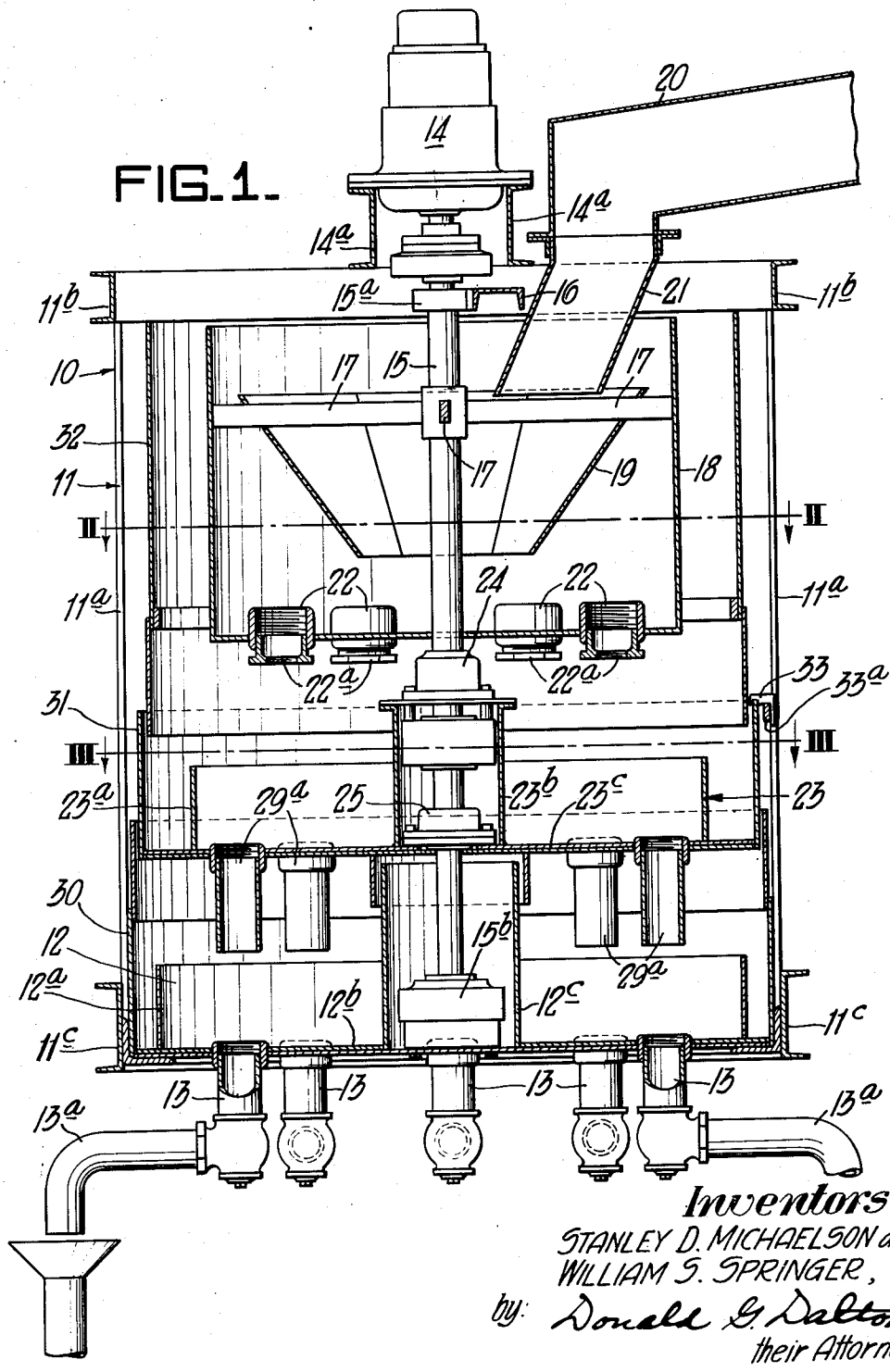
Sept. 16, 1952 S. D. MICHAELSON ET AL 2,610,646

PROPORTIONING DISTRIBUTOR FOR MINERAL PULP OR THE LIKE

Filed June 29, 1950 2 SHEETS—SHEET 1

FIG. 1.



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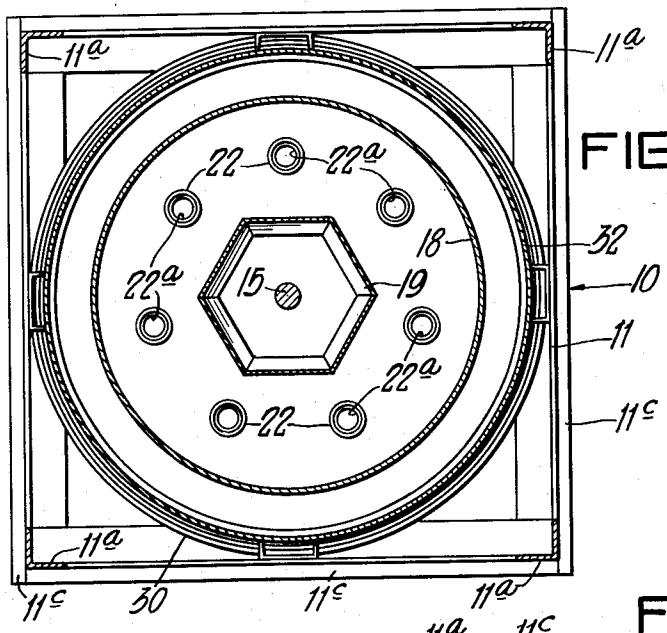


FIG. 2.

FIG. 3.

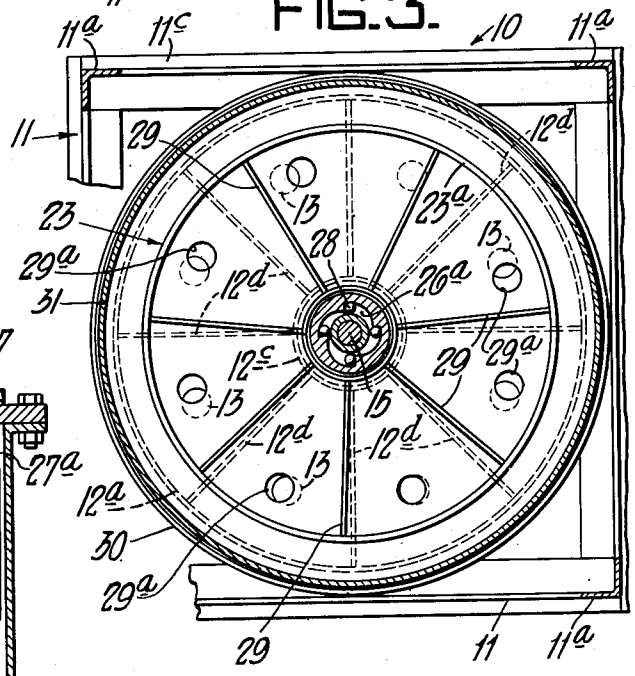
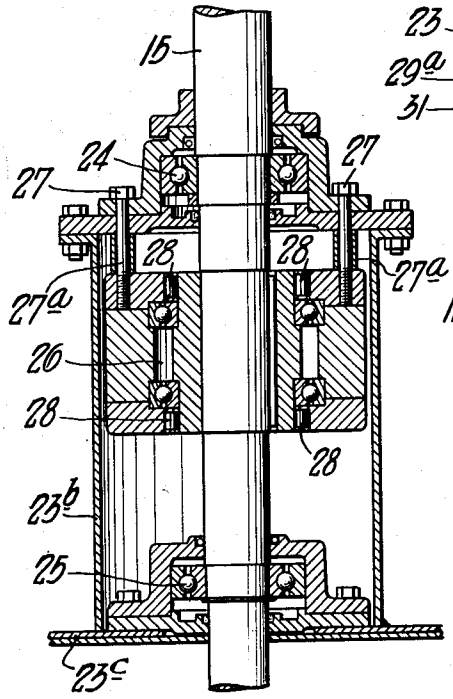


FIG. 4.



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UNITED STATES PATENT OFFICE

2,610,646

PROPORTIONING DISTRIBUTOR FOR MINERAL PULP OR THE LIKE

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7 Claims. (Cl. 137—262)

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This invention relates to apparatus for subdividing a stream of fluid material into fractions or "splits" which are equal quantitatively and qualitatively and, in particular, to apparatus having provision for reducing the number of splits or fractions by one, while maintaining equal distribution among the reduced number of fractions and without changing the flow of the parent stream.

In numerous industrial operations, it is desired to divide a stream of fluid material, e. g., a flotation liquid carrying solids in suspension, into fractions for delivery to a battery of processing apparatus units. An example is the treatment of pulp (a mixture of ore or coal with a liquid flotation medium) on concentrating or washing tables. In such operation, the pulp is mixed in a large tank and a stream therefrom is divided between a number of tables which is sometimes large. Thus the subdivision may involve successive stages, i. e., a primary subdivision followed by a secondary separation of each stream resulting from the primary stage. For purposes of maintenance or repair, it is occasionally necessary to shut down one of the processing units or tables of a group or battery. When this happens, the stream of pulp feeding the particular unit requiring maintenance attention must be either diverted to a spare unit or re-distributed among the units remaining in operation.

We have invented a novel apparatus for subdividing a pulp stream into a given number of fractions, which is capable of equally redistributing any selected fraction among the remainder when desired, thereby reducing the number of fractions by one and permitting the discontinuance of the supply of pulp to any unit of a battery of coal-washing or ore-concentrating tables, for example, without altering the flow of the main supply stream. In a preferred embodiment, we provide a tank having compartments to the desired number spaced about a common center, each with a bottom outlet. A rotating tank mounted on a vertical spindle above the stationary tank receives the main supply stream to be subdivided and is provided with bottom outlets spaced around the spindle, one less in number than the outlets of the stationary tank. An intermediate tank is journaled on the spindle between the rotating and stationary tanks and has compartments spaced about the spindle equal in number to the outlets of the rotating tank. Each compartment of the intermediate tank has a bottom outlet and the outlets are so located that, when the intermediate tank is stationary, they

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feed all but one of the compartments of the stationary tank. An overrunning clutch on the spindle causes it to drive the intermediate tank on rotation of the spindle in one direction but not in the other. A latch is provided for holding the intermediate tank in a selected position when it is not being driven.

We also make provisions for combining the streams from adjacent outlets in the stationary tank, thereby reducing the number of equal fractions to half the number of outlets.

A complete understanding of the invention may be obtained from the following detailed description and explanation which refer to the accompanying drawings illustrating a preferred embodiment.

In the drawings,

Figure 1 is a central vertical section through our distributor showing parts in elevation;

Figures 2 and 3 are transverse sections taken along the planes of lines II—II and III—III, respectively, of Figure 1; and

Figure 4 is a vertical section through the bearings and overrunning clutch of the intermediate tank.

Referring now in detail to the drawings, the distributor indicated generally at 10 is mounted within a structural frame 11 including corner posts 11a and upper and lower cross-members 11b and 11c, respectively. A tank 12 is disposed at the bottom of the frame. It is composed of a circular side wall 12a, a bottom 12b, a central sleeve 12c and is divided into a plurality of compartments by radial partitions 12d. The compartments are spaced circumferentially about the axis of sleeve 12c. An outlet 13 extends through the bottom of each compartment and is provided with a nozzle 13a swiveled thereto. The tank 12 may be divided into any desired number of compartments. In the illustrated embodiment, there are eight, as shown in Figure 3.

A gear motor 14 is mounted on cross-beams 14a on top of the frame 11 and drives a vertical spindle 15 journaled centrally in the frame in a radial bearing 15a and a thrust bearing 15b. The bearing 15a is mounted on a cross-beam 16 and bearing 15b is mounted on the bottom of the tank 12 within the sleeve 12c. Arms 17 extending radially from the spindle 15 support a rotating tank 18 and a baffle 19 disposed therein which is open at the top and bottom and converges downwardly. The fluid stream to be divided into fractions is delivered by a launder 20 to a feed box or spout 21 which discharges into the baffle 19. The tank 18 has outlets 22 in the bottom thereof

spaced circumferentially about the axis of the spindle 15. The number of these outlets is one less than the number of compartments and bottom outlets 13 in tank 12, i. e., seven in the illustrated example, as shown in Figure 2. Each outlet has a spud 22a removably disposed therein so that the combined volume of flow from the tank may be adjusted by changing spuds.

An intermediate tank 23 is journaled on the spindle 15 between the tank 12 and the tank 18. The tank 23 comprises a circular side wall 23a, a central sleeve 23b and a bottom 23c. Spindle 15 extends through the sleeve and the upper end of the latter is secured to a bearing 24 while the bottom is secured to a bearing 25 on the spindle, as shown more clearly in Figure 4. These bearings permit the tank 23 to remain stationary while the spindle 15 turns. An overrunning clutch 26 between the bearings has an inner member keyed to the spindle and an outer member secured to the outer race of bearing 24 by bolts 27 extending through spacer sleeves 27a. Wedging recesses 26a between the inner and outer members of the clutch have rollers 28 therein which serve in the known manner to cause frictional engagement between the clutch members when the spindle is driven clockwise, as shown in Figure 3. Thus, the tank 23 turns with the spindle when the latter is driven clockwise but remains stationary when the spindle is driven in the reverse direction. Tank 23 is divided into a plurality of compartments by radial partitions 29 and each compartment has an outlet 29a extending through the bottom thereof. The number of compartments and outlets in tank 23 is the same as the number of outlets 22a from tank 18, i. e., one less than the number of outlets 13, or seven, in the illustrated embodiment.

A cylindrical stationary splash guard 30 extends upwardly from the bottom of tank 12. A similar guard 31 within the guard 30 extends upwardly from the bottom of tank 23 which extends outwardly beyond the side wall thereof. The guard 31 therefore rotates with tank 23 when it is in motion. A similar stationary guard 32 is suspended from the top of the frame 11 and fits within the guard 31. A latch member 33 is pivoted on a cross-bar 33a secured to the frame 11 and is adapted to enter one of a plurality of notches spaced circumferentially about the upper edge of the guard 31 to hold the tank 23 in a pre-selected position when the spindle 15 is driven counter-clockwise, for a purpose which will appear shortly.

In order to explain the operation of the apparatus, it will first be assumed that spindle 15 is being driven clockwise so that the intermediate tank 23 rotates with tank 18. The fluid stream, e. g., mineral pulp, delivered by launder 20 falls through feed box 21 and baffle 19 into tank 18. The spuds 22a have openings of such size as to maintain tank 18 normally about one-half full of fluid. Since the tank 23 rotates with the tank 18, each of the outlets 22 of the latter feeds one of the compartments defined by the baffles 29 in tank 23. Each outlet 29a of tank 23, furthermore, distributes its portion of the supply stream uniformly among the compartments of tank 12 defined by partitions 12d. The total input to each compartment of tank 12, of course, will be constituted by the fractional portions deposited therein by each of the outlets 29a in passing over that compartment. It is evident that, with a uniform speed of spindle 15, equal amounts of fluid material will be deposited in each compartment of tank 12. The resulting eight fractions of the supply stream are conducted to the several processing units by suitable connections (not shown) extending from the nozzles 13a swiveled to outlets 13.

In order to reduce the number of sub-divisions or fractions of the main stream leaving the distributor 18 from eight to seven, it is only necessary to reverse the direction in which the spindle 15 is driven and operate latch 33 to hold tank 23 in a pre-selected position. When tank 18 is driven counter-clockwise by spindle 15, its outlets 22a distribute the supply stream among the compartments of tank 23, now being held stationary, in the same manner in which the tank 23, when rotating distributes the fluid material uniformly among the compartments of tank 12, as described above. It will be noted from Figure 3 that all compartments of tank 12, except one, are supplied by an outlet 29a from tank 23. That is, the outlets 29a number one less than the compartments in tank 12 and are positioned so that each one discharges into only one of seven of the compartments of tank 12 leaving the eighth without fluid material. The distribution of the incoming stream from tank 18 to the compartments of tank 23 being uniform because of the relative rotation, the incoming material is now redistributed uniformly among seven of the outlets 13 from tank 12 instead of eight as previously, the flow from each outlet being increased proportionately.

The particular compartment of tank 12 which is deprived of fluid material depends on the position of tank 23 relative to tank 12, i. e., it depends on which of the outlets 13 is under the portion of tank 23 between the most widely spaced outlets 29a, as readily observable in Figure 3. Thus, by adjusting tank 23 appropriately relative to any one of the outlets 13 from tank 12, the fluid supply to that particular outlet may be discontinued. For this purpose, the splash guard 31 has eight notches spaced circumferentially at its upper edge for cooperation with latch member 33.

By virtue of the construction and operation described, it will be apparent that the incoming fluid material is distributed uniformly among all the outlets 13 while the tank 23 is rotating and that the flow of material from any one of the outlets 13 may be stopped by holding tank 23 stationary in a previously selected position. This permits the processing unit fed from any one of the outlets to be shut down without interfering with the continued operation of the others and without requiring any stoppage or change in the flow of incoming material. The swiveled nozzles on outlets 13 may be adjusted or positioned so that each pair of adjacent outlets discharge into the same duct or pipe, thus reducing the total number of sub-divisions of the main stream to one-half the number usually existing, i. e., from eight to four.

We claim:

1. A proportioning distributor for subdividing a stream of fluid material comprising a tank having a plurality of compartments spaced about a common center, each compartment having an outlet, a rotating tank above said first-mentioned tank mounted on a vertical spindle adapted to receive said stream, said rotating tank having outlets fewer in number than those of said first-mentioned tank, an intermediate tank journaled on said spindle between the first-mentioned tank and the rotating tank, said intermediate tank

having compartments spaced about said spindle of the same number as the outlets from said rotating tank, said intermediate tank having outlets, one from each compartment, said last-mentioned outlets being spaced so that each one is alined with but one of the compartments of the first-mentioned tank when the intermediate tank is held stationary, and an overrunning clutch on said spindle for driving said intermediate tank when said spindle rotates in one direction.

2. The apparatus defined by claim 1 characterized by the compartments in said first-mentioned and intermediate tanks being defined by walls disposed radially relative to the axis of said spindle.

3. The apparatus defined by claim 1 characterized by said first-mentioned and intermediate tanks having sleeves spaced radially from and surrounding said spindle and walls extending radially outward from said sleeves forming said compartments.

4. The apparatus defined by claim 1 characterized by a thrust bearing for said shaft in said first-mentioned tank and a radial bearing for the spindle above said rotating tank.

5. The apparatus defined by claim 1 characterized by said spindle being in substantially axial alignment with said common center.

6. A proportioning distributor for subdividing a stream of fluid material comprising a tank having a plurality of compartments spaced about a common center, a rotating tank mounted on a vertical spindle above said first-mentioned tank, said rotating tank having circumferentially

spaced outlets in the bottom thereof numbering fewer than said compartments, an intermediate tank journaled on said spindle between the first-mentioned tank and the rotating tank, having compartments spaced thereabout to the same number as the outlets from the rotating tank, said intermediate tank being adapted to remain stationary while the spindle rotates or to turn therewith, the compartments of the intermediate tank having outlets spaced so that each discharges into one only of the compartments of the first-mentioned tank when the intermediate tank is stationary.

7. The apparatus defined by claim 6 characterized by means effecting a driving connection between said spindle and said intermediate tank when the spindle turns in one direction.

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