

Sept. 9, 1969

F. L. YOUNG, JR

3,465,889

LIQUID CLARIFIER WEIR CONSTRUCTION

Filed June 24, 1968

5 Sheets-Sheet 1

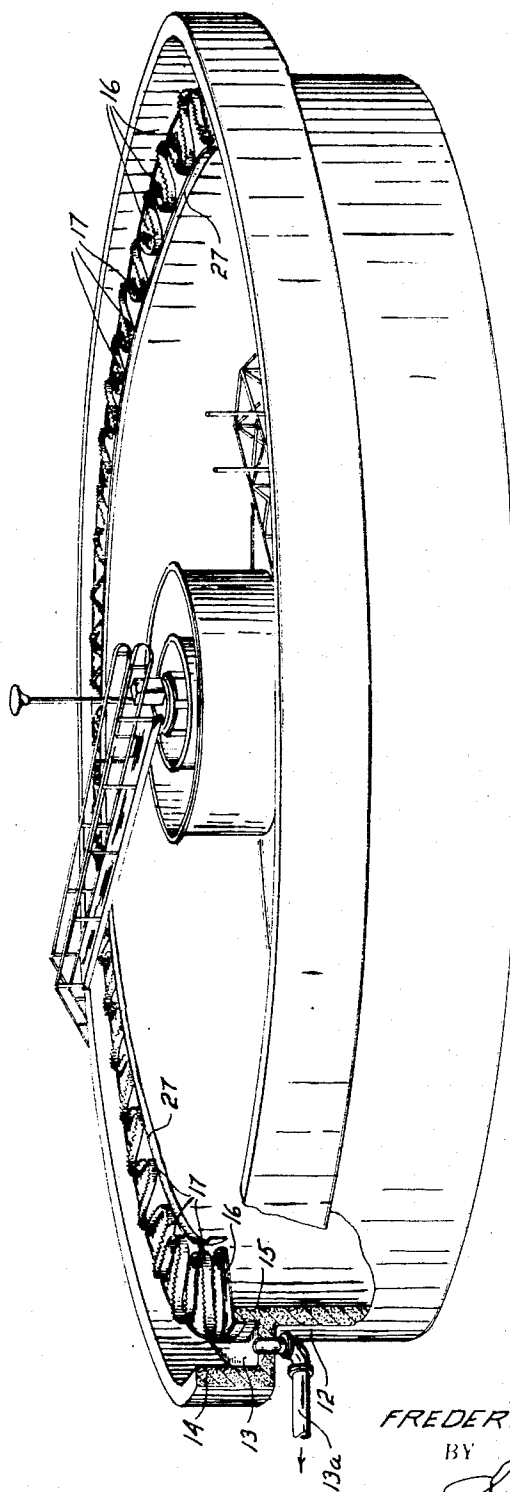


Fig. 1

INVENTOR.
FREDERICK L. YOUNG, JR.
BY
Spencer & Lechner
ATTORNEYS

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F. L. YOUNG, JR

3,465,889

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5 Sheets-Sheet 2

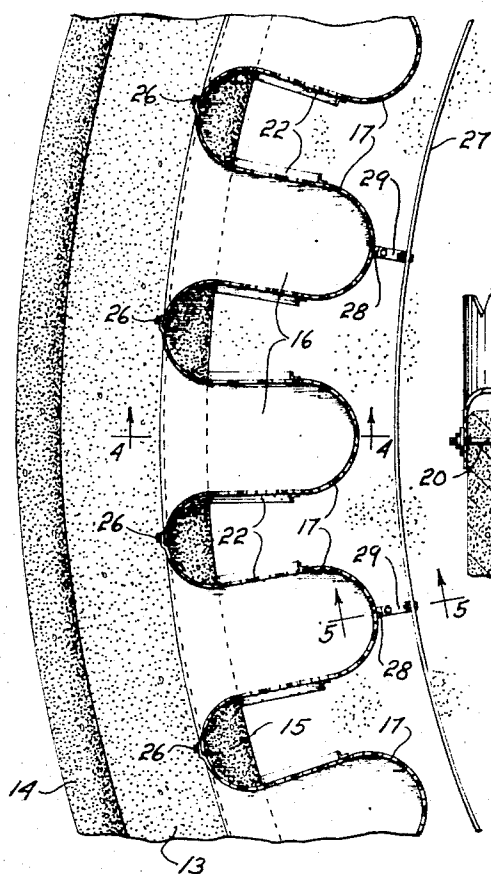


FIG-2

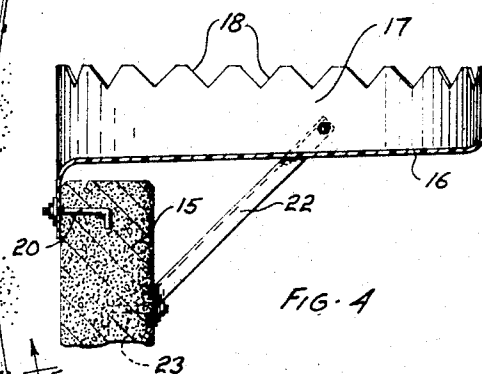


FIG-4

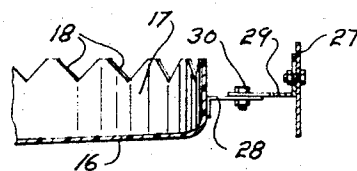


FIG-5

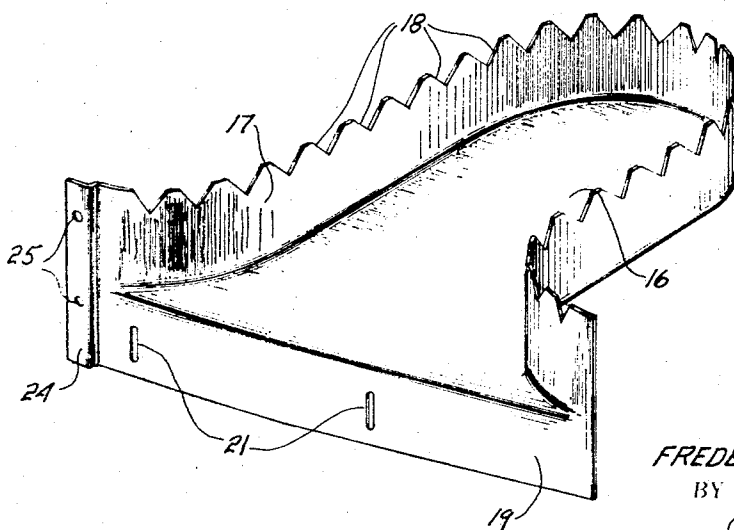


FIG-3

INVENTOR.
FREDERICK L. YOUNG, JR.
BY
Lyndon D. Latham
ATTORNEYS

Sept. 9, 1969

F. L. YOUNG, JR

3,465,889

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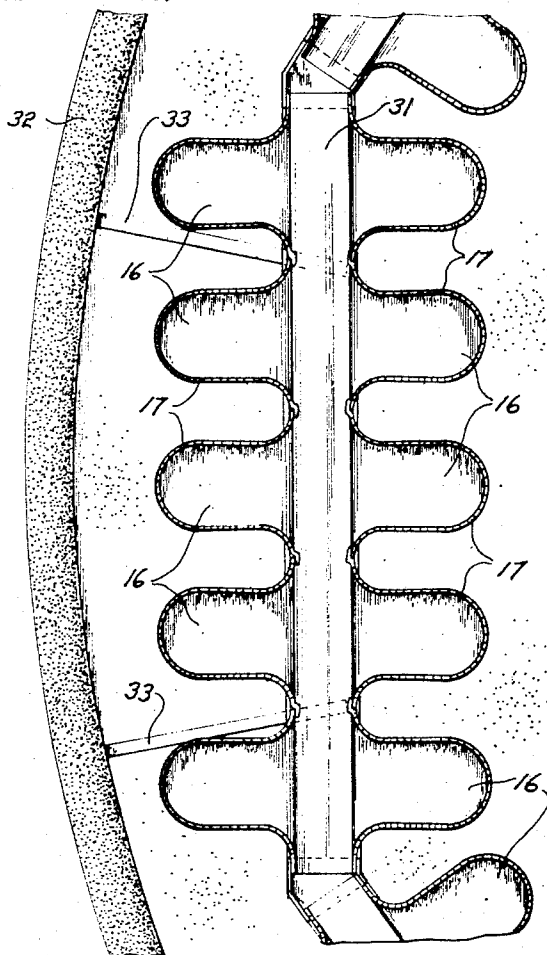


FIG-6

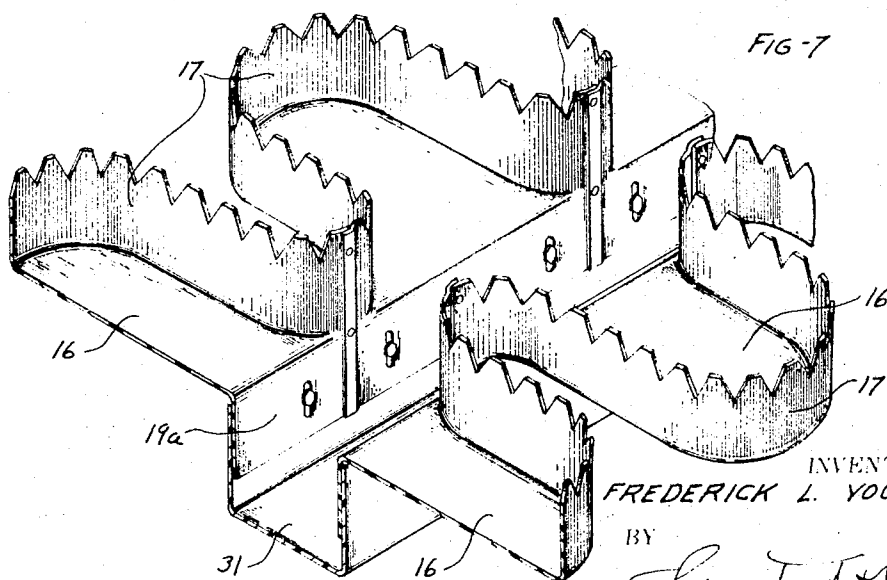


FIG-7

INVENTOR.
FREDERICK L. YOUNG, JR.

BY

Symon & Lechner
ATTORNEYS

Sept. 9, 1969

F. L. YOUNG, JR

3,465,889

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5 Sheets-Sheet 4

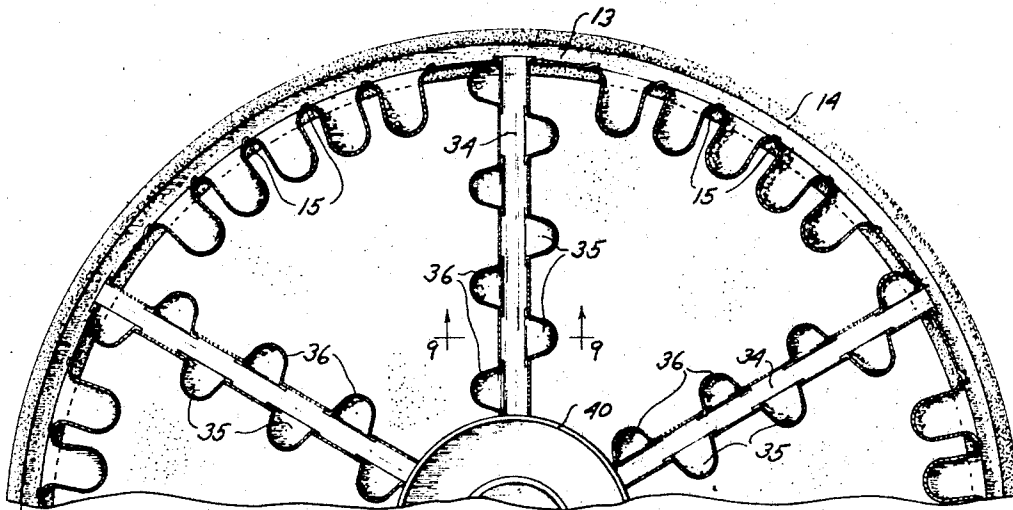


FIG-8

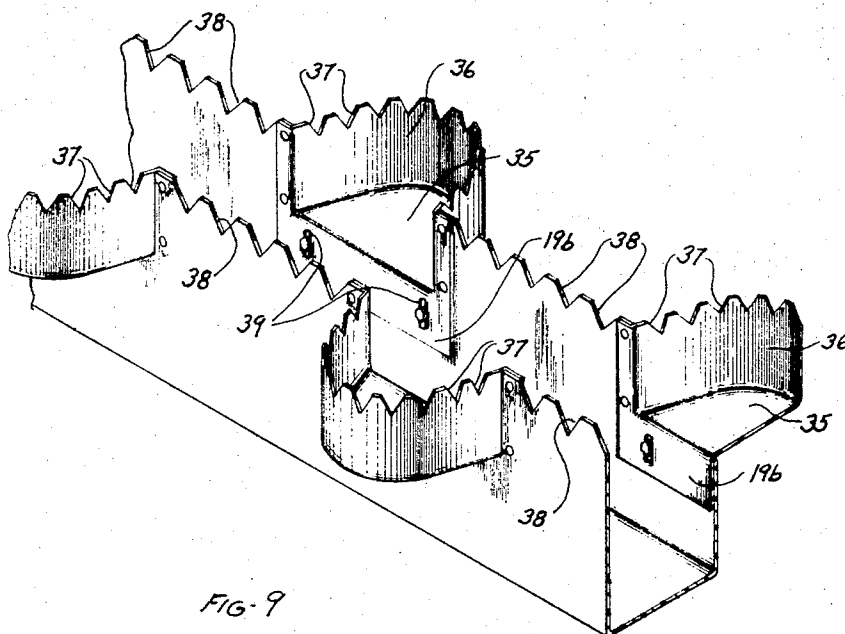


FIG-9

INVENTOR.
FREDERICK L. YOUNG, Jr.

BY

Signature
ATTORNEYS

Sept. 9, 1969

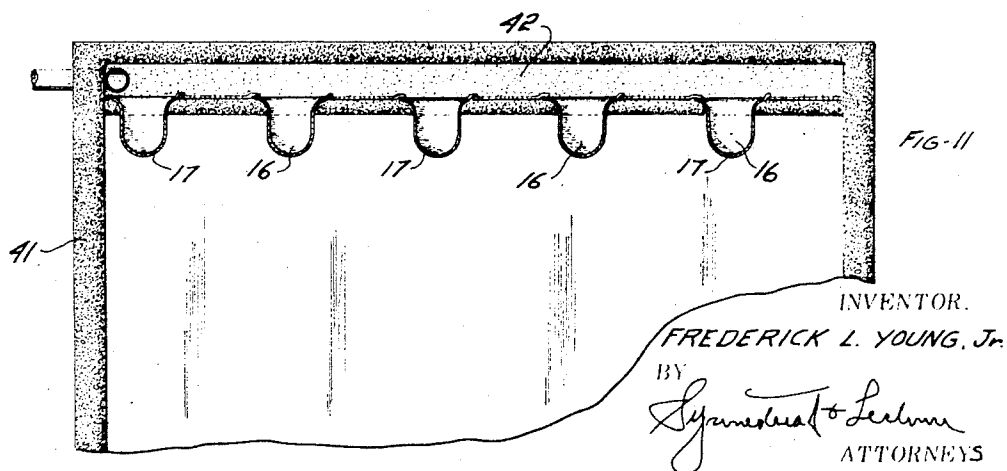
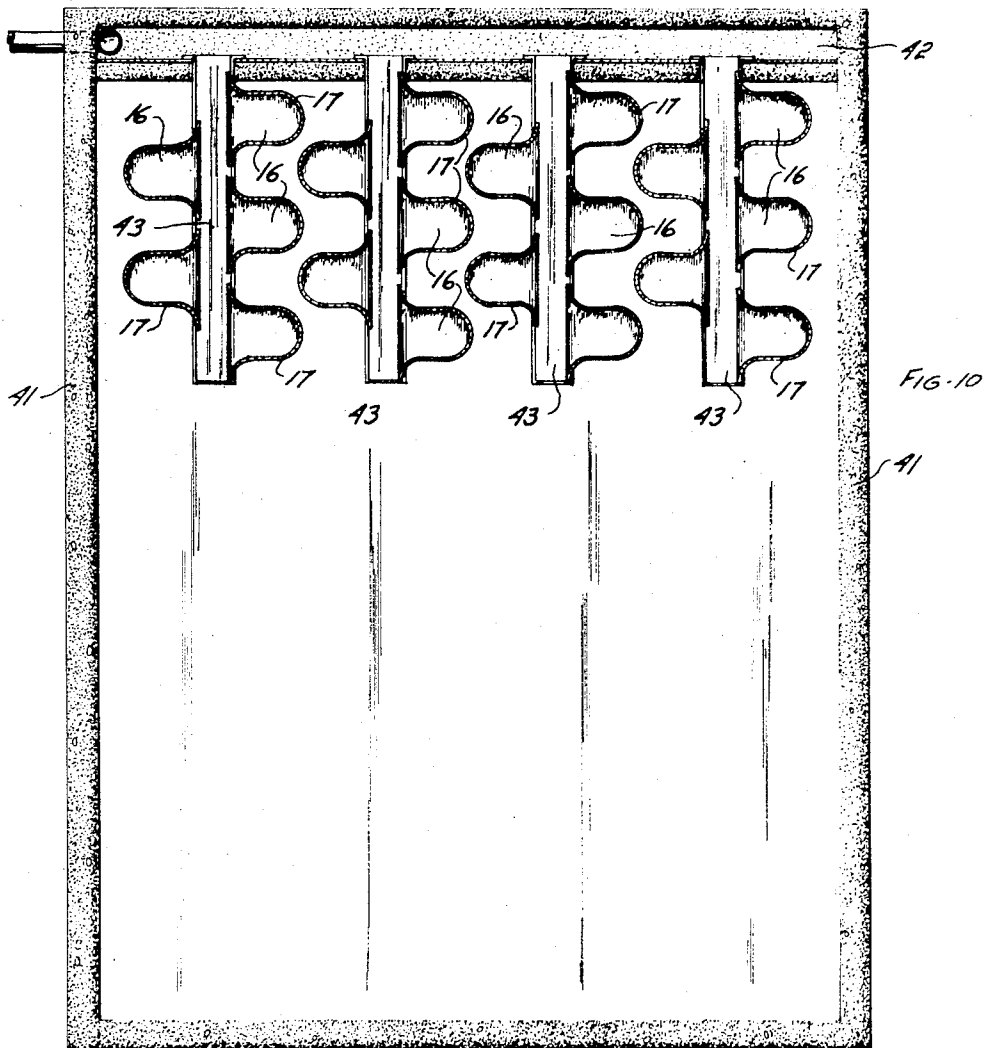
F. L. YOUNG, JR

3,465,889

LIQUID CLARIFIER WEIR CONSTRUCTION

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5 Sheets-Sheet 5



INVENTOR.

FREDERICK L. YOUNG, JR.

BY

Symmes & Lechner
ATTORNEYS

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3,465,889

LIQUID CLARIFIER WEIR CONSTRUCTION
 Frederick L. Young, Jr., Dallas, Tex., assignor to F. B. Leopold Company, Inc., Zelenople, Pa., a corporation of Delaware

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10 Claims

ABSTRACT OF THE DISCLOSURE

Weir construction for use with a liquid offtake trough of a liquid clarifier including a plurality of weir devices arranged in a series along the trough and each comprising a pan having one open side and side walls at its other sides, the side walls having a plurality of weir notches, and the side walls of the weir devices having end portions meeting each other from one device to the next in the series and jointly forming a sinuous notched weir wall of total length substantially greater than the length of the offtake trough with which the devices are associated.

This invention relates to liquid clarifier equipment and is especially concerned with a weir arrangement adapted to be associated with a liquid offtake trough and providing extensively increased length of the notched weir wall in relation to the length of the offtake trough with which the weir is associated, thereby providing for increase in flow capacity without increasing the flow through each individual weir notch.

To facilitate explanation of additional objectives and advantages, reference is first made to the arrangement of a typical clarifier tank. Although such tanks may be either rectangular or circular, in a typical installation, a clarifier tank, for instance of a sewage disposal plant, comprises a circular structure of diameter from about 30 to 150 feet, the tank having a centrally located inlet for the sewage to be clarified and having a liquid offtake trough extended substantially around the perimeter.

In a typical prior installation of the kind referred to, a weir plate having a multiplicity of weir notches in its upper edge is extended around the tank adjacent the inner wall of the offtake trough so that the liquid flowing into the offtake trough passes through the weir notches. According to prior practice, where additional weir notch capacity was desired, this was achieved either by adding finger weirs or inboard weirs. In a typical circular clarifier tank, the finger weirs comprised additional troughs radiating from a central portion of the tank outwardly to the offtake trough at the perimeter, in the manner of spokes, each of the finger troughs being provided with notched weir plates at both edges for flow of liquid into the finger troughs and thence into the offtake trough around the perimeter of the tank.

When the alternative of employment of inboard weirs was resorted to in order to increase the weir capacity, an inboard offtake trough was arranged in spaced relation to the perimeter of the tank and provided with weir plates at both sides thereof, so that the liquid entering the inboard trough could pass through the weir notches at both sides of that trough.

Each of the foregoing prior art expedients (finger and inboard weirs) are open to serious disadvantages, one of which is the complication of mounting arrangements which must be made in the tank, and the other of which is the difficulty which these alternatives both involve from the standpoint of cleaning operations.

In contrast with the foregoing, the present invention provides for extension of the weir wall associated with the offtake trough at the perimeter of the tank by ar-

ranging the weir wall to extend sinuously or in an undulating path adjacent to the inner edge of the offtake trough. The arrangement of the invention, therefore, does not require the complex mounting arrangements needed for finger and inboard weirs. In addition, since the sinuous weir wall is positioned adjacent of the offtake trough at the perimeter of the tank, it is so located that it is readily accessible for cleaning merely by standing on the ground outside of the tank. This is particularly important in a clarifier tank for use in a sewage disposal plant and results in a large decrease in the maintenance problem.

Although it is preferred according to the present invention to avoid the use of finger or inboard weirs, it is to be understood that in certain instances where very high weir capacity is needed, finger weirs may be included in the installation, but in this event I prefer to use a sinuous weir plate at each edge of each finger trough and to shorten the length of the finger trough, thereby providing considerable increase in weir plate length while still retaining the weir structure close to the outside wall of the tank and thus maintain all of the weir structure readily accessible for cleaning from a position outside of the tank.

Still further, in accordance with the invention, the sinuous or serpentine weir plate which is characteristic of the present invention is provided by the employment of a series of weir pans, each having an open side and having weir walls at its other sides, the several pans being mounted with their open sides adjacent to the offtake trough. In this way the extended weir wall is provided in a manner which retains great simplicity from the standpoint of mounting arrangements, it being a simple matter to mount a series of adjacent weir pans on or adjacent to a wall of the offtake trough.

The invention also contemplates the provision of adjustment devices in the mounting for the weir pans, thereby facilitating location of the weir plates at the desired elevation on relation to the water level to be maintained in the tank.

How the foregoing and other objects and advantages are attained will appear more fully from the following description referring to the accompanying drawings illustrating several preferred embodiments of the invention and in which:

FIGURE 1 is an overall perspective view of a circular clarifier tank equipped with weir devices according to the present invention, a portion of the tank being broken out to better show certain features of the construction;

FIGURE 2 is an enlarged fragmentary plan view of a portion of the tank wall shown in FIGURE 1, and of the offtake trough arranged at the perimeter, with the weir plates of the present invention associated therewith;

FIGURE 3 is a still further enlarged perspective view of one of the weir pans employed in the arrangement of FIGURES 1 and 2;

FIGURE 4 is a sectional view taken as indicated by the section line 4—4 on FIGURE 2 but illustrating the construction on an enlarged scale as compared with FIGURE 2;

FIGURE 5 is a further enlarged view, taken as indicated by the section line 5—5 on FIGURE 2, illustrating certain details relating to the mounting of a scum baffle in association with the weir devices of FIGURES 1—4, inclusive;

FIGURE 6 is a partial plan view of a modified form of weir construction according to the invention;

FIGURE 7 is an isometric view of a portion of the weir construction shown in FIGURE 6;

FIGURE 8 is a partial plan view of still another form of construction according to the invention;

FIGURE 9 is an isometric view similar to FIGURE 7

but illustrating a portion of the weir construction of FIGURE 8;

FIGURE 10 is a plan view of an adaptation of the weir construction of the present invention to finger troughs employed in a rectangular clarifier tank; and

FIGURE 11 is a fragmentary view of still another embodiment of the weir construction of the invention, this view also showing use of the invention in a rectangular clarifier tank.

Referring first to the embodiment illustrated in FIGURES 1-5, inclusive, the clarifier tank there shown includes an upright generally cylindrical wall 12 defining a circular clarifier tank having an offtake trough 13 at the circumference or perimeter of the tank, this trough being formed between the outer wall 14 and the inner wall 15. A discharge pipe 13a may serve to deliver the liquid from the trough 13. The tank and trough walls 12, 13, 14 and 15 are all desirably formed of concrete.

An inlet, for instance a sewage inlet may be provided at the center of the tank in known manner, and the liquid to be clarified flows radially outwardly in all directions from the inlet toward the circumference of the tank. During this flow, settling or sedimentation occurs and the tank would of course be provided with known type of mechanism for periodically removing the settled solids.

The weir construction in the embodiment illustrated in FIGURES 1-5, inclusive, consists of a series of weir devices, each comprising a pan having a bottom wall 16 and having an upright weir wall 17 extended along all sides of the pan, except for one side, which latter is to be associated with the offtake trough. As best seen in FIGURE 2, 3 and 4, the wall 17 is provided with a multiplicity of weir notches 18, and the end portions of this wall are curved so that when the series of pans is assembled, the end walls meet each other from pan to pan in the series. Although the weir pans may be of angular plan form, preferably they are arranged to provide a weir wall 17 which is curved not only in the end portions but also intermediate the end portions, so that when a series of pans are assembled, the overall weir wall provided takes a sinuous or serpentine form, with portions extended transverse the axis of the offtake trough.

For mounting the pans adjacent to the offtake trough, each pan is provided with a downwardly projecting flange 19 at the side thereof which is open, and this flange may be fastened to the inner wall 15 of the offtake trough by means of studs 20 anchored in the concrete, as clearly appears in FIGURE 4. Preferably the flange 19 is slightly curved in order to conform to and snugly fit the curved surface of the wall 15 at the inner side of the trough 13. Slotted holes 21 in the flange 19 provide freedom for vertical adjustment of the pan and also for angular adjustment of the pan in a vertical plane paralleling the axis of the offtake trough.

One or more diagonal braces 22 are also provided for each pan, these braces being connected with the weir wall 17 of the pan and secured to the inner wall 15 of the offtake trough by means of studs 23. Slotted apertures in the lower ends of the braces 22 serve to provide for both vertical and angular adjustment of the trough position.

Each of the weir pans is provided with an offset edge portion 24 providing for lap-jointing with the adjacent edge portion of the next pan in the series. Apertures 25 may serve as guides for the drilling of corresponding holes in the other part of each lapped joint and for reception of fastening bolts as indicated at 26 in FIGURE 2.

In the case of employment of the construction in a clarifier used for the handling of sewage, a scum baffle 27 is desirably employed in combination with the weir plate. The scum baffle 27 may conveniently be mounted by means of angle brackets 28 and 29, the former of which may be fastened to the outer portion of various of the weir pans in the manner clearly indicated in FIGURE 5, the other angle bracket 29 being secured to the scum

baffle 27, and the two brackets 28 and 29 being bolted together as indicated at 30 in FIGURE 5. Slotted bolt holes are desirably provided, for instance in one or both of the brackets 28 and 29 to permit adjustment of the scum baffle both vertically and radially in the tank.

Ordinarily the scum baffle merely comprises a flat strip, for instance 12" in width, with its lower edge extended below the surface of the liquid in the tank and with its upper edge extended somewhat above, for instance 2" above the upper edge of the weir plate 17. In operation the liquid flowing from the center of the tank radially outwardly toward the offtake trough passes under the scum baffle and thence upwardly and through the weir notches. In this manner only relatively clear liquid reaches the weir notches, the floating scum being held back by the scum baffle and being periodically removed by means of scum removal equipment of known type.

It should be understood that a scum baffle is not necessarily employed in all installations. Indeed, in many water supply and purification systems a scum baffle is not needed, and in various of the embodiments described hereinafter, no scum baffle is employed although it could of course be added in the event that the alternative embodiments are used in the handling of sewage.

In accordance with the preferred practice of the invention, the weir devices or weir pans are molded of glass fiber reinforced plastic material, preferably in a form having rounded corners and edges, especially in the interior of the pins.

With the weir pans located adjacent to the offtake trough at the perimeter of the tank, and with the weir pans formed of glass fiber reinforced plastic material, and still further with the pans formed with curved surfaces and with rounded corners and edges, maximum convenience for cleaning is maintained and, at the same time, a minimum of maintenance is needed. The fiber reinforced plastic material requires no painting or application of corrosion resistant coatings.

Preferably also the scum baffle is formed of glass fiber reinforced plastic material. Mounting brackets and other parts associated with this equipment, for instance the braces 22 and the bracket elements 28 and 29 may also be formed of such plastic material.

Where glass fiber reinforced plastic materials are utilized it is preferred to employ thermosetting laminating resins, for instance the polyester resins. For certain of the parts, such as brackets and braces, it is also practical to employ resin materials without fiber reinforcement, for instance the well known rigid polyvinyl chloride resin materials.

In connection with the operation of the embodiment described above with reference to FIGURES 1-5, it is to be noted that not only is the entire weir structure kept close to the perimeter of the clarifier tank for easy cleaning, but in addition a large increase in total weir length has been provided without however appreciably shortening the flow distance between the tank inlet and the weir notches. This results in increase in capacity of the clarifier without reducing the flow distance, in view of which effective settling out of the solids is still retained.

FIGURES 6 and 7 illustrate an alternative embodiment in which weir pans of the general type shown in FIGURE 3 are adapted and applied to an existing inboard offtake trough 31. Here the tank wall appears at 32 and supports for the inboard offtake trough are indicated at 33. In an installation having such an inboard offtake trough, if it is desired to extensively increase the weir length, this may be accomplished by removing the simple or straight weir plates which heretofore have been employed at both edges of the inboard trough, and replacing those plates with weir pans of the general kind shown in FIGURE 3. The pans here employed have bottom walls 16 and side walls 17 of the construction and configuration above described, but in this instance it is preferred that the mounting flange 19a at the open

side of the pan be flat or straight, instead of curved as in FIGURE 3, in order to provide a snug fit with the straight walls of the trough 31.

The embodiment shown in FIGURES 8 and 9 has certain features in common with that shown in FIGURES 1-5. Here, as in FIGURES 1-5 an offtake trough 13 is provided at the perimeter of the tank between the walls 14 and 15, and groups of weir pans are associated with that trough in the same general manner as described above in connection with the first embodiment. However, the embodiment of FIGURES 8 and 9 further illustrates an adaptation of the invention to an installation, for instance an existing installation, in which finger weirs are also incorporated. The finger troughs are indicated at 34, being arranged to extend radially in the manner of spokes, with their outer ends in communication with the offtake trough 13.

As best seen in FIGURE 9, each side wall of the trough 34 is cut out to receive a weir pan having a bottom wall 35 and a weir wall 36 with notches 37. The upper edges of the trough 34 are also provided with notches as indicated at 38 between the inserted weir pans.

It will be understood that the edges provided with the notches 38 may if desired be formed in separate plate elements fastened to the walls of the trough to provide freedom for adjustment. Such adjustment is preferably also provided for in relation to the weir pans 35, 36, for instance by means of slotted apertures 39 provided in the mounting flanges 19b.

By employing weir pans having extended weir wall length, the weir capacity of the finger troughs is increased. Such increase may be sufficient to permit shortening of the finger troughs, so that they need not necessarily extend all the way from the periphery to the central structure 40 provided in the tank. However, if desired, in order to attain an exceedingly high weir capacity, the weir pans of the present invention may be associated both with the peripheral trough and throughout the length of finger troughs, as is illustrated in FIGURE 8.

In the embodiment shown in FIGURE 10, the weir pan or sinuous weir arrangement of the invention is shown as applied to an installation in a rectangular clarifier tank the wall of which is indicated at 41. This tank is provided with an offtake trough 42 along one end of the tank, for instance the end shown at the top of FIGURE 10 and any known inlet mechanism may be arranged at the opposite end of the tank. The series of finger troughs 43 project inwardly from the end trough 42, and each one of these finger troughs is provided with a series of weir pans at each side thereof. These pans may take the form of those described above with reference particularly to FIGURES 3 and 4, although here, as in FIGURES 6 and 7, the mounting flange at the open side of the pan should be straight so as to provide a tight fit with the side wall of the trough 43. To permit free flow to all of the weir notches provided on the series of pans incorporated in this embodiment, the weir pans at the opposite sides of each trough 43 are preferably staggered so that the pans at adjacent sides of adjacent finger troughs are staggered with relation to each other.

By employing an arrangement such as shown in FIGURE 10, it is possible to reduce the overall length of the finger troughs, as compared to an arrangement in which straight weir plates are extended along the edges of the troughs, and this is of advantage for a number of reasons including the fact that the weir pans and the notches in the walls thereof are kept as close as possible to the end wall of the tank, thereby facilitating access to the weir pans for purposes of cleaning. The shortening of the finger length which is made possible by this construction is also of advantage because the flow distance from the tank inlet to the weir notches is increased. This in turn provides a longer path of flow during which the sedimentation or settling of the solids may occur. This

effect is still further enhanced by the arrangement of FIGURE 11 described below.

In the embodiment shown in FIGURE 11, which also illustrates an installation in a rectangular tank, the finger troughs have been completely eliminated, and an extended weir length is provided merely by associating a series of weir pans according to the present invention with the upstream wall of the offtake trough 42. Here again the pans may be of the same type as described above with particular reference to FIGURES 3 and 4.

From the foregoing it will be seen that all embodiments described provide for an increase in weir length by the use of a sinuous weir wall, preferably formed in sections as a part of weir pans which are of size and shape greatly simplifying the mounting and adjustment thereof. Moreover, with various of the embodiments it is possible to attain the important objective of so locating all of the weir elements that they are readily accessible for cleaning by standing outside of the tank adjacent to the offtake trough which is provided along at least a portion of the perimeter of the tank.

I claim:

1. Equipment for use in a liquid clarifier tank, including a liquid offtake trough with its axis extended along and adjacent to at least a portion of the perimeter of the tank, a weir plate at the inner edge of the said trough with its upper edge extended generally along the inner wall of the offtake trough but being sinuous with portions thereof extending in directions generally transverse the axis of the offtake trough, the sinuous upper edge of the plate having a multiplicity of weir notches delivering liquid from the tank into the offtake trough, a scum baffle positioned upstream of the sinuous weir plate edge, and means for mounting the scum baffle on portions of the sinuous weir plate edge projecting upstream from the offtake trough.

2. Equipment adapted for use in a liquid clarifier tank, including a liquid offtake trough, and a weir device comprising a pan having one open side and side walls at its other sides, the side walls having a plurality of weir notches at all sides of the pan except for said open side for flow of liquid into the pan, and the pan having mounting means providing for cantilever mounting of the pan at its open side and with its open side adjacent the trough to discharge the liquid from the pan into the trough.

3. Equipment adapted for use in a liquid clarifier tank, including a liquid offtake trough, and a weir device comprising a pan having one open side and side walls at its other sides, the upper edges of the side walls having a plurality of weir notches for flow of liquid into the pan, the pan being positioned with its open side adjacent the trough to discharge the liquid from the pan into the trough, and mounting mechanism for the pan including means for mounting the pan on the trough with freedom for vertical adjustment of the pan and thus of the notched upper edges of the side walls thereof.

4. Equipment according to claim 3 in which the means providing for vertical adjustment comprises adjustment devices for the elevation and also for the angular relation of the weir pan with respect to the horizontal.

5. Equipment adapted for use in a liquid clarifier tank, including a liquid offtake trough, and a weir device comprising a pan having one open side and side walls at its other sides, the upper edges of the side walls having a plurality of weir notches for flow of liquid into the pan, and mechanism for mounting the pan with its open side adjacent the trough to discharge the liquid from the pan into the trough, the mounting mechanism including means providing for vertical adjustment of the notched upper edges of the side walls, the adjustment means comprising a flange along the open side of the pan projecting downwardly therefrom and means providing for attachment of the flange to the trough wall at various different elevations with respect to the offtake trough.

6. Equipment adapted for use in a liquid clarifier tank,

including a liquid offtake trough, and a weir mechanism comprising a series of side-by-side pans each having one open side and side walls at its other sides, the side walls of each pan having end portions curved away from each other and into the plane of the open side of the pan in positions adapted to meet similar portions of adjacent pans of the series, the side walls of each pan having a plurality of weir notches for flow of liquid into the pan, and each pan being mounted with its open side adjacent the trough to discharge the liquid from the pan into the trough.

7. Equipment for use in a circular liquid clarifier tank, including a liquid offtake trough extended around the perimeter of the tank, and a plurality of weir devices arranged in side-by-side relation along the inner side of the trough, each weir device comprising a pan having one open side and side walls at its other sides, the side walls having a plurality of weir notches for flow of liquid into the pan, the pans being mounted in a series around the tank with their open sides adjacent the trough to discharge the liquid from the pans into the trough, and the side walls of the pans having end portions meeting each other from pan to pan in the series around the tank and the side walls of the several pans in the series jointly forming a sinuous notched weir wall of total length substantially greater than the perimeter of the tank.

8. Equipment for use in a rectangular liquid clarifier tank, including an elongated liquid offtake trough along one wall of the tank, and a plurality of weir devices arranged in side-by-side relation along the upstream side of the trough, each weir device comprising a pan having one open side and side walls at its other sides, the side walls having a plurality of weir notches for flow of liquid into the pan, and the pans being mounted in a series along said trough with their open sides adjacent the trough to discharge the liquid from the pans into the trough, and the side walls of the pans having end portions meeting each other from pan to pan in the series along the trough and the side walls of the several pans in the series jointly forming a sinuous notched weir wall of total length substantially greater than the length of said trough.

9. Equipment for use in a liquid clarifier tank, including an elongated liquid offtake trough adjacent at least a portion of the perimeter of the tank, a plurality of finger troughs connected with said offtake trough and projecting upstream therefrom, and a plurality of weir devices arranged in side-by-side relation along at least one side of each of the finger troughs, each weir device comprising a pan having one open side and side walls at its other sides, the side walls having a plurality of weir notches for flow of liquid into the pan, and the pans being mounted with their open sides adjacent the finger troughs to discharge the liquid from the pans into the offtake trough.

10. Liquid clarifying equipment including a tank having an offtake trough structure adjacent at least a portion of the perimeter of the tank, and a plurality of weir pans positioned in a side-by-side series along the trough structure, each pan having an open side and having side walls with weir notches at its other sides, the end portions of the notched side walls of each pan near the open side of the pan extending away from each other in positions to meet the end side wall portions of adjacent pans in the series, each pan further having a mounting flange at its open side fastened to the structure of the trough with the pan positioned to project into the tank upstream of the trough and with the open side of the pan located to drain into the trough.

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JAMES L. DE CESARE, Primary Examiner

U.S. Cl. X.R.

210—525