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L. HORNOSTEL

3,080,074

PRESSURE CHAMBER FEEDER

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2 Sheets-Sheet 1

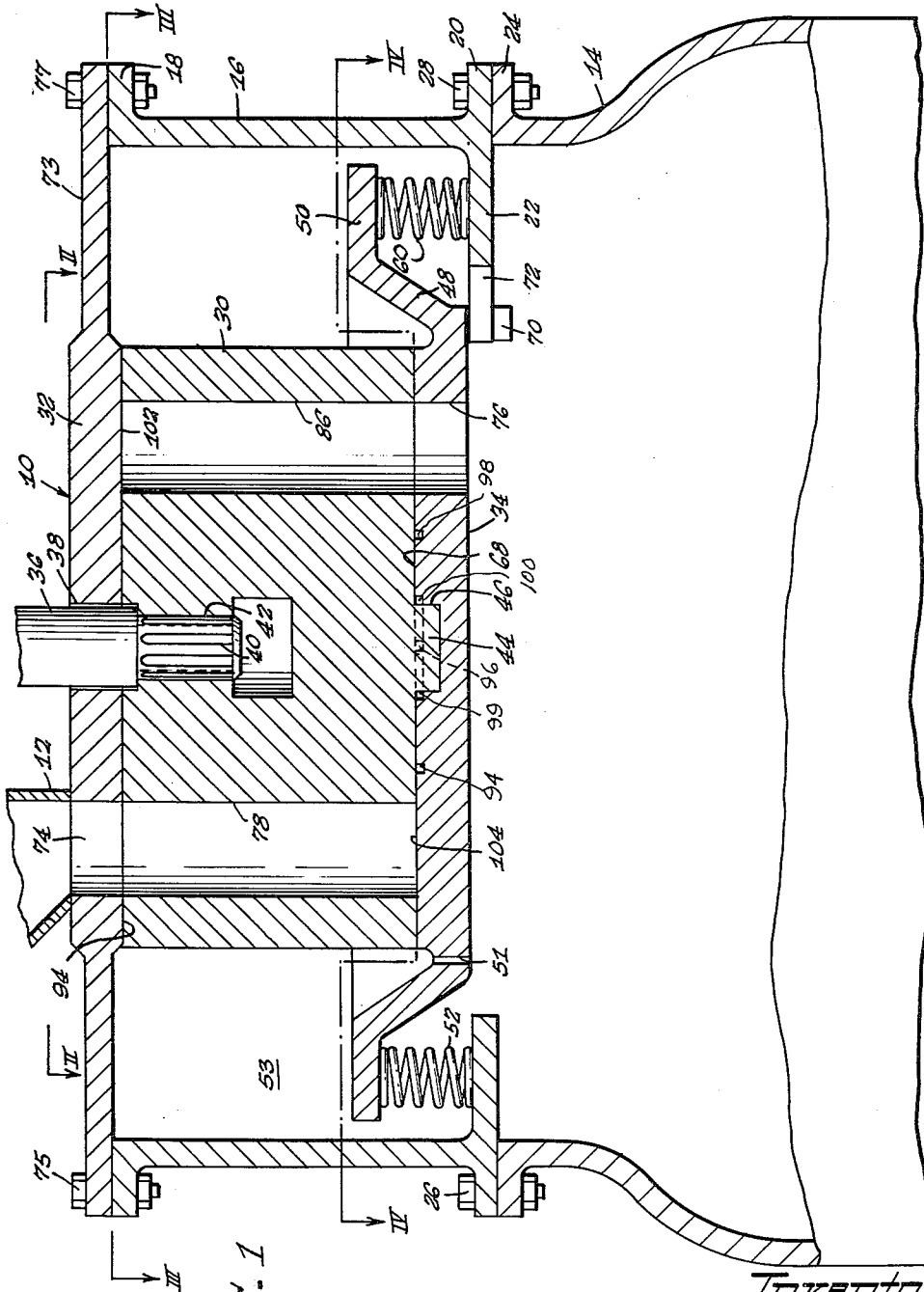


FIG. 1

Inventor
Lloyd Hornbostel

By *Will Sherman Merwin* *Lawson* *Attys*

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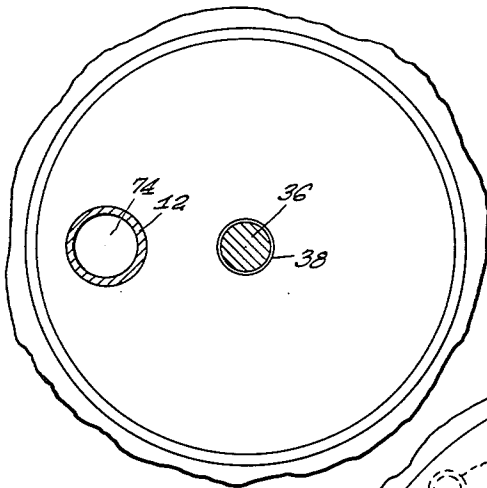


FIG. 2

FIG. 3

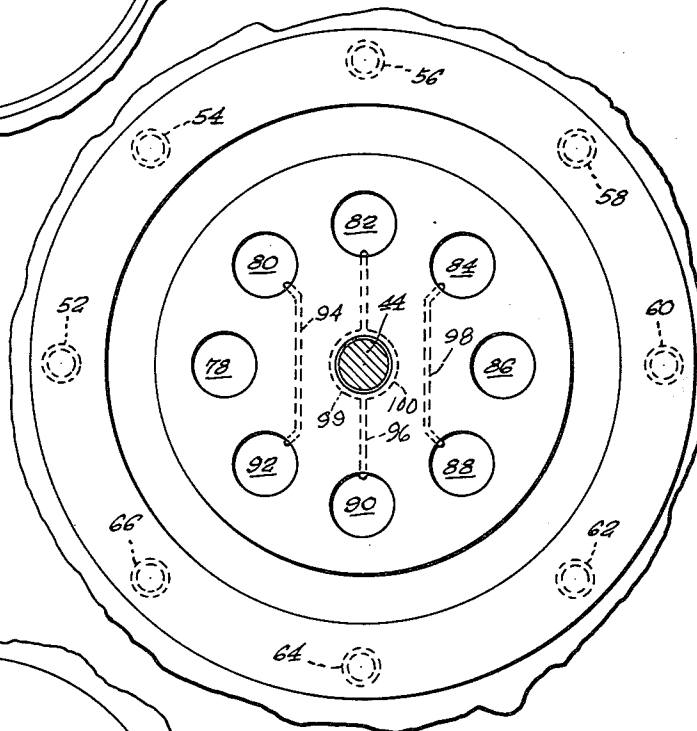
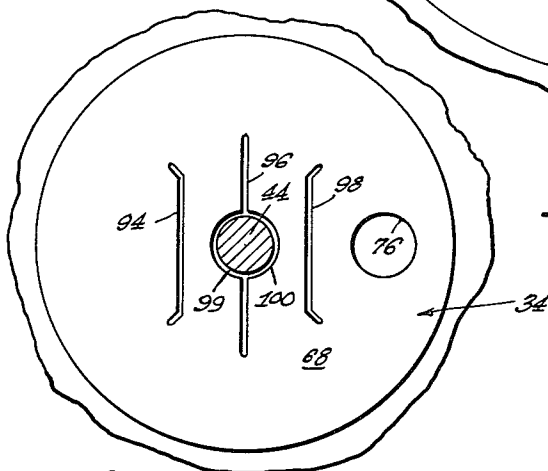


FIG. 4



Inventor
Lloyd Hornbostel

By *Lill, Sherman, Merani, Guss & Simpson Attys*

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PRESSURE CHAMBER FEEDER

Lloyd Hornbostel, Beloit, Wis., assignor to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin
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This invention relates to a pressure chamber feeder, and more particularly to a device for feeding wood chips or the like to a digester for subjecting the chips to steam pressure conditions, having means for saving steam load in the digester chamber.

Heretofore, a variety of methods of feeding wood chips to the digester for a paper mill or the like have been attempted, including plunger means for forcing chips into the digester, rotary valve means, wheel structures using pressure transfer manifolds, and the like. These expedients have generally entailed the loss of a substantial proportion of the steam load in the digester or cooking chamber, or have resulted in undesirable changes in the chips during the feeding process or excessive wear on the feeder mechanism.

The present invention resolves these difficulties by providing a pressure chamber feeder of an unusually simple construction, and which affords a gradual decay of steam pressure from an outlet therefor to an inlet for receiving the chips from a supply bin. The pressure chamber feeder includes a unitary rotor of preferably cylindrical configuration, which is journaled between upper and lower closure plates by drive shaft and stub shaft means and is resiliently supported by the lower closure plate by means of a plurality of angularly spaced spring elements to afford an effective seal between the plates and the rotor. The upper closure plate is provided with an inlet port for receiving wood chips and the like from a supply bin, and the lower plate is provided with an outlet port for introducing the chips to the digester chamber, the inlet and outlet ports being in diametrical alignment and in predetermined equally spaced relation to the axis of the structure. In order to transport chips fed into the inlet port to the outlet port with minimal loss of steam loads from the digester, and with gradual pressurization of the chips as they pass through the outlet port, the rotor defines a plurality of axially extending, angularly spaced cylindrical bores or chambers which are similarly equally radially spaced from the axis of the structure so as to pass successively in register with the inlet port and the outlet port by rotation of the rotor. However, steam introduced into cylindrical chambers registering with the outlet port is bled off successively to the chip filled cylindrical chambers which have not yet reached the outlet port by means of pressure equalizing passages formed preferably in the bottom closure plate. The pressure equalizing passages are constructed so that the maximum steam pressure in a cylindrical chamber which has just left the outlet port will be communicated to the cylindrical chamber immediately on the other side of the outlet port, while the chambers from which pressure has been thus depleted are placed in communication with opposite, chip filled chambers further from the outlet port, so that an automatic build-up of pressure is afforded as an individual chamber carrying wood chips approaches the outlet port and an automatic successive depletion is afforded as chambers which have deposited wood chips to the outlet port pass therefrom toward the inlet port.

Accordingly, it is an object of the present invention to provide a feeder for feeding wood chips or the like to a digester such as is used in paper mills, wherein the steam load in the digester is preserved by improved means affording gradual decay of steam pressure between the

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chip dispensing and the chip receiving phases of the feeder cycle.

Another object of the invention is to provide a pressure feeder chamber wherein steam is gradually bled off in the feeder between the outlet and the inlet, but is preserved for use in pressurizing wood chips as they are transported from the inlet of the feeder to the outlet therefor.

Another object of the invention is to provide a device as described wherein pressure at the inlet of the feeder is minimized so that there is no interference with the introduction of chips from a supply bin into the feeder.

Another object of the invention is to provide a rotary pressure chamber feeder affording steam communication between individual feeder chambers which are equally angularly spaced from an outlet port therefor.

Another object of the invention is to provide a pressure feeder chamber having a rotor for transporting chips, which is sealed between upper and lower support plates so that steam losses are minimized without the need for complicated sealing mechanism.

Another object of the invention is to provide a device as described wherein resilient means support the lower plate in a manner which maintains a desired pressure engagement with the rotor such as to provide a self-compensating substantially constant seal between the rotor and the plates.

Yet another object of the invention is to provide a device as described having pressure equalizing passages formed in one of the plates for communicating steam from individual chip transporting chambers in the rotor which have been depleted of chips to individual chip transporting chambers in the rotor which are filled with chips so that manifolds and external conduits are eliminated and wherein the equalizing passages are formed by the sealing and support means for the rotor.

Other objects and advantages of the invention will become apparent as the description proceeds in accordance with the drawings in which:

In the drawings:

FIGURE 1 is an enlarged vertical sectional view of a pressure chamber feeder according to the invention mounted on a digester for receiving wood chips and the like therefrom;

FIGURE 2 is a top plan view taken along the line II—II of FIGURE 1;

FIGURE 3 is a view taken along the line III—III of FIGURE 1; and

FIGURE 4 is a view taken along the line IV—IV of FIGURE 1.

Referring now to the drawings, a pressure chamber feeder 10 is shown according to the present invention for use in feeding wood chips or the like from a supply bin diagrammatically indicated at 12, to a cooker or digester 14 for treating the chips under conditions of steam pressure to prepare them for use in a paper mill or the like.

The pressure chamber feeder 10 may be mounted on the digester 14 by means of a cylindrical wall 16 having upper and lower outwardly extending flanges 18 and 20 and a radially inwardly extending support flange or shelf 22 as hereinafter described. The lower flange 20 may be bolted to a complementary annular flange 24 at the mouth of the digester 14 by suitable bolt means 26 and 28.

The digester 10 of the invention includes a unitary rotor 30 of preferably cylindrical configuration, which is journaled between upper and lower closure plates 32 and 34 by means of a drive shaft 36 extending through an opening 38 in the wall 32 and splined at 40 for mating engagement with a coaxial bore 42 in the rotor 30. The rotor may also be journaled in the lower plate 34 by suitable means such as the cylindrical boss 44, which may be formed integrally, or otherwise, on the rotor 30

and is received in a bearing recess 46 in the plate 34. The lower plate 34 may have a dished construction and is provided with a peripheral annular support flange including an upwardly and outwardly extending flange portion 48 and a radially outwardly extending flange portion 50. A port or opening 51 may be provided in the annular trough thus formed so that any condensate in the chamber 53 surrounding the rotor may be drained off.

In order to resiliently support the rotor 30 in sealing engagement with the plates 32 and 34 such as to permit easy, controlled angular rotation of the rotor by the drive shaft 36 in response to the energization thereof by a motor (not shown), resilient means are provided which include a plurality of preferably helical springs indicated by reference numerals 52 through 66 in FIGURES 1 and 3. The springs 52 through 66 bear at their lower ends upon the shelf 22 and at their upper ends against the bearing flange 50, the bearing flange 50 being elevated above the upper surface 68 of the plate 34 a suitable distance such as to accommodate the springs. In order to prevent angular rotation of the plate 34 relative to the cylindrical wall 16 and the digester 14, the plate 34 may be provided with a depending lug 70 engageable with an inwardly extending detent 72 formed integrally with the flange 22. The upper plate 32 is provided with a peripheral, coplanar flange portion 73 and is secured to the flange 18 at the upper end of the wall 16 by bolt means 75 and 77.

In accordance with the invention, the upper plate 32 defines an inlet port 74 for receiving wood chips or the like from the supply bin 12, in accordance with the understanding of those skilled in the art; and the lower plate 34 defines a preferably diametrically aligned outlet port 76, the ports 74 and 76 being equally radially spaced from the axis of the rotor. Preferably, the ports 74 and 76 are of cylindrical configuration and extend axially of the rotor 30, the outlet port 76 opening into the digester 14 as shown.

Wood chips entering the inlet port 74 are transported to the outlet port 76 to be deposited in the digester 14 by a plurality of preferably cylindrically formed axially extending transport chambers, designated by reference numerals 78 through 92 in FIGURES 1 and 3 and which are equally radially spaced from the axis of the rotor 30 correspondingly with the inlet port 74 and the outlet port 76 and are equally angularly spaced for successive registration with the inlet port and the outlet port as herein-after further described. Thus, as shown in FIGURE 1, the chambers 78 through 92 are each configured to form a continuous cylinder with the respective ports 74 and 76 when in register therewith for easy ingress and egress of the wood chips into and from the pressure feeder 10.

In order to conserve the steam load in the digester 14, and also to permit the wood chips to enter the successive transport chambers 78 through 92 without interference from steam pressure at the inlet port 74, pressure equalizing means are provided to afford a gradual decay of steam pressure within the rotor as chambers which have been depleted of chips are carried rotationally from the outlet port 76 toward the inlet port 78, in the example shown. The pressure equalizing means further provide a gradual increment or build-up of steam pressure in the transport chambers as they are carried from the inlet port 74 to the outlet port 76. These means include pressure equalizing passages herein designated by reference numerals 94, 96 and 98 respectively, which are configured and dimensioned to afford intercommunication between pairs of chambers which are equally angularly spaced from both the inlet port and the outlet port. Desirably, the upper and lower ends of the passages 94 through 98 have a length such as to terminate at the inner boundaries of the chambers 78 through 92 and perpendicularly to a tangent to the boundaries for affording bleeding of steam pressure from chambers leaving the outlet port to chambers approaching it substantially only during the period when

a pair of chambers are aligned with the inlet and outlet ports. However, it will be understood that variations may be afforded in this particular relationship, as well as in the number of chambers provided in the rotor, within the scope of the invention.

Thus, the passage 94 is constructed to interconnect transport chambers immediately on either side of a transport chamber which is in registration with the inlet port 74, while the passage 98 is constructed to interconnect transport chambers which are immediately on either side of the outlet chamber 76; and the central passage 96 is adapted to interconnect a pair of chambers which are intermediate the respective pairs of chambers connected by the passages 94 and 98. The respective passages 94 through 98 may be suitably machined in the surface 68 of the bottom plate 34, although it will be appreciated that such passages may also be formed in the lower surface 94 of the upper plate 32. The passage 96 is preferably bifurcated to transmit steam around the stub shaft or boss 44, as shown in FIGURE 4, the individual branches therein being designated by reference numerals 99 and 100. The upper and lower plate surfaces 94 and 68 have a planar configuration such as to mate in sealing relationship with corresponding surfaces 102 and 104 of the rotor 30, and the resilient pressure engagement between these surfaces is thus maintained at all times by the spring means 52 through 66 as described.

In operation, wood chips will be fed into the inlet port 74 and thence into successive transport chambers 78 through 92 at a desired rate corresponding to the rate of rotation of the rotor 30, and will be carried for 180° to the outlet port 76 and deposited in the digester 14. The emptied chambers will thereupon return to the inlet port for reloading.

However, pressure in the chambers will be successively reduced as the chambers 78 through 92 proceed from the outlet port to the inlet port, and will be correspondingly increased as the filled chambers proceed from the inlet port to the outlet port. For example, if the chamber 88 shown in FIGURE 3 be considered as having just dispensed a load of chips to the digester 14, it will have had an internal steam pressure equal to the pressure in the digester 14 from the time of its registration with port 76 until reaching the position shown, whereupon a predetermined portion of its steam pressure is released to the chamber 84 on the other side of the chamber 86.

Desirably, the passages 94 through 98 are formed cooperatively with the rotor to permit substantially half the steam pressure in the chambers leaving the outlet port to be released to the chambers approaching the outlet port during interconnection by the several passages, so that the chamber 88 will approach the position indicated by numeral 90 with its pressure decreased by half in comparison with its initial pressure immediately after leaving the outlet port. Upon reaching the position of numeral 90, the chamber 88 will again release half its pressure to the chamber 80, which would then be in the position occupied by chamber 82 in FIGURE 3. Further rotation of the chamber 88 to the position indicated by numeral 92 would again serve to reduce its pressure in half by communication with the chamber 92.

Correspondingly, the chambers approaching the outlet from the inlet will receive successive increments of pressure, and thus will be gradually pressurized so that there is no degrading of the fiber of the chips such as occurs in feeders where sudden introduction to high pressure is produced.

Likewise, the pressure in the rotor will gradually decay from the outlet port 76 toward the inlet port 74 and will thus be minimized for each individual chamber as it is in register with the inlet port, thereby saving the load in the digester and also maintaining the inlet port in a condition where chips may be easily fed to the underlying transport chambers.

There has thus been provided a pressure chamber feeder

which is extremely simple in construction and easily maintained, and which requires no complicated feeding mechanisms or complex steam conduits such as have characterized previous devices of this type. The operation of the feeder is extremely efficient, and permits chips to be fed to the digester at a desired rate without interference from the steam while preserving the steam in the digester from escape through the feeder. Furthermore, the sealing means afforded by the resilient mounting for the rotor automatically compensates for any wear between the surfaces of the support plates and the rotor; and since the rotor is open to steam temperatures there is no loss of steam pressure by condensation within the rotor itself.

Although I have herein set forth and described my invention with respect to certain specific principles and details thereof, it will be understood by those skilled in the art that these may be varied without departing from the spirit and scope of the invention as set forth in the hereunto appended claims.

I claim as my invention:

1. In combination with a digester for wood chips and the like, a digester feeder comprising a rotor, a pair of closure plates, said rotor being journaled in said closure plates, means on said digester supporting said closure plates in sealing relation with said rotor including a plurality of equi-angularly spaced springs underlying the bottom one of said closure plates in bearing relation to the rotor, said supporting means supporting the springs in radially spaced relation to the rotor to provide a balanced sealing contact of the said one of the closure plates with the rotor, inlet means in the other of said closure plates, outlet means in said one of said closure plates and a plurality of chambers in said rotor for receiving wood chips and the like through said inlet means and depositing them into said digester through said outlet means.

2. In combination with a digester for wood chips and the like, a digester feeder comprising a rotor, a pair of closure plates, said rotor being journaled in said closure plates, means on said digester supporting said closure plates in sealing relation with said rotor including a wall on said digester and resilient means underlying the bottom one of said closure plates in bearing relation, said wall having an inwardly extending support portion for said resilient means supporting said resilient means in radially spaced relation to the rotor to provide an equalization of sealing force for the said one of the closure plates in respect to the rotor, the other of said plates being secured to said wall to form with said wall a chamber around said rotor, inlet means in the other of said closure plates, outlet means in said one of said closure plates and a plu-

ality of chambers in said rotor for receiving wood chips and the like through said inlet means and depositing them into said digester through said outlet means.

3. A pressure chamber feeder for charging a pressurized container with solids comprising a rotor having at least eight angularly spaced chambers extending axially therethrough with the rotor forming the boundaries of the chambers, closure means for said rotor including an upper horizontal closure plate and a lower horizontal closure plate, means journaling said rotor horizontally between said plates for rotation in said closure means, said closure means including a housing portion surrounding the rotor in sealing relation to the upper closure plate, and a plurality of springs on the housing portion, said lower closure plate having a radially outwardly extending portion engaged by the springs and urged upwardly thereby to maintain the lower closure plate in constant balanced sealing relationship with the rotor, and said upper closure plate having an inlet for introducing solids to successive chambers in said rotor, said lower closure plate having an outlet for removing solids from successive chambers in said rotor and disposed in predetermined angularly spaced relationship to said inlet, at least one of said closure plates forming at least one conduit on the inner bearing surfaces thereof and intercommunicating opposed pairs of chambers on opposite sides of the inlet and outlet, said conduits producing a gradual buildup of pressure in the respective chambers between the inlet and outlet in the direction of the outlet, and a gradual decay of pressure in the respective chambers between the outlet and the inlet in the direction of the inlet, to prevent sudden high pressurization of solids such as might degrade the solids and to maintain a relatively uniform pressure at the inlet so that solids may be readily introduced to the chambers.

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