LIQUID EXTRACTING APPARATUS

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This invention relates to liquid extracting apparatus. More particularly the invention relates to liquid extracting apparatus of the type wherein wet material is carried upon a perforated carrier past a suction zone whereupon liquid is extracted from the wet material. In this type of apparatus a substantial part of the work done in maintaining a reduced pressure in the suction zone is expended in the removal from the perforations of the carrier of the air entrapped therein.

The object of the present invention is to reduce the work expended in maintaining the suction zone at a reduced pressure.

According to the invention apparatus for extracting liquid from wet material includes a perforated carrier for the wet material, means to provide a suction zone, means for causing the carrier to pass over and beyond said suction zone and a pressure equalizing passage which is sealed except for open ends to which the carrier is exposed immediately before and beyond the suction zone.

It will be understood that the term "wet material" is used to include not only a mixture of liquid and solid material from which the liquid is to be extracted but also a filtering medium carrying such a mixture of wet material and a wet pervious material itself, for example, a wet fabric or a wet felt in a paper making machine.

In one embodiment of the invention the carrier is a perforated roll and the suction zone is provided by a suction box mounted inside the roll, the suction box having double walls to bound the pressure equalizing passage. The carrier may for example be the suction roll of a paper making machine around which a felt is passed carrying the wet pulp web or it may be a felt drying roll.

There may be provided a succession of two or more pressure equalizing passages before and beyond the suction zone.

In another embodiment of the invention, the carrier is a hollow rotatable drum adapted to dip into a tank containing the solid and liquid to be separated, said drum being divided into a plurality of circumferential sections and having radial passages connecting said circumferential sections to the bore of the drum, fixed partitions being arranged in said bore to provide a suction zone and a pressure equalizing passage. There may be also arranged further fixed partitions in the bore to provide a chamber connected to a source of pressure and a drainage chamber maintained at atmospheric pressure.

In both embodiments the means may be provided for draining liquid from the pressure equalizing passage or passages.

Two embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a section through part of a suction roll of a paper making machine according to the invention, and

Figure 2 is a section through a continuous rotary filter according to the invention.

Referring now to Figure 1, 1 indicates the shell of a perforated suction roll having holes 2. A felt 3 is entrained around the suction roll and carries a wet pulp web 4. A double walled suction box, indicated generally at 5, is situated inside the suction roll and has walls 6 and 7, the edges of which have resilient lips 8A, 8B, 8C and 8D which seal against the inside surface of the shell. The walls 6 and 7 bound a pressure equalizing passage 9 which is sealed except for its open ends and is drained of liquid by means of a pipe 10 and a siphon chamber 11.

The operation of the device is as follows:

The suction roll rotates in the direction of the arrow 12 and the space 13 within the wall 7 is maintained at a reduced pressure to provide a suction zone. All the holes in the suction roll between the lips 8B and 8C, therefore, will be subjected to vacuum, for example, a vacuum of 20" Hg. As the suction roll rotates the holes which pass the lips 8C will contain air at an absolute pressure of 10" Hg, i.e. 20" Hg vacuum. The pressure in the holes between the lips 8A and 8B will be atmospheric i.e. 30" Hg and therefore, when a steady state has been reached the pressure in the pressure equalizing passage will be about 20" Hg, that is, the mean between 30" Hg and 10" Hg. Thus, the holes entering the suction zone by passing the lip 8B will contain air at a pressure of 20" Hg rather than 30" Hg if no pressure equalizing passage were provided and less air will have to be pumped from the suction zone 13.

As an example of the saving of power effected by this apparatus consider the effect when the suction zone 13 is maintained at an absolute pressure of 10" Hg, i.e. a vacuum of 20" Hg whilst the remainder of the inside of the drum is at atmospheric pressure, i.e. 30" Hg. In known constructions where a suction box is used without the provision of a pressure equalizing passage each drum hole, as it passes into communication with the suction zone, contains air at 30" Hg absolute which is reduced to 10" Hg absolute, thus 20 units of air enter the suction zone and must be pumped out. In the construction shown in Figure 1, however, as the suction roll passing the lip 8B and coming into communication with the suction zone 13 contains air at 20" Hg, i.e. the pressure in the equalizing passage 9 and, therefore, the pressure in the hole has only to be reduced from 20" to 10", that is to say, 10 units of air enter the suction zone and must be pumped out. Thus the air removed from the suction zone is only half that which it would be were no pressure equalizing passage provided. If more pressure equalizing passages are provided at the entering and leaving edges of the suction zone the carry over into the suction zone is reduced still further.

This comparison is only approximate since inflow of water into the holes and other factors modify the values but do not seriously affect the saving in power. Due to the reduction in the weight of air which has to be removed from the suction zone it is possible to use smaller pumps and less power than heretofore.

Referring now to Figure 2 a rotary filter comprises a perforated carrier in the form of a hollow rotatable drum 14 which dips into a tank 15 containing a mixture of solid and liquid, from which the liquid is to be extracted. The drum 14 is divided into sixteen circumferential sections by internal radial walls 16. Each circumferential section is formed with a chamber 17 which contains a filter pad 18 and communicates with the bore of the drum by a radial passage 19. In fixed positions inside the bore of the drum are partitions 20 and 21. The former is provided at its ends with resilient lips 22 and 23 and the latter is provided with resilient lips 24, 25, 26 and 27, all of which seal against the surface of the bore of the drum.
The zone between the lips 22 and 23 is maintained under a vacuum via the passage 28 and provides the suction zone. The space between the partitions 21 and 22 bounded by the lips 23 and 24 at one end and the lips 22 and 27 at the other end provides a pressure equalizing passage sealed except for the open ends and which is drained by means of a hole 29 communicating with a siphon whereby liquid may be drained therefrom. The zone between the lips 24 and 25 is maintained at atmospheric pressure via the passage way 30 and the partition 21 is drilled to provide a passage way 31 communicating with the space between the lips 25 and 26 by a slot 32. The passage way 31 is connected to a source of compressed air for a purpose hereinafter to be described. A chute 33 is provided to collect the solid material from which the liquid has been extracted.

The operation of the apparatus is as follows:

The drum 14 is caused to rotate in the direction of the arrow 34, the partitions 29 and 21 remaining stationary. Air is removed from the chambers 17 and the passages 19 which are in communication with the suction zone between the lips 22 and 23 whereby a layer of the wet mixture is caused to adhere to the surface of the drum. As the drum rotates the layer of wet material will emerge from the surface of the mixture in the tank whilst still subjected to suction to remove the liquid. The position of the lip 23 is adjusted so that as much liquid as possible is extracted from the wet material without an appreciable amount of air being drawn through into the suction zone. Each chamber 17 and passage 19 which comes into communication with the end of the pressure equalizing passage between the lips 23 and 24 will contain air at the reduced pressure of the suction zone whereas each chamber 17 and passage 19 coming into communication with the other end of the pressure equalizing passage will contain air at atmospheric pressure. The pressure in the pressure equalizing passage will thus tend to settle down at the mean between atmospheric pressure and the pressure in the suction zone. It follows that each chamber 17 and passage way 19 entering the suction zone past the seal 22 will be at this mean pressure and thus less air will have to be removed from the suction zone than if no pressure equalizing passage were provided. The zone between the lips 24 and 25 acts as a drainage zone and the compressed air provided via the slot 32 in the space between the seals 25 and 26 blows off the compacted and dried solid material into the chute 33 whereby the filter pads 18 are cleaned before again entering the mixture in the tank 15.

It will be seen that with apparatus according to the invention the weight of air which has to be removed from the suction zone is reduced in comparison with known apparatus and thus a saving of power is effected.

What is claimed is:

1. Apparatus for extracting liquid from wet material comprising a perforated endless carrier for said material, means to provide a suction zone in communication with said carrier over which successive portions of said carrier may pass, means for causing successive portions of said carrier to pass over and beyond said suction zone, and a pressure equalizing passage which is sealed except for open ends over which successive portions of said carrier pass in communication with said open ends immediately before and beyond said suction zone.

2. Apparatus according to claim 1 wherein the carrier comprises a rotatable hollow perforated roll and the suction zone is provided by a suction box mounted inside the roll, the suction box having double walls to bound the pressure equalizing passage.

3. Apparatus according to claim 1 wherein means are provided for draining liquid from the pressure equalizing passage.

4. Apparatus according to claim 1 in which the carrier is a hollow rotatable drum adapted to dip into a tank containing the material from which liquid is to be separated, said drum having a bore provided with fixed partitions to form said suction zone and having its surface divided into a plurality of circumferential sections by internal radial walls, and radial passages connecting said circumferential sections to the suction zone in the bore of the drum.

5. Apparatus according to claim 3 including further fixed partitions in the bore to provide a chamber adapted for connection to a source of pressure said further fixed partitions also providing a drainage chamber adapted to be maintained at atmospheric pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,449,902 Kiersted Sept. 21, 1948
2,677,467 Giorgini May 4, 1954
2,688,406 Holland Sept. 7, 1954