

June 10, 1969

A. J. ROERIG

3,449,014

REVOLVING CHIP FEEDER

Filed March 11, 1966

Sheet 1 of 4

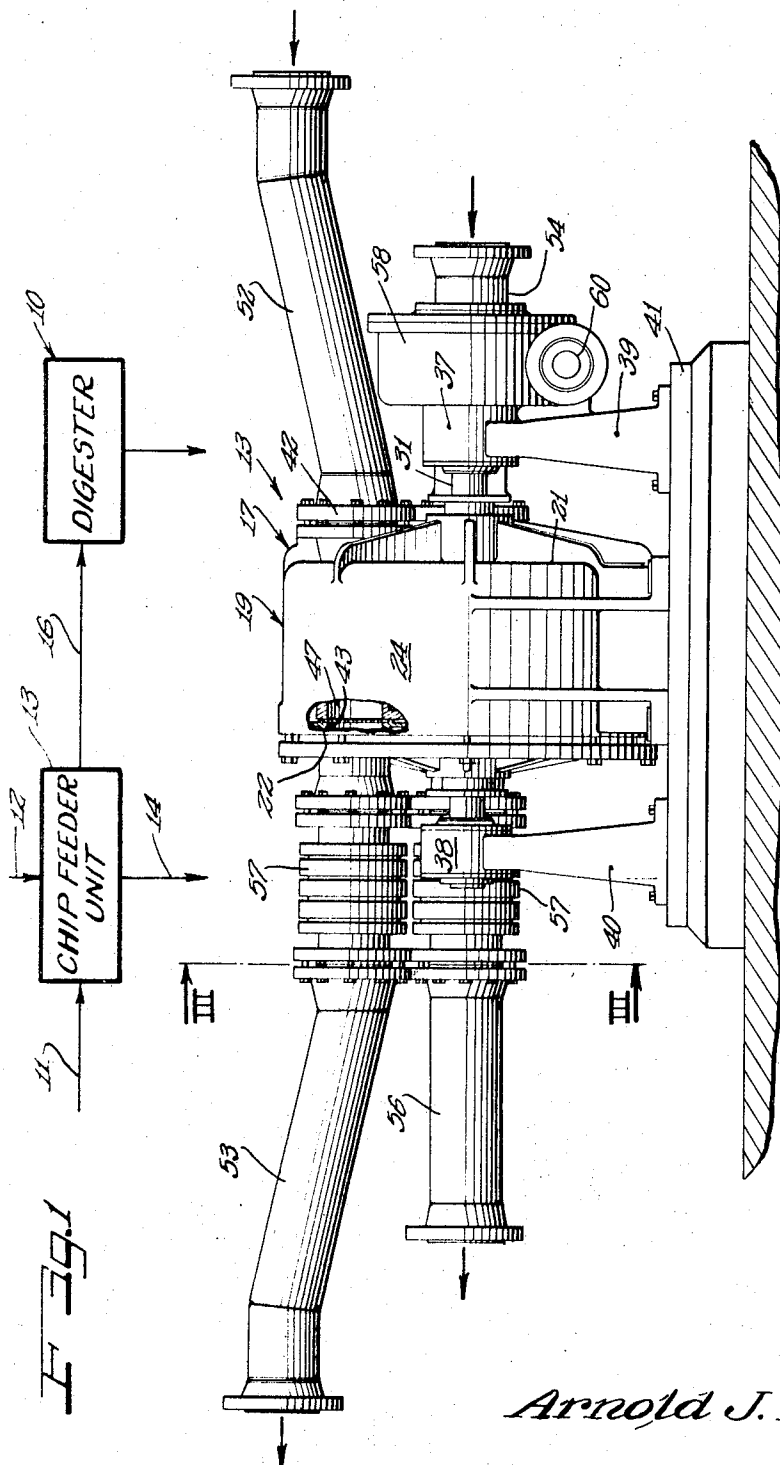


Fig. 2

INVENTOR.

Arnold J. Roerig

By *Kell, Sherman, Merani, Gass & Simpson*

ATTORNEYS

June 10, 1969

A. J. ROERIG

3,449,014

REVOLVING CHIP FEEDER

Filed March 11, 1966

Sheet 2 of 4

Fig. 3

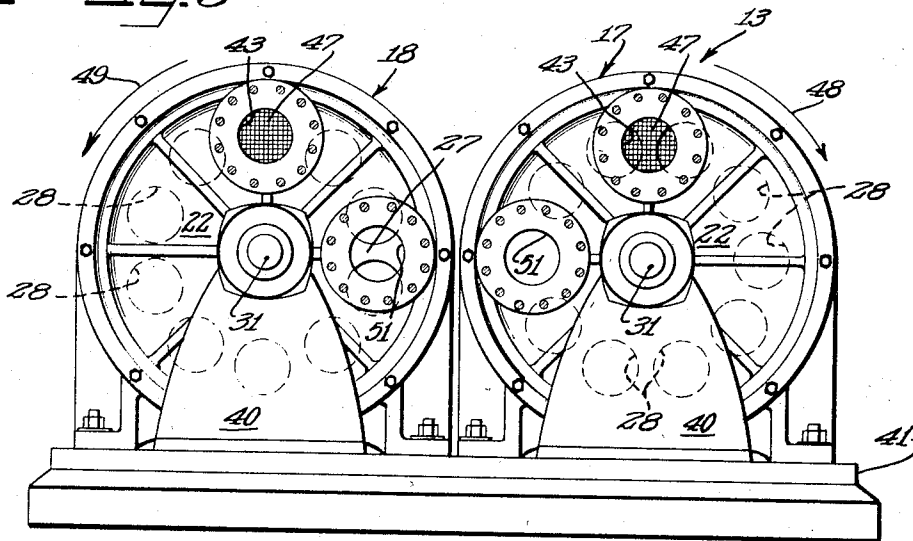
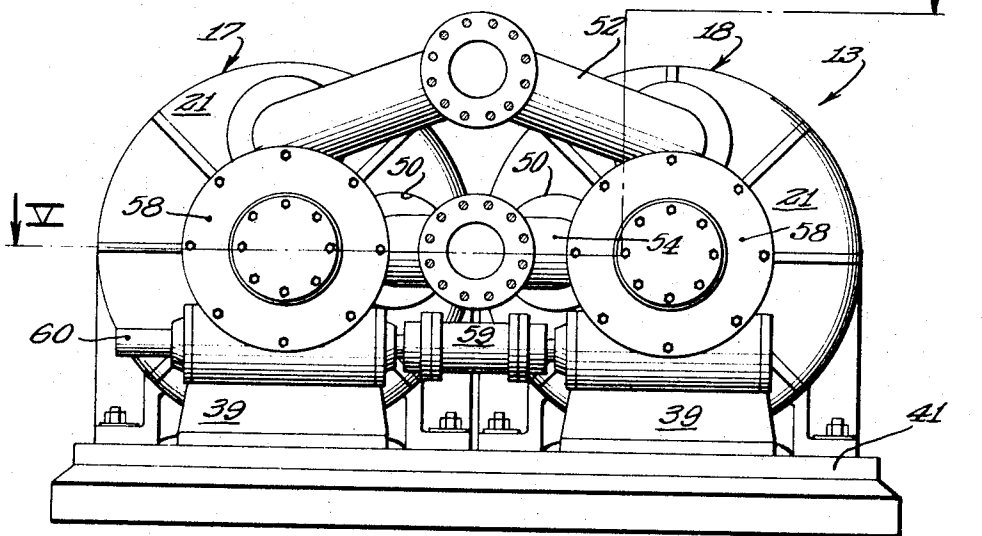


Fig. 4



INVENTOR.

Arnold J. Roerig

Hill, Sherman, Meroni, Guss & Anglin ATTORNEYS

June 10, 1969

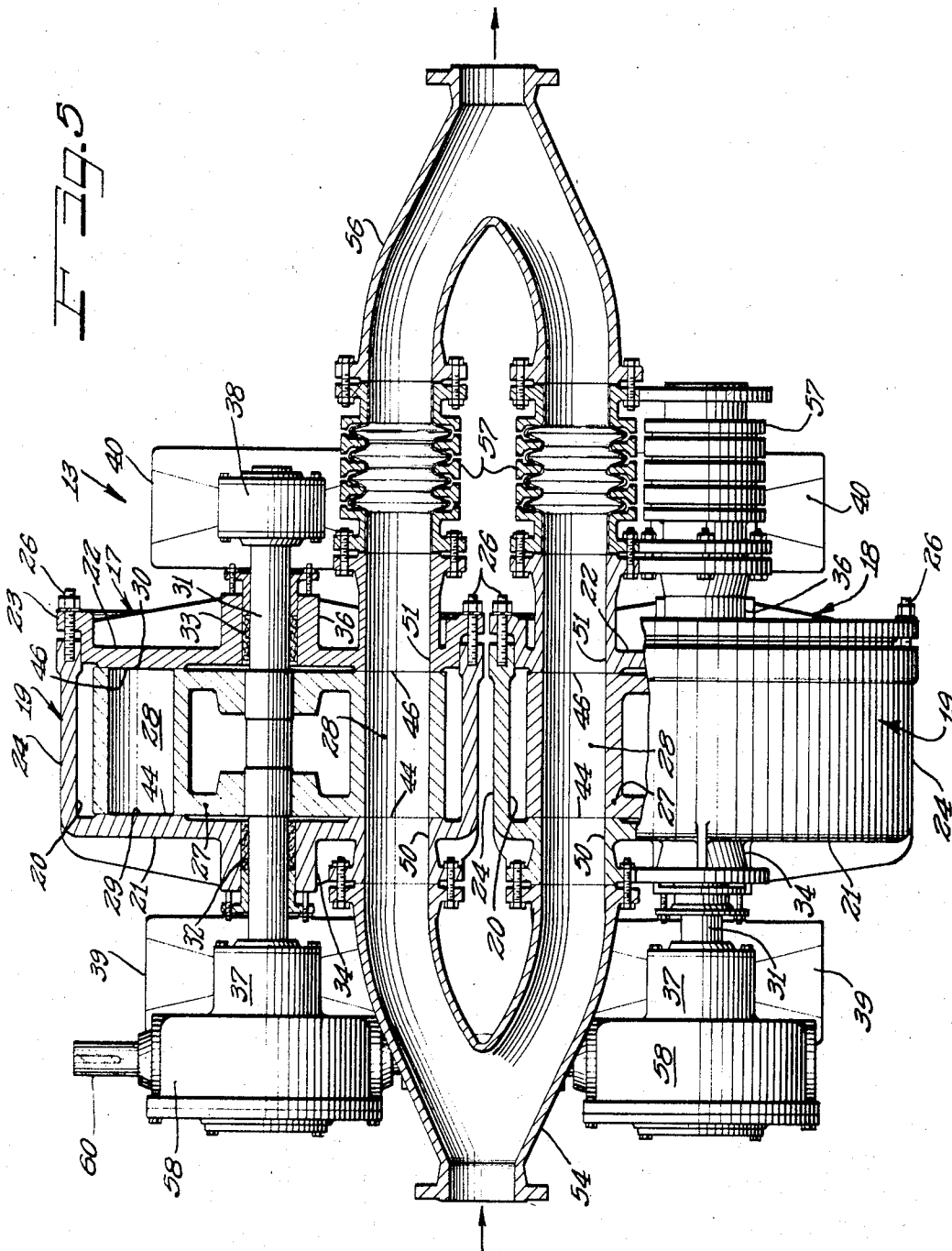
A. J. ROERIG

3,449,014

REVOLVING CHIP FEEDER

Filed March 11, 1966

Sheet 3 of 4



F 79.5

INVENTOR.
Arnold J. Roerig

BY *Hill, Sherman, Meloni, Gaus & Simpson* ATTORNEYS

June 10, 1969

A. J. ROERIG

3,449,014

REVOLVING CHIP FEEDER

Filed March 11, 1966

Sheet 4 of 4

Fig. 6

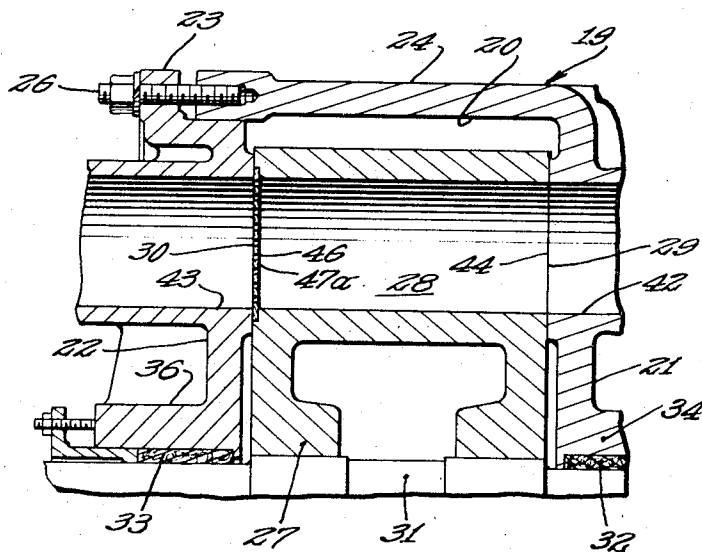
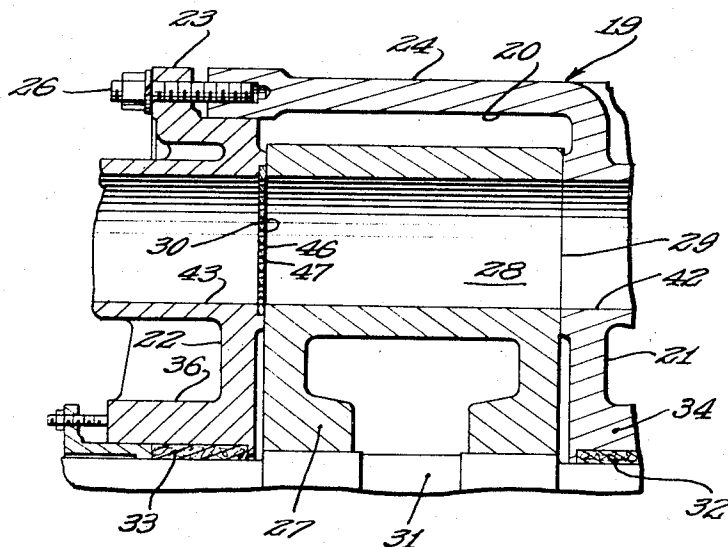


Fig. 7

INVENTOR.

Arnold J. Roerig

BY *Hill Sherman, Morris, Chase & Simpson* ATTORNEYS

1

3,449,014

REVOLVING CHIP FEEDER

Arnold J. Roerig, Beloit, Wis., assignor to Beloit Corporation, Beloit, Wis., a corporation of Wisconsin

Filed Mar. 11, 1966, Ser. No. 533,668

Int. Cl. B65g 53/30; B01d 43/00

U.S. Cl. 302-14

3 Claims

ABSTRACT OF THE DISCLOSURE

A revolving chip feeder including a pair of rotors arranged in side-by-side relation on parallel axes for successively removing chips from a first liquor flowing through passages formed therein and for transferring the chips to a second liquor for delivery to a digester. The rotors are rotated together and at the same speed and the passages formed therein are so arranged that chips are continuously delivered to the digester.

This invention relates generally to pulp and papermaking apparatus and more particularly to apparatus for transferring and feeding wood chips during a continuous pulping process.

Advances have been made in the development of continuous pulping processes and there are now a number of soundly developed systems for continuous pulping, particularly of the chemical and semichemical types. Continuous pulping can afford many advantages over a batch operation, among which are reduced time requirements, a more uniform product, utilization of better control methods, and greater flexibility.

Continuous pulping processes are often complicated, however, and have presented problems of mechanical design. For example, in some operations such as in feeding wood chips to the digesters or in transferring the wood chips from one digester to another the chips may desirably be first carried in one fluid medium such as a first liquor and then transferred to another fluid medium such as a second liquor which might be at a different pressure, temperature, etc., than the first liquor.

The present invention is addressed to such problems and provides means not only for effecting such transfer but for accomplishing the transfer continuously as required in feeding wood chips in a continuous pulping process. The feeding or transfer apparatus of the present invention is simple in design, relatively inexpensive in manufacture, provides a high transfer or feeding capacity, is easy to operate, can be controlled automatically, is rugged in construction and can serve a long, useful life.

It is, therefore, an object of the present invention to provide means for transferring wood chips from a first liquor to a second liquor, the two liquors having different conditions of pressure or temperature or the like.

Another object of the invention is to provide a digesting system for a continuous pulping process including means for continuously delivering wood chips to the digester for processing.

Another object of the invention is to provide a revolving chip feeder for a digester system incorporating a stationary housing and a rotatable rotor and including a plurality of passages extending axially straight through the rotor for transferring the chips from one liquor to another with minimum perturbation of the chips.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings, in which preferred structural embodi-

2

ments incorporating the principles of the present invention are shown by way of illustrative example only.

In the drawings:

FIGURE 1 is a schematic plumbing diagram of a continuous digesting system incorporating the principles of the present invention;

FIGURE 2 is a side elevational view of a pair of revolving chip feeders constructed in accordance with the principles of this invention and manifolded together for tandem operation, the housing of one of the chip feeders being partially cutaway;

FIGURE 3 is a vertical sectional view taken along lines III-III of FIGURE 2;

FIGURE 4 is a front elevational view of the tandem chip feeder arrangement of FIGURE 2;

FIGURE 5 is a cross-sectional view taken substantially along lines V-V of FIGURE 4;

FIGURE 6 is an enlarged fragmentary cross-sectional view of a rotor mounted in the housing of a chip feeder and illustrating especially one embodiment of a chip retaining screen member; and

FIGURE 7 is similar to FIGURE 6 and shows an alternative embodiment of the chip retaining screen member.

As shown in the drawings:

Although the principles of the present invention are applicable in any system wherein solids are to be transferred from one fluid medium to another, a particularly useful application is made to a pulping process in the manufacture of stock for making paper products wherein wood chips are treated mechanically and/or chemically at a plurality of treatment stations or zones and may be transferred from one treatment zone to another in one or more liquor media, as will be understood by those skilled in the art.

Referring to FIGURE 1, a typical digester is indicated generally at reference numeral 10. Usually the digester receives wood chips after they have been acted upon or treated at preceding treatment zones or stations.

For example, in some pulping processes the chips are delivered from a chipper to a first treatment zone in a liquor medium, the composition, pressure, temperature, etc., of which is determined by the type of chips involved, the treatment which they are to undergo, etc. After this phase of the process is completed the chips may be moved to a second treatment zone. The second treatment may require a different liquor than the first, and such differences may relate to chemical composition or merely to differences in temperature and/or pressure. In any event, the second liquor may be characterized as being different from the first, and when the chips are transferred from the first to the second treatment zone, the zones themselves should be isolated from one another to avoid admixture of the two liquors.

In FIGURE 1 it will be assumed that the treatment involved in the digester 10 requires a high pressure liquor and that the next preceding treatment station utilizes a liquor similar to the liquor used in the digester but maintained at a lower pressure. It will be understood, however, that the difference between the two liquors could be temperature rather than pressure, or temperature and pressure, or the two liquors could differ chemically. It is thus desirable to keep the two liquors separated from one another, or at least substantially so.

Reference numeral 11 denotes a conduit for conveying a flow of low pressure liquor having wood chips suspended therein from a treatment zone which precedes the digester 10 in a continuous pulping process. Another conduit 12 delivers a supply of high pressure liquor in the direction indicated by the arrow from a source thereof. The wood chips carried in the low pressure liquor in conduit 11 are transferred to the high pressure liquor in conduit 12 for delivery to the digester 10 and to effect such transfer con-

duits 11 and 12 are connected respectively to a chip feeder unit indicated at 13.

A conduit conveying the low pressure liquor from the chip feeder unit 13 after the wood chips suspended therein have been removed therefrom and transferred to the high pressure liquor is indicated at 14. Another conduit 16 interconnects the chip feeder unit 13 and the digester 10 for feeding the high pressure liquor and the wood chips transferred thereto to the digester 10.

Referring to FIGURES 2-5 the exemplary chip feeder unit 13 illustrated therein, which is constructed in accordance with the principles of this invention, comprises a pair of chip feeders 17 and 18 operatively interconnected for tandem operation. The feeders 17 and 18 are mirror images of each other and will be described together in the interest of brevity.

Each of the chip feeders 17 and 18 comprises a housing 19 having formed therein a generally cylindrically shaped bore 20 which is closed at one end thereof by a radial end wall 21 formed on the housing 19 and closed at the other end thereof by a radial end wall 22 formed on a circularly shaped end plate 23 securely mounted on a peripheral wall 24 of the housing 19 by means of a plurality of suitable fasteners indicated at 26.

A complementarily shaped rotor 27 is housed in the bore 20 and has formed therein a plurality of cylindrically shaped passages 28 which extend axially through the rotor 27 from one radial end wall 29 thereof to an opposite radial end wall 30. In the form shown a total of 10 passages 28 are formed in each of the rotors 27 with an equal angular spacing therebetween of about 36°. The axes of all of the passages 28 of each of the rotors 27 are spaced radially from the axis of their respective rotors an equal distance and thus intersect the periphery of a circle having as its center the axis of the rotor.

Each of the rotors 27 is carried for rotation on a shaft 31 which extends through packing members 32 and 33 housed respectively in hub portions 34 and 36 of the radial end walls 21 and 22. The shaft 31 is supported for rotation on a pair of outboard bearing members 37 and 38 which are mounted on a pair of upstanding pedestals 39 and 40 secured at their bases to a common bottom frame plate 41.

In accordance with the principles of this invention wood chips are carried by low pressure liquor into the passages 28 of the rotors 27 from the next preceding treatment zone or station. The chips are then flushed from the passages and transferred to high pressure liquor for delivery to the digester 10. Accordingly, a low pressure liquor connection 42 is formed in each of the housing end walls 21 for connection to a source of low pressure liquor and chips such as, for example, the conduit 11 shown in FIGURE 1. Each of the connections 42 is situated in a radial direction from the axis of rotation of its corresponding rotor 27 a distance which is equal to the radial distance of the axes of the passages 28 from the axis of rotation of their corresponding rotor so that the connections 42 register successively with the individual passages of their respective rotors as the rotors are turned.

In order to convey the low pressure liquor with the chips removed from the feeder unit 13 a low pressure liquor outlet connection 43 is formed in each of the housing end walls 22 and is adapted for connection to the conduit 14 shown in FIGURE 1. Each of the low pressure liquor connections 43 is disposed in coaxial alignment with its corresponding low pressure liquor inlet connection 42 so that as the rotors 27 are turned the low pressure liquor inlet connections 42 are in fluid communication with the outlet connections 43 as the respective passages 28 move thereacross, with one end 44 of the passages registering with the inlet connection 42 as an opposite end 46 of the passages registers with the outlet connection 43.

In order to collect the chips carried by the low pres-

sure liquid within the passages 28 a screen member 47 extends across the outlet end 46 of the passages 28 as the passage register with the inlet and outlet connections 42 and 43. In one form of the invention as shown in FIGURES 2 and 6 the screen member 47 is mounted in fixed assembly on the housing end wall 22 across the outlet connection 43, whereas in another form of the invention shown in FIGURE 7 the screen member indicated at 47a is corotatably mounted on the rotor 27 to extend across the outlet end 46 of the passage 28. In the embodiment shown in FIGURE 7 it will be appreciated that a screen member 47a is provided for each of the passages 28, whereas in the embodiment of FIGURE 6 only one screen member 47 is required for each of the feeders 17 and 18. In addition, the form shown in FIGURE 7 requires reverse flushing of the passages 28, as will be described further hereinafter.

After the passages 28 are rotated across the inlet connection 42 and the outlet connection 43, whereby chips are collected within the passages, upon continued rotation of the rotors 27, 27 in the direction of the arrows indicated at 48 and 49 in FIGURE 3 the passages 28 move successively into registry with a high pressure liquor inlet connection 50 and a high pressure liquor and chips outlet connection 51 formed, respectively, in the housing end walls 21 and 22 of the chip feeders 17 and 18. The inlet and outlet connections 50 and 51 are coaxially aligned and in the embodiment illustrated are spaced angularly from their respective low pressure liquor inlet and outlet connections 42 and 43 by about 270°. The high pressure liquor connections 50, 50 are adapted for connection to the conduit 12 shown in FIGURE 1, and the high pressure liquor and chips outlet connections 51, 51 are adapted for connection to conduits 16.

Since the chips are retained within the rotor passages 28 during the time interval required for the rotors to turn approximately 270°, the chips can be subjected to additional treatments within the chip feeders 17 and 18 before they are flushed to the digester 10. For example, a steam connection could be provided on each of the housings 19 to register with the passages 28 between the low pressure liquor connections 42 and 43 and the high pressure liquor connections 50 and 51 whereby additional heat could be supplied to the chips before they are delivered to the digester 10. It is also noted that because of the "straight-through" arrangement of the passages 28, the chips are subjected to minimal perturbation as they are transferred from the low pressure to the high pressure liquor.

In the tandem arrangement shown, the corresponding connections of the two chip feeders 17 and 18 may be interconnected in order to simplify the piping arrangement. Thus, a Y-shaped manifold 52 interconnects the low pressure liquor and chips connections 42, 42 of the feeders 17 and 18 with the main header 11 shown in FIGURE 1. A manifold 53 communicates connections 43, 43 with the main conduit header 14, another manifold 54 joins the high pressure liquor inlet connections 50, 50 with the main conduit header 12, and another manifold 56 joins the connections 51, 51 with the main header 16.

In order to reduce surging of the high pressure liquor and chips into the digester 10, the rotors 27, 27 of the tandem arrangement shown in the drawings are displaced angularly with respect to one another so that chips are always being flushed from at least one passage 28 for delivery to the digester 10. This angular offset relationship is best seen in FIGURE 3 wherein one of the passages 28 of the feeder 17 is positioned in exact registry with the outlet connections 51 thereof and each of two passages 28 of the feeder 18 is in partial registry with its corresponding outlet connection 51. It should be noted that in the cross-sectional view of FIGURE 5 the rotors 27, 27 of the feeders 17 and 18 have not been shown in this offset relationship in order to provide a better cross-sectional illustration of the rotor.

5

As well understood by skilled workers in the art, it is desirable to provide means to accommodate expansion and contraction of the conduit headers 14 and 16 when the headers are directly coupled to the chip feeders 17 and 18, and for this purpose a plurality of expansion joints 57 are mounted between the outlet manifolds 53 and 56 and the feeders 17 and 18.

In addition the expansion joints 57, 57 allow for the axial movement of end walls 22, 22 to provide for clearance and wear adjustment between rotor end walls 29 and 30 and inside radial end walls of the housings 19, 19.

It is also desirable to turn the rotors, 27, 27 in synchronism. Accordingly, a pair of gear boxes 58, 58 are mounted respectively on the driving ends of the rotor shafts 31, 31 and are interconnected by a drive coupling 59 so that both of the gear boxes 58 and their corresponding rotors 27 are driven by a single drive shaft 60 adapted for connection to any suitable driving mechanism such as, for example, an electric motor.

Referring to FIGURE 7 wherein the screen 47a is mounted on the rotor 27 rather than the end wall 22 of the housing 19, in order to flush the chips from the passages 28 the high pressure liquor must flow through the passages in a direction opposite to the direction in which the low pressure liquor and chips are delivered to the passages. Such reverse flow of the high pressure liquor requires no structural modification but merely that the high pressure liquor connections 51, 51 be connected to the supply conduit 12 and connections 50, 50 be connected to the conduit 16 which feeds the digester 10.

I claim as my invention:

1. In a digester system for digesting wood chips, a revolving chip feeder comprising

a housing having a pair of substantially cylindrical bores formed therein and a pair of radial end walls enclosing the ends of said bores,

said bores having spaced parallel axes, complementarily shaped rotors mounted for rotation within said bores,

a plurality of passages extending axially straight through each of said rotors,

the axes of said passages of each of said rotors being arranged in parallel relation and said passages being arranged in circular patterns about the axis of their respective rotors,

first and second pairs of axially aligned connections formed respectively in the end walls of said housing,

6

said first and second pairs of connections corresponding with and being registerable respectively with said passages of each of said rotors and adapted to deliver low pressure liquor and chips into said passages and to remove low pressure liquor from said passages, respectively, as the individual passages register with said first and second pairs of connections,

screen means extending across the end of each of said passages adjacent said second pair of connections as the passages register therewith,

third and fourth pairs of coaxially aligned connections formed respectively on the end walls of said housing, said third and fourth pairs of connections corresponding with and being registerable respectively with said passages of each of said rotors and adapted to deliver high pressure liquor into said passages and to flush the high pressure liquor and chips from said passages to a digester as the respective passages in each of said rotors register with said third and fourth pairs of connections, and

means for rotating the rotors together and at the same rate of speed and in angularly offset relation,

whereby at any given time at least some of the passages of one of the rotors is being flushed of high pressure liquor and chips for delivery to the digester.

2. The digester system as defined in claim 1 wherein said screen means are formed stationarily on said housing.

3. The digester system as defined in claim 1 wherein said screen means are mounted on said rotor across the ends of said passages adjacent said second connections, respectively.

References Cited

UNITED STATES PATENTS

2,512,194	6/1950	Asaro et al.	302—14
2,680,683	6/1954	Obenshain	302—49
2,907,499	10/1959	Agronin	302—49
2,921,721	1/1960	Brooks	302—49

ANDRES H. NIELSEN, *Primary Examiner.*

U.S. CI. X.R.

302—49