently while the bilateral valve is still and turning the bilateral valve one-half turn intermittently while the quadrant-sector valve is still, thereby transferring the material from the opening into the upper chamber through the chambers and discharging it from the opening in the lower chamber.

2. Apparatus according to claim 1 in which the cylindrically curved walls of the upper chamber and the openings of said upper chamber are substantially equal in width to the arcuate width between the sealing means of the quadrant-sector valve.

3. Apparatus according to claim 1 which comprises a quadrant-sector valve in which the sector surfaces have radii equal to the radius of the bilateral valve and the two valves are so spaced apart that when the quadrant-sector valve is still the bilateral valve rotates with its sealing means in bearing contact with the sector surfaces, the inner surfaces of the curved walls of the lower chamber and the sector surfaces being contiguous cylindrical surfaces during rotation.

4. Apparatus according to claim 1 which comprises a gear mounted on the shaft of the bilateral valve, a gear twice the diameter of the first-mentioned gear mounted on the shaft of the quadrant-sector valve, a drive shaft, and a one-half-tooth gear mounted on the power shaft and so positioned and proportioned that on each revolution it turns the bilateral valve one-half turn while the quadrant-sector valve is still and turns the quadrant-sector valve one-quarter turn while the bilateral valve is still.

References Cited in the file of this patent

UNITED STATES PATENTS

1,143,634	Lane et al.	June 22, 1915
1,402,184	Sinclair	Jan. 3, 1922
1,515,993	Beyer	Nov. 18, 1924