The present invention is related generally to machinery for handling granular material, and is more particularly concerned with apparatus for dewatering or removing from granular material the water or fluid content of the same that is present therein incidental to treatment with water or other fluids.

Various devices, such as screw conveyors set on an incline, chains dragging scrapers up an incline, mechanical rakes, various forms of separating wheels, etc., long have been used for the broad purpose for which the present invention is intended. These devices, however, have proven expensive to maintain and difficult to adjust to suit different materials as well as different conditions with similar materials. Moreover, these prior devices have failed to attain the desired separation of the fluids from the material to the required degree.

The main and primary object of this invention is the provision of a dewatering apparatus of simple but rugged construction so designed and organized that maintenance is reduced to a minimum, but readily adjustable to meet and care for substantially any condition occurring in the operation of the apparatus.

A further object of the invention is to provide apparatus of the character set forth wherein separation of the fluids from the granular materials may be effected with a high degree of economy, and with a maximum percentage of recovery of the granular materials.

A more specific object of the invention is the provision of a dewatering wheel equipped with a plurality of buckets so constructed and arranged as to give free entrance to and discharge of the granular material, the construction and arrangement being such that fluid percolating from the granular material is caused to be freely discharged from the buckets and the latter automatically drained.

A further object contemplated is to embody in the dewatering wheel efficient and effectual means for adjusting the angular position of the buckets on the wheel to suit varying conditions.

Other objects and advantages will appear as the nature of the improvements is better understood, the invention consisting substantially in the novel construction, combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawing and finally pointed out in the appended claims.

The form of the invention herein shown and described is a practical embodiment of the same, and attains the objects and advantages sought to be accomplished. It is susceptible to change, modification and variation, and the present disclosure, therefore, is to be taken from the illustrative standpoint and not as imposing restriction or limitation on the invention.

In the drawing

Fig. 1 is a vertical longitudinal sectional view of a dewatering wheel constructed in accordance with the present invention;

Fig. 2 is a transverse sectional view thereof, as on the line 2—2, Fig. 1;

Fig. 3 is a detail fragmentary elevation illustrating the bucket connections and the adjustable mountings for the same;

Fig. 4 is a detail fragmentary sectional view taken through the connections and mountings illustrated in Fig. 3, as on the line 4—4, Fig. 3.

Referring now in detail to the accompanying drawing, the numeral 10 designates a circular plate, preferably formed of sheet steel or other suitable material, and of the desired diameter, which plate 10 constitutes the body of the herein-described dewatering wheel. It is provided at its center with a flanged hub 11 suitably fastened to the body plate 10, and said hub 11 receives a shaft 12 by which the body plate 10 is carried and rotated. The ends of the shaft 12 are fitted within bearings 13, said bearings being mounted upon the side portions of a tank 14 to be herein-after more fully described.

The shaft 12 may be driven by any desired form of motive power, and suitable gearing may be interposed between the shaft 12 and the prime mover to impart to the shaft 12 the required speed of rotation. For the purposes for which the dewatering wheel is intended the speed of rotation of the body plate 10 should be relatively slow.

Associated with the body plate 10 is a plurality of buckets 15. These buckets are arranged in pairs, one of the same being disposed at each side of the body plate 10. Thus, oppositely-disposed series of the buckets 15 are located at the sides of the body plate 10 and extend around the periphery of the same.

Each pair of the buckets 15 is supported by an elongated bolt 16, each end of each of said bolts projecting sufficiently beyond the body plate 10 to receive and accommodate one of the buckets 15. The bolts 16 likewise are received by, and find support in, sleeves 17 carried by the body plate 10. The outer extremities of the bolts 16 are screw-threaded and have mounted thereon a plurality of fastening nuts 18, thereby to hold the buckets 15 in place on the bolts 16.
The outer ends of the bolts 16 are tied together by a plurality of links 19, which links extend from bolt to bolt throughout the entire series of buckets, and being held in position thereto by the fastening nuts 18. These links 19 serve to strengthen the structure and to keep the buckets 15 aligned with respect to each other.

Each of the buckets 15 comprises a body member 20 that is semicircular in cross-section, or of trough-like formation, the ends of the body member 20 being closed by terminal plates 21 located at the inner and outer ends of the body member 20, the terminal plates 21 and the body member 20 being suitably connected together so as to provide a unitary structure.

That the buckets 15 may be adjustably supported on their respective bolts 16 the latter penetrate the terminal plates 21 at points outside of the interior of the body members 20, and by reason of this mounting of the buckets on the bolts 16 the buckets are capable of angular adjustment with respect to the bolts 16 for purposes presently to appear.

The terminal plates 21 are provided with a plurality of openings 22 arranged on an arc with the bolts 16 as the centers from which the arcs are struck, and this permits the buckets 15 to be swung concentrically with respect to the bolts 16.

Each of the links 19 is provided with an opening wherein a holding bolt 23 is mounted, these bolts 23 being designed to register with and to enter any one of the openings 22 of the terminal plates 21 that is immediately contiguous thereto. When the holding bolts 23 thus are engaged with the terminal plates of the buckets 15 these buckets are held in different angular positions on the bolts 16.

The tank 14 is designed to receive the fluid that is charged with the granular material. The fluid and material are fed to the tank 14 in a stream that is introduced by a feed spout 24 arranged above one end of the tank 14. A deflecting plate 25 is arranged across the end of the tank 14 adjacent the top of the latter at the point where the fluid and granular material enter the tank so that the stream is directed downwardly within the tank 14 to a point below the fluid line 14b therein. Extending from the lower edge of the deflecting plate 25 to the adjacent end wall of the tank 14 is a horizontally-disposed screen 26. The size of the mesh of this screen is sufficient to permit the granular material to pass therethrough with the fluid. By reason of the greater specific gravity of the granular material it sinks to the bottom of the tank, and with a tank of the shape shown the granular material first would form a fill 27 somewhat along the dotted line 28 shown in the drawing. The deflecting plate 25 and the screen 26 constitute a receiving well for the material to be treated.

By passing the stream of fluid and granular material through the screen 26 turbulence within the tank 14 is greatly reduced and the efficiency of settling of the granular material promoted.

In the end of the tank 14 opposite to the deflecting plate 25 is located a dam 29, which is in the form of a vertically-disposed transversely-arranged barrier plate, the upper edge of which terminates short of the upper edges of the side and end walls of the tank 14. This dam 29 regulates the flow of the fluid and granular material through the tank and assists in building up the fill to which reference has been made. The dam 29 is spaced from the adjacent end wall of the tank 14, in which end wall is mounted an outlet pipe 30, and by reason of the spaced relation of the dam 29 to the end wall of the tank 14 the fluid rises upwardly and flows around and so as to pass out through the outlet pipe 30. The space between the dam 29 and the adjacent end wall of the tank serves as a delivery well for the fluid overflowing the dam 29. In the operation of the herein described device the flow of liquid through the discharge pipe of the tank 14 is in a direction of rotation of the same is indicated by the arrow appearing in Fig. 1. With the movement of the wheel the buckets 15 dig into the material that has settled above fill line 28 and scoop up the same as they progressively move through the tank 14. In this movement the granular material will be carried out of the fluid in the tank, but more or less of the fluid also will be carried upwardly by the buckets as they rise from the fluid, particularly so if there is not sufficient granular material to fill the buckets completely. Even with the buckets completely filled some fluid will be carried out in the interstices between the grains of the granular material and this fluid will percolate to the bottom of the buckets in their upward movement with the rotation of the wheel.

That the fluid content in the buckets 15 may be drained therefrom and returned to the tank, the inner edge portions of the buckets, considered with respect to the periphery of the wheel, are provided with a series of discharge openings 31. Also V-shaped discharge notches 32 are provided in order so care for fluid in excess of the quantity that will discharge through the openings 31.

The positioning of the discharge openings 31 and discharge notches 32 in their respective buckets is such that fluid discharged therefrom will fall back into the tank 14 after the buckets have passed upwardly somewhat beyond the horizontal center line of wheel rotation and will not fall into the following buckets.

As the buckets 15 approach the upper left-hand quarter of the cycle of rotation, as the apparatus is viewed in Fig. 1, the granular material carried thereby will be adjacent the lower part of the discharge sector. To compensate for these variations is the purpose of the openings 31 and 32.
the holding bolts 23, this provision making it possible to adjust the buckets 15 on the bolts 16 so as to impart the entrance angle necessary for efficiently digging the granular material below the fluid line in the tank, and also for giving the discharge angle necessary for efficiently discharging the granular material at the upper quarter of the circle of rotation.

Briefly recited, the operation of the herein-described dewatering wheel is as follows:

The stream of fluid and granular material discharging from the feed pipe 24 is received at the screen 25 and the deflecting plate 29 within the tank 14. With the screen 26 operating to reduce turbulence, settling of the granular material within the tank 14 follows. Slow movement of the fluid contributes to this settlement of the granular material, the water finding its way to the dam 29, rising and flowing over its upper edge, and finally being discharged through the outlet pipe 33.

In the rotary movement of the body member 10 and the associated buckets 15 the submerged lower segment of the wheel passes through the water and the built-up fill 27 of the granular material. Each bucket scoops up its quota of the granular material, and as the buckets rise and emerge from the fluid of the tank the circular path which they follow changes their angular position with respect to the horizontal so that whatever fluid may remain in the buckets will pass out through the discharge openings 31 and the discharge notches 32, with a resultant draining of the respective buckets, but without the fluid, so drained, falling into the succeeding buckets. In the further rotation of the wheel the angular relation of the buckets to the horizontal increases so as to position them for dumping the granular material contained therein. This occurs when the buckets move over the receiving ends of the receiving hoppers 33. When received by the hoppers 33 the granular material passes onwardly through and out through the discharge spouts 34 and thus is delivered from the apparatus at the exterior of the tank 14 largely freed from the fluid content and for disposal to the ultimate use of the granular material.

It will be observed that the fill 27 is in the zone of progressive travel of the buckets 15, and results from settlement of the granular component of the material being treated. Because of the effect of the screen 25 in reducing turbulence in the incoming body of fluid and granular material, settlement of the granular component is accelerated.

It is obvious the bottom of tank 14 might be made to substantially conform to fill line 26, if for any reason desired. The form of tank 14 shown by Fig. 4 is, of course, the most simple to construct.

I claim:

1. In a rotating dewatering apparatus of the type useable for transporting material mixed with water from one section to another while separating the material from the water, the combination comprising a rotatable plate, a plurality of buckets peripherally spaced around said plate in pairs, one of each of said pairs of buckets being pivotally carried on opposite sides of said plate by means of spaced apart carrying bolts connected to said plate, said bolts projecting on each side thereof and holding said buckets in spaced apart relationship, each of said bolts projecting beyond the side wall confines of each bucket which it carries and each projecting portion of adjoining bolts being connected by links secured thereto in order to hold said buckets in alignment and to strengthen said structure, said walls of said buckets having bucket-adjusting holes and said links having bucket-adjusting members adapted to be received by said adjusting holes whereby said buckets can angularly be adjusted and secured in desired position with respect to each other and to adjoining associated structure.

2. A structure of the type defined in claim 1 wherein said buckets each consists of a body member of trough-like formation, the ends of said body member being closed by inner and outer terminal end plates forming walls, said adjusting holes being located within said walls forming said outer terminal end plate.

3. In an apparatus of the class described, the combination comprising a storage tank adapted to hold a granular material mixed with a washing liquid, a structure having said central axis within said tank and supported thereby, said structure carrying a plurality of spaced apart buckets peripherally mounted thereon and pivotally secured thereto by means of holding bolts and bucket adjusting members which hold the buckets at an angle no greater than the angle of repose for said granular material, said buckets being substantially semi-circular in cross section and spaced in the direction of rotation of said structure to position a portion of said granular material and washing liquid, each bucket having a plurality of liquid drainage openings therein and a V-shaped drainage notch opposite its scooping end adapted to separate said liquid from said granular material before being emptied of its contents, a delivery station consisting of a hopper connected with the sides of said storage tank and associated with said rotating structure whereby, as the buckets rise and emerge from the liquid of the tank the circular path which they follow changes their angular position with respect to the horizontal so that whatever liquid may remain in the buckets will pass out through the drainage openings, and during the further rotation of said rotating structure the angular relation of the buckets to the horizontal increases so as to position them for dumping the granular material contained therein and deliver substantially dry granular material from the sides of said storage tanks.

4. In a tiltable dewatering receptacle including a body portion and a rim portion, for use in delivering material mixed with water from a storage station to a delivery station, drainage openings for said water in said body portion, and a notched water discharge opening in said rim portion.

5. A receptacle as defined in claim 4 wherein said notched opening is substantially V-shaped and is located in that part of the rim portion that is tilted downwardly approaching said delivery station.

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