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2,765,085

ROTARY SUCTION DRUM FILTER

Filed Feb. 24, 1954

2 Sheets-Sheet 1

FIG-1

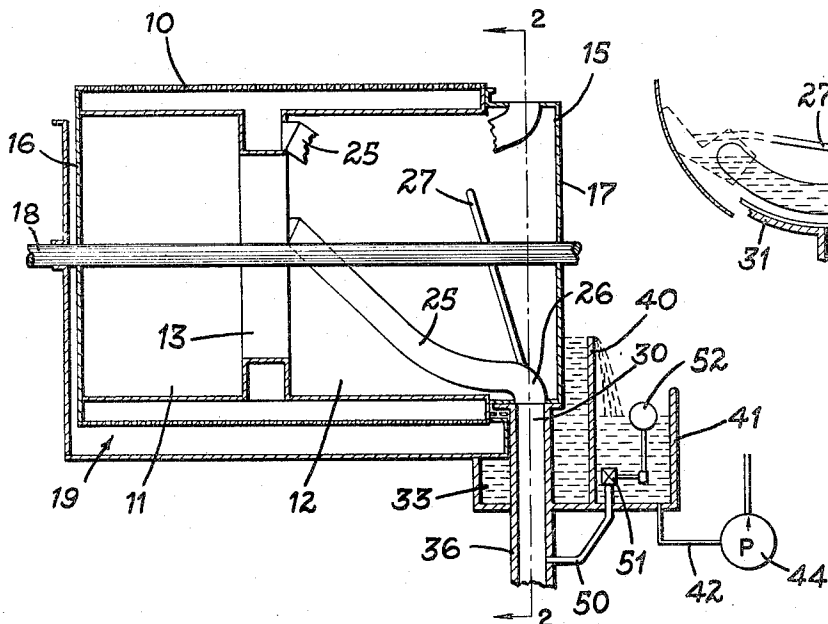


FIG-3

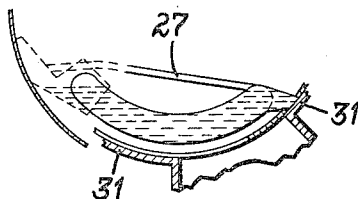


FIG-2

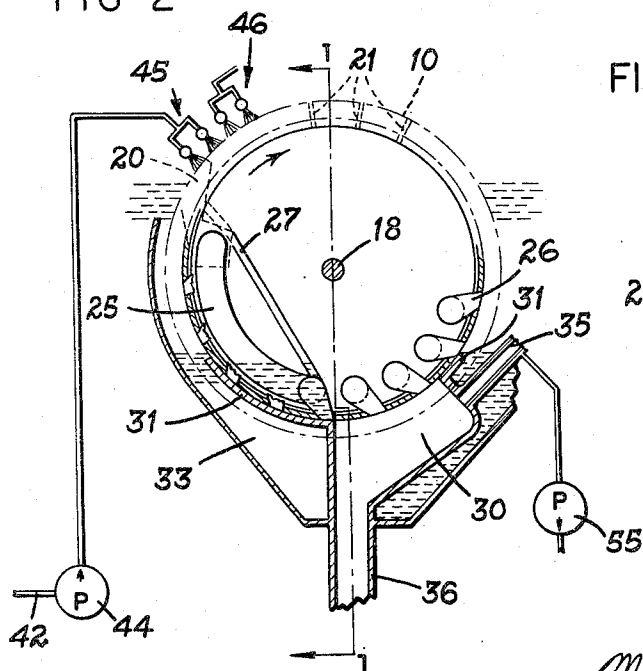
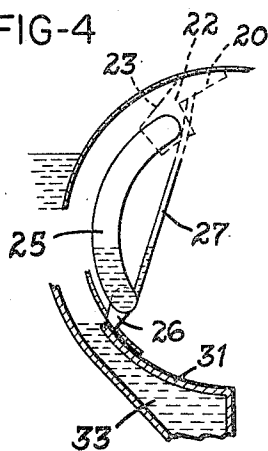


FIG-4



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2 Sheets-Sheet 2

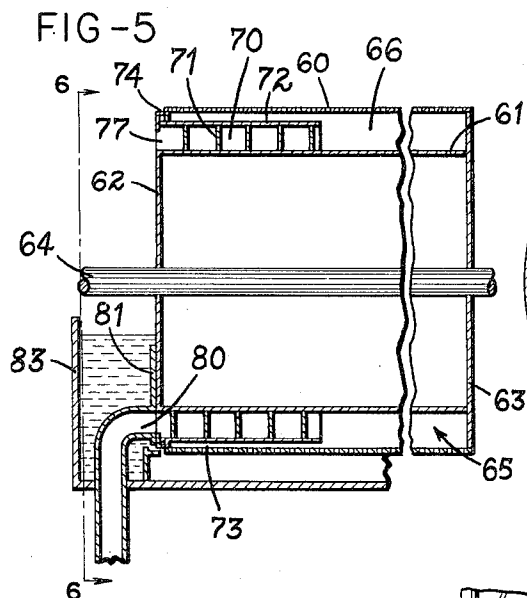
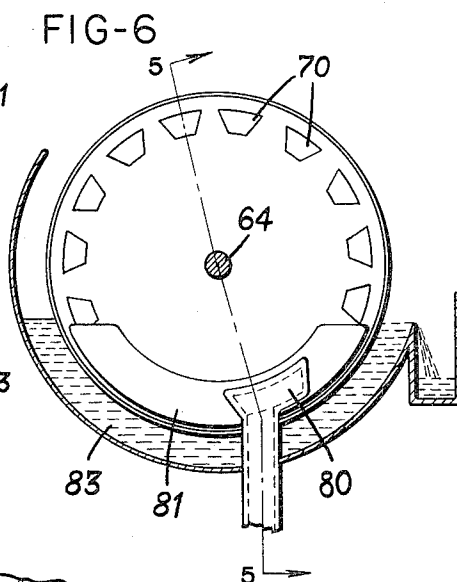


FIG-7

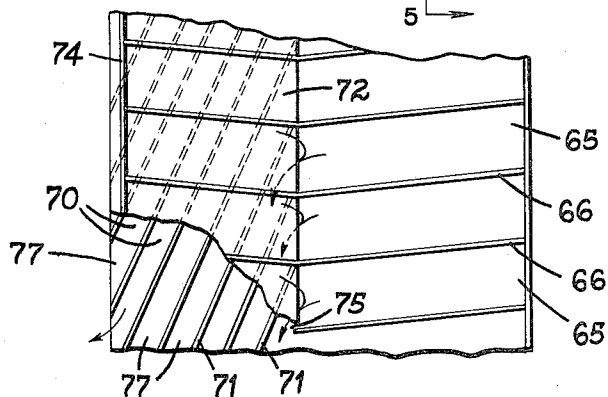
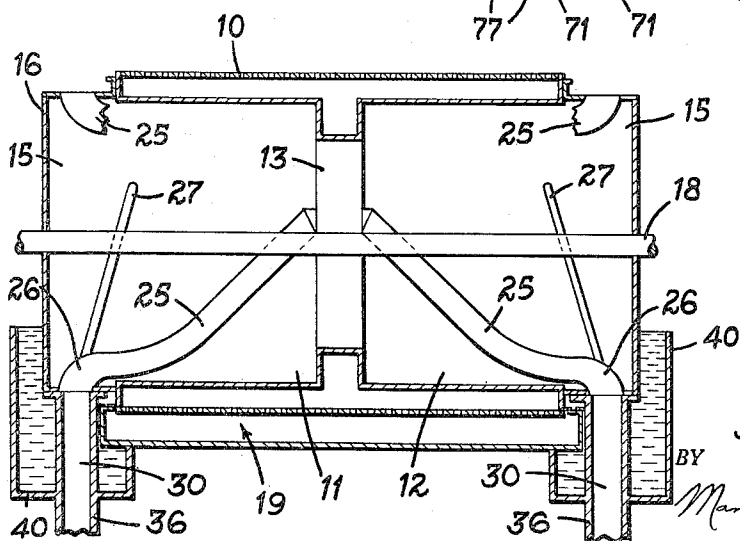


FIG-8



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1

2,765,085

ROTARY SUCTION DRUM FILTER

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Application February 24, 1954, Serial No. 412,335

5 Claims. (Cl. 210—202)

This invention relates to rotary suction drum filters of the type including a cylindrical strainer disposed in spaced relation to the outer surface of an inner shell or casing, a circumferential row of longitudinally extending cells located between the casing and the strainer and each having an outlet, and rearwardly bent discharge ducts leading from the outlets of the cells to discharge the liquid entering the cells through the strainer.

One of the primary objects of the invention is to provide such a rotary filter which includes a stationary suction box located in such relation with the drum that it registers successively with the discharge ends of the discharge ducts during a part of the rotational movement of each duct to increase the effective suction through the corresponding cell.

In accordance with the invention, the suction box is so constructed and arranged with respect to the rotating discharge ducts that the discharge end of each duct reaches the suction area of the box at a predetermined interval when the duct is substantially filled with liquid and its associated cell is wholly immersed in the pulp suspension outside the drum but is still partly filled with air. As the discharge end of the duct passes across the suction area of the suction box, a substantial portion of the liquid is withdrawn from the duct, and this in turn creates a partial vacuum within the duct which promotes further suction through the outer surface of the associated cell.

Further in accordance with the invention, the suction box is arranged to shut off outward flow from the discharge duct for a substantial interval following passage of the discharge end of the duct across the suction area and thereby to provide time for the additional suction into the associated cell resulting from the partial vacuum in the cell and duct. Thereafter, the discharge end of the duct is uncovered for free drainage into a liquid chamber adjacent the suction box. The liquid from this chamber may in turn be pumped to the first washing stage of the pulp on the exposed surface of the filter, particularly if it is desired to obtain relatively concentrated liquor from the pulp, or if concentration of liquor is not important, this drained liquid may be conveyed from the chamber to the downspout of the suction box to augment its suction effect.

This construction in accordance with the invention provides a further advantage in that substantially no air reaches the downspout of the suction box so that a highly effective vacuum can be maintained therein. At the same time, if foam or gas should be present with the liquid reaching the suction box, the upper part of the box may readily be connected to a suction pump for removing such foam or gas separately from the liquid.

It is an object of the present invention to provide a rotary suction drum filter having the structural and operational characteristics outlined above, and especially to provide such a filter in which the discharge ducts are arranged to discharge at one or both ends of the drum and in which there is a suction box correspondingly lo-

2

cated at one or both ends of the drum for cooperation with the discharge ends of the discharge ducts.

Additional objects and advantages of the invention will be apparent from the following description, the accompanying drawings, and the appended claims.

In the drawings—

Fig. 1 is a sectional view taken on the line 1—1 of Fig. 2 and showing a rotary suction drum filter constructed in accordance with the invention;

Fig. 2 is a radial section on the line 2—2 of Fig. 1;

Figs. 3 and 4 are fragmentary sectional views similar to Fig. 2 and illustrating moved positions of one of the discharge ducts with relation to the suction box;

Fig. 5 is a section on the line 5—5 of Fig. 6 illustrating another construction of filter in accordance with the invention;

Fig. 6 is a section on the line 6—6 of Fig. 5;

Fig. 7 is a developed side elevational view of the filter of Figs. 5 and 6 with the strainer removed; and

Fig. 8 is a view similar to Fig. 1 showing a filter in accordance with the invention having a suction box at each end thereof.

Referring to the drawings, which illustrate preferred embodiments of the invention, in Figs. 1 and 2, the cylindrical perforate strainer 10 is supported on an inner shell or casing shell or casing shown as formed by two drum sections 11 and 12 of the same diameter connected in axially spaced relation by a middle drum section 13 of lesser diameter. One end of the drum is extended beyond the strainer 10 to form a cylindrical suction face 15, and the drum as a whole is supported by end plates 16 and 17 on a shaft 18 for rotation in the vat indicated diagrammatically at 19. The annular space between the strainer 10 and the inner casing is separated into a plurality of cells 20 by generally radially and axially extending walls 21, and each cell 20 has an outlet 22 formed by walls 23 in the space bounded by the drum section 13 and the adjacent end walls of the drum sections 11 and 12.

Each of the outlets 22 is provided with a discharge duct 25 formed of pipe or flexible tubing opening through the end wall of the drum section 12 and extending axially of the drum in a generally helical spiral in the direction opposite the direction of rotation of the drum indicated by the arrow in Fig. 2 to locate the discharge end of each duct at the desired angular spacing rearwardly of its associated outlet, reference being made in this connection to my copending application Serial No. 412,334 filed of even date herewith and assigned to the same assignee as this application. The discharge end of each duct 25 is formed with an outlet 26 extending radially through the suction face 15, and the ducts are also shown as provided with venting tubes 27 connecting through the drum section 12 with their associated cells 20 in accordance with my application Serial No. 337,826, filed February 19, 1953, and issued January 24, 1956, as Patent No. 2,732,081 to the same assignee as this application.

At the end of the vat is a suction box 30 which includes an extended contact face 31 adapted to engage the suction face 15 sufficiently tightly to close the discharge outlets 26 of the ducts as they pass thereacross with the rotating drum. The suction box 30 is surrounded by a liquid container 33 which extends upwardly at both sides of the box above the ends of the contact faces 31. The suction box 30 is also shown as provided with a connection 35 at its upper end adapted to be connected to a suction pump as described hereinafter, and the downspout of the suction box is indicated at 36.

In operation with this filter as shown, each cell 20 begins to fill with liquid as it passes below the level of the liquid in the vat. When a given cell and its associated discharge duct reach the position indicated in Fig. 3, the duct is substantially filled with liquid, and there is also

some liquid in the cell but also still some air. In the position of Fig. 3, the duct outlet 26 is shut off by the entering side of the contact face 31, but as the drum rotates from this position, the duct outlet registers with the suction area of the suction box as indicated in Fig. 2, in which position the full effective suction of the suction box will be applied to the duct to draw out the liquid which has collected therein.

After each duct outlet 26 has passed the suction area of the suction box, it engages and is closed by the leaving side of the contact face 31 as shown in Fig. 2. However, since the suction applied to the duct by the suction box has substantially emptied it of liquid, a partial vacuum has been created therein, and as the duct outlet moves across the contact face 31, this partial vacuum creates new effective suction through the perforate outer surface of the associated cell 20. Then when the duct outlet passes beyond the contact face 31 as indicated in Fig. 4, it is again opened to permit it to drain into the liquid chamber 33 surrounding the suction box. Preferred results are obtained if the contact face 31 is so proportioned that the duct outlet is shut off at approximately the same moment when the face of its corresponding cell emerges from the liquid within the vat, and it is also desirable to maintain sufficient height of liquid in container 33 to submerge all parts of contact face 31 at all times.

It will accordingly be seen that this construction of filter provides for highly effective and efficient operation. There are no less than three distinct suction periods during each revolution of a given cell, namely, the first interval beginning when the cell passes below the liquid level and continuing until the discharge end of its duct is first closed by its contact face 31, the second interval when suction is directly applied to the duct of the suction box, and the third interval when the partial vacuum is effective within the cell as the discharge end of its duct passes from the suction box across the contact face 31. Another advantage of this filter is the reduced power requirements for its operation, resulting from the fact that the cells and ducts contain relatively little liquid while they are on the rising side of the drum.

As pointed out above, the filter of the invention is especially adapted for the filtering and washing of pulp to obtain concentrated liquor therefrom, and Figs. 2 and 3 illustrate operation of the filter for this purpose. The liquid discharged into the chamber 33 is shown as flowing over a dam 40 into an outer chamber 41 from which a pipe 42 leads to a pump 44 arranged to pump this liquid to the first set of shower pipes 45 above the liquid level in the vat. Thus this filtered liquid is sprayed back through the pulp for primary washing and is again recovered through the filter. If desired, clean water can be supplied to the second stage of shower pipes 46 as indicated in Fig. 2.

Fig. 1 also illustrates the operation of the invention with the liquid recovered in chamber 33 being supplied to the downspout 36 of the suction box 30 to increase the effective suction therein. A pipe 50 connects the chamber 41 with the downspout 36, and the upper end of this pipe within the chamber 41 is controlled by a valve 51 operated by a float 52 in chamber 41. Thus when the liquid in the chamber 41 reaches a predetermined level, the valve 51 will open to supply this liquid directly to the downspout 36. It will also be apparent as previously noted that if there is foam or gas with the liquid entering the suction box, it is readily removed by way of the connection 35 and any suitable suction pump 55 as indicated in Fig. 2.

Figs. 5-7 show another construction of filter in accordance with the present invention in which the discharge ducts discharge axially at one end of the drum, and the suction box is correspondingly arranged for contact with the end of the drum. In these views, the strainer 60 is supported by a drum casing 61 having end plates 62 and 63 mounted on shaft 64. The space between the strainer

60 and casing 61 is divided into cells 65 by walls 66 which extend forwardly in the direction of the rotation of the drum to establish a relatively flat V-shape for the cells 65, reference being made in this connection to my co-pending application Serial No. 297,746, filed July 8, 1952, and issued January 24, 1956, as Patent No. 2,732,080 to the same assignee as this application. The discharge ducts 70 from the cells 65 are formed by helically arranged partitions 71 mounted between the outer surface of the casing 61 and a cylindrical cover 72 of lesser diameter than the strainer 60 to leave a space 73 therebetween which is closed at its outer end by a ring 74 between the strainer 60 and cover 62.

As shown in Fig. 7, each partition 71 leads from the point formed by one of the V-shaped walls 66 to the end of the drum, and since these walls 66 lie only in the spaces radially outwardly of cover 72 and axially to the right of this cover in Fig. 5, this leaves an outlet opening 75 for each cell into its associated duct. The liquid entering each cell through the strainer thus flows from both ends of the drum to the outlet opening 75 as indicated by the arrows in Fig. 7, and the discharge ends of the ducts are indicated at 77 in Fig. 7. The suction box 80 is accordingly mounted outside this end of the drum, and it includes a vertically arranged extended contact face 81 of generally crescent shape for closing engagement with the discharge openings 77 in the same manner as already described in connection with Figs. 1-4. The liquid container 83 corresponds to the part 33 as described in connection with Figs. 1-4 and operates in the same manner.

The invention is equally applicable to drum filters in which a pair of ducts extend from each cell to opposite ends of the drum. Fig. 8 shows such a filter construction which is generally as described in connection with Fig. 1 but includes two ducts 25 leading from each outlet 22 to the opposite ends of the drum, and these ducts are arranged in opposite spirals to position their discharge ends at the desired angular spacing rearwardly of their associated cell and outlet. A suction box 30 is accordingly provided at both ends of the filter, with each functioning in the same manner as described in connection with Figs. 1-4.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A rotary suction drum filter comprising a drum casing, a cylindrical strainer disposed in concentric outwardly spaced relation to the outer surface of said casing, generally radially arranged walls disposed between said casing and said strainer to define a plurality of cells in the space between said strainer and said casing, means forming a separate discharge outlet from each of said cells, discharge ducts extending from said outlets to a discharge position at one end of said drum and being bent rearwardly in the direction of rotation of said drum to locate the discharge end of each of said ducts at a substantial angular distance rearwardly of the associated said outlets, a suction box located at said one end of said drum and arranged for registry with said discharge ends of successive said ducts during a minor fraction of a complete revolution of each said duct to withdraw collected liquid therefrom with resulting creation of a partial vacuum therein, means cooperating with said suction box to close the discharge end of each said duct for a further minor fraction of a complete revolution to provide for suction through said strainer into the associated said cell under the influence of said vacuum therein, and conduit means positioned for registry with said discharge ends of successive said conduits following said further minor fraction of a complete revolution to receive

5

therefrom the liquid accumulated therein during said further minor fraction of a revolution.

2. A rotary suction drum filter comprising a drum casing, a cylindrical strainer disposed in concentric outwardly spaced relation to the outer surface of said casing, generally radially arranged walls disposed between said casing and said strainer to define a plurality of cells in the space between said strainer and said casing, means forming a separate discharge outlet from each of said cells, discharge ducts extending from said outlets to a discharge position at one end of said drum and being bent rearwardly in the direction of rotation of said drum to locate the discharge end of each of said ducts at a substantial angular distance rearwardly of the associated said outlet, a suction box located at said one end of said drum and arranged for registry with said discharge ends of successive said ducts during a minor fraction of a complete revolution of each said duct, and a liquid container surrounding said suction box and adapted to register with said discharge ends of successive said ducts following movement thereof past said suction box for receiving further discharge of liquid from said ducts.

3. A rotary suction drum filter comprising a drum casing, a cylindrical strainer disposed in concentric outwardly spaced relation to the outer surface of said casing, generally radially arranged walls disposed between said casing and said strainer to define a plurality of cells in the space between said strainer and said casing, means forming a separate discharge outlet from each of said cells, discharge ducts extending from said outlets to a discharge position at one end of said drum and being bent rearwardly in the direction of rotation of said drum to locate the discharge end of each of said ducts at a substantial angular distance rearwardly of the associated said outlets, a suction box located at said one end of said drum and arranged for registry with said discharge ends of successive said ducts during a minor fraction of a complete revolution of each said duct to withdraw collected liquid therefrom with resulting creation of a partial vacuum therein, means cooperating with said suction box to close the discharge end of each said duct for a further minor fraction of a complete revolution to provide for suction through said strainer into the associated said cell under the influence of said vacuum therein, and a liquid container surrounding said suction box and said cooperating means for receiving the further discharge of liquid from said ducts following movement of the successive discharge ends thereof past said cooperating means.

4. A rotary suction drum filter comprising a drum casing, a cylindrical strainer disposed in concentric outwardly spaced relation to the outer surface of said casing, generally radially arranged walls disposed between said casing and said strainer to define a plurality of cells in the space between said strainer and said casing, means forming a separate discharge outlet from each of said

6

cells, discharge ducts extending from said outlets to a discharge position at one end of said drum and being bent rearwardly in the direction of rotation of said drum to locate the discharge end of each of said ducts at a substantial angular distance rearwardly of the associated said outlet, a suction box located at said one end of said drum and arranged for registry with said discharge ends of successive said ducts during a minor fraction of a complete revolution of each said duct, a liquid container surrounding said suction box and adapted to register with said discharge ends of successive said ducts following movement thereof past said suction box for receiving further discharge of liquid from said ducts, and means for conducting said liquid from said container to a position above said drum and for spraying said liquid onto the surface of said drum above the level of liquid outside said drum.

5. A rotary suction drum filter comprising a drum casing, a cylindrical strainer disposed in concentric outwardly spaced relation to the outer surface of said casing, generally radially arranged walls disposed between said casing and said strainer to define a plurality of cells in the space between said strainer and said casing, means forming a separate discharge outlet from each of said cells, discharge ducts extending from said outlets to a discharge position at one end of said drum and being bent rearwardly in the direction of rotation of said drum to locate the discharge end of each of said ducts at a substantial angular distance rearwardly of the associated said outlet, a suction box located at said one end of said drum and arranged for registry with said discharge ends of successive said ducts during a minor fraction of a complete revolution of each said duct, a downspout leading from said suction box, a liquid container surrounding said suction box and adapted to register with said discharge ends of successive said ducts following movement thereof past said suction box for receiving further discharge of liquid from said ducts, and means for conducting said liquid from said container to said downspout for increasing the effective suction in said suction box.

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