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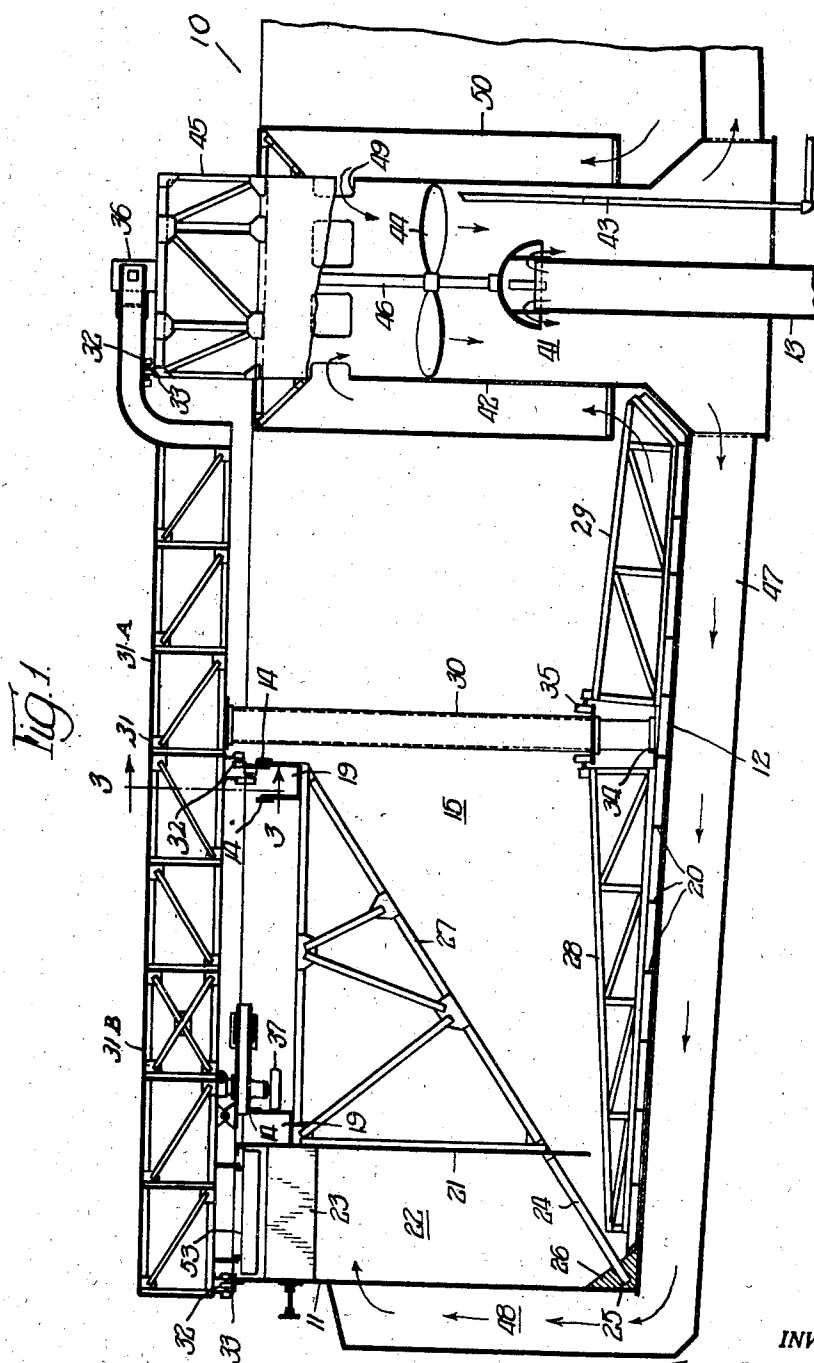
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SCRAPER STRUCTURE FOR LIQUID TREATMENT TANKS

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3 Sheets-Sheet 1



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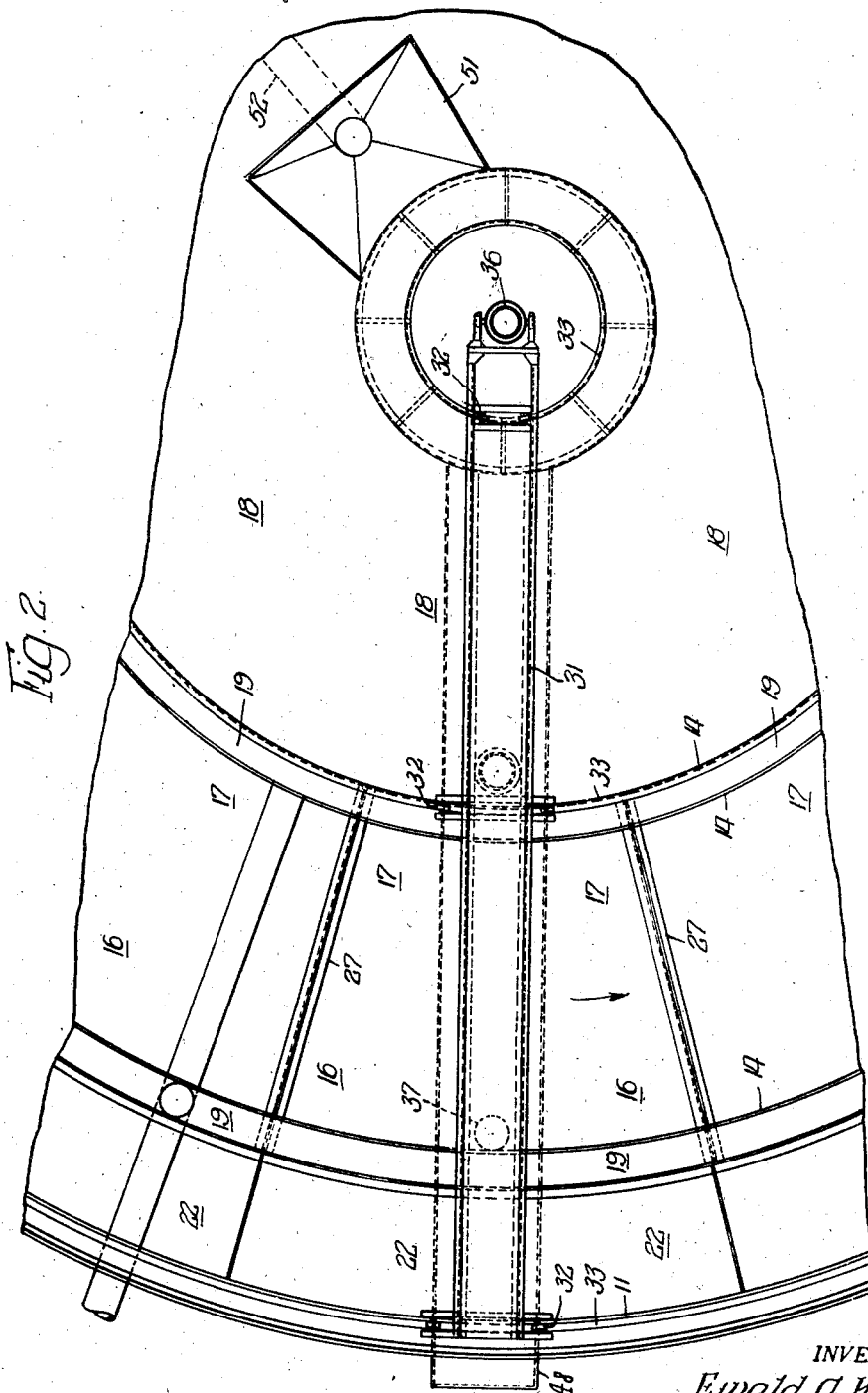
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SCRAPER STRUCTURE FOR LIQUID TREATMENT TANKS

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3 Sheets-Sheet 2



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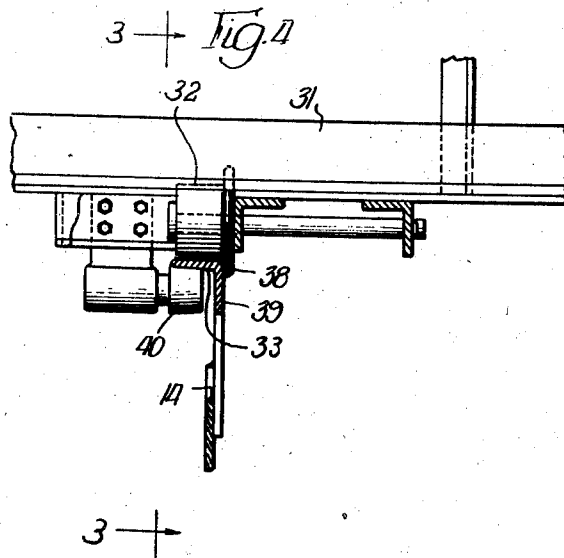
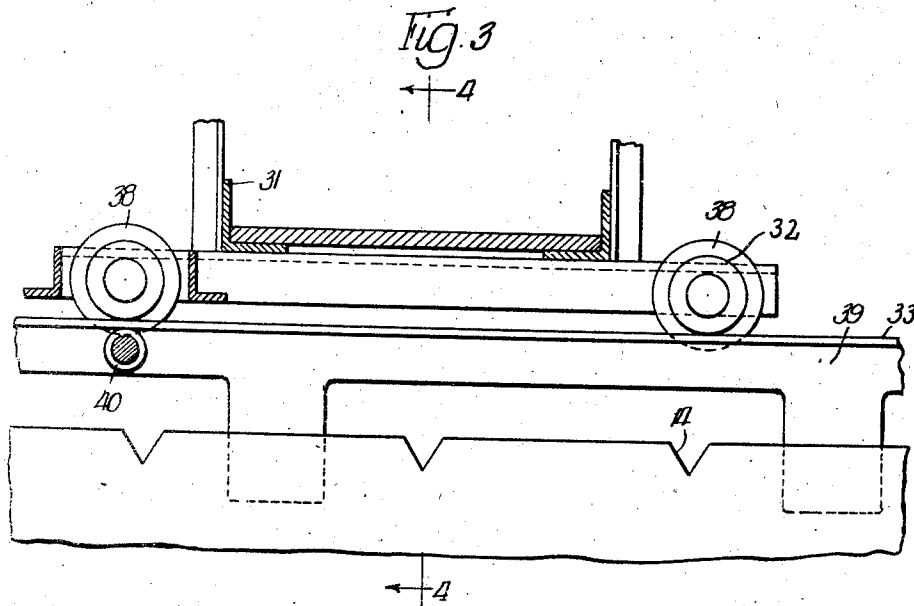
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SCRAPER STRUCTURE FOR LIQUID TREATMENT TANKS

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3 Sheets-Sheet 3



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SCRAPER STRUCTURE FOR LIQUID
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Application August 26, 1944, Serial No. 551,388

5 Claims. (Cl. 210-55)

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This invention relates to liquid treatment and particularly to sludge removal devices for clarification tanks of large area and capacity. It is an improvement over the invention of A. C. Durdin III, covered by the copending application, Serial No. 507,631, filed October 25, 1943.

It is an object of this invention to provide such devices which are relatively inexpensive while being efficient, adaptable to tanks of different types and sizes, and free from features interfering with other structures in such tanks. The and other objects will be more clearly understood upon consideration of the detailed description which follows, in connection with the drawing, wherein:

Fig. 1 is a central sectional elevation of an embodiment hereof;

Fig. 2 is a plan view of the apparatus shown in Fig. 1.

Fig. 3 is a sectional detail taken along lines 3-3 in Figs. 1 and 4.

Fig. 4 is a further section taken along lines 4-4 in Fig. 3.

The drawing shows a circular clarification tank 10 having a cylindrical side wall 11, substantially flat, circular bottom 12, and open top. Raw liquid enters through the pipe 13, and treated liquid is withdrawn over weirs 14 installed adjacent to the top of the tank, but slightly below said top, in a horizontal plane.

Since the invention relates to a tank of large area, wherein difficulties are encountered if an attempt is made to withdraw clarified liquid over a single, annular weir, a plurality of such weirs 14 are shown, concentrically with one another and with the tank. It will be understood that these weirs may have either straight top edges or spaced V-notches, or other similar expedients. The important thing is that the several weirs are so arranged with respect to the clarification zone 15 within the tank 10 that excessive flow velocities are avoided throughout this zone. For this purpose, I preferably install the several weirs so that each of them has, next adjoining to it, a partial, annular, concentric tank area 16, 17, 18, constituting a substantial portion of the total area of the clarification zone 15; the sum of these partial areas being equal to the total area. When referring to a substantial portion, I mean, in general, an approximately proportional portion; for instance, with three weirs 14 as shown, each area 16, 17, and 18 would cover approximately one-third of the total area of the clarification zone 15. This arrangement, however, is subject to modification, inasmuch as the weirs have different lengths, being concentric circles around the common center. Also, for best results, it is necessary to consider distance of horizontal travel of

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the outgoing liquid towards the weirs, as well as the area available for the flow rising to the several weirs. For such reasons, it is frequently desirable to have the innermost weir 14 installed more closely adjacent the center of the tank than would be required for a strictly uniform area associated with each weir. Furthermore, any V-notches distributed along the several weirs are preferably more closely spaced in the inner weirs than in the outer ones, to insure substantially uniform withdrawal of liquid.

This arrangement of concentric weirs has substantial advantages, particularly in a tank having an open top exposed to the influence of wind; and the clarifying capacity of a tank is greatly increased thereby. However, various difficulties heretofore prevented the use of such concentric weirs. The several weirs, of course, are associated with annular launders 19; a plurality of concentric launders being shown in the present embodiment. While the outermost launder 19 and weir 14 may be supported from the tank wall 11, in manner to be described hereinafter, it is a further question how the interior launder or launders, with their weirs, should be supported. In this connection, it must be kept in mind that a tank of this type requires sludge scrapers 20, which are most desirably pivoted above the liquid level, in the center of the tank, and driven in a slow motion which should be as uniform and quiet as possible, to avoid disturbance of the process of clarification. The most desirable type, in this respect, involves a motorized traction wheel installed adjacent the periphery of the tank, and various structural members, whereby the scrapers and traction wheel are associated with one another and with the tank.

The present embodiment comprises a large cylindrical baffle wall or partition 21 positioned above a peripheral part of the bottom 12, that is installed relatively adjacent to the outer wall 11. This wall extends from the top of the tank downwards to a level spaced above the bottom 12, for purposes to be described hereinafter; the clarification zone 15 being arranged inside of this baffle, and a channel or coagulation zone 22 being arranged outside of the same. This annular baffle wall 21 is supported by horizontal tension members 23 adjacent the top of the tank, and inclined compression members 24 extending inwardly from the corners 25 between the outer wall 11 and the bottom 12, which corners may be filled in with a corner fill 26 of concrete. The sludge scrapers 20 operate over the whole of the bottom 12, except for limited area covered by such corner fill.

The outermost effluent launder 19 is supported on the inside of the annular baffle 21 and has a single weir 14, on the inside thereof. In addition,

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I provide an inner launder 19 spaced from the baffle wall 21 and having a weir 14 on the outside and one on the inside thereof. This inner launder is supported from the annular partition 21 by means of structural trusses or support means 27 inwardly extending from the baffle wall or partition 21, above the bottom 12.

The scrapers 20 are carried by truss elements 28 and 29, extending outward and inward, respectively, from the bottom of a structural member 30 and forming, together, a single, radial scraper assembly, arm, or truss for tank 10; the outer part 28 of this assembly extending below the launder support structure and inner launder 27, 19. The member 30 extends upwardly from the point of juncture of these scraper truss elements to a part of the tank surrounded by and adjacent to the inner launder 19, above the weirs 14. There it is secured to a further truss 31 which extends substantially horizontally above said weirs, from the center to the periphery of the tank 10. The members 28, 29, 30, and 31 form a substantially rigid scraper assembly, which in principle has the shape of a large, extended, Roman letter I, with long cross-strokes or "serifs." This scraper assembly is supported by the upper "serifs," that is, by the upper truss 31, by means including rollers 32 secured to this upper truss and running on annular tracks 33 installed in conventional manner.

While the scraper assembly is substantially rigid in itself, it may comprise pivot members and adjustments as illustrated at 34 and 35 respectively, for proper adjustment. The scraper assembly is centered and held radially with respect to the tank by means of a pivot 36 at the inner end of the upper truss 31. It is driven by a motorized traction wheel 37 installed remotely from the tank center and relatively adjacent the outer wall 11, which traction wheel in the present embodiment contacts the inside of the outer launder 19, below the water level determined by the weirs 14.

Instead of being fastened to a central pivot 36, the scraper assembly can be held in radial position by means of flanges 38 on the rollers 32, engaging flanges 39 on the tracks 33, as shown in Figures 3 and 4, or in other, well-known ways.

Three sets of rollers 32 are shown, operating over three tracks 33, with a pair of rollers 32 on each track. One track and set of rollers is located adjacent to and directly supported by the outer tank wall 11. One is located adjacent to and directly supported by structural means in the central part of the tank. The third is located between these two, adjacent the innermost launder 19, and supported by that launder. If the weight of the structural parts 20, 28, 29 and 30 is insignificant, as compared with that of the upper truss 31, the intermediate rollers 32 can be omitted. On the other hand if the weight of the upper truss 31 is relatively insignificant, as compared with that of the parts 20, 28, 29 and 30, the outermost rollers 32 can be omitted.

Preferably, however, all three sets of rollers are used, as shown. In this event, most of the weight of the scraper assembly is carried by the intermediate and innermost rollers, and the outermost rollers carry only about one-half of the weight of the outer part 31—B of the upper truss 31. This part 31—B, and the inner part 31—A of the upper truss 31, is mainly, if not exclusively, relied upon to provide rigidity in a horizontal plane, whereby the peripheral drive wheel 37 can drive the scraper assembly against the load due to the re-

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moval of sludge, which load is applied to the scrapers 20 and transmitted by the vertical member 30 to an intermediate part of the top truss 31.

As the scrapers 20 are driven to remove settled sludge from over the bottom 12, they encounter a thrust reaction, which includes a major component tending to tilt the scraper assembly in a plane which is tangential to the circle of rotation of said assembly. This tilting component can be restrained in various manners, one of which is shown in Figs. 3 and 4. A roller 40 engages the intermediate track 33 from below, and is secured to the truss 31 so that it may serve as an anti-tilt roller, in manner well understood in the art. The drag on the vertical structural member 30, induced by the sludge load on the scrapers 20, tends to induce a tilting of the structural member 30; but the member 30 is restrained by this anti-tilt roller, so that the intermediate support rollers 32 stay safely on their track 33, and the top truss 31 can not be twisted. Similar anti-tilt rollers could be installed adjacent the aforementioned end rollers 32, but in that event, the truss 31 would have to be made stronger and heavier.

The raw water inlet 13 discharges into the tank 10 adjacent the center thereof, and the liquid enters a central mixing chamber 41, which is separated from the clarification zone 15 by means of a cylindrical partition 42 extending from the bottom to the top of the tank and forming a central, hollow pier in the tank. In this mixing chamber, the incoming liquid is mixed with chemicals received through the feed pipe 43, the materials being mixed by a rotary propeller 44, which is actuated by a drive mechanism generally indicated at 45, through a shaft 46. The mixed materials are received, at the bottom of the mixing chamber, in a series of radial transfer pipes 47, extending below the bottom 12 of the tank, and merging into vertical pipes 48, adjacent the tank periphery, which vertical pipes discharge into an upper part of the coagulation chamber 22.

In the present embodiment, the central partition 42 has openings 49 in the upper part thereof, and is surrounded by a cylindrical partition 50 extending from the top to above the bottom of the tank, so that upon rotation of the propeller 44, there is established and maintained a fluid circulation or recirculation downwardly through the mixing chamber 41, then through the ducts 47 and 48, coagulation chamber 22, lower part of the clarification chamber 15, and drum 50 back into the mixing chamber 41. The advantage of this recirculation is that substantially perfect distribution of the liquid and suspension of some of the sludge, in the clarification zone 15, can be maintained at all times, irrespective of variations in the rate of liquid input through the pipe 13; aside from the fact that the results may be improved in well-known manner by starting and completing the chemical treatment in the presence of sludge previously formed in liquid of the same kind. It will be understood that the concentric launders as described are particularly useful in connection with this method of distributing the liquid and suspending the sludge in the clarification zone.

While large amounts of sludge may be suspended and recirculated in this manner, all of the sludge ultimately settles on the bottom 12, and is collected by the scrapers 20, in a conventional sludge sump 51, which is preferably formed in a relatively central part of the bottom 12, and drained by a pipe 52 in well-known manner.

The central partition 42, among other things,

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serves as a structural support for the central track 33, pivot 36 and agitator drive 45.

In some instances there is a tendency for scum and other floating matters to accumulate on top of the coagulation channel 22. Such matters can be removed by a scum blade 53, cooperating with other known devices (not shown), in manner well understood in the art.

The drive wheel 37 is suitably motorized and supported, in manner known from other constructions, and rotates to drive the whole scraper assembly around the center of the tank. By means of the I-shaped construction of the scraper assembly, interference between the structural members 27 and 30 is avoided, while desirable types of effluent weirs and scraper drives are used. If the vertical member 30 were located adjacent the center or periphery of the tank, additional weight would be required for the truss that would take the place of the scraper arms 28 and 29, since this truss would cantilever from the vertical member over the entire length of a radius of the tank, unless objectionable, submerged rollers were used. Furthermore, a centrally located, vertical member would be conducive to an objectionable "whipping" tendency of the scraper assembly. A peripherally located, vertical member would make it impossible to use the necessary inner weirs and overflow launder, unless these were supported and connected through a central structure, which is complicated and undesirable.

It will be observed that in the present construction, a single scraper arm or assembly is radially installed in the tank, to rotate over the bottom of the tank. Previously, it was usual to provide at least two radial scraper arms and sometimes four or more, for the purpose of balancing such arms around a central pivot in the tank. No such balancing is required in accordance herewith, inasmuch as the I-shaped scraper assembly is safely supported by the expedients shown and described. Considerable material can be saved in this manner. Furthermore, it is possible to standardize, inasmuch as practically all tanks in accordance herewith may be equipped with the same type of motorized drive wheel 37, support rollers 32, and anti-tilt rollers 40. Finally, a single radial scraper has operating advantages over a plurality thereof, particularly in a tank providing circulating flows over the bottom, inasmuch as every scraper assembly unavoidably deflects and disturbs the liquid flow over the bottom, and such disturbance is minimized by a minimum number of scraper trusses.

It will be obvious to persons skilled in this art, upon consideration hereof, that various modifications can be applied.

I claim:

1. A tank for liquid treatment by the precipitation of sludge, comprising a flat, circular bottom; a sludge sump in said bottom; a peripheral wall; an annular baffle wall positioned above a peripheral part of said bottom within said peripheral wall to form an outer channel and an inner zone, the bottom of said channel communicating with the bottom of said zone; at least one annular launder horizontally positioned in and concentric with an upper part of said tank and inwardly spaced from said baffle wall to provide overflow means for treated liquid; a plurality of support means inwardly extending from said baffle wall, above said bottom, to support said launder; a sludge scraper truss radially extending adjacent said bottom and below said support means; sludge scraper means on said truss to scrape pre-

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cipitated sludge into said sump; structural means extending upwards from said truss to a part of the tank surrounded by and located above said launder, and further extending, above said launder and support means, towards said peripheral wall; said structural means and truss being rotatable in a path around the center of the tank; means to slowly rotate said structural means and truss over said path; liquid inlet means adjacent a central part of said tank; passage means between said central part and said channel; and means to rapidly circulate liquid from said central part through said passage means.

2. A tank according to claim 1 comprising a pier concentric with and extending from the bottom to the top of said central part; wherein said structural means extends from said part of the tank surrounded by and located above said launder, to said pier as well as towards said baffle wall, and is rotatably supported by the top of said pier; and wherein said sludge scraper truss extends inwardly away from said structural means, as well as below said support means; so that said structural means and truss forms a substantially I-shaped assembly.

3. A tank according to claim 1 wherein said means to rotate said structural means and truss is installed on the portion of said structural means extending above said launder and support means.

4. A tank for liquid treatment by the precipitation of sludge, comprising a flat, circular bottom; a sludge sump in said bottom; an upright, annular wall positioned above a peripheral part of said bottom; annular track means adjacent the top of said wall; a plurality of annular launders horizontally positioned in and concentric with an upper part of said tank, at least one such launder being inwardly spaced from said wall, to provide overflow means for treated liquid; a plurality of support means inwardly extending from said wall, above said bottom, to support said spaced launder; a sludge scraper truss radially extending adjacent said bottom and below said support means; sludge scraper means on said truss to scrape precipitated sludge into said sump; structural means extending upwards from said truss to a part of the tank surrounded by and located above said spaced launder, and further extending, above said launders and support means, towards said wall and track means; said structural means and truss being rotatable in a path around the center of the tank; means installed on said structural means and engaging said track means to rotate said structural means and truss over said path; and liquid inlet means in a central part of the tank.

5. A tank according to claim 4, comprising additional track means on said launder, and roller means supported by said additional track means and cooperating to support said structural means and truss.

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