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A. C. LIND

3,204,773

APPARATUS FOR SKIMMING

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FIG. 1.

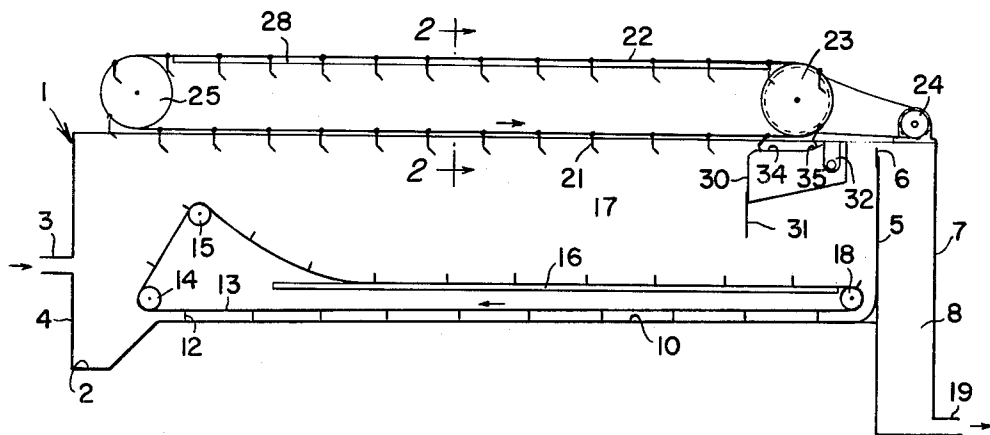


FIG. 2.

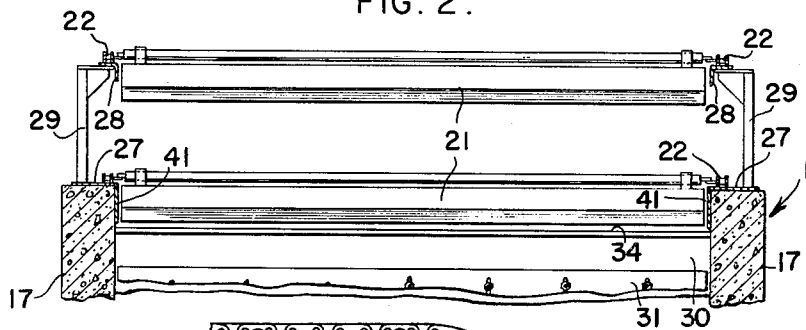
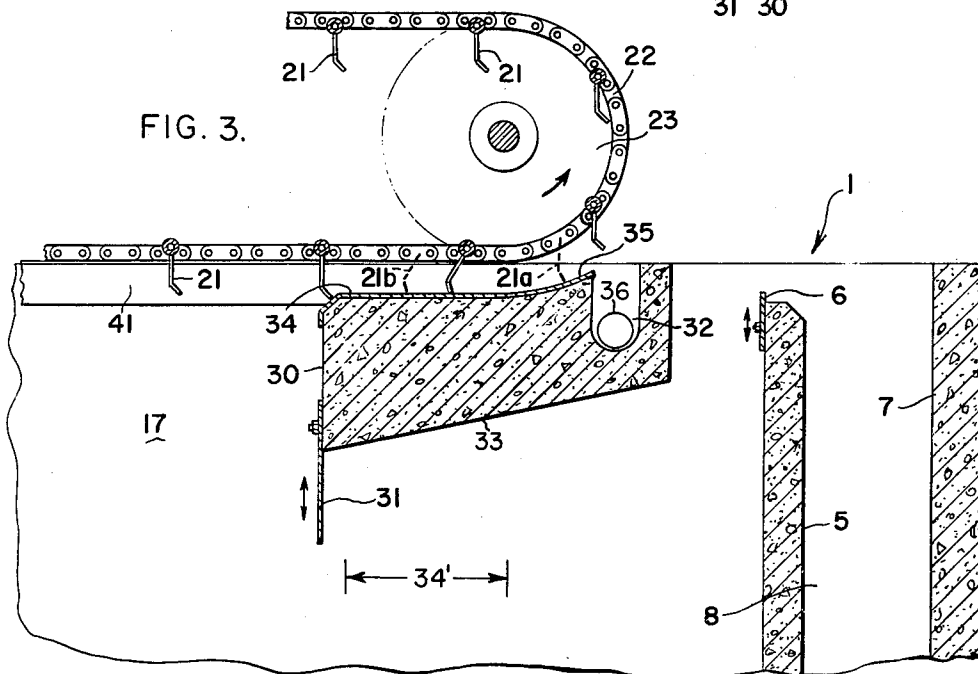


FIG. 3.



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APPARATUS FOR SKIMMING

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Continuation of application Ser. No. 151,817, Nov. 13, 1961. This application Mar. 2, 1964, Ser. No. 349,792

1 Claim. (Cl. 210—525)

This application is a continuation of my application Serial Number 151,817 filed on November 13, 1961, and now abandoned.

This invention relates to flotation tanks and particularly to the skimming of the floatable material or scum having a large amount of entrained air and material of a density near or even greater than that of water so that the scum blanket is easily disturbed and the material is then likely to be carried out with the effluent. That is, the invention is directed to flotation thickening tanks wherein a scum blanket is to be maintained at all times and only a small upper fraction thereof is ever to be removed at any time.

According to the present invention a series of uniformly spaced flights or blades extend across the tank and downwardly into the floating scum blanket to divide the upper layer of the blanket into sections and each section between two adjacent blades is pushed onto a submerged, horizontal shelf before being pushed up the beach and into the receiving trough for the scum. The flow through the tank is directed below a vertical baffle extending downwardly from the forward edge of the shelf so that the floating material is pushed by the flow against the vertical baffle and tends to rise upwardly in front of the shelf. The shelf, being longer than the spacing between blades and horizontal throughout, assures that no hydrostatic head is developed on or over the scum blanket rising in front of the vertical baffle. The shelf isolates the section being pushed up the beach from the scum blanket in front of the vertical baffle.

A particularly unusual or surprising consequence results from the use of this long shelf with a relatively deep vertical baffle at the front of the shelf and against which the scum blanket is pushed both by the flow through the tank and by the flights. As a result, the blanket is deeper and higher ahead of the shelf and by adjustment of the weir controlling the liquid level of the tank a high scum removal rate may be maintained. This result is only made possible by the isolation of the blanket in the separation zone of the tank from the scum being pushed up the beach provided for as described.

In the preferred embodiment of the invention, hinged flights or blades are pivotally mounted and spaced to operate over a relatively long shelf ahead of the beach so that the backwash from the flight going up the beach has little effect on the scum blanket or layer being moved along over the shelf and no effect upon the scum blanket in the separation zone of the tank. The spacing of the flights for such purposes also must be at least slightly less than the length of the shelf so that there is always at least one flight on the shelf to isolate the beach from the tank.

The object of the invention is to provide means for more efficient removal of the scum blanket from a flotation tank.

Another object of the invention is to provide means for maintaining and not exceeding the maximum depth of the scum blanket particularly at the point of removal of the floating material.

The drawings furnished herewith illustrate the best mode of carrying out the invention as presently contemplated and set forth hereinafter.

In the drawings:

FIGURE 1 is a diagrammatic, longitudinal sectional view of a settling and flotation tank with the scum removal means at the effluent end of the tank;

FIG. 2 is an enlarged vertical, lateral section of the upper part of the tank as taken on line 2—2 of FIGURE 1 and showing upper and lower skimming blades in elevation. The forward end of the scum removal beach structure is partially shown in elevation and the upper portions of each side of the tank are shown as formed of concrete; and

FIG. 3 is a longitudinal, vertical section at the effluent end of the tank shown in FIG. 2 and shows the ends of the skimming blades operating over the scum removal beach structure. A dimensional arrow below the structure shows the length of the horizontal shelf of the structure. One of the parallel chains supporting the blades and a drive sprocket are shown in elevation.

The tank 1 as shown in FIGURE 1 of the drawings is provided with the trough 2 extending across the tank below the inlet pipe 3 opening into the tank through the influent end wall 4. The baffle 5 at the effluent end of the tank is provided with the adjustable overflow weir 6 and is spaced from the effluent end wall 7 of the tank to define the effluent receiving well 8 therebetween. The outlet 19 from well 8 is preferably located below the level of the floor 10 which slopes downwardly slightly from baffle 5 to trough 2.

The material settling on floor 10 is transported to trough 2 by the collector mechanism shown diagrammatically and including the scrapers 12 and chain 13 operating over the sprockets 14 and 15 at the influent end of the tank. The return run of scrapers 12 and chain 13 is supported at each side of the tank on a track 16 above floor 10. Each track 16 is fixed to a side wall 17 of tank 1 and extends up to the return sprocket 18 over which the chain operates.

The blades 21 for collecting the floating material received by the tank are pivotally supported by and between parallel endless chains 22 operating along and above each side wall 17 of the tank. Each chain operates over a drive sprocket 23 driven by the motor 24 at the effluent end of the tank and over the driven sprocket 25 at the opposite end of the tank.

The lower blades extend downwardly into the scum blanket formed by the floating material at the liquid level of the tank established and maintained by weir 6 as shown or other means, not shown. The lower runs of chains 22 slide on the steel plates 27 fixed to the top face of side wall 17 of the tank and the upper runs of chains 22 slide on the rails 28 supported by the columns 29 above plates 27.

The rigid structure 30 extending across the tank at the effluent end thereof is provided with the vertically adjustable baffle at its front side and with the scum trough 32 extending across the tank near the rear of structure 30. The underside 33 of structure 30 slopes upwardly to the rear of the structure which is spaced from weir 6 to allow the clarified effluent passing under baffle 31 to flow up to the weir and into well 8. The top side of structure 30 includes the flat horizontal shelf 34 extending from the front of the structure to the sloping portion or beach 35 which extends to trough 32. The front of structure 30 is vertical to form with adjustable baffle 31 the baffle referred to as extending downwardly from the forward edge of shelf 34.

Scum trough 32 may be provided with a chain or screw conveyer, not shown, to push the scum to the outlet 36 in one wall 17 of tank 1. Structure 30 may be of all steel-plate construction, for example particularly if the tank 1 is also of steel construction. If tank 1 is of con-

crete construction as shown in FIGS. 2 and 3, it is believed that the structure would be preferably formed of reinforced concrete integral with the tank as shown. To prevent wear of the blades, it may be preferably to secure a steel plate to the topside of the concrete structure 30 also as shown.

In the operation of tank 1, the floating material forms a scum blanket which may be of relatively shallow depth at the influent end of the tank, said depth being measured downwardly from the liquid level maintained within the tank by weir 6. Blade 21 extends downwardly into the scum blanket a preselected distance and in moving toward scum trough 32, the blades tend to push the entire blanket against the front side of structure 30 and baffle 31. This movement is further aided by the flow of the liquid through the tank in the same direction. The movement of the scum blanket against structure 30 and baffle 31 causes floating material to pile up in front of shelf 34. The material in the lower part of the blanket also moves or collects in front of baffle 31. The relatively deep scum blanket developed ahead of shelf 34 promotes the dewatering of the upper part of the blanket which is removed by blades 21 onto shelf 34. To provide for operation of the tank so that the depth of the blanket does not reach below the lower edge of baffle 31, the baffle is set as low as possible to prevent floating material from passing out of the tank with the effluent. However, the distance from baffle 31 to floor 10 of the tank cannot be so reduced that material settled on floor 10 is carried out with the effluent because of the increased velocity.

Skimming blades 21 as such extend approximately to or just below the water level maintained within the tank and in effect divide the floating scum blanket into sections extending the width of the tank. The lower level of each section is determined by the lower edges of the skimming blades. However, as the sections move toward structure 30, the floating material pushing up from below, causes each section to become higher, or deeper or thicker. Each section is moved onto shelf 34 with no change in elevation because the shelf is located at or near the water level maintained within the tank and because the shelf is entirely horizontal. The angular front edge of shelf 34 as shown is provided merely for direct edgewise-engagement of the blades 21 so that they do not "wipe" against the forward edge of shelf 34. Only after each section is fully supported on shelf 34, is the section moved upwardly on beach 35 for delivery to trough 32. Accordingly, no section is ever partly unsupported in front of structure 30 and partly elevated on beach 35, such that the unsupported part becomes depressed by the elevated part. Such depressing of the unsupported blanket pushes the floating material downwardly in front of structure 30 and results in reduced removal efficiency and an un-

controllable blanket depth at baffle 31 with the result that floatable solids are carried out of the tank with the effluent.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

In a floatation thickening tank having a floor, side walls, inlet and outlet ends, a vertical, relatively deep baffle extending across and spaced from the floor of the tank and defining an effluent outlet therebetween, weir means associated with said effluent outlet for maintaining a predetermined water level in the tank, an upper thickening zone being defined between said inlet end and said baffle, the flow through the tank being directed beneath said zone toward said effluent outlet beneath said baffle, a shelf at approximately the water level of the tank extending from the top edge of said baffle toward the outlet end of the tank, an inclined beach extending from said shelf upwardly to above the water level within the tank and toward the outlet end thereof, a trough having one side connected to the upper end of said beach and extending across the tank, and collector means including a series of skimming blades extending across the tank and downwardly into the scum blanket formed by the floating material at the liquid level of the tank, said collector means being operable and disposed to move said blades toward the outlet end of the tank and to push sections of the scum blanket between blades onto said shelf and up said beach for delivery into said trough, said shelf being horizontal and having a length at least equal to the spacing between said skimming blades so that each of said sections referred to being pushed up the beach is entirely supported by the shelf and beach whereby the floating material pushed by the flow against said vertical baffle is effective to support the following one of said sections being pushed over said baffle and onto said shelf.

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