Oct. 14, 1952 V. C. LORENZ 2,613,810

FROTH BREAKING APPARATUS

Filed Sept. 7, 1949 2 SHEETS—SHEET 1

FIG 1

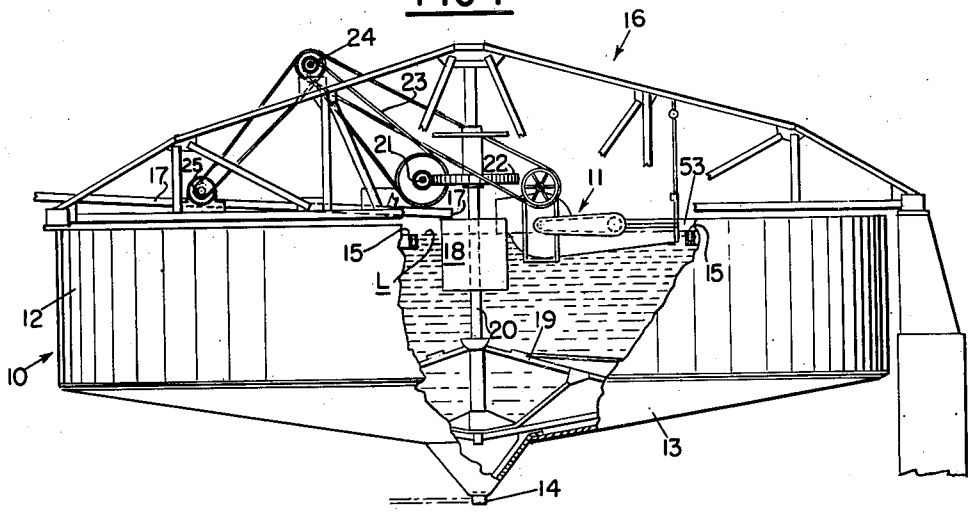
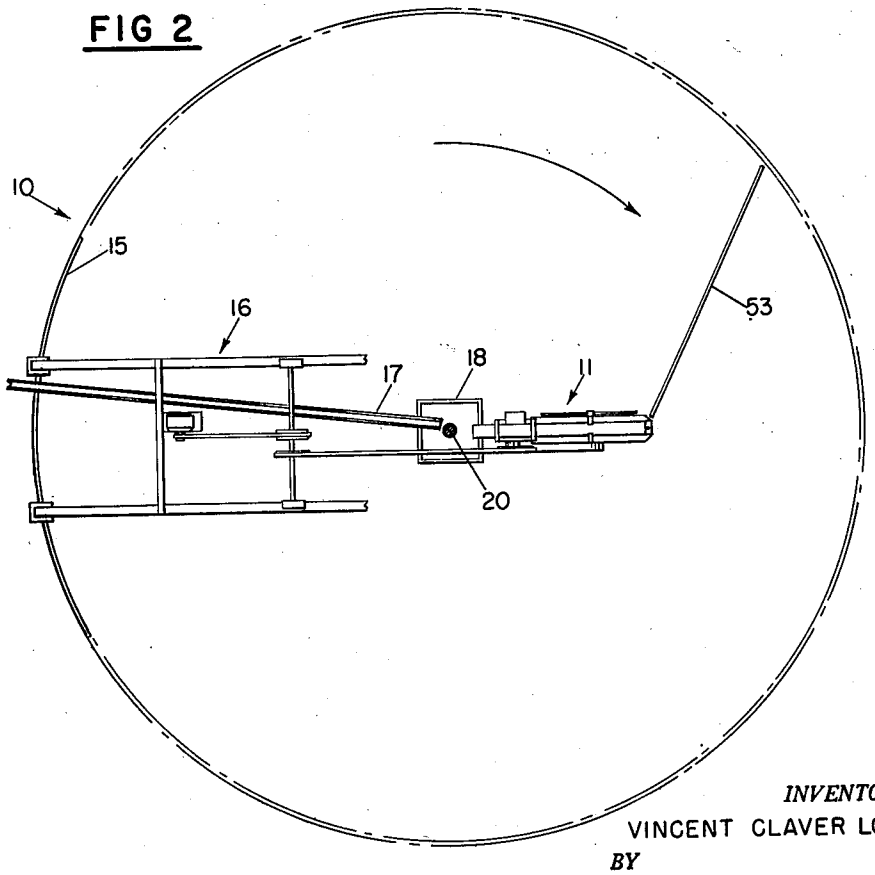



FIG 2




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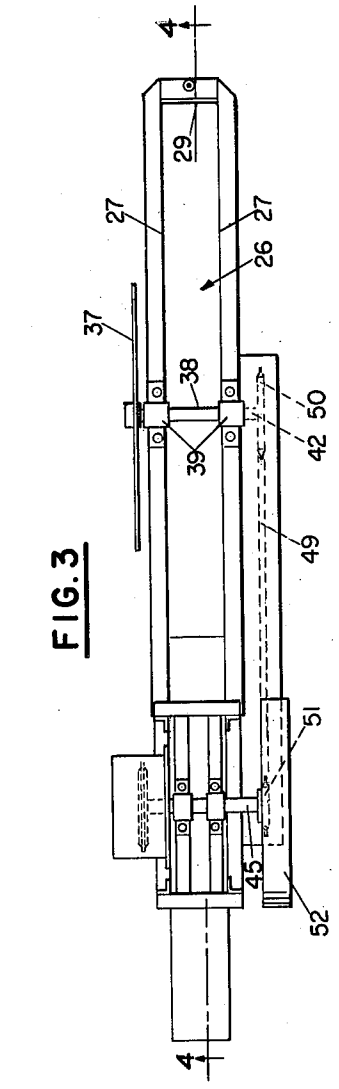


FIG. 3

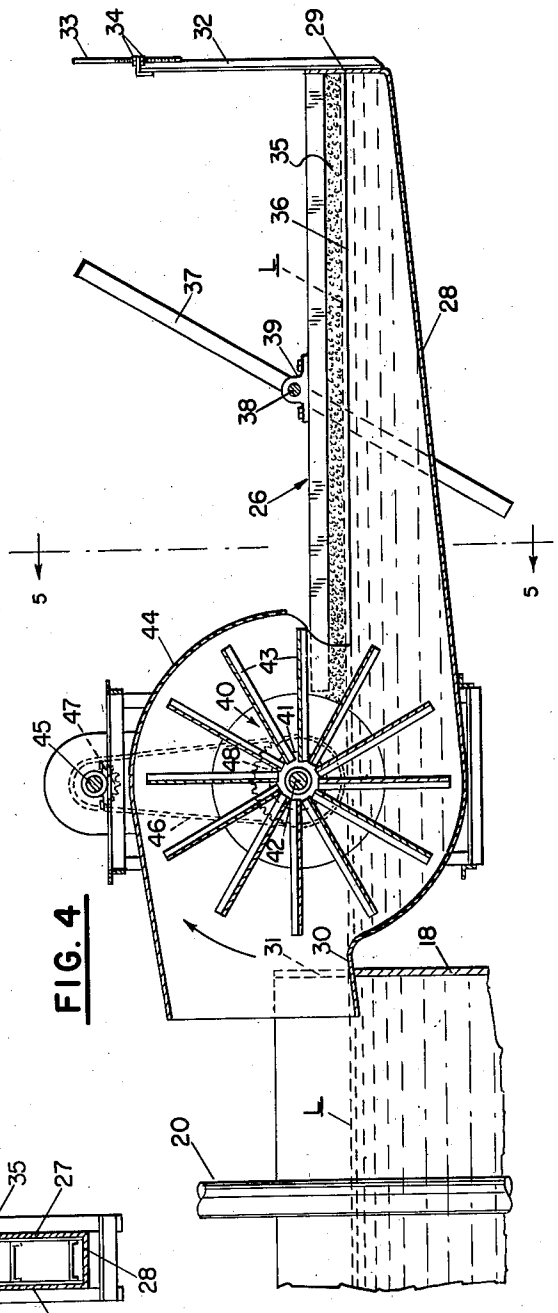


FIG. 4

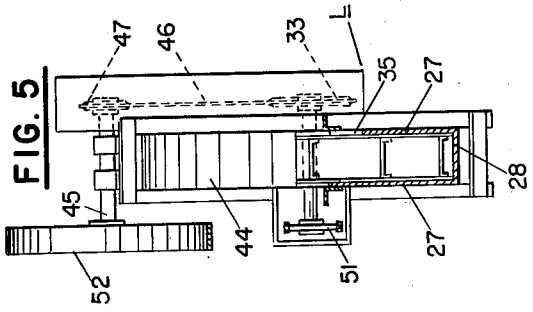


FIG. 5

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2,613,810

## FROTH BREAKING APPARATUS

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Application September 7, 1949, Serial No. 114,332

6 Claims. (Cl. 210—51)

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This invention relates to froth-breaking apparatus, and is directed particularly to the provision of an improved form of apparatus for breaking down froth that tends to form when a flotation concentrate pulp is thickened. It is quite common practice to dewater dilute flotation concentrate pulp in a conventional thickener, but not infrequently sufficient residual frothing and flotation reagents are present in the pulp fed into the thickener so that a substantial mat of mineral-bearing froth collects at the surface of the body of pulp therein. The presence of such froth in the thickener is highly objectionable because it tends to overflow with the clarified water, and the mineral particles it carries are thereby lost from the thickened concentrate.

The present invention provides an improved and highly effective froth-breaking apparatus that is readily installed on thickeners of conventional construction. The new froth-breaking apparatus comprises a launder which is mounted in the thickener in a substantially radial position, its inner end being in communication with the interior of the central feed well of the thickener and its outer end being closed. The launder lies about at the normal liquid level of the body of pulp in the thickener, and is partially but not wholly submerged in the pulp. One of the side walls of the launder is formed with a horizontal slot the lower edge of which lies just below the normal liquid level of the pulp, whereby pulp may flow continuously through the slot into the launder. A cutter blade is mounted adjacent the slotted side of the launder and is movable across the mouth of the slot, in close proximity thereto, in a plane parallel to the slotted side of the launder, thereby to break up froth carried on the surface of pulp flowing through the slot into the launder. Advantageously the cutter blade is a rotary device which is rotated in a vertical plane closely adjacent the outer surface of the slotted side of the launder. A continuous acting elevator is mounted in the launder adjacent its inner end to lift pulp out of the launder and over a discharge lip at the inner end thereof into the thickener feed well, thereby to enable pulp to flow continuously in through the slot. A froth-gathering baffle may extend from the closed outer end of the launder to the wall of the thickener tank to direct froth floating on the surface of the pulp toward the cutter blade.

The foregoing and other features of the new froth-breaking apparatus are described below with reference to the accompanying drawings, showing a particularly advantageous form of the apparatus, in which

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Fig. 1 is an elevation, partially in section, of a thickener provided with the froth-breaking apparatus of the invention;

Fig. 2 is a plan view of the thickener shown in Fig. 1, showing more clearly the location of the froth-breaking apparatus;

Fig. 3 is a plan view on an enlarged scale of the froth-breaking apparatus itself;

Fig. 4 is a longitudinal section through the apparatus, taken substantially along the line 4—4 of Fig. 3, showing also its relation to the feed well of the thickener; and

Fig. 5 is a section taken substantially along line 5—5 of Fig. 4.

Figs. 1 and 2 show a conventional thickener 10 equipped with the new froth-breaking apparatus 11 of the invention. The thickener itself comprises a large, relatively shallow, cylindrical tank 12 having a bottom 13 which slopes down from the walls of a tank to a central pulp discharge spigot 14 for the thickened pulp. About the inside periphery of the tank 12, near its upper edge, is an overflow launder 15 for clarified water from which the solid components of the pulp have settled. The tank 10 is spanned by a bridge structure 16 for supporting the thickener mechanism, and which is also used to provide support for the froth-breaking apparatus of the invention.

The concentrate pulp to be thickened flows into the thickener through a feed launder 17 which discharges into a central feed well 18. The feed well, which is open both at top and at bottom and which is suspended from the bridge, prevents the incoming stream of pulp from seriously agitating the main body of pulp in the thickener tank. The thickener tank is normally filled with pulp to a level L determined by the location of the upper edge of the overflow launder 15. The main body of pulp in the thickener is maintained substantially quiescent, so that the fine, solid particles therein are given an opportunity to settle to the bottom. A trussed rake mechanism 19, suspended from and slowly rotated by a central shaft 20, rakes the settled solids to the central discharge spigot 14. The shaft 20 is rotated by a worm 21 engaging with a worm gear 22 and driven by a belt 23 from a countershaft 24, which in turn is driven by a motor 25.

Referring more particularly to Figs. 3 to 5, the new froth-breaking apparatus 11 comprises a launder (i. e., a trough-like chamber) 26 having vertical side walls 27 and a bottom 28 which slopes downwardly from the closed outer end 29 of the launder toward the inner end thereof ad-

jacent the feed well 18 of the thickener. The inner end of the launder 26 is formed with a pulp-discharge lip 30, and in the form of apparatus shown in the drawings the inner end of the launder is mounted in place by pivotally supporting the discharge lip on a wall of the feed well 18. This wall of the feed well is formed with a slot 31 in which the discharge lip 30 is received, and of sufficient depth so that the discharge lip lies about at the normal liquid level L of the pulp. The outer end 29 of the launder is suspended by a bracket 32 attached to a tie rod 33 fastened in turn to the bridge structure 16. This support for the outer end of the launder is made vertically adjustable by the provision of nuts 34 engaging the threaded lower end of the tie rod and clamping the bracket 32 between them, thereby to permit movement of the launder through an arcuate path in a vertical plane about the pivotal support of the pulp-discharge lip 30 on the wall of the feed well, and so make it possible to adjust the position of the launder vertically relative to the liquid level L of the pulp in the thickener.

One of the side walls 27 of the launder is formed with a substantially horizontal slot 35 which extends throughout most of the length of the launder. The lower edge 36 of this slot lies just below the normal level L of the pulp, so that pulp is enabled to flow continuously through the slot into the launder. To assist in breaking up froth floating on the surface of the pulp flowing into the launder, a rotary cutter blade 37 is provided. The cutter blade is mounted on the end of a horizontal shaft 38 journalled in bearings 39 fastened to the side walls of the launder, and so may be rotated in a vertical plane in close proximity to the slotted side wall of the launder and to the mouth of the slot 35.

Mounted in the launder at its inner end adjacent the thickener feed well 18 is a pulp elevator 40 of the paddle wheel type. The elevator comprises a hub 41 secured to a horizontal shaft 42 and provided with a series of radial pulp lifting paddles 43. By rotating the elevator wheel 40 in the direction indicated by the arrow, pulp in the launder is propelled toward the feed well 18 and is lifted sufficiently to discharge it over the discharge lip 30 into the feed well. The elevator assembly is covered by a hood 44 to prevent it from splashing pulp into the main body thereof in the thickener.

Both the pulp elevator 40 and the cutter blade 37 are driven from a countershaft 45. The shaft 42 of the elevator is connected directly to the countershaft 45 by means of a sprocket chain 46 engaging sprocket wheels 47 and 48 on the countershaft and on the elevator shaft, respectively; and the cutter blade shaft is indirectly connected to the countershaft by a sprocket chain 49 engaging sprocket wheels 50 and 51 on the cutter blade shaft and on the elevator shaft, respectively. The countershaft 45 is provided with a pulley wheel 52 by which it is belt-driven from the same countershaft 24 through which the thickener rake mechanism is actuated.

Operation of the apparatus is as follows: The slow rotation of the rake structure 19 at the bottom of the thickener tank 12 imparts a slow rotary motion (in the direction of the arrow in Fig. 2) to the body of pulp. The action of the rake in imparting such rotary motion may be augmented, if desired, by directing small jets of water against the surface of the pulp, at an acute angle thereto near the periphery of the thickener tank. Thereby any froth carried on the surface of the pulp is soon brought into position to flow through the slot 35 into the launder of the froth-breaking apparatus 11. When, as shown in the drawing, the length of the froth-breaking apparatus is less than the radius of the thickener tank, a froth-gathering baffle 53 is provided, extending obliquely from the closed outer end 29 of the launder 26 to the wall of the thickener tank, in order to direct froth accumulating in the peripheral portion of the pulp body in toward the froth-breaking apparatus. The baffle 53 of course is positioned so that it lies partially submerged in and partially extending above the body of the pulp.

As the pulp flows through the slot 35, it carries the floating froth under the cutter blade 37, which is advantageously rotated at, say, about 25 R. P. M. To a considerable extent, the froth is broken down mechanically by the action of the cutter blade. A continual inflow of pulp into the launder of the froth-breaking apparatus, and hence a continual flow of froth through the plane of rotation of the cutter blade, is assured by rotation of the pulp elevator, which continuously discharges pulp from the launder over the discharge lip 30 into the feed well of the thickener, whence it flows downwardly into the main body of pulp well below the surface thereof. Since the discharge lip 30 is in about the same horizontal plane as the lower edge 36 of the slot 35, the elevator does not have to lift the pulp very much to assure a continuous inflow thereof through the slot. Any froth still persisting after passing by the cutter blade is subjected to the mechanical froth-breaking action of the elevator, and thereafter to the froth-breaking agitation which takes place within the feed well due to the continual inflow of fresh pulp through the launder 17 and of circulated pulp flowing over the discharge lip 30 of the froth-breaking apparatus.

The new froth-breaking apparatus has been found to be highly effective in actual use. A Dorr-type thickener equipped with froth-breaking apparatus of the character described and used to thicken a zinc-lead sulphide flotation concentrate practically eliminated the froth mat that had persistently floated on the surface of the pulp in the thickener prior to installation of the froth-breaking apparatus. Coincidentally, the amount of zinc lost in the thickener overflow was reduced by over 4000 pounds per month, and the amount of lead lost similarly was reduced by over 1000 pounds per month. Equivalent froth-breaking efficiency and savings in mineral values can be obtained when the new froth-breaking apparatus is used in combination with thickeners employed in the dewatering of other froth flotation concentrate pulps.

I claim:

1. The combination with a thickener adapted to be filled with a body of pulp to a normal liquid level and having a central pulp feed well, of froth-breaking apparatus which comprises a launder communicating at its inner end with the interior of the feed well and projecting outwardly therefrom, said launder being closed at its outer end and being positioned about at the normal liquid level of the pulp, one of the side walls of said launder being formed with a horizontal slot the lower edge of which lies just below the normal liquid level of the pulp, whereby pulp may flow continuously through said slot into the launder, a rotary cutter blade mounted for rota-

tion closely adjacent the slotted side of the launder and movable across the mouth of the slot in a plane substantially parallel to the plane of the slotted side of the launder, thereby to break up froth carried on the surface of pulp flowing into the launder, and an elevator mounted in the launder adjacent its inner end for lifting pulp out of the launder and into the feed well.

2. Apparatus according to claim 1, characterized in that the inner end of the launder is pivotally supported on a wall of the feed well, and further characterized in that the outer end of the launder is held in place by a vertically adjustable support, whereby the launder may be moved through an arc in a vertical plane about the point of its pivotal support on the feed well wall to adjust its position relative to the normal liquid level of pulp in the thickener.

3. The combination with a thickener adapted to be filled with a body of pulp to a normal liquid level and having a central pulp feed well and means for slowly rotating the body of pulp, of froth-breaking apparatus which comprises a launder closed at its outer end and communicating at its inner end with the interior of the feed well, said launder being partially submerged in the body of pulp when the thickener is filled with pulp to its normal liquid level, one side wall of the launder being formed with a horizontal slot the lower edge of which lies just below the normal liquid level of the pulp, whereby pulp may flow through the slot into the launder, and the bottom of the launder being sloped downwardly in the direction of the feeding well, a rotary cutter blade mounted for rotation in a vertical plane closely adjacent the outer surface of the slotted side of the launder, thereby to break up froth carried on the surface of pulp flowing into the launder, a froth-gathering baffle extending horizontally from the closed end of the launder to the wall of the thickener for directing froth floating on the slowly rotating pulp body toward the rotary cutter blade and the slot in the side wall of the launder, and a rotary elevator wheel mounted in the launder adjacent its inner end for lifting pulp out of the launder and into the feed well.

4. Froth-breaking apparatus of the character described comprising a launder having a substantially horizontal pulp inlet slot in one of its side walls, a rotary cutter blade mounted for rotation closely adjacent said slotted side wall and movable across the mouth of the slot in close proximity thereto and in a plane substantially parallel to the plane of the slotted side, thereby to break up froth carried by pulp entering through the slot into the launder, a pulp discharge lip at one end of the launder, and a pulp elevator mounted in the launder adjacent said lip for lifting pulp thereover and out of the launder.



5. Froth-breaking apparatus of the character described comprising a launder having a substantially horizontal pulp inlet slot in one of its side walls, a rotary cutter blade mounted for rotation in a vertical plane in close proximity to the mouth of the slot, thereby to break up froth carried by pulp entering through the slot into the launder, a pulp discharge lip at one end of the launder and in substantially the same horizontal plane as the lower edge of the slot, and an elevator mounted in the launder adjacent said discharge lip, whereby pulp entering the launder through the inlet slot may be lifted sufficiently to be discharged over said discharge lip.

6. Froth-breaking apparatus of the character described comprising a launder having a bottom sloping downwardly from one end to the other and having a substantially horizontal pulp inlet slot in one of its side walls, a rotary cutter blade mounted for rotation across the mouth of said slot in close proximity thereto and in a plane substantially parallel to the slotted side wall, thereby to break up froth carried by pulp entering through the slot into the launder, a pulp discharge lip at the deep end of the launder and in substantially the same horizontal plane as the lower edge of the pulp inlet slot, and a rotary paddle wheel elevator mounted in the launder adjacent said pulp discharge lip, whereby pulp entering through the inlet slot may be discharged from the launder over the discharge lip.

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