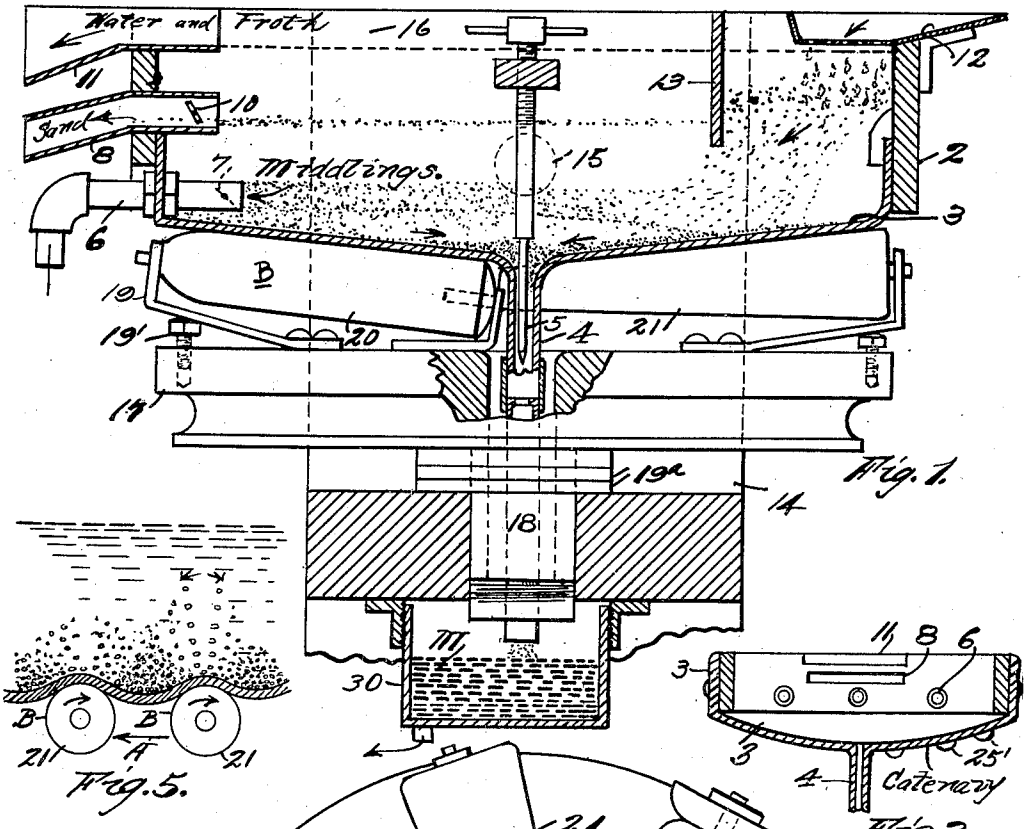
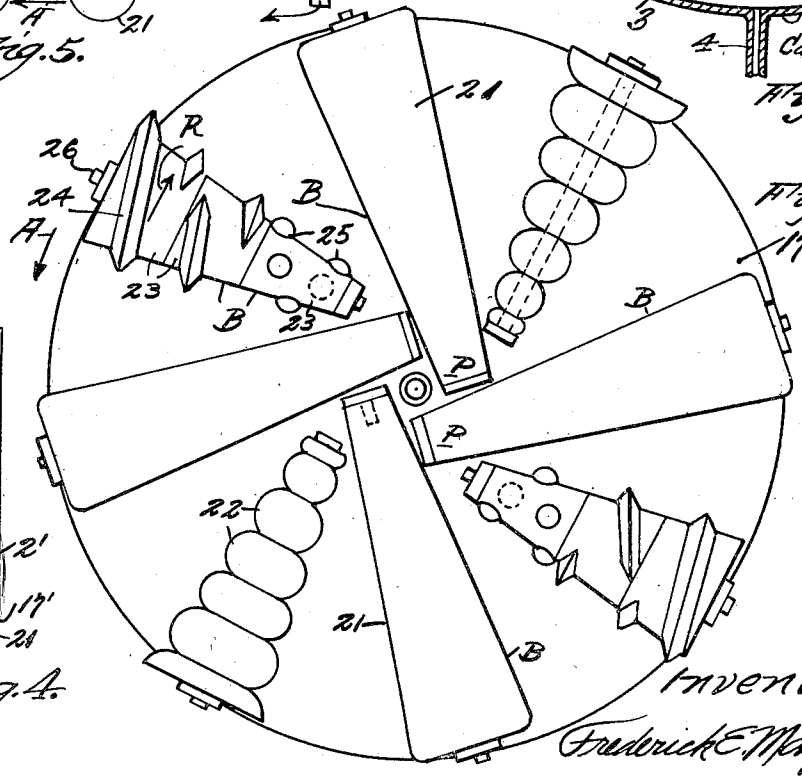
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Sept. 18, 1945. F. E. MAYNARD 2,385,094

CLAY SETTLING, CENTRIPETAL REACTION CONCENTRATOR AND AMALGAMATOR

Filed Nov. 15, 1943 3 Sheets-Sheet 1







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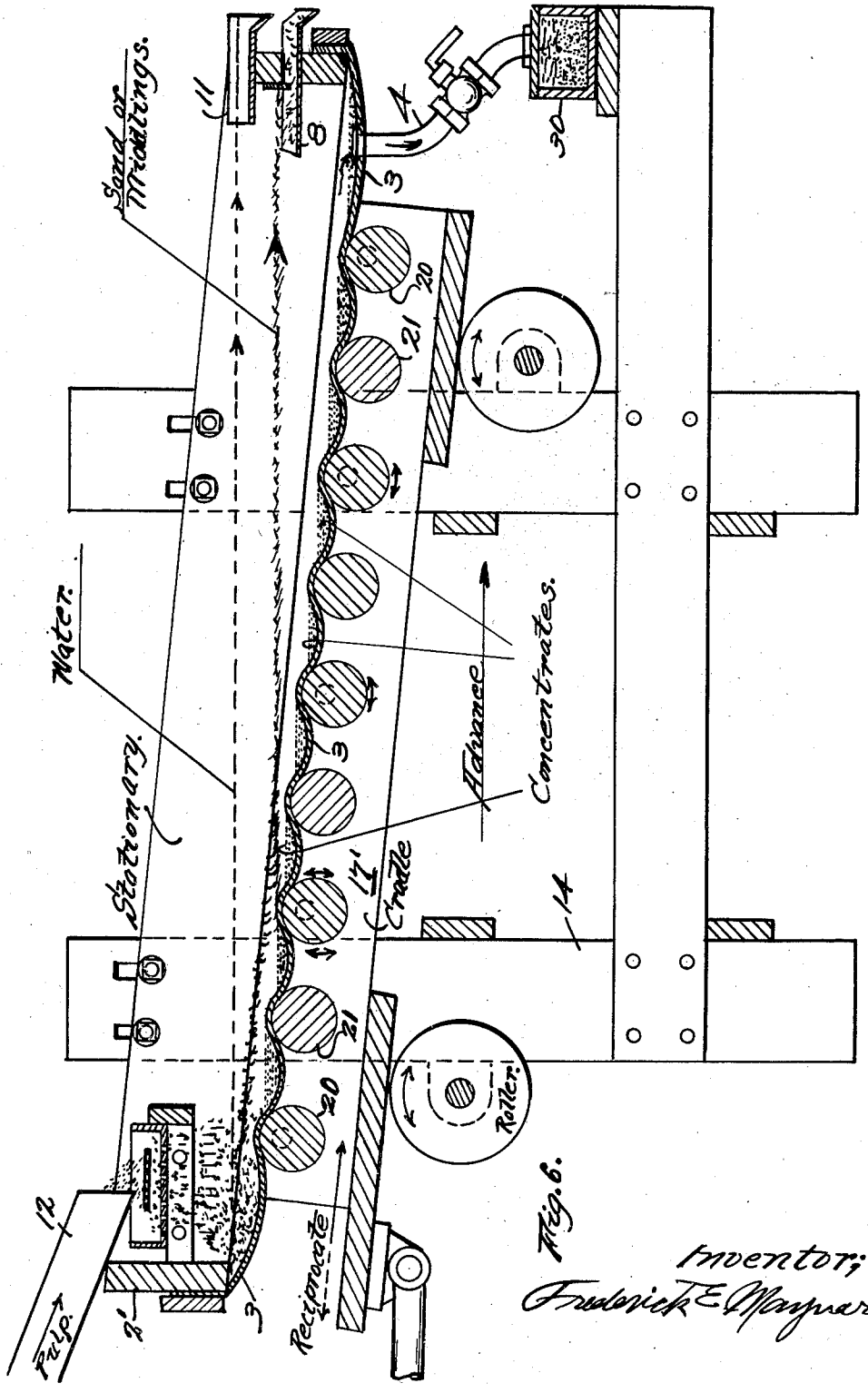


Fig. 6.

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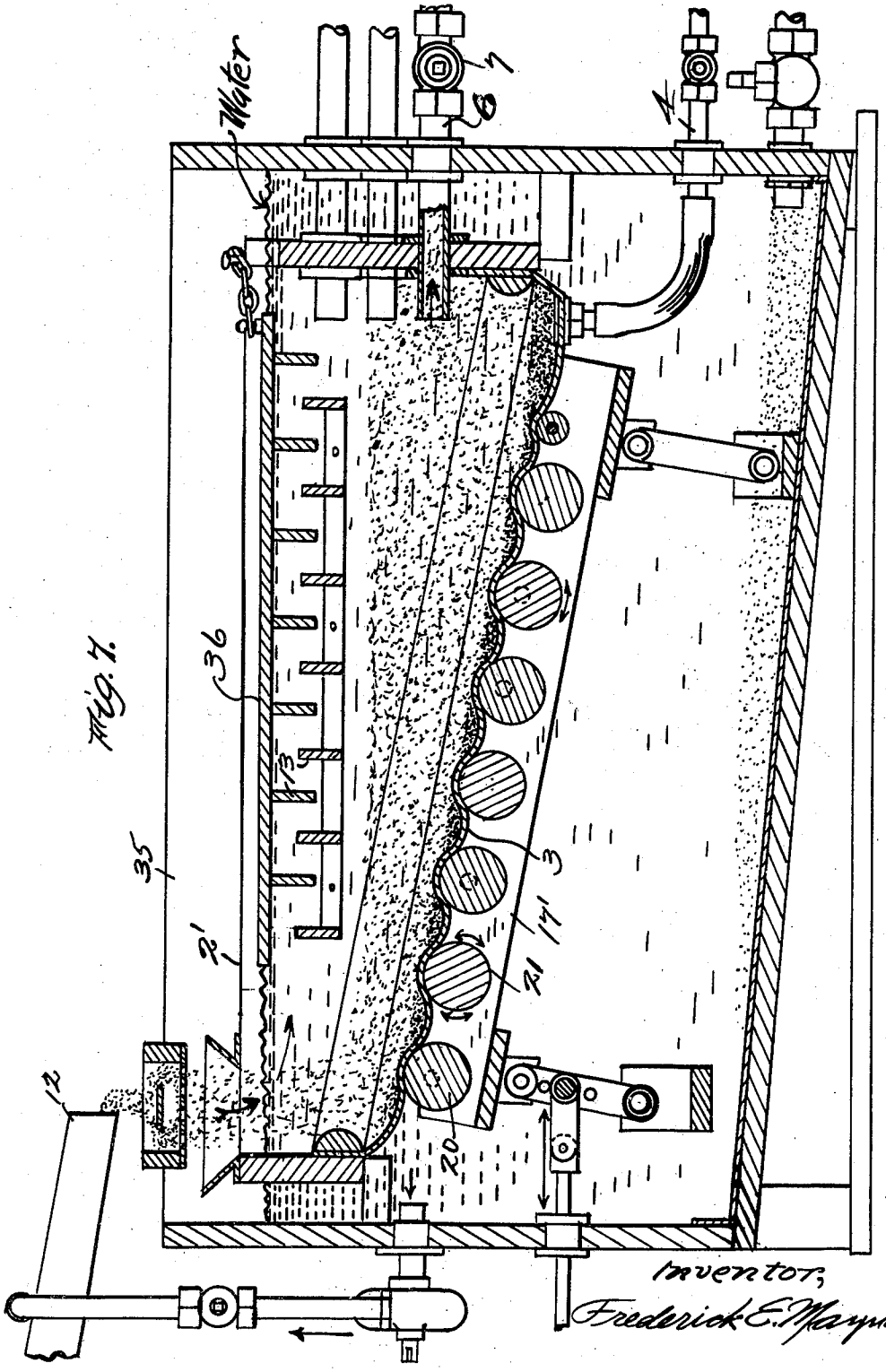


Fig. 4.

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CLAY SETTLING, CENTRIPETAL REACTION CONCENTRATOR AND AMALGAMATOR

Frederick E. Maynard, Los Angeles, Calif.

Application November 15, 1943, Serial No. 510,410

12 Claims. (Cl. 209—422)

This invention is a means and a method for gravity concentration of a desired concentrate from its gangue or pulp.

This invention, by its principle, allows the heaviest grains in a pulp mass, whether wet or dry and according to the condition and nature of the pulp, to easily and quickly settle to a pliant sheet bottom on which a substantially stationary pool or mass of the pulp is created between a pulp feed means and a tailings discharge and which sheet is free to sag down and has at its lowermost point a tap outlet for the desired concentrate. Further, this invention causes the concentrate to gradually advance by gravity as well as by a mechanical advancing means toward said concentrate tap.

In order to accomplish the quick and clear concentration of the heaviest particles, according to specific gravity, it is an object of the invention to create a considerable area pool or dry bed of the gauge or pulp and to keep the pool stationary except for control-flow from supply to discharge sides, and to continuously, gently, upwardly knead the granular, settled mass in such a manner that all particles will be repeatedly loosened up and thus prevent the building of a solid, stiff bed of grains, which form of bed would prevent the natural law of gravitation from taking effect on the fine, heavy particles unable to pass or push their way down through a matted layer of grains even if they are lighter in weight.

A purpose of the invention is to provide a simple means to carry on the method of this invention so as to facilitate upward kneading of the pool in undulation generally throughout the mass, and to provide means for accelerating a centripetal creep of the concentrate toward a bottommost tap therefor, and also for separate drain off of middlings.

Variant forms of the invention are shown in the drawings, and

Figure 1 is a vertical section of a stationary pool pan. Figure 2 is a plan of a rotary actuator to undulate the pan bottom and pulp grains thereon. Figure 3 is a vertical section showing the normally smooth, free catenate form of the pan bottom. Figure 4 is a plan showing a sluice box form. Figure 5 diagrammatically shows the wave-form undulation of the pan bottom, made by the actuator. Figure 6 is a detail, vertical, longitudinal section of the box of Fig. 4. Figure 7 is a longitudinal section of a submerged box and a surface wave breaker floated therein.

A suitable, stationary pan 2 or box 2' has an impervious sheet bottom 3, of pliable material, on which a stationary pool of dry or wet pulp is created and which contains components of different specific gravity. This bottom 3 is normally smooth or unruffled to obtain a uniform bedding of pulp grains.

A concentrated tap 4 controlled by a valve 5 leads from the center and lowermost point of the bottom 3.

The bottom 3 of Figure 6 inclines down toward the outlet tap 4 to effect gravity advance of the concentrates away from the pulp inlet 12. Middlings can be drained off by a series of tubes having valves 7. Light grains can be let off at discharge outlet 8 by a control valve 9, if a valve is needed, Figure 1. Water and silt slimes are flowed off at a chute 11 above the sand outlet 8.

The pan or box is tiltably supported; as in a frame 15 by a pivot 15, and a clamp screw 16 fixes the pan inclined for pulp flow toward the tail outlet 11.

The flexible bottom 3 is gently, upwardly kneaded or undulated, Figure 5, by a system of rollers 20 and 21, of different forms, whose outer ends are journaled in bearings 16 which can be vertically adjusted by jack-screws 19', Figure 1, all mounted on a rotary or oscillating carrier 17 having a hollow shaft 18. Shims 19a raise or lower the carrier and rollers as to the bottom 3. The tops of the rollers all incline downwardly toward the central bottom zone of the sheet bottom 3.

The rollers knead or undulate the bottom 3 and also the bed of grains settling in the stationary pool and as the grains loosen in the bed spaces or interstices are created throughout the mass (without shaking the pan or box sidewise) and the heavy fine particles as of gold, or platinum, or cinnabar, or zinc or lead ores, can easily settle in the whole bed of agitated grains. The long, roller breasts B aid in pushing the concentrate toward the tap 4 when orbitting in direction A.

Ends P of the rollers cluster tangentially around the center outlet 4, Figure 2; other rollers are shorter in the assembly.

Conical rollers are made of relatively free, annular, peaked beads 22 as shown, to aid in commoting the grains. Inward or contripetal movement of the concentrates is accelerated by loose rollers 23 mounted on spindles 26 and having helical ridges 26, or having a helical row of nogs, 25, or both. The under face of the pliant bottom 3 may have nogs or ribs 25', Figure 3, to engage a relatively movable carrier-mounted actuator, as member 20.

Under the long sluice box 2', Figures 4 and 6,

is a cradle 17 reciprocating endwise and having a system of commoting rollers 20—21, all having top surfaces inclining, as in Figure 1, toward the low center of the bottom 3, which sags down under the load of pulp and rests on the shifting system of rollers, Figure 5.

The kneading commotion rubs the concentrate particles one on the other and aids in cleaning them of adherents and oxidation.

The tap 4 leads concentrates to a sealed pocket 30 which may contain mercury M which is never scoured away by flowing pulp because it is remote from the stream of flowing gangue to the discharge.

It is to be noticed that the grains are thoroughly loosened in the bed on the weaving bottom 3 but the mass is not violently tumbled over, and the valuable concentrate is not again jumbled back into the worthless gangue; the heavy particles once getting to the bottom 3 remain on and flow along the top face of the bottom until collected at the tap 4.

To avoid waste of expensive water in arid mine country the sluice box 2' is shown in Figure 7 as mounted fixed in a large tank 35 and its pliant bottom 3 is undulated by the desirably supported, oscillating, roller carrier 17'. Dry or mushy pulp is fed to the upper end of the box 2' and this is quickly thinned and washed by the water in which the box is well submerged. The one charge of tank water washes the pulp and carries to suspended silt and fines out into the tank where the particles has ample settling time, while gangue and sand is constantly led off, as free from water as reasonable, by tail pipes 6 packed in the tank wall. It is well known that certain mineral ores tend to crush into very fine grains and unless stopped in a settling receiver will cause a heavy loss. The tank 35 conserves water and gives settling time. Tap 4 is also sealed in the tank wall.

The forces commoting the water in the pan or box cause the formation of surface waves on the water above the pulp. Means, as a flat float 36 on the surface of the water, stops the wave formation and causes the generating lines of force to be expended in usefully breaking up the gangue bed on the bottom 3.

A suitable arrangement of barriers 13 is provided to increase the length of the flow path of water to give more settling time.

The static head in the box, Fig. 7, is substantially equalled by water head in the tank 35, therefore there is no water load on the bottom 3 or the rollers; the load of the gangue or pulp solids is imposed.

Reference is here made to parent application Ser. No. 399,488.

What is claimed is:

1. Concentrator comprising a pulp receiving pan having stationary, perimitral walls and a flexible sheet secured to the pan walls and forming the pan bottom and being free to flex downwardly toward its central zone and provided at about its lowest part with a concentrate discharge opening, pulp feed means and tail outlet means between which the pulp is confined for flow by the stationary pan structure, and an actuating means located below the pan bottom and having a device bodily movable as to and engaging and supporting portions of the bottom sheet above the general level of the unengaged portions of the sheet, whereby as the said device is bodily motivated by the actuating means the concentrated layer on the sheet will be kneaded; said device supporting the sheet on inclination toward the said discharge means; said device including a system of suitably spaced kneader members movable along the bottom surface of the sheet to continually change the effective supporting positions to facilitate advance of concentrates on the inclined sheet toward said concentrate discharge at the lowest part of the sheet.

2. A concentrator comprising a pan having vertically extending enclosing walls and a flexible sheet bottom secured to the lower edge of the enclosing walls, said sheet being free to flex downwardly to the center, and having a concentrate discharge opening at its lowest point, and an actuating means located below the pan and having a member rotatable about a vertical axis substantially concentric with the center of the pan, said member supporting a portion of the bottom of the sheet above the general level of the sheet, whereby as said member is rotating, the material on the sheet will be kneaded.

3. A gravity, pulp concentrator including a receiver for containing a volume of pulp in a generally horizontal position to permit settling and being fixed stationarily and having substantially opposite pulp feed means and tail outlet means for unidirectional feed flow as the pulp settles, said receiver having a generally smooth, pliant, freely downwardly, flexing bottom fixed thereon against any other than an upward kneading effect and over which the pulp feeds from inlet to outlet with a direct motion between the confining walls of the receiver, a concentrate discharge means from the lowest part of the pliant bottom to take off concentrate from the pulp as the pulp advances toward the outlet, a bodily horizontally movable system of members under the said bottom and engaging and supporting imposed portions thereof and arching the engaged portions as to the general contour of the pliant sheet to make alternate ridges and valleys therein and thereof, and means to horizontally shift the said system as to the supported sheet, whereby pulp grains on the sheet will be subjected to upward kneading and shifting actions by said members while the pulp flows unidirectionally between the stationary walls of the receiver; said members operating to facilitate the advance of the bedded concentrate toward said discharge means, and the said pliant bottom being normally unruffled other than by the corrugations formed by the said arching members to effect a substantially uniform and gentle kneading function.

4. The concentrator of claim 3; the said members having their upper surfaces, each for their whole length, unidirectionally inclined generally toward the low central portion of the flexed bottom to effect gravitational, shifting movement of concentrates toward said portion.

5. A pulp, gravity concentrating vessel having a pliant, freely flexing, water impervious bottom of normally unruffled, catenate section, laterally spaced, circumferentially helical-ridged members contacting and supporting imposed outer face portions of said pliant bottom in arches flexed inwardly from the general catenate contour of the bottom, and means for effecting a relative horizontal shifting of the bottom supporting members and the engagement positions on the bottom; whereby the helical features of said members will cause concurrently a kneading action of the thus supported bottom and any pulp material bedded thereon and will also cause a

desired, given travel of the concentrates, in the bedded material, on said bottom.

6. The concentrator of claim 1, and means lying contiguous to the upper, horizontal surface of the pulp to confine it thereat and prevent the generation of surficial waves incident to the vertical undulations set up in the pulp as it is kneaded.

7. The concentrator of claim 1, and baffle means, in the pan, intercepting the moving pulp to give it a lengthened path from inlet to outlet to secure a longer settling period of time.

8. The concentrator of claim 1, means lying horizontally in the pan and baffling lines of force tending to make surface waves in the pulp and thereby causing said waves to be dispelled in directions to increase pulp disturbance.

9. The concentrator of claim 1, and a relatively stiff float supported on the pulp mass and covering a large proportion of its surface and confining it against generation of surficial waves incident to undulations created by the kneading action.

10. A concentrator including a water tank, and a sluice box substantially submerged and rigidly fixed in the tank and in open communication therewith and having an upwardly kneadable impervious bottom, means to generally knead the said bottom to agitate pulp material settled thereon, means to tap concentrate from the bottom of the box, and means to separately drain off waste material from the pulp; the submerged bottom being substantially free of water load and subject substantially to only the load of the solids in the flowing pulp, and means for continuously feeding pulp to the box for passage to the outlets.

11. The method in gravity, pulp concentration, which consists of the formation of a substantially stationary pool of the pulp and the creation of a substantially continuous blanket of the pulp grains to facilitate gradual, unjostled descent of a mass from the pulp and keeping the blanket substantially stationary, feeding fluent pulp to the pool at one portion, generally uniformly upwardly kneading the blanket by uparching the same at numerous spaced portions and at the same time laterally shifting the up-arched portions to open interstices in the blanket of grains from the pulp to effect gravitation of the heaviest particles to concentrate the same at the bottom of the blanket, and running off tailings at a point separate from the point of pulp feed, and tapping off the concentrate from the lowest point of the pool.

12. The method of claim 11, and at the same time also working the concentrate to effect a centripetal advance thereof in the bottom of the blanket mass.

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