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APPARATUS FOR SEPARATING SOLID MATERIALS HAVING DIFFERENT SPECIFIC GRAVITIES BY MEANS OF A SUSPENSION

Filed May 14, 1940

Serial No.
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2 Sheets-Sheet 1

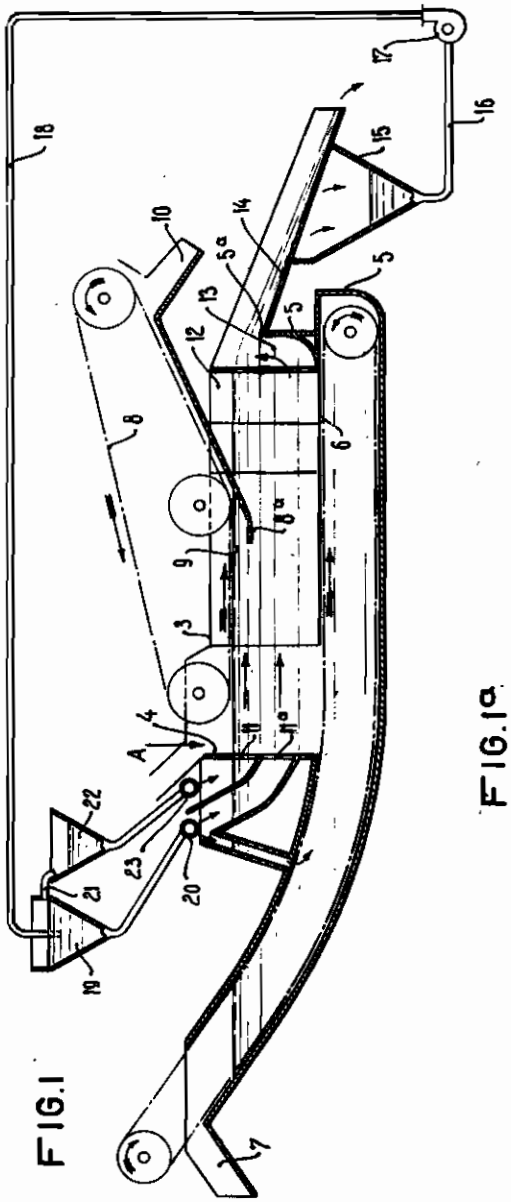

FIG. 1

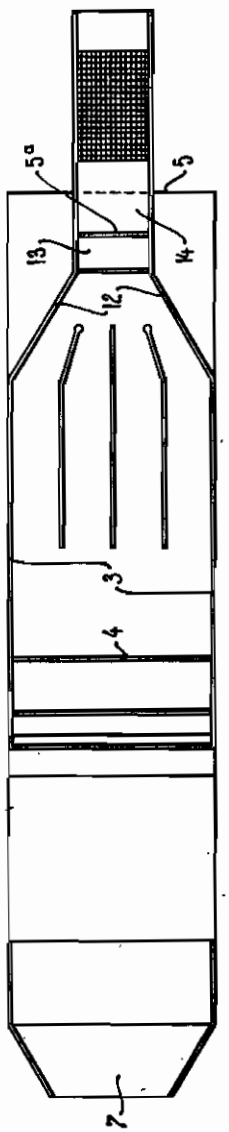

FIG. 1a

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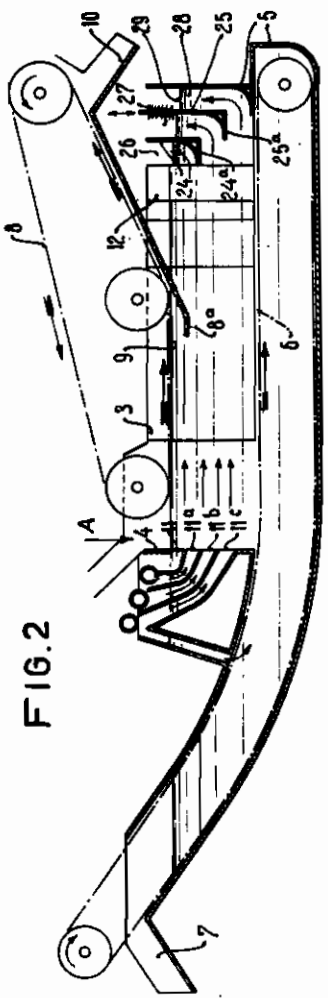

FIG. 2

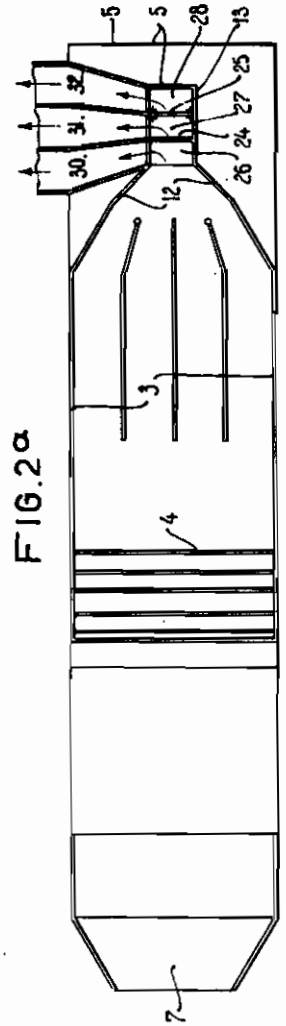

FIG. 2a

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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR SEPARATING SOLID MATERIALS HAVING DIFFERENT SPECIFIC GRAVITIES BY MEANS OF A SUSPENSION

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Application filed May 14, 1940

This invention relates to an improvement in the apparatus disclosed by my prior United States Patent 2,139,047, i. e. in apparatus for separating solid materials having different specific gravities by means of a suspension of "sand" in "water." This apparatus comprises a tank containing a body of a suspension of sand in water having a downwardly increasing density, said tank being further provided, in addition to means for creating substantially horizontal currents in the suspension at different distances above the bottom, with means for removing suspension from different levels in the tank, means for removing the floating products, and one or more means for removing products transported by the currents towards the side wall at an intermediate level in the tank.

More especially my invention relates to the aforesaid means for removing products transported by the currents towards the side wall at an intermediate level in the tank. In accordance with my aforesaid prior patent, these means comprise one or more drag conveyors movable across side wall openings, through which suspension is adapted to be discharged from different levels in the tank. In practice it has been found that this construction is not entirely satisfactory, owing, inter alia, to the fact that a movable drag conveyor disturbs the parallel flow of the suspension and sets up eddies therein, whereby the suspended products are difficult to be caught. Moreover, the separation of these products from the suspension requires the use of a drag conveyor composed of perforated plate-links, or the provision of strainers in the discharge openings, and this has the inconvenience that said perforations or strainers are liable to be obstructed, whereby the horizontal flow of the suspension is braked.

This braking effect will increase as the amount of middlings increases, although just under these circumstances it is essential for the horizontal flow to be relatively strong in order that excessive concentration of middlings in the bath may be avoided.

The object of my present invention is to do away with the use of strainers, sieves or the like, so as to ensure an unimpeded transport of the middlings through the bath and thus to better adapt the apparatus to the separation of relatively fine materials, i. e. of materials that are very liable to clog the meshes of sieves or the like.

With this and other objects in view, my invention consists in the dispension with of the mechanical means for removing middlings from the bath, and by the provision, beyond the submerged portion of the mechanical means for removing floating products, of a weir for discharging substantially the whole amount of fluid flowing along substantially horizontal paths through the tank, together with the middlings suspended therein. It will be understood that with this construction the middlings will be discharged by hydraulic means, i. e. by an upwardly directed current of fluid in the vicinity of the weir.

The hydraulic discharge of the middlings transported towards the side wall of the tank requires a predetermined minimum velocity of flow of the suspension near the weir. If this velocity exceeds the desired relatively low horizontal velocity of the currents created in the main portion of the tank, the end portion of the tank may taper in the direction of flow. Alternately, or additionally, part of the suspension discharged by the weir may be returned directly to said end portion, instead of to the suspension inlet openings of the tank as described in our prior specification.

Other features of my invention will appear from the following description and be set forth in the appended claims.

The annexed drawing shows, by way of example, two embodiments of the invention.

Fig. 1 is a vertical longitudinal section of the first embodiment, and

Fig. 1*a* is a top plan view thereof with the drag conveyor for the floating products broken away.

Figs. 2 and 2*a* are corresponding views of the second embodiment.

In Figs. 1 and 1*a*, the tank 3 has tapering front and rear walls, and vertical left and right hand side walls 4 and 5, respectively. Mounted in the lower portion of the tank is a horizontal drag conveyor 6 driven in clockwise direction and having its delivery end located vertically above an inclined chute 7. A second drag conveyor 8, driven in anti-clockwise direction, is mounted with a portion of its lower part parallel with the surface 9 of the body of suspension within the tank 3, a further portion of said part being parallel with an inclined dewatering screen 6*a*, the lower end of which extends downwardly to say 4–6'' below the level 9. The delivery end of conveyor 8 is located vertically above an inclined chute 10 connected to said screen.

The left hand side wall 4 is provided with two vertically spaced suspension inlet openings 11, 11*a*.

As distinguished from the apparatus disclosed by my prior Patent 2,139,047, the right hand side wall 5 of tank 3 is not provided with vertically spaced suspension outlet openings, and neither is there provided a drag conveyor for removing from the bath the middlings transported, by the suspension supplied through openings 11, 11*a*, from left to right towards said side wall intermediate the surface 9 of the bath and the drag conveyor 6. Instead, the right hand side portion 12 of the tank located above the conveyor 6 tapers in the direction of flow of the suspension as indicated by arrows in Fig. 1, and merges into a relatively narrow, parallel-walled end portion 13, whose right hand side bottom corner is suitably rounded off as shown. The top edge of wall 5 is located substantially at, or somewhat below the level of the lower edge of dewatering screen 8*a* and forms a weir 5*a*.

Secured to the outer face of wall 5 is a dewatering screen 14, and mounted below said screen is a boot 15. The lower end of boot 15 is connected, through a conduit 16, with the suction side of a pump 17, the delivery side of which communicates, through a conduit 18, with a thickener 19. The lower end of the thickener is connected with a distributing pipe 20, and its overflow pipe 21 discharges into a hopper 22, the lower end of which is connected to a distributing pipe 23. Said distributing pipes are adapted to discharge into conduits communicating with the inlet openings 11*a* and 11, respectively.

The modus operandi of the described apparatus, as far as the gravimetric separation of the material treated therein is concerned, is not essentially different from that of the apparatus disclosed by my aforesaid prior patent. That is to say, assuming run-of-mine coal to be charged into the tank as at A, and the drag conveyors 6 and 6 to be suitably driven, the pure coal will float, be carried by the lower part of conveyor 8 towards the dewatering screen 8*a*, and raked over this screen so as to be lifted out of the bath, whereupon it slides down over the chute 10 to be further conveyed by means not shown.

The slate sinks to the bottom, from which it is removed by the conveyor 6.

The middlings, for instance bony coal, will sink below the surface 8 of the bath and remain suspended at a greater or smaller depth below the level of the submerged left hand side portion of screen 8*a*, since the suspension in the tank has a density increasing from top to bottom owing to the slow settling of the "sand." The substantially horizontal currents created by the suspension fed into the tank through the inlet openings 11 carry the suspended middlings towards the right, i. e. towards the portion 13, in which the fluid is compelled to flow upwards. The middlings are forced to follow this movement so as to be discharged, together with the suspension, by the weir 5*a*, provided that the suspension in said portion has the required vertical velocity. As will be understood, the taper of the right hand side portion 12 of tank 3 has the effect of increasing the velocity of the suspension flowing towards the portion 13 so as to ensure the desired hydraulic discharge of the middlings in upward direction through said portion, which thus actually functions as an uptake.

The middlings thus discharged are further conveyed by means not shown, and the suspension is collected in boot 15, whence it is fed, by pump 17, to the thickener 19. In this thickener, the "sand" is allowed to settle to a certain extent, so that a relatively light suspension overflows into hopper 22 to be supplied to the tank through the distributing pipe 23 and the upper feed opening 11, and a relatively heavy suspension is discharged into the distributing pipe 20, whence at least part thereof returns to the tank through the lower feed opening 11*a*.

Figs. 2 and 2*a* show an apparatus, which, as far as the parts designated by the references 3 to inclusive 12 are concerned, does not essentially differ from the one illustrated in Figs. 1 and 1*a*. As to the narrow, parallel-walled right hand side end portion 13 of the tank, however, this has mounted therein two vertical, transverse partitions 24 and 25 suitably spaced in the direction of flow so as to divide portion 13 into three compartments 26, 27, 28. The lower edges of these partitions are located at different levels intermediate the level of the lower, submerged edge of screen 8*a*, and the conveyor 6. The partition 25 nearest to the side wall 5 extends to a greater depth than partition 24. Said partitions are provided, along their lower edges, with more or less horizontal extensions 24*a*, 25*a*, respectively, pointing to the left.

The rear wall of the portion 13 of the tank is of reduced height so as to form a stepped weir 29 for the discharge of suspension and middlings from compartments 26, 27 and 28, respectively into chutes 30, 31 and 32, respectively. As will be observed, the stepped weir extends on either side of partition 25 as also of partition 24.

As diagrammatically shown, partition 25 is adapted for vertical adjustment. Partition 24 may be mounted in a similar manner.

Obviously, in the apparatus just described suspensions and middlings of increasing specific gravities will be hydraulically discharged, through compartments 26, 27 and 28, respectively, by the weir 29, which delivers them to the chutes 30, 31 and 32, respectively. The suspensions are drained off and the middlings washed by means not shown. Said suspensions as well as the suspensions recuperated from the washing water may be collected and returned to the inlet openings 11, 11*a*, 11*b*, 11*c* of the tank in the manner described in our prior specification. If desired, part of said suspensions may be returned directly to the lower portions of said compartments so as to still further increase the vertical velocity of flow therein. This has the advantage that with a predetermined low velocity of the substantially horizontal currents created in the main part of the tank any desired vertical velocity of flow in the uptakes 26, 27 and 28 can be obtained.

Figs. 2 and 2*a* show an apparatus with three uptakes 26, 27, 28, but it will be understood that if necessary the middlings may still further be graded by providing the right hand side portion 13 of the tank with three or more suitably spaced partitions, the lower edges of which extend downwardly to depths increasing in the direction of flow of the suspension. In other cases, only one partition will suffice.

KLAAS F. TROMP.