Feb. 27, 1945. S. I. BOUSMAN 2,370,120

SEDIMENTATION APPARATUS

Filed Jan. 29, 1943 4 Sheets-Sheet 1

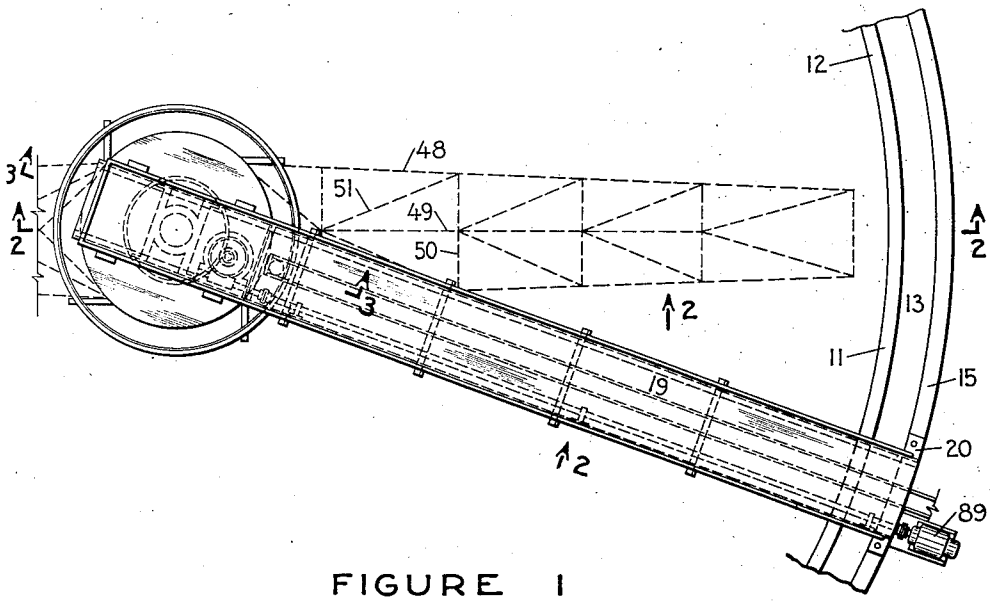


FIGURE 1

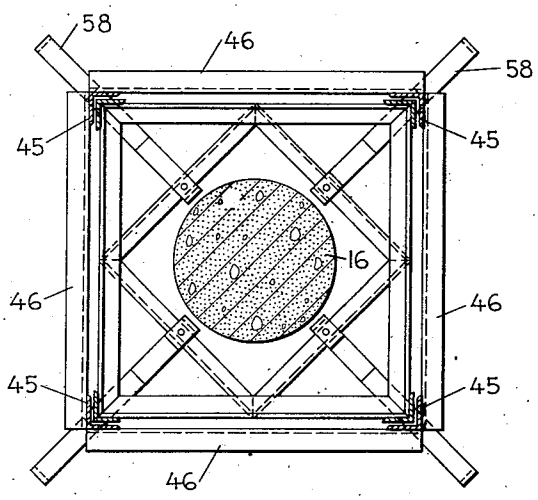


FIGURE 5

INVENTOR.
SAMUEL I. BOUSMAN

BY
Martin E. Anderson

ATTORNEY

Feb. 27, 1945. S. I. BOUSMAN 2,370,120

SEDIMENTATION APPARATUS

Filed Jan. 29, 1943 4 Sheets-Sheet 2

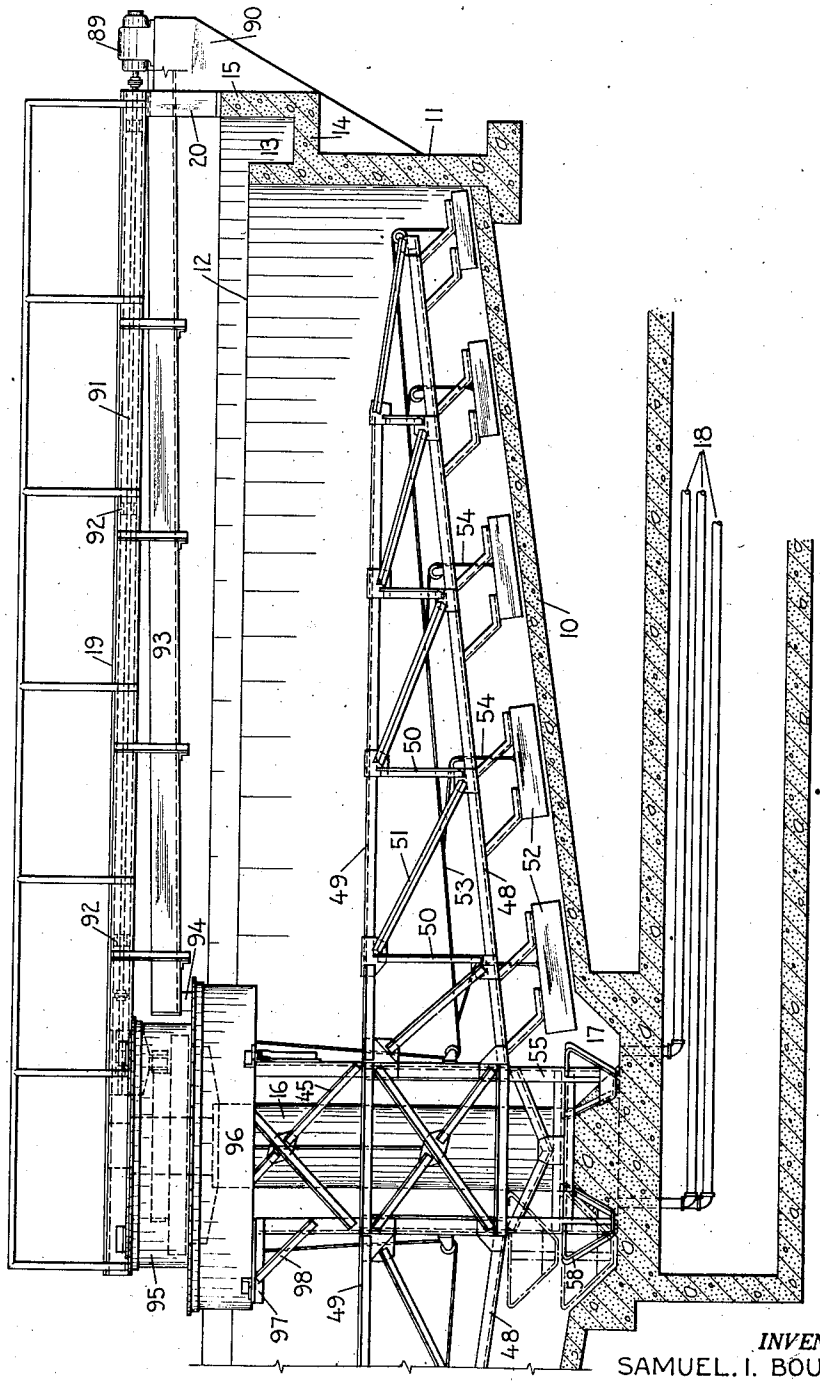


FIGURE 2

INVENTOR.
SAMUEL. I. BOUSMAN

BY Marion E. Anderson

ATTORNEY

Feb. 27, 1945. S. I. BOUSMAN 2,370,120

SEDIMENTATION APPARATUS

Filed Jan. 29, 1943 4 Sheets-Sheet 3

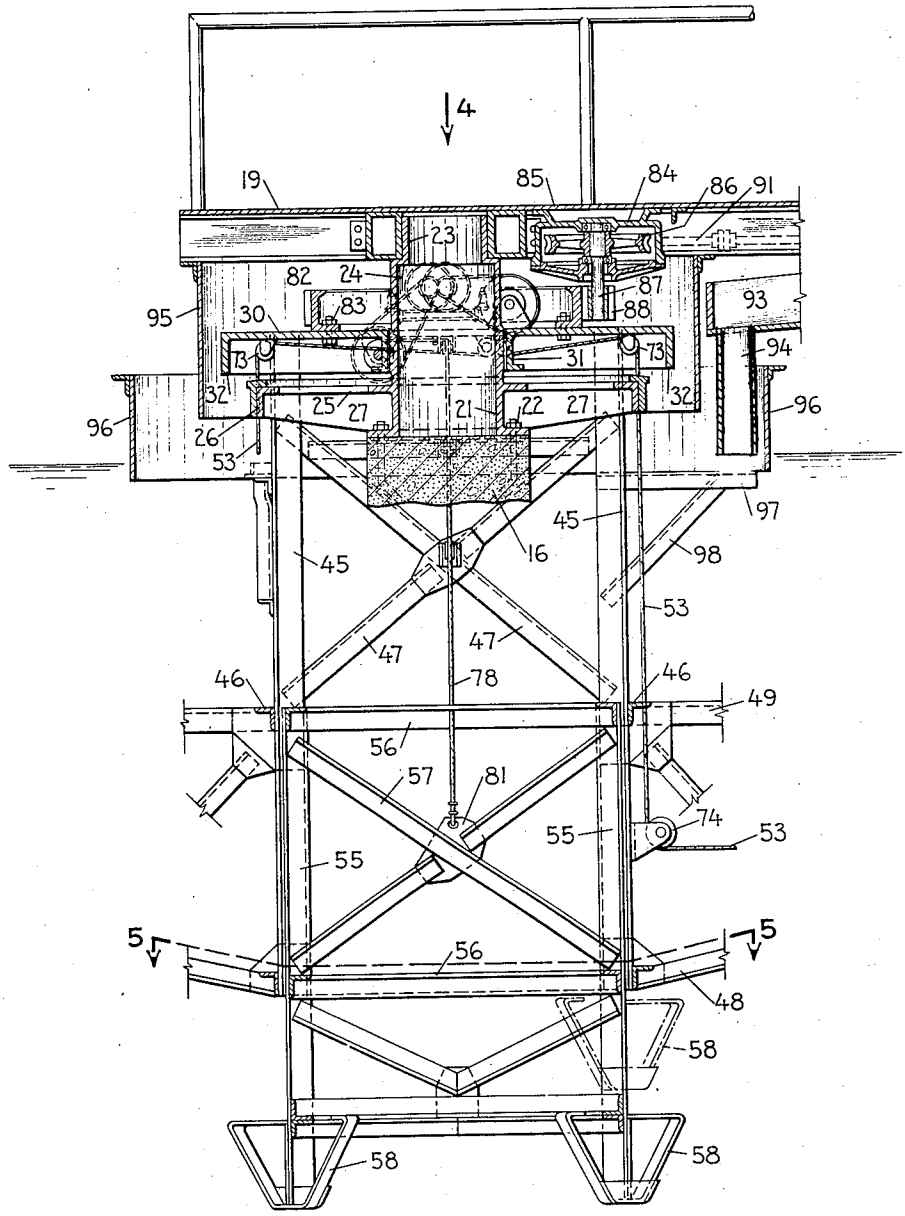


FIGURE 3

INVENTOR.
SAMUEL I. BOUSMAN

BY Martin E. Anderson

ATTORNEY

Feb. 27, 1945. S. I. BOUSMAN 2,370,120

SEDIMENTATION APPARATUS

Filed Jan. 29, 1943 4 Sheets-Sheet 4

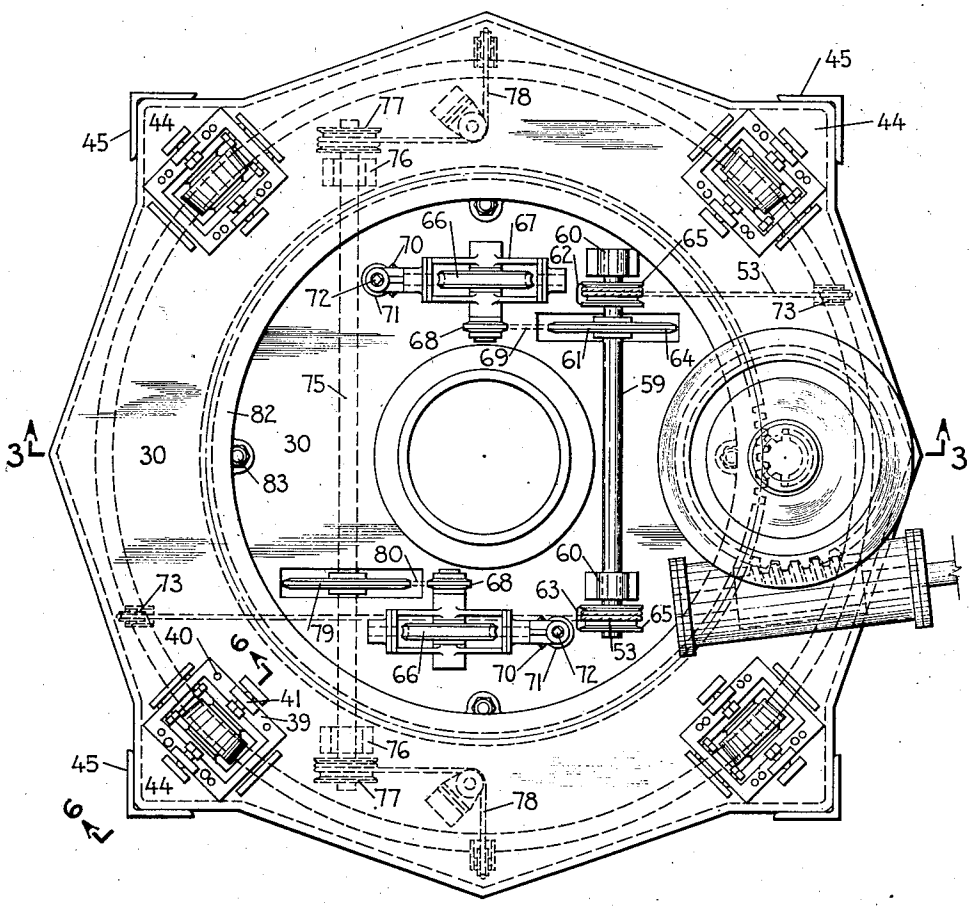


FIGURE 4

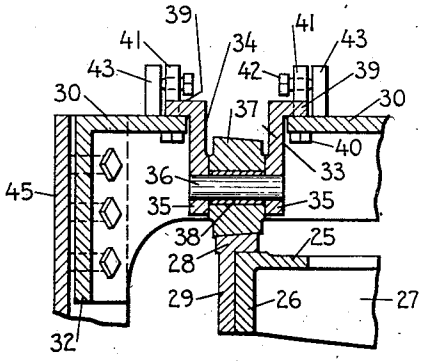


FIGURE 6

INVENTOR.
SAMUEL I. BOUSMAN
BY
Marion E. Anderson
ATTORNEY

Patented Feb. 27, 1945 2,370,120

UNITED STATES PATENT OFFICE

2,370,120

SEDIMENTATION APPARATUS

Samuel I. Bousman, San Francisco, Calif., assignor to Western Machinery Company, San Francisco, Calif., a corporation of Utah

Application January 29, 1943, Serial No. 474,026

7 Claims. (Cl. 210—55)

This invention relates to improvements in sedimentation apparatus of the type frequently referred to as thickeners.

It is the object of this invention to produce an apparatus of the type specified in which the torque strains produced during the rotation of the scraper arms will not be transmitted to the center pier, but will be borne by a special truss arrangement extending from the pier to the outer wall of the basin.

Another object of this invention is to produce an apparatus of the class specified in which the motor for producing rotation shall be mounted in a stationary position at or near the outer wall of the basin in such a manner that its weight will not be supported by the center pier.

Another object of this invention is to produce a sedimentation apparatus in which the scraper arms are supported by a center pier the base of which is surrounded by a discharge groove or cone and in which means is provided for agitating and scraping the material in the groove so as to prevent packing of the same.

A still further object of this invention is to produce an apparatus of the class described in which the cone scraper can be readily raised to inoperative position for the purpose of facilitating the starting of the apparatus after it has been closed down.

Another object of the invention is to produce a sedimentation apparatus in which the rake arms are provided with a plurality of independently supported scraper blades and with means for raising and lowering the blades so as to disengage them from the sediment after the apparatus has been closed down.

A still further object is to provide a sedimentation apparatus in which the cone scraper and the scraper blades on the rake arms can be raised and lowered independently.

Another object is to provide an apparatus of the class described in which the rake arms are rigidly connected with a center cage that is supported by and surrounds the center pier and which, therefore, do not have to be tilted or in any other way moved relative to the cage for the purpose of releasing the scraper blades.

The above and any other objects that may become apparent as this description proceeds are attained by means of a construction and an arrangement of parts that will now be described in detail, and for this purpose reference will be had to the accompanying drawings in which the invention has been illustrated, and in which:

Figure 1 is a fragmentary top view of an apparatus embodying this invention;

Figure 2 is a view showing a diametrical section through the basin and showing the walkway truss and one of the rake arms in side elevation looking in the direction of arrows 2, in Figure 1;

Figure 3 is a section taken on line 3—3, Figures 1 and 4;

Figure 4 is a top plan view looking in the direction of arrow 4 in Figure 3 with the walkway truss removed;

Figure 5 is a section taken on line 5—5, Figure 3; and

Figure 6 is a section taken on line 6—6, Figure 4.

Referring now to the drawings, reference numeral 10 designates the bottom of the sedimentation basin. This bottom has the shape of a truncated cone and in the embodiment shown is circular. A circular wall 11 extends around the outside of the bottom and terminates at point 12. An overflow launder 13 surrounds the wall and is formed by an outwardly extending wall portion 14 and a vertically extending circular wall 15. Projecting upwardly from the center of the basin is a pier 16. A groove or discharge cone 17 surrounds the base of the pier and connected with this groove are a number of pipes 18 through which the material is discharged. In the present embodiment a walkway truss, which has been designated in its entirety by reference numeral 19, has its inner end supported indirectly through other members by the pier and its outer end supported from the top of the wall 15 by some means such as a steel bracket 20, or from a pier or support separate from the wall.

Referring now more particularly to Figures 3 and 6, it will be seen that a tubular cylindrical member 21 is supported on the top of the pier and secured thereto by some suitable means such as bolts 22. The upper end of the tubular member has a section 23 of somewhat smaller diameter than the lower section and is connected therewith by an annular portion 24, whose upper surface forms a support for the walkway truss. Extending laterally from the tubular member 21, a short distance above the pier, is a circular flange 25 that is surrounded by a downwardly extending flange 26 and reenforced by radial webs 27. Reference may be had at this point to Figure 6 where these parts are shown to a somewhat larger scale. A steel track 28, having a downwardly extending flange 29, surrounds the member 25 and rests thereon in the manner shown in Figure 6.

A turntable 30 is provided at its center with an opening for the reception of the tubular member 21. This opening is surrounded by a cylindrical section 31. The outer edge of the turntable has a downwardly extending cylindrical section 32. At angularly spaced intervals the turntable is provided with openings which have been designated by reference numeral 33 in Figure 6. In the present embodiment there are four of these openings spaced ninety degrees apart. Positioned in each opening is a roller assembly comprising a casting 34 having spaced downwardly extending sides or flanges 35. These flanges are provided with openings for the reception of a short shaft 36. A roller 37 is mounted for rotation on each shaft and between the roller and the shaft a bushing 38 is provided. The surface of the track and the outer surface of the roller are inclined in a well known manner so as to produce rolling contact without sliding. The casting 34 is provided with an outwardly extending flange 39, through which bolts 40 extend and by means of which it is secured to the turntable. The side flanges 39 are provided with upwardly extending lugs or ears 41 that have threaded openings for the reception of the set screws 42 by means of which the casting can be adjusted radially into its proper position with respect to the track. The turntable is provided with upwardly extending lugs 43 with which the screws engage, all in the manner indicated in Figure 6. From Figure 4 it will be seen that the turntable is broadly octagonal in shape and that alternate angles are projected outwardly so as to form right angular portions like those indicated by reference numeral 44. Angle irons 45 are secured to the flange 32 at each of the corners 44. These angle irons extend downwardly in the manner shown in Figure 3 and are connected by means of transverse angle irons 46 and diagonal braces 47 so as to form a rigid rectangular cage. It will be noted that the angle irons 46 and the brace members are secured to the outer surfaces of angle irons 45 so as to leave the inner angles unobstructed for a purpose which will presently appear. Extending outwardly from the cage that has just been described, are at least two rake arms. These rake arms will be described only in a general way because they form no particular part of this invention and have been fully described in applicant's copending application, Serial No. 474,025, of even date herewith. The rake arms are each provided with two base angle irons 48 and an upper angle iron 49 that extends along and connects the upper vertices of a number of triangular trusses 50. Other brace members 51 extend from the vertices of the triangular trusses to the bases of the outwardly adjacent trusses in the manner indicated in Figures 1 and 2. Hingedly connected with each rake arm are a plurality of scraper blades 52 that can be raised and lowered by means of a hoist mechanism and the cables 53 and 54.

Referring again to Figure 3, it will be seen that a second cage, constructed in a manner similar to the one previously described, is positioned within the first cage and consists of four vertical angle irons 55 interconnected by means of transverse angle irons 56 and diagonal brace 57 so as to form a rigid rectangular cage assembly. Since the inside angles of angle irons 45 are unobstructed, the inside cage can telescope with respect to the first cage. The angle irons 55 extend downwardly and are each provided at the bottom with a scraper 58 and these scrapers are so positioned that they engage in the groove 17 in the manner shown in Figure 2. In Figure 3 the scrapers 58 are shown in operative position by full lines and in inoperative position by broken lines.

The hoist mechanism by which the scraper blades are raised and lowered relative to the rake arm will now be described.

Referring now more particularly to Figure 4, it will be seen that a shaft 59 is mounted for rotation in bearings 60 that are secured to the upper surface of the turntable and the latter is provided with three openings, 61, 62 and 63. A sprocket wheel 64 is attached to the shaft 59 and projects through the opening 61. Two drums 65 are also secured to the shaft, one projecting in part into the opening 62 and the other into the opening 63. Shaft 59 is rotated by a gear reduction mechanism comprising a worm gear 66 that is mounted for rotation in a casing 67 secured to the turntable. The worm gear is secured to a shaft and attached to the outer end of this shaft is a sprocket wheel 68 which a chain 69 connects with the sprocket wheel 64. A worm, not shown in Figure 4, is in cooperative engagement with the lower surface of the worm gear and the shaft to which it is secured is provided at its outer end with a pinion 70 which meshes with a similar pinion 71 secured to the lower end of shaft 72. The upper end of shaft 72 is preferably square so as to receive a socket wrench by means of which it can be rotated. Whenever shaft 72 is rotated, it will rotate the worm gear 66 and this, in turn, will cause the shaft 59 and drums 65 to rotate. Cables 53 are attached to the drums and extend laterally and after passing over the pulleys 73 extend downwardly along the upper cage, thence around pulleys 74 and thence outwardly in the manner shown in Figure 2. From the cables 53, branch cables 54 connect with the scraper blades.

The mechanism for raising and lowering the cone scraper cage is of a similar construction to that just described and consists of a shaft 75 that is mounted for rotation in bearing 76 secured to the under surface of the turntable. Secured to each end of shaft 75 are drums 77 to which hoisting cables 78 are attached. A sprocket wheel 79 is attached to the shaft 75 and this is connected by means of a sprocket chain 80 with the sprocket 68 that is secured to the shaft to which the worm gear 66 is attached. The worm for rotating the worm gear 66 is secured to a shaft to the outer end of which the pinion 70 is attached. A pinion 71 attached to the lower end of shaft 72 serves to rotate the worm and turn the shaft 75. It will be seen from the above that the worm gear reduction mechanism is of the same construction for the two hoists. The cables 78 pass around various pulleys so as to bring the vertical portion thereof outside of the track 28 and the lower ends of the cables are attached to the cone scraper frame at points 81 as shown in Figure 3.

From the above description it will be seen that the cone scrapers and the scraper blades on the rake arms can be independently raised and lowered.

The two telescopically connected cages and the rake arms connected therewith are rotated by a mechanism which will now be described.

A bull gear 82 is secured to the upper surface of the turntable by means of bolts 83. In Figure 4 the bull gear has been shown in plan view, the gear teeth being indicated by the three circles indicating the pitch and the inner and outer portions of the teeth. A worm gear housing 84 is secured to the floor 85 of the walkway truss 19. Within this housing is positioned a worm gear 86

that is secured to a downwardly extending shaft 87 which carries a spur pinion 88. The pinion engages with the teeth on the bull gear and since the pinion is secured to the walkway truss, it is apparent that whenever it is rotated, it will cause the bull gear with the parts attached thereto to rotate about a vertical axis. For the purpose of rotating the worm gear 86, a motor 89 is supported on a suitable shelf 90 at the outer end of the basin wall 15. A shaft 91 extends from the motor to the housing 84 where it is attached to a worm that is in operative engagement with the worm gear 86. Shaft 91 is supported by suitable bearings 92 spaced along the walkway truss. The motor is, of course, connected with a source of electricity by means of suitable switches and speed control rheostats if desired.

It is now apparent that whenever shaft 91 rotates, it will cause the worm gear 86 to rotate and this in turn will rotate the two telescopic cages together with the rake arms.

The material to be treated is fed to the thickener through a launder 93, that is provided at its inner end with a downwardly extending spout 94. A splash shield 95 is secured to the under side of the walkway truss and projects downwardly some distance terminating above the lower end of the spout 94. Another splash shield 96 is supported from the upper cage by means of brackets comprising radial angle irons 97 and angular braces 98.

When the apparatus above described is in operation the sewage, or other material to be treated, is fed to the center of the apparatus by means of the launder and at the same time the rake arms are slowly rotated. The scraper blades are inclined so as to move the solids that settle onto the bottom, towards the groove or cone 17 from which they are discharged through pipes 18. The level of the liquid is determined by the height of the wall 12 and this permits the clear liquid at the top to discharge at a rate proportional to the rate of feed. As long as the apparatus is operating, the scraper blades 52 and the cone scrapers 58 keep the material in motion and prevent it from hardening. Should the apparatus be closed down for any length of time, it is apparent that the solids in suspension will deposit on the upper surface of the bottom and in the groove 17 and if the close down is for any length of time, the solids become quite dense which would effectively prevent a resumption of operation due to the resistance thus offered. In order to release the rake arms after a close down, the winches are operated so as to lift the blades 52 and the scrapers 58 above the precipitated solids. After the arms have been put in motion, the cone scraper frame is lowered so as to loosen the material in the groove 17, after which the blades 52 are gradually lowered so as to stir up the material that has settled on the bottom of the basin.

Particular attention is called to the cone scraper frame assembly comprising the two telescopic cages and the means for raising and lowering the lower cage with respect to the upper. Attention is further directed to the manner in which power is transmitted from the gear motor 89 to the rotating assembly. This power transmission mechanism is so designed that it relieves the pier of all torque strains and the pier merely serves as a support for the walkway truss and a fulcrum about which the rotary forces tend to turn it. Since the outer end of the walkway truss is secured to the wall 15, or to some other stationary support, it is evident that it remains stationary during the operation.

Motor 89 has been indicated in a general way and may be of any suitable type. In some cases it may be desirable to employ what is called a "gear motor" which has an inbuilt speed reduction gear. Since the shaft 91 is often quite long, it is preferable to have the speed reducing gears adjacent the inner end of the shaft as this permits the shaft to rotate at a higher speed and with less torque wherefore a smaller diameter shaft can be used. If any speed reducing gears other than the worm gear shown, is needed, it may be positioned in the most desirable place.

In the embodiment illustrated and described, the power is transmitted from the motor to the worm reduction gear by means of shaft 91. It is to be understood, however, that any other mechanically equivalent power transmission can be substituted, as for example, a rope or cable drive, the principal object to be attained being the positioning of the motor where it will be readily available for servicing and inspection.

In the embodiment illustrated, the outer end of the walkway truss has been shown as being supported by a bracket 20 that rests on wall 15, which is the preferable way. It is to be understood, however, that the walkway truss may be supported by a separate pier positioned outside of the wall 11. In case the boundary wall is entirely eliminated, as it sometimes is in cheap installation the outer end of the walkway truss would still have to be supported and would then most probably rest on a special pier or support.

Having described the invention what is claimed as new is:

1. In a sedimentation apparatus comprising a basin provided with a central pier surrounded at its base by a circular discharge groove, means for introducing a liquid mixture into the basin adjacent the pier, and a clarified liquid effluent overflow surrounding the basin, a turntable mounted for rotation on the pier, a cage suspended from the turntable and surrounding the upper end of the pier, means for rotating the turntable and the cage, a cone scraper frame surrounding the lower end of the pier, positioned on the inside of the cage and connected therewith for conjoint rotation and relative vertical movement, scrapers on the lower end of the frame, positioned to engage in the circular discharge groove, and means for raising and lowering the frame comprising, a winch mechanism including a drum supported by the turntable, and cables operatively connecting the frame with the drum, the winch mechanism including the drum and the cables serving to raise and to lower the frame with respect to the cage.

2. In a sedimentation apparatus comprising a basin provided with a central pier surrounded at its base by a circular discharge groove, means for introducing fluid mixture adjacent the pier and means for overflowing clarified effluent, a turntable supported by the pier and mounted to rotate about a vertical axis, means for rotating the turntable, a cage suspended from the turntable, said cage comprising a plurality of vertically arranged angle irons attached at their upper ends to the turntable, the angles between the flanges facing inwardly, a plurality of braces attached to the outer surface of the angle irons, a cone scraper frame positioned within and slidably interconnected with the vertical angle irons, said interconnections forming means for resisting forces tending to effect relative rotation be-

tween the cage and frame, cone scrapers attached to the lower end of the frame in position to engage in the discharge groove, a winch drum carried by the turntable, means comprising a speed reduction gear, for rotating the drum, and cables operatively connecting the frame with the drum, the drum and the cables forming means for raising and lowering the frame relative to the cage and the turntable.

3. In a sedimentation apparatus comprising a basin provided with a central pier whose base is surrounded by a circular discharge groove, forming a sediment outlet, means for introducing a fluid mixture to the basin near its center, and a clarified liquid overflow, means for moving solids towards the discharge groove, and means for stirring the contents of the latter, comprising a cage surrounding the upper end of the pier and rotatable thereabout, means for rotating the cage, scraper arms extending radially from the cage, scraper blades on the arms, a frame positioned within the cage and telescopically connected therewith, means interconnecting the cage and frame for conjoint rotation, means for raising and lowering the frame relative to the cage and independently of the scraper blades, comprising a winch mechanism carried by the cage, and scrapers secured to the frame extending downwardly therefrom and positioned to enter the discharge groove.

4. In a sedimentation apparatus comprising a basin provided with a central pier whose base is surrounded by a circular discharge groove, forming a sediment outlet means for introducing a fluid mixture to the basin near its center, and a clarified liquid overflow, means for moving solids towards the discharge groove, comprising a cage of polygonal cross section having vertical angle irons at the corners, said angle irons being positioned with the angles towards the inside, a plurality of scraper arms extending radially from the cage, means for rotating the cage and arms, inclined scraper blades carried by the arms, and means for stirring the contents of the discharge groove comprising a frame of the same cross sectional shape as the cage, positioned within the latter and provided with vertical angle irons at the corners, positioned to slidably engage the inner surfaces of the flanges of the corresponding angle irons of the cage, the lower end of the frame having at least one scraper positioned to enter the discharge groove, and means comprising a winch mechanism carried by the cage for raising and lowering the frame relative to the cage and independently of the arms.

5. In a sedimentation apparatus comprising a basin having a central pier surrounded by a discharge groove, means for feeding a liquid mixture to the basin adjacent the pier, and a clarified liquid effluent overflow surrounding the basin, means for moving settled material towards the discharge groove, comprising a turntable rotatably supported on the pier, means for rotating the turntable, rake arms carried thereby, a cage depending from the turntable and surrounding the upper end of the pier, a frame surrounding the pier positioned within the cage and mounted for relative vertical movement therewith, means interconnecting the cage and frame for conjoint rotation about the pier, at least one stirring element connected with the lower end of the frame, positioned to extend into the discharge groove, a winch mechanism comprising a drum, carried by the turntable, means for turning the drum, and cables connecting the frame to the drum, whereby when the latter is rotated the frame will be moved vertically relative to the cage and the turntable to adjust the stirring element relative to the discharge groove.

6. In a sedimentation apparatus having a basin with a pier upstanding therein and provided with means for feeding a fluid mixture thereto and with a clarified effluent overflow, a stationary bearing member mounted on the pier, a sediment raking structure comprising a turntable and at least two arms, supported by and mounted for rotation on said pier, a plurality of scraper blades positioned beneath said arms and carried thereby, means for rotating the raking structure the basin having a circular discharge receiving groove surrounding the base of the pier, forming a sediment outlet a cone scraper frame surrounding the pier and supported by the rotatable sedimentation rake structure, for conjoint rotation and for independent vertical movement, the lower end of said frame having at least one cone scraper positioned to project into the annular groove, and means for raising and lowering the frame independently of the rake structure to raise the scraper from the groove and to lower it there into.

7. In a sedimentation apparatus having a basin with a pier upstanding therein and provided with means for introducing a fluid mixture, and with a clarified effluent overflow, a sediment raking structure comprising at least two arms mounted for rotation about said pier and supported thereby, a plurality of scraper blades positioned beneath and attached to each arm means for rotating the raking structure, the basin having a circular sediment discharge groove surrounding the base of the pier forming a sediment outlet, a cone scraper frame surrounding the pier and carried by the sedimentation raking structure for conjoint rotation, the frame having its lower end provided with at least one scraper for entering the groove, and means comprising a hoist mechanism carried by the raking structure for raising and lowering the scraper frame independently of the sediment raking structure, whereby the cone scraper can be brought into and out of sediment engaging position.

SAMUEL I. BOUSMAN.