

[72] Inventor Carl J. Bordner
Rockville, Md.
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[73] Assignee Defiance Company
Tallavast, Fla.
A division of Davis Industries, Inc.
Thomasville, Ga.

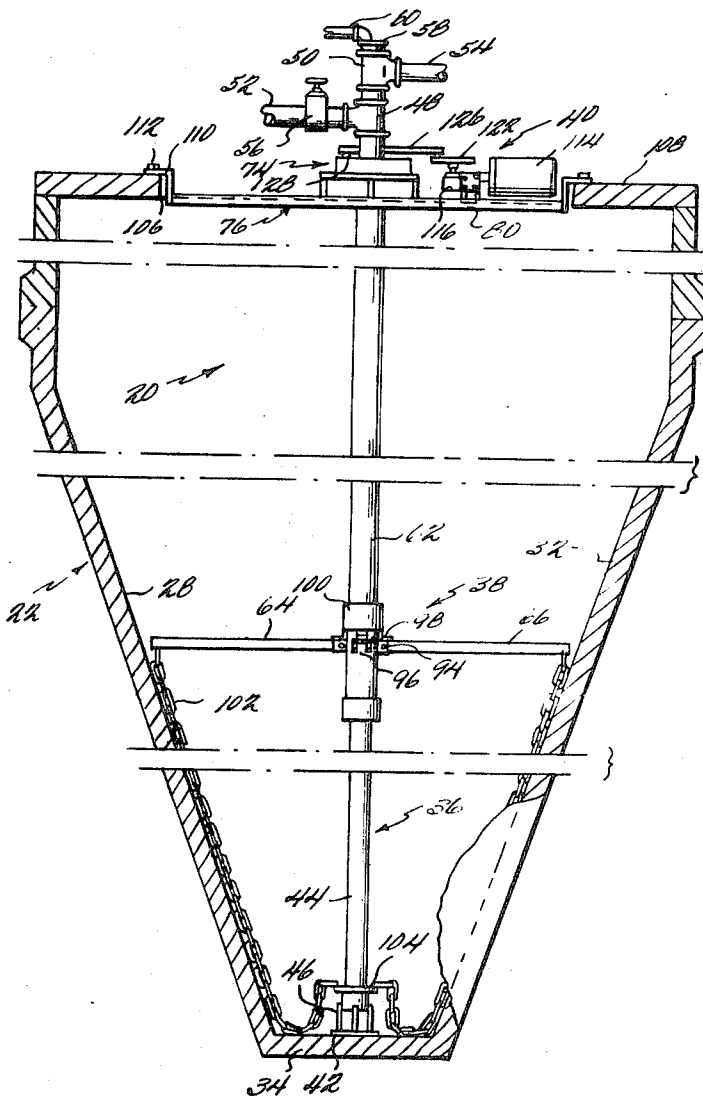
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Primary Examiner—John Adeo
Attorney—Cushman, Darby & Cushman

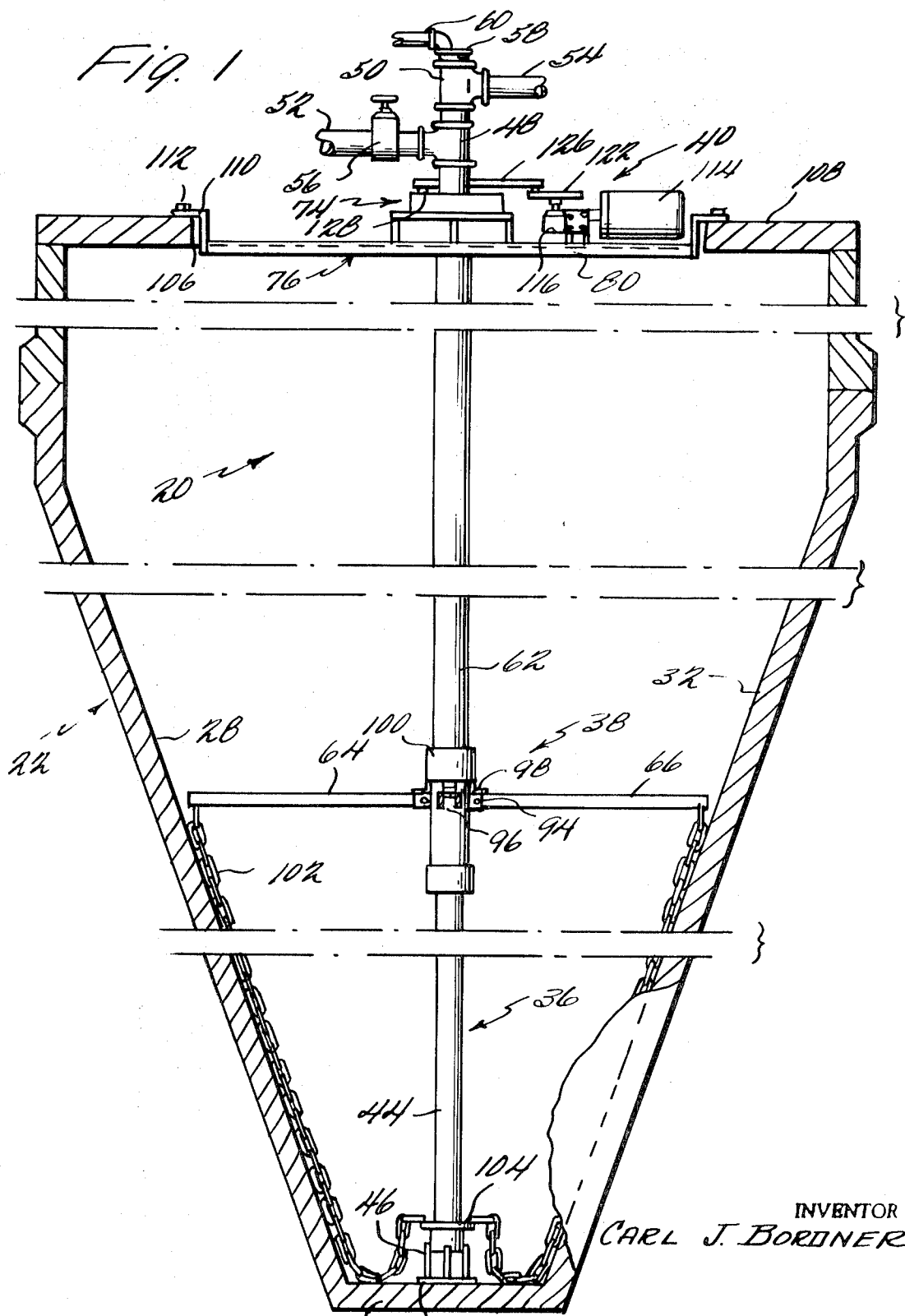
[54] **MECHANICAL SLUDGE COLLECTOR AND THICKENER**
8 Claims, 5 Drawing Figs.

[52] U.S. Cl. 210/528,
210/532
[51] Int. Cl. B01d 21/06,
B01d 21/18
[50] Field of Search 210/416,
523, 528-531

ABSTRACT: A sludge collector for settling tanks and the like comprises an eductor pipe with a lift pump airline therein and a wiper arm assembly rotatably mounted thereon. The wiper arm assembly comprises normally radially extending wiper arms having chains depending from the outer ends thereof to scrape the walls of the settling tank so that the sludge can be removed from the tank by the eductor pipe. A drive means is provided to reciprocate the wiper arms through a specific arc and the arms can be pivoted from their normally horizontal operating position to a substantially vertical position to facilitate removal of the wiper arm assembly from the tank.



SHEET 1 OF 3



INVENTOR
CARL J. BORDNER

34 42 BY *Cushman, Peabody & Cushman*
ATTORNEYS

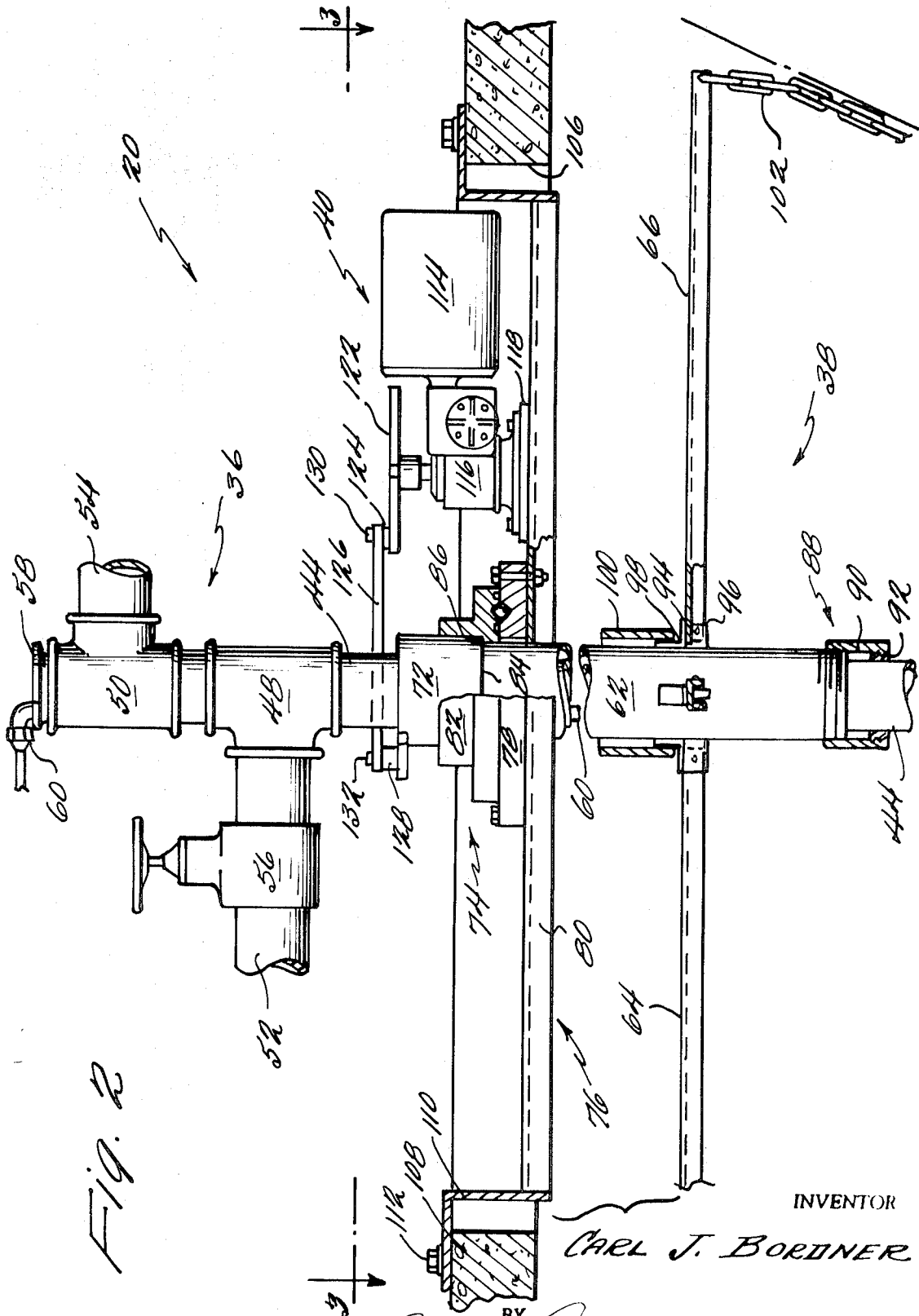


Fig. 2

INVENTOR

CARL J. BORDNER

BY

Cushman, Ruby & Cushman
ATTORNEY

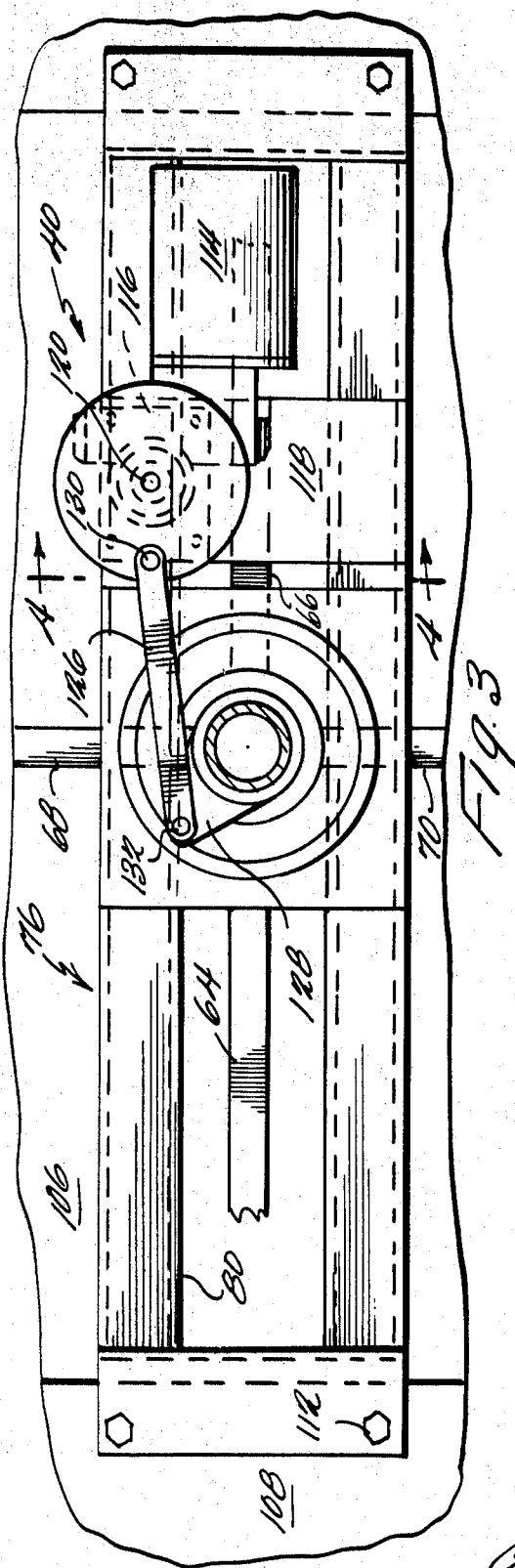


FIG. 3

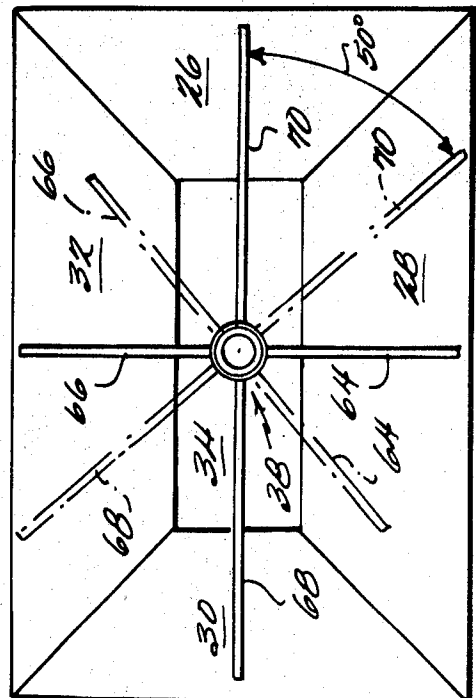


FIG. 5

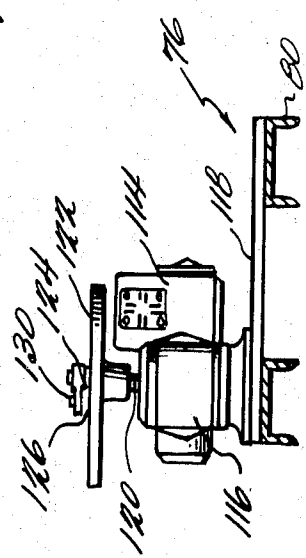


FIG. 4

INVENTOR
CARL J. BORNER

BY
Cushman, Rosky & Cushman
ATTORNEYS

MECHANICAL SLUDGE COLLECTOR AND THICKENER

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to mechanical sludge collectors and thickeners and, in particular, to an unique sludge collector and thickener which facilitates the flocculation process during the removal of sludge from tanks having obelisk shaped bottoms and the like.

It is a primary object of the present invention to provide a scraper-flocculator mechanism which can effectively and efficiently be used in hoppers have lower sidewalls of differing angles, shapes and sizes and which can effectively scrape the corners of multisided hoppers thereby insuring efficient removal of excess sludge through a center air eductor.

It is a further object to provide a mechanical sludge collector and thickener of the above character which can be readily removed from a tank without necessitating the dewatering of the tank.

Briefly, a preferred embodiment of the invention comprises a central, vertically extending eductor pipe having a sludge inlet at the lower end thereof and carrying a lift pump air line therein which causes the sludge within the eductor pipe to be carried upward within the pipe and out through appropriate discharge lines. A wiper arm assembly is rotatably mounted on the eductor pipe. The assembly comprises a sleeve with a plurality of wiper arms that normally extend radially outward from the eductor pipe in substantially horizontal directions but which are capable of being pivoted to a substantially vertical position to facilitate removal of the assembly without having to dewater the tank. Chains depend from the radially outermost ends of the arms for engaging the sidewalls and the bottom of a tank with the relative movement of the chain links with respect to each other enabling the chains to conform to the various contours of the tank. The sleeve on which the wiper arms are pivotally mounted is reciprocated through a specified arc, the arc depending upon the number of wiper arms and the horizontal cross-sectional configuration of the tank, by means of an eccentric cam connected to the sleeve through a drive arm. The cam is driven by a conventional electrical motor with a suitable reduction drive between the output of the motor and the eccentric cam so that the movement of the wiper arms will be at a selected rate.

The above objects and advantages will become more apparent and other objects and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawing in which:

FIG. 1 is a fragmentary vertical cross section of a settling tank with the mechanical sludge collector and thickener of the present invention mounted therein;

FIG. 2 is an enlarged fragmentary vertical section of an upper portion of the mechanical sludge collector and thickener assembly illustrating the mounting of the wiper arms on the drive sleeve and the mounting of the drive sleeve within the support bearing;

FIG. 3 is a plan view from above of the drive assembly taken substantially along lines 3—3 of FIG. 2;

FIG. 4 is a sectional view through the drive assembly taken substantially along lines 4—4 of FIG. 3 and illustrating the power unit mounting; and

FIG. 5 is a diagrammatic plan view illustrating the use of the subject invention in a tank having a rectangular horizontal cross-sectional configuration with sloping sidewalls and illustrating in phantom line the wiper arms at one extreme of the arcuate movement of the assembly for such a tank.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the figures, the sludge collector and thickener 20 of the present invention is shown mounted within a concrete tank 22 which has an obelisk shaped bottom section 24 with inclined sidewalls 26, 28, 30, 32 and a bottom wall 34. The mechanical sludge collector and thickener comprises an eductor pipe assembly 36, a wiper arm assembly 38,

and a drive assembly 40 which cooperate to aid the flocculation process, scrape the sidewalls of the tank and remove the sludge from the tank.

The eductor pipe 36 is provided at its lower end with a base plate 42 that is interconnected to the lower end of the eductor pipe 44 by means of vertically extending spacer bars 46 to maintain the lower end of the eductor pipe 44 off the bottom wall or floor 34 of the tank. In the embodiment shown, there are four spacer bars 46 spaced equidistantly around the circumference of the plate 42 and the lower end of pipe 44 to allow the flow of sludge between the bars and into the lower end of the pipe. These bars are welded or otherwise rigidly secured at their upper and lower ends to the eductor pipe 44 and baseplate 42, respectively, to maintain these members in a fixed spaced relation.

The upper end of eductor pipe 44 is provided with a pair of conventional T-fittings 48 and 50 which connect the eductor pipe to sludge return lines 52, 54 respectively. While only line 52 is shown provided with a valve 56, it is to be understood that line 54 can also be provided with a valve, if desired or necessitated, to control the flow of sludge from the tank out through line 54.

The upper end of the eductor assembly is provided with a plug 58 which is received within the T-fitting 50. An air line 60 connected to a suitably supply of pressurized air, not shown, passes down through plug 58 and into eductor pipe 44. The air line 60 extends down within pipe 44 to a point adjacent the lower terminal end of the pipe wherein the air is introduced into the pipe and mixes with the sludge so as to form an airlift. The sludge and air mixture rises in the pipe and out through the sludge return lines 52 and/or 54.

The wiper arm assembly 38 is carried on the eductor pipe 44 and comprises a drive sleeve 62 and a plurality of wiper arms 64, 66, 68 and 70 extending radially outward from the drive sleeve 62. While in the particular embodiment shown, there are four wiper arms spaced equidistantly about the circumference of drive sleeve 62, it is to be understood that the number of wiper arms provided and their relative length depends on the configuration of the lower portion of the tank and the arc through which the wiper arms are reciprocated.

The drive sleeve 62 is provided with an enlarged portion 72 at its uppermost end which is received within the support bearing 74 located on the power unit mounting 76. The lower section 78 of the support bearing 74 is bolted or otherwise rigidly affixed to the spaced apart channel members 80 of the power unit mounting 76 while the upper section 82 of the bearing is rotatably mounted on the lower section 78 and carries drive sleeve 62 which passes down between channel members 80. As best shown in FIG. 2, drive sleeve 62 passes up through the lower section 78 and is slidably retained therein, while portion 72 of the sleeve is press-fit or otherwise retained in the upper section 82. The shoulder 84 between section 72 and the lower portion of the drive sleeve 62 cooperates with a complementary shoulder 86 within the upper section 82 of the bearing to limit the downward movement of the drive sleeve with respect to the bearing.

The lowermost end of drive sleeve 62 is provided with a bearing 88 made up of a collar 90, which is threaded onto the lowermost portion of drive sleeve 62, and a sintered bronze bearing 92 affixed to the collar and slidably engaging eductor pipe 44 to maintain the drive sleeve in proper vertical alignment while allowing reciprocating movement of the drive sleeve 62 relative to the stationary eductor pipe 44.

Intermediate the lowermost and uppermost ends of the drive sleeve 62, wiper arm channel members 64, 66, 68 and 70 extend radially out from drive sleeve 62. Each wiper arm channel member is pivotally mounted to the drive sleeve adjacent its innermost end by means of a pin 94 passing through aligned apertures within the inner terminal portion of the wiper arm and a lug 96 which is welded or otherwise suitably secured to the outer surface of the drive sleeve.

In addition, each wiper arm is provided with an angle member 98 having one flange thereof welded or otherwise af-

fixed to the upper surface of the wiper arm and the other flange extending vertically up from the wiper arm adjacent drive sleeve 62 when the wiper arm is in its normal operating position. A retaining collar 100 is provided on the drive sleeve to maintain the wiper arms in their normal operating positions by engaging the outer surfaces of the upstanding flanges on the angle member 98. With the collar in place, the upstanding flanges are retained between the collar 100 and the drive sleeve whereby the wiper arms extend radially outward from the drive sleeve in a substantially horizontal direction. Collar 100 is slidably retained on the drive sleeve 62 so that when it is desired to remove the wiper arm assembly from the tank, the sleeve 100 can be moved upward relative to the wiper arms until the vertically extending flanges on the angle members 98 have been cleared thereby allowing the wiper arms to assume a substantially vertical position.

Depending from the outermost end of each wiper arm is a length of chain 102 having its uppermost link welded or otherwise suitably secured to the outermost end of the wiper arm. The chains extend downwardly along the sidewalls of the sludge tank and, as shown, are secured at their lower terminal ends to a chain tie bracket 104 that it carried on eductor pipe 44. The chain tie bracket is rotatably carried on the eductor pipe with the shoulder formed between the enlarged lowermost portion of the eductor pipe and the midportion of the eductor pipe maintaining the chain tie bracket 104 in the proper position on the eductor pipe. While in the embodiment shown, a chain tie bracket 104 is provided on the eductor pipe, it is to be understood that the chain tie bracket can be omitted. When the chain tie bracket is not used, the chains hang loose at the bottom of the tank being dragged from side-to-side by the reciprocal action of the wiper arm.

The drive assembly 40 is carried on mounting unit 76 which is located within an opening 106 of the tank deck 108. As previously mentioned, the mounting unit 76 comprises spaced-apart channel members 80. These members 80 are welded or otherwise suitably secured at each end to angle members 110 which, in turn, are affixed by bolts 112 to the deck. The support bearing 74 is affixed directly to channel members 80 of the mounting unit while the drive motor 114 and conventional reduction drive unit 116 are bolted or otherwise suitably secured to plate 118 of the mounting unit.

The output shaft 120 of the reduction drive unit 116 is affixed to and turns a circular drive plate 122 having an eccentric cam element 124 mounted thereon. A drive arm 126 extends between an apertured boss 128 on the drive sleeve 62 and the eccentric cam element 124 to convert the circular motion of cam member 124 into a reciprocating motion for the drive sleeve 62. The drive arm 126 is pivotally secured at its ends to the cam element 124 and the drive sleeve, respectively, by pins 130, 132 passing down through aligned apertures in the drive arm and the cam element 124 and boss 128.

In the embodiments shown, the reciprocating motion imparted to the drive sleeve 62 by drive arm 126 is approximately 100° so that wiper arms 64, 66, 68 and 70 sweep through arcs which overlap to insure that the lower sidewalls of the tank including the corners thereof are cleaned by the chains which sweep along the walls and through the corners scraping the sludge from the sidewalls. As shown in FIG. 5, due to the rectangular configuration of the hopper bottom, wiper arms 68 and 70 are longer than wiper arms 66 and 64 to insure that the depending chains from wiper arms 68 and 70 reach the inclined lower side walls of lower tank sections. In tanks such as that illustrated in FIG. 5, the arcuate movement of the members must be restricted to approximately 100° to prevent the wiper arms 68 and 70 from coming into contact with the inclined sidewalls 28 and 32 of the tank.

In the operation of the embodiment illustrated in the drawings, the output speed of the motor 114 is reduced through unit 116 so that the circular plate 122 rotates at approximately 1.5 revolutions per minute. As a result, the wiper arms 64, 66, 68 and 70 of the scraper mechanism reciprocate at a very slow speed through their 100°-arc and thereby act as

flocclulator panels to thicken the sludge. As the wiper arms are reciprocated through the 100°-arc, the chains depending from the outermost ends of the wiper arms engage the inclined sidewalls of the tank to scrape the sludge from the tank with the relative movement allowed between the chain links allowing the chains to conform to the contour of the tank sidewalls. The sludge which is loosened by the chains is removed from the bottom of the tank through the eductor pipe 44 by means of the airlift pump provided within the eductor pipe. In this manner, the sludge from the tank can be removed therefrom and pumped out from sludge return lines 52, 54.

While the preferred form of the invention has been shown and described, it is to be understood that all suitable modifications and equivalents may be resorted to which fall within the scope of the invention.

What is claimed is:

1. A sludge collector for settling tanks and the like having a lower portion defined by downwardly and inwardly inclined walls, said collector comprising:

eductor pipe means for mounting within a tank, said eductor pipe means having an inlet at a lower end portion thereof for admitting sludge to be removed from the tank; wiper arm assembly means carried by said eductor pipe means, said wiper arm assembly means having wiper arm means extending radially out from said eductor pipe means during operation of said sludge collector, the outer ends of said wiper arm means having chainlike means depending therefrom to an extent such that the chainlike means lie parallel to the inclined walls and parallel thereto for scraping the same; and

drive means for effecting movement of said wiper arms means through a specific arc to cause said chainlike means to scrape said interior surface of the tank.

2. In the sludge collector of claim 1:

said drive means comprising means for reciprocally driving said wiper arms means through a specific arc.

3. A sludge collector as in claim 2 wherein the inclined walls of the tank are flat whereby the reciprocation of the wiper arm means drags the chainlike means into and out of the corners defined by adjacent inclined walls.

4. A sludge collector for settling tanks and the like comprising:

eductor pipe means for mounting within a tank, said eductor pipe means having an inlet at a lower end portion thereof for admitting sludge to be removed from the tank, and said eductor pipe means having airlift pump means therein for pumping sludge through said eductor pipe means to discharge means;

wiper arm assembly means carried by said eductor pipe means, said wiper arm assembly means comprising a plurality of radially extending wiper arm means pivotally mounted at their radially innermost end portions to drive sleeve carried on said eductor pipe means, said wiper arm means having chainlike means depending therefrom for scraping the interior surface of the tank, and said wiper arm assembly means comprising retaining means for normally maintaining said wiper arm means in radially extended positions whereby said wiper arm means can be pivoted from a radially extended position during the operation of said sludge collector to a position extending substantially parallel to the longitudinal axis of the eductor pipe means to facilitate removal of the wiper arm assembly means for the tank; and

drive means for effecting reciprocal movement of said wiper arm through a specified arc to cause said chainlike means of said wiper arm means to scrape the interior surface of a tank.

5. In the sludge collector of claim 4: said wiper arm means comprising wiper arms having differing lengths.

6. A sludge collector for settling tanks and the like comprising:

eductor pipe means for mounting within a tank, said eductor pipe means having an inlet at a lower end por-

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tion thereof for admitting sludge to be removed from the tank;

wiper arm assembly means carried by said eductor pipe means, said wiper arm assembly means having wiper arm means extending radially out from said eductor pipe means during operation of said sludge collector, said wiper arms means having chainlike means depending therefrom for scraping an interior surface of the tank, said chainlike means having lower end portions thereof secured to a bracket means carried by said eductor pipe means at the lower end portion thereof; and

drive means for effecting movement of said wiper arm means through a specific arc to cause said chainlike means to scrape said interior surface of the tank.

7. A sludge collector for settling tanks and the like comprising:

eductor pipe means for mounting within a tank, said eductor pipe means having an inlet at a lower end portion thereof for admitting sludge to be removed from the tank;

wiper arm assembly means carried by said eductor pipe means, said wiper arm assembly means having wiper arm means extending radially out from said eductor pipe means during operation of said sludge collector, said wiper arm means having chainlike means depending

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therefrom for scraping an interior surface of the tank, said wiper arm assembly means comprising a plurality of radially extending wiper arm means pivotally mounted at their radially innermost end portions on a drive sleeve carried by said eductor pipe means and said wiper arm assembly means comprising retaining means for normally maintaining said wiper arm means in radially extended positions whereby said wiper arm means can be pivoted from a radially extended position during the operating of said sludge collector to a position extending substantially parallel to the longitudinal axis of the eductor pipe means to facilitate removal of said wiper arm assembly means from a tank; and

drive means for effecting movement of said wiper arm means through a specific arc to cause said chainlike means to scrape said interior surface of the tank.

8. In the sludge collector of claim 7:

said retaining means comprising a collar means axially slidable relative to said drive sleeve means and extensions on said wiper arm means which are retained between said drive sleeve means and said collar means during the operation of said sludge collector.

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