ABSTRACT OF THE DISCLOSURE

A device adapted to present particulate materials sequentially to a plurality of fluid medium having a member which contains at least six ports which are capable of transferring fluid, a second member within the first member and capable of rotation with respect to the first member, said second member containing a plurality of pockets arranged to sequentially communicate with each of the ports in the first member and drive means to rotate the second member with respect to the first member. The first port is adapted to charge a pocket with low pressure fluid, the second port charges the pocket with a high pressure fluid containing particulate materials in such a manner whereby a screen covers the outlet area of the port to permit collection of the particulate material without impeding the inlet flow of the high pressure fluid. The third port permits discharge of the fluid from the pocket as it passes into communication with the third port while prohibiting the release of the particulate material by the use of a screen or other foraminous device. The fourth port receives a second fluid under low pressure to fill the pocket which contains the particulate materials. A fifth port is used to charge the pocket with high pressure quantities of the second fluid, thereby removing the particulate material from the pocket. Finally, a sixth pocket is adapted to discharge or drain out any fluid remaining in the pockets.

Background of the Invention

This invention relates to apparatus which may be used in any system wherein solids are to be transferred from one fluid medium to another and is particularly useful in the pulping process in the manufacture of stock for making paper products wherein wood chips are treated mechanically and/or chemically in a plurality of treatment stations. Oftentimes it is necessary to subject wood chips to certain treatments with one fluid before they enter the digester and then transfer the chips to a second fluid for use in a digester, whether the digester is continuous or of the batch type process.

Since the trend in the paper and pulping industry is toward continuous processes, substantial problems have arisen, not the least of which involves the continuous transfer of chips from one fluid medium to another through various treatment zones. As time is often a critical factor in continuous processes, many of the treating liquors or fluids are under substantial pressure to increase the rate of reaction and the like. Moreover, specialization in the pulping industry has brought about the use of specific fluids or treating liquors for specific parts of the continuous process. Oftentimes, these fluids adversely affect one another when mixed, and thus great effort is expended to prevent contamination of one fluid or treating liquor with another. In addition, certain processes have been developed for treating pulping liquor which require the use of dissolved gases in one or another of the phases of the treatment. These gases are dissolved in a treating liquor under pressure and assist or catalyze in the pulping process. Oftentimes these gases are expensive and/or have a toxic or otherwise undesirable nature. Accordingly, it is desirable to segregate those fluids containing these dissolved gases from the rest of the system, and it is further advantageous to have some means for collecting the gases for recovery and/or reuse.

Prior art attempts to accomplish these and other processes in the pulping industry, as well as in other industries wherein particulate materials are sequentially presented to a plurality of fluid media, have resulted in the development of various transfer valves or feeders. Among the most successful of these is described in a copending application of common ownership filed on July 27, 1965 and having Ser. No. 477,242, which application describes an axial flow rotary feeder of the type wherein a stator contains a number of ports which sequentially treat pockets contained in a rotating rotor internal of the stator. In devices of the nature described in his above identified copending application, various ports containing an inlet and an outlet present fluids to pockets in the rotor whereby, for example, wood chips contained in one treating liquor could be transferred to a second treating liquor by passing the first chip containing liquor into the device whereby the chips are collected in a pocket which rotates to a second port whereby an inlet presents a second fluid to withdraw the chips, thereby accomplishing the transfer.

While these valves have been found to be admirably suitable for many applications, certain difficulties have still been found to detract from their overall usefulness. By the nature of the design, the pockets contained in the rotor communicate with the various inlets under circumstances wherein little or no fluid is contained in the pocket. When fluids of relatively high pressure are employed, as is necessary in a wide number of commercial processes, a knocking effect is noticed wherein the fluid slams into the empty pocket, causing distortion and stress in the valve. This ultimately leads to leakage of the treating liquors and eventual destruction of the valve. Moreover, after the pocket has been filled by the treating fluid, the rotation of the rotor necessitates a certain quantity of this first fluid to be present in the device when the second treating fluid is presented to the system to a second inlet and outlet port. Under most circumstances, wherein the major distinction between the treating fluids is merely temperature and/or pressure, little harm is caused by such contamination. However, when the chemicals are distinct or when one or another of the fluids contain other substances such as dissolved gases, contamination is particularly undesirable.

Accordingly, it is an object of this invention to provide a high pressure transfer valve device which is capable of transferring particulate materials from one fluid medium to another without significant contamination or mixing of the two fluids.

It is another object of this invention to provide a transfer device which is resistant to forces exerted by the introduction of high pressure fluids.

It is still another object of this invention to provide a device containing means for withdrawing dissolved gases therefrom without contamination of other fluids and/or the atmosphere.

It is a specific object of this invention to provide a transfer means wherein solids contain particulate material contained in one fluid may be transferred to a second fluid with an absolute minimum of contamination between the fluids.

The invention

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.
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In the drawings, FIGURE 1 is a side elevational view, partially cut away, of a transfer or feeder unit constructed in accordance with the principles of the present invention; FIGURE 2 is a sectional view of the feeder taken along lines A—A of FIGURE 1; and FIGURE 3 is a partial sectional view along line B—B of FIGURE 2.

Although the principles of the present invention are applicable in any system where solids are to be transferred from one fluid medium to another, a particular useful application is made to a pulping process in the manufacture of stock for paper products wherein wood chips are transferred from one liquor medium to another. Particular reference is made to a continuous pulping process, which reference is made to best illustrate the embodiments of this invention.

Referring to FIGURE 1, the transfer device is generally shown by the numeral 10. In this embodiment, the frame 12 supports various ports 14 which contain inlets 15 and outlets 16 which are connected to various sources of fluid media for inlets 15 and to storage tanks whereby material leaving the outlets 16 may be stored or further processed. For the purposes of this example, the inlets 15 have been shown at the bottom, but this is a mere matter of choice and it would be readily convenient to place the outlet 16 at the bottom in some or all of the instances of the ports 14. It is also shown that the vessel 50 contains a plurality of pockets 20. The rotor is attached to a shaft 22 which is driven such as by drive means attached to spindle 24. Various seal means (not described) may conventionally be employed to seal the rotor on the shaft while permitting rotation thereof.

Said means for mounting the shaft and for driving the same are shown in the above referred to copending commonly owned application filed July 27, 1965 and having Ser. No. 477,242. Reference is made to this copending application to illustrate means suitable for mounting the shaft and providing for bearing means, seals and other devices.

Referring to FIGURE 2, the basic concepts of the invention may now be seen. The rotor 18 is rotating in a counterclockwise direction about shaft 22 thereby permitting the various pockets in communication with each of the respective ports. Of course, where one port is shown, more than one can be employed without departing from the scope of the invention as long as the groups of ports function as herein described. The function of each of the six ports shown in FIGURE 2 is, of course, critical to the operation of the present invention. A first port 26 is adapted to fill a pocket 38 with a low pressure fluid. The purpose of this step is merely to fill the pocket. Screen 50 may or may not be employed depending upon the particular choice of the manufacturer. As the rotor 18 rotates about the shaft 22, the pocket 38 moves to a position shown by pocket 40 which is in communication with port 28. At this point, port 28, the second port, is adapted to charge the pocket with high pressure fluid which further contains particulate materials suspended therein.

As shown in FIGURE 1, the high pressure fluid enters through the inlet 15 and the particulate solid is forced into the pocket 20 by the pressure of the fluid. As the pocket 20 communicates with the outlet 16, screen 17 prevents the particulate material from escaping from the pocket 20. The high pressure of the fluid coming through inlet 15 additionally prevents the materials from returning back through the inlet 15. Thus a quantity of solids are collected in the pocket. Referring again to FIGURE 2, the further rotation of the rotor 18 about shaft 22 causes the pocket 40 to rotate to a position shown by pocket 42, which is in communication with a third port 30. Screen 54 completely covers the area between the pocket 42 and the third port 30. FIGURE 3 shows the position of the screen 54, the pocket 42 and the port 30. Entrained fluid may conveniently drain through opening 15 while any gas contained in the fluid will escape through opening 16 since the liquid is no longer in contact with the solid material. Further, any undissolved solid material is essentially free from the fluid which was used to introduce it to the device.

Further rotation of the rotor 18 about shaft 22, as shown in FIGURE 2, will bring the pocket 42 into the plane shown by pocket 44 so that the pocket 44 communicates with port 32. Again a screen is used to keep the solid particles in pocket 44. Port 32 is adapted to fill the pocket 44 with a second liquor or fluid under low pressure. This is done so that when pocket 44 rotates to the position occupied by pocket 46, introduction of high pressure fluid through port 34 will not cause a knocling effect as would happen if pocket 46 were empty. In the present embodiment, high pressure fluid is introduced through port 34 and the suspended solids are forced out of pocket 46. As shown in FIGURE 1, the high pressure liquid enters port 34 through the opening 15 at high velocity and exits from the port 34 after passing through the pocket 46. The fluid is then directed through the port 34 into the port 40 and back through the shaft 22 to the port 48. Entrained fluid may conveniently drain through opening 15 while any gas contained in the fluid will escape through opening 16 since the liquid is no longer in contact with the solid material.
member, said second member containing a plurality of pockets arranged to sequentially communicate
with each of said ports in said first member;
whereby each pocket sequentially connects with each
of said six ports;
the first port being adapted to charge the pocket
with low pressure first fluid;
the second port being adapted to charge the pocket
with high pressure first fluid containing particulate material suspended therein, said second
port having a screen across the outlet area con-
necting said port with said pocket to permit
collection of said particulate material without
impeding the inlet flow of said fluid;
the third port being adapted to permit discharge
of the first fluid contained in said pocket, said
third port having a screen across the area con-
necting said port with said pocket to keep said
particulate material within said pocket;
the fourth port being adapted to receive a second
fluid under low pressure to thereby fill said
pocket containing said particulate material, said
fourth pocket having a screen across the area con-
necting said port with said pocket;
the fifth port being adapted to receive said sec-
ond fluid under high pressure, to permit removal
of said particulate material from said pocket; and
the sixth port being adapted to discharge any
fluid remaining in said pocket;
and drive means adapted to cause rotation of said
second member with respect to said first member.

2. The device of claim 1 wherein said third port has
an upper outlet and a lower outlet whereby said port is
adapted to discharge gas and other vapors contained in
said fluid and said lower outlet is adapted to discharge
said fluid.

3. The device of claim 1 wherein said second member
is attached to a shaft, said shaft being connected to said
drive means, whereby said second member rotates within
said first member.

4. The device of claim 1 wherein said ports contain
at least two separate openings capable of communi-
cation with said pockets.

5. The device of claim 1 wherein said six ports are
equally spaced around said second member such that
said second port and said fifth port are radially opposed.

6. The device of claim 1 wherein said second port has
an opening in open communication with said pockets and
a second opening in screened communication with said
pockets.

7. The device of claim 1 wherein the area of said
pockets in communication with said port is less than the
area of said port.

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