July 28, 1942. S. L. TOLMAN 2,291,121

SEWAGE APPARATUS

Filed Nov. 1, 1938

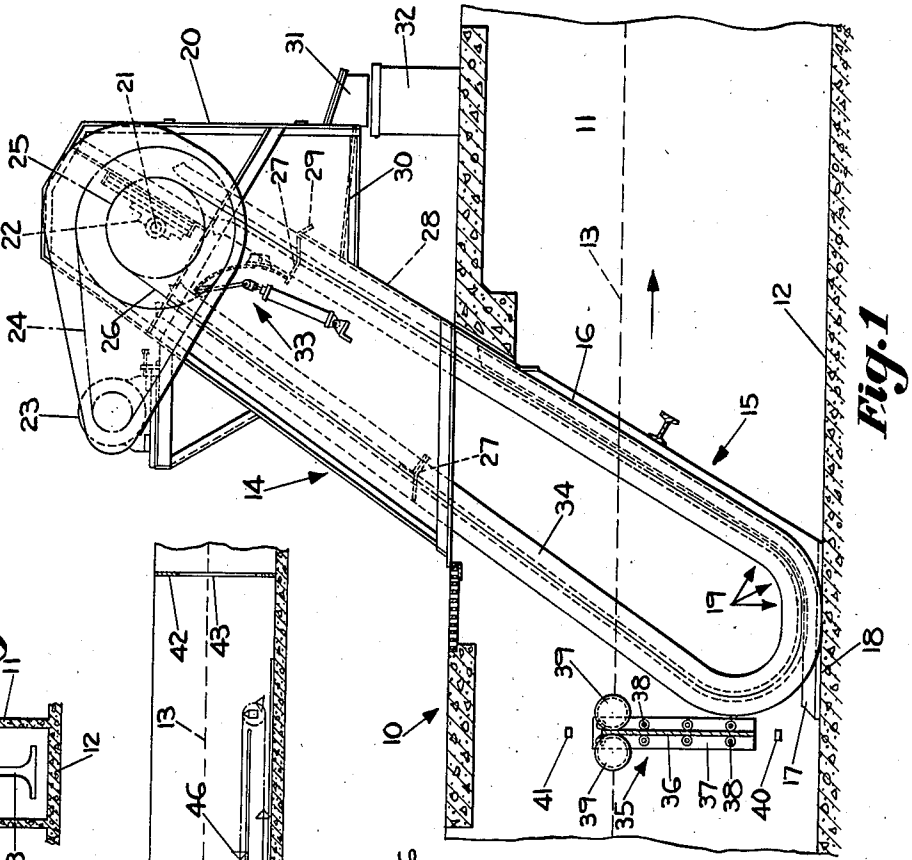


Fig. 1

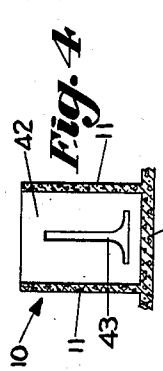


Fig. 4

Fig. 3

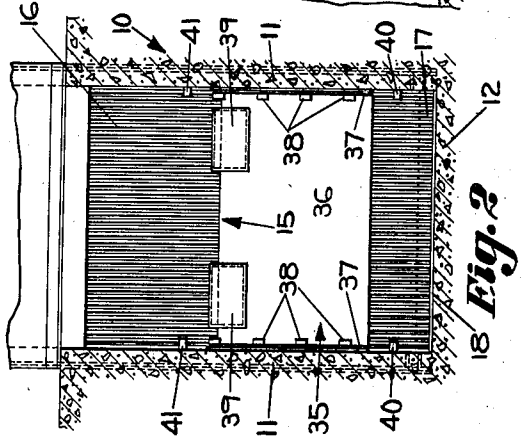


Fig. 2

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2,291,121

SEWAGE APPARATUS

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18 Claims. (Cl. 210—176)

This invention relates to sewage or water treating apparatus and particularly to apparatus for removing refuse or large particles of material from a flowing stream of water which is laden with sewage or such particles of material.

An object of the invention is to provide apparatus of the above-mentioned type with baffle means to prevent undesirable accumulation of large particles of material or refuse at an undesired position with respect to the screen and to insure the deposition of the refuse or large particles of material in the desired area.

Another object of the invention is to provide an improved and automatically adjustable baffle to effect the above mentioned desired results.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawing:

Fig. 1 is a side elevational view of the apparatus my invention with certain parts shown in section;

Fig. 2 is a front view of the lower portion of the apparatus of Fig. 1;

Fig. 3 is a diagrammatic side elevational and sectional view of apparatus of my invention showing certain modifications; and

Fig. 4 is a sectional elevational view of a constant velocity weir preferably incorporated as a part of the apparatus of my invention.

Referring particularly to Figs. 1 and 2 of the drawing, there is seen a trough, sluiceway or sewage grit channel 10, comprising side walls 11 and bottom 12, which is formed as a monolith of poured concrete. To remove refuse or large particles of material flowing in the water or sewage 13 in the trough or sluiceway 10 I provide a bar screen mechanism 14 of any desired structure but which preferably follows in general the structure disclosed in the patent to Robert E. Briggs, No. 2,128,346, dated August 30, 1938, entitled Bar screen scraper; or as disclosed in the application of Raymond B. Plummer, Serial No. 208,616, filed May 18, 1938, entitled Sewage apparatus.

Briefly described, the bar screen mechanism 14 comprises a stationary screen 15 having an upwardly inclined screening portion 16 formed by a plurality of spaced bars standing on edge which at their bottoms continue adjacent the bottom 12 of the trough or sluiceway 10 to form a guiding portion 17 having rigidly attached thereto a bottom wear plate 18 rigidly attached to the bottom 12. It is evident that the guiding portion 17 and the screening portion 16 of the screen 15 are continuous and at their points of connection form a smooth curve at which there is a refuse or material accumulating area 19.

To remove the material caught by the screen 15 the bar screen mechanism 14 includes a rake operating mechanism comprising a frame 20 which carries a drive shaft 21 on adjustable bearing boxes 22 which shaft 21 is driven from a motor 23 by appropriate chain and sprocket drive mechanism 24. The drive shaft 21 carries a pair of spaced sprockets one near each end, one of which is seen at 25, and with which are associated draft chains 26 carrying one or more rakes 27 having teeth adapted to enter the bars of the screen 15 first adjacent the upstream edge of the guide portion 17 from which the rakes move along said guide portion over the refuse accumulating area 19 and up the screening portion 16 from which said rakes move over a slide plate 28 and discharges material over a lip 29 onto an inclined chute 30 from which the discharged material passes through hopper 31 to container 32.

It may be stated that to insure a removal of material from the rakes 27 at the lip 29 a rake cleaning mechanism 33 is provided which, as illustrated in the drawing, takes the form illustrated in the above mentioned application of Raymond B. Plummer, though if desired, any other form of rake cleaning mechanism may be employed, such as that illustrated in the above mentioned patent to Robert E. Briggs.

To effect a proper guiding of the rakes 27 and draft chains 26 into and out of the water or sewage 13 spaced guides 34 are provided one for each of said chains 26, which guides are generally of distorted U-shape and are of the structure specifically disclosed in the above mentioned patent or application.

It is, of course, evident that the travel of each rake 27 is downwardly through the water or sewage 13 upstream of the screen 15. As a rake 27 approaches the bottom 12 of the trough, sluiceway or grit channel 10 it is moved to interleaving relation with the bars of the guide portion 17 of said screen 15, and as above described, thereafter moves along said guiding portion 17, across the refuse or material accumulating area 19, and upwardly along the screening portion 16 and finally out of the water or sewage 13, carrying with it the collected refuse or accumulated material.

It has been found in practice that sometimes there is a tendency for large particles of mate-

rial or refuse to accumulate at or near the upstream edge of the guide portion 17 of said screen 15 rather than at the proper refuse or accumulating area 19. Whenever this condition occurs a rake 27 in moving downwardly to interleaving position with the guiding portion 17, encounters a pile of this refuse or accumulated material before it became interleaved with the bars of the screen 15 along the guiding portion 17. This tends to damage the rake 27 or stop its movement.

I have provided mechanism to increase appreciably the velocity of water or sewage flow adjacent this area thereby to insure the accumulation of the refuse or material adjacent the area 19 or, under certain conditions, to cause it to distribute over the lower part of the screening portion 16 of said screen 15 thereby to insure a complete absence of any appreciable refuse or material where the teeth of the rake 27 interleave the bars of the guide portion 17, thus insuring the proper interleaving relation. I have therefore provided baffle means 35 which, as illustrated in Fig. 1 of the drawing, is positioned slightly ahead of the upstream edge of the guiding portion 17 of screen 15 and thus insures a liquid velocity along this area which is relatively uniform and which is considerably higher than the velocity in the rest of the trough, sluiceway or grit channel 10. I have found in practice that a ratio of three to one between these velocities is very satisfactory, though obviously other and even variable ratios may be satisfactory.

The baffle means 35 comprises a vertically adjustable baffle plate 36 which extends substantially the entire width of the trough, sluiceway or grit channel 10 and is supported at each side edge in a guideway comprising a vertical plate 37 attached to a wall 11 and carrying a plurality of spaced anti-friction rollers 38 between pairs of which the baffle plate 36 is adapted to be held in position against horizontal movement while being free to move vertically.

To provide for automatic adjustment of the position of the baffle plate 36 thereby to compensate automatically for the level of the water or sewage 13 thereby maintaining automatically a substantially constant rate of fluid flow under the baffle 36, said plate 36 is provided with floats 39 rigidly attached to the top thereof. In the drawing I have shown four of the floats 39, there being a pair adjacent each side edge, one of each pair being on each side of the baffle plate 36.

As clearly illustrated in Fig. 1 of the drawing, the floats 39 are adapted to adjust the vertical position of the baffle plate 36 in accordance with the level of the water or sewage 13.

To limit the downward movement of the baffle plate 36 under low water conditions I provide lower limit stops 40 and to limit the upward movement of the baffle plate 36 under high water conditions I provide upper limit stops 41. It is, of course, evident that the baffle plate 36 is free to move vertically between the stops 40 and 41, as determined by the level of the water or sewage 13 in the trough, sluiceway or grit channel 10. As a consequence, the velocity of the water flowing under the baffle plate 36 will be maintained at a relatively high value, comparable with the normal rate of water or sewage flow through the trough, sluiceway or grit channel 10, thereby preventing an undesirable accumulation of refuse or material at an area where the rake interleaves the bars of the guiding portion 17 of screen 15.

Referring to Fig. 3 of the drawing, there is shown a more complete apparatus of the sewage system of my invention, and in addition, a modified form of bar screen mechanism and an alternate position for the baffle means 35.

Except for differences specifically pointed out, it is to be understood that the complete system of Figs. 3 and 4 is to be included with the mechanism specifically above described and illustrated in Figs. 1 and 2.

As shown particularly in Fig. 4 of the drawing, the trough, sluiceway or grit channel 10 is preferably provided with a weir 42 which has a constant velocity opening 43; that is, the opening 43 is so formed that the velocity of the water or sewage 13 through the trough, sluiceway or grit channel 10 is substantially constant regardless of the head or depth thereof.

The trough, sluiceway or grit channel 10 of Fig. 3 has associated therewith a bar screen mechanism 14' which differs slightly from that disclosed in Figs. 1 and 2 of the drawing, and is preferably of the construction disclosed in full detail and claimed in the patent to R. E. Briggs, No. 2,128,348, dated August 30, 1938, and entitled Bar screen scraper.

It may be stated that the principal difference between the bar screen mechanism 14' and the above described bar screen mechanism 14 is that the guiding portion of the screen, similar to the guiding portion 17 of screen 15, extends upstream a greater distance and the guide means, similar to the guide means 34 of mechanism 14, is wider at the bottom, consequently providing a longer path of movement of the rake over the guiding portion similar to said guiding portion 17.

As illustrated particularly in Fig. 3 of the drawing, I have placed the baffle means 35 intermediate the lowering and elevating runs of the rake or, in other words, baffle means 35 is positioned directly above the guiding portion of the rake and near to the refuse accumulating area, similar to the above described refuse accumulating area 19. The specific structure of the baffle means 35 has not been changed at all, the change being only in its position with respect to the bar screen mechanism 14'.

Also in Fig. 3 of the drawing, I have illustrated a conveyor mechanism 44 which, along with the weir 42, is to be understood as being included with the mechanism of Figs. 1 and 2, for the purpose of removing settled grit from the grit channel 10. The conveyor mechanism 44 may be briefly described as comprising a pair of endless draft chains 45 carrying perforated buckets 46 which are adapted to move along the bottom of the grit channel 10 to gather settled grit and convey it upwardly over drive sprockets 47 where the buckets 46 are inverted and discharged onto a belt conveyor 48. A motor 49 is provided for driving the drive sprockets 47 and draft chains 45.

In the operation of the apparatus comprising my invention, water, such as city drinking water, or sewage, flows in a trough or sluiceway, or if the latter, in a grit channel 10, at a substantially constant velocity as determined by the weir 42 regardless of the head or depth of the water or sewage.

Large particles of material or refuse are screened out by the screen, such as the screen 15, and tend to accumulate adjacent the bottom thereof, such as adjacent the refuse accumulating area 19. If it is sewage that is being treated the grit therein will settle in the grit channel 10 and be scraped up and removed by the conveyor

mechanism 44; if city water said conveyor mechanism need not be used.

Any tendency for the refuse or large material to collect in a pile at an undesirable position, such as near the upstream end of the guiding portion of the screen, such as the guiding portion 17 of screen 15, will be eliminated by the baffle mechanism 35 in that the water or sewage velocity at this area is materially increased over the water velocity in the rest of the trough, sluiceway or grit channel 10. Furthermore, the automatic adjustability of the baffle plate 36, as determined by the level of the water or sewage 13, maintains this velocity sufficiently high for varying depths of water or sewage.

The stops 40 and 41 are effective to limit the upward and downward movement of the baffle plate 36, the stops 40 being effective to prevent the entire shutting off of the orifice formed between the bottom of the baffle plate 36 and the bottom 12 of trough, sluiceway or grit channel 10, and the stops 41 serving the double purpose of preventing this orifice becoming too large and also preventing the baffle plate 36 from being moved entirely out of the guide rollers 38.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and I therefore wish not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In water treating apparatus, the combination with a trough, of a screen therein having an upwardly extending screening portion and a substantially horizontal guiding portion, a rake, means for conveying said rake downwardly into said trough upstream of said screen to engage the upstream end of said guiding portion and to move therefrom over said guiding portion and screening portion in sequence, a baffle extending across said trough and positioned upstream of said screen and of the path of travel of said rake and near the upstream edge of the guiding portion of said screen and having its bottom near and above the trough bottom to increase the current flow at the position the rake engages said guiding portion, and float means responsive to the liquid level of said trough for adjusting the height of said baffle as said liquid level varies.

2. In water treating apparatus, the combination with a trough, of a screen therein having an upwardly extending screening portion and a substantially horizontal guiding portion, a rake, and means for conveying said rake downwardly into said trough upstream of said screen to engage the upstream end of said guiding portion and to move therefrom over said guiding portion and screening portion in sequence, a baffle extending across said trough and positioned upstream of said screen and intermediate the lowering and elevating runs of said rake and having its bottom near and above the trough bottom and above the guiding portion of said screen to increase the current flow at the position the rake engages said guiding portion, and float means responsive to the liquid level of said trough for adjusting the height of said baffle as said liquid level varies.

3. In combination, a sluiceway, an upwardly extending screen, a vertically adjustable baffle extending laterally across said sluiceway near said screen and slightly above the sluiceway bottom, guide means for said baffle comprising antifriction rollers, and float means for vertically adjusting said baffle in accordance with the liquid level in said sluiceway.

4. In combination, a sluiceway, an upwardly extending screen, a vertically adjustable baffle extending laterally across said sluiceway near said screen and slightly above the sluiceway bottom, guide means for said baffle, and float means for vertically adjusting said baffle in accordance with the liquid level in said sluiceway.

5. In apparatus of the class described, the combination with a sluiceway, of a screen therein, a baffle plate in advance of said screen, spaced guides for said baffle plate comprising anti-friction rollers, and float-means connected to said baffle plate to hold the upper edge of the baffle plate above the surface of the liquid in the sluiceway and to hold the lower edge of the baffle plate spaced above the bottom of the sluiceway at variable distances in accordance with variation in the depth of the liquid in the sluiceway.

6. In apparatus of the class described, the combination with a sluiceway, of a screen therein, a baffle plate in advance of said screen, guide means for said plate, and float means for supporting said plate in said sluiceway with the lower edge of the plate spaced above the bottom of said sluiceway to compel the liquid flowing toward said screen to first pass under said baffle plate.

7. In apparatus of the class described, the combination with a sluiceway, of a screen therein, a baffle plate in advance of said screen, guides for said plate, and floats connected to said plate on opposite sides thereof to carry said plate with its lower edge spaced above the bottom of said sluiceway.

8. In apparatus of the class described, the combination with a sluiceway, of a screen therein, a baffle plate, guiding means for said plate comprising anti-friction rollers, and float means for suspending said plate with its lower edge spaced above the bottom of said sluiceway to compel the liquid in said sluiceway to flow under said baffle plate before reaching said screen.

9. In apparatus of the class described, the combination with a sluiceway, of a screen therein, an adjustable baffle plate in advance of said screen, guides for said plate, float means for adjusting said plate in said guides, and a stop for limiting its movement in one direction.

10. In apparatus of the class described, the combination with a channel for the flow of liquid, of a screen in said channel, a baffle plate in said channel, guides for said baffle plate, float means for adjusting said baffle plate in said guides, and a stop for limiting the upward movement of said baffle plate.

11. In apparatus of the class described, the combination with a channel for liquid flow, of a screen in said channel, a baffle plate in said channel, guides for said plate, float means for adjusting said plate in said guides, and a stop for limiting the downward movement of said plate.

12. In apparatus of the class described, the combination with a channel for liquid flow, of a screen therein, a baffle plate, spaced guide means for said plate on the opposite inner walls of said channel, float means for adjusting said baffle plate relative to said channel, and stops for limiting the movements of said plate in opposite directions.

13. In apparatus of the class described, the combination with a channel for liquid flow, of a

screen therein, a baffle plate in advance of said screen, guiding means for said plate, float means for vertically adjusting said plate, and stops for limiting the movements of said plate in opposite directions.

14. In water treating apparatus, the combination with a trough through which solid containing liquid flows, of an upwardly extending screen therein, a rake for removing material collected by said screen, draft and guide means for said rake to effect movement thereof downwardly toward the bottom of said trough upstream of said screen and then along the bottom of said trough and upwardly along said screen, means including a baffle in advance of said screen and serving as a partial partition to reduce the cross-sectional area of fluid flow to effect a higher rate of flow ahead of said screen to prevent accumulation of material at an area where the rake first approaches the trough bottom, and automatic means for adjusting said baffle in accordance with the liquid level in said trough.

15. In a water treating system, the combination with a trough through which water to be screened is adapted to flow, of a screen extending upwardly and across said trough and constructed to remove large particles of material therefrom, a rake, means for guiding and moving said rake downwardly into said trough upstream of said screen and then upwardly along said screen, adjustable baffle means submerged in the liquid in said trough with its lower edge spaced above the bottom of said trough to effect increased velocity of flow under said edge to prevent accumulation of material where the rake first approaches the trough bottom, and means for automatically adjusting said baffle means in accordance with the liquid level in said trough.

16. In a water treating system, the combination with a trough through which water to be screened is adapted to flow, of a substantially constant velocity weir in said trough, a screen extending upwardly and across said trough and adapted to remove relatively large particles of material therefrom, a rake, means for guiding and moving said rake downwardly into said trough upstream of said screen and upwardly along said screen, and baffle means submerged in the liquid in said trough ahead of said screen with its lower edge spaced above the bottom of the trough, said baffle means being adapted to reduce the cross-sectional area of fluid flow to that below said baffle means to effect increase in velocity of such flow above that effected by the constant velocity weir in the main part of the trough, the construction and arrangement being such that accumulation of material will be avoided where the rake approaches the trough bottom by such increased velocity of flow of the liquid.

17. In water treating apparatus, the combination with a trough adapted to carry material laden water, of a screen for removing relatively large particles of material therefrom having an upwardly extending screening portion and a bottom guiding portion which at their position of connection form a refuse accumulation area, rake means adapted to co-operate with said guiding portion to effect movement of refuse material therefrom to said refuse accumulation area and then along said screening portion, and a baffle plate submerged in the liquid with its lower edge spaced above the bottom of said trough upstream from said screening portion to effect a relatively high rate of liquid flow over said guiding portion to effect accumulation of refuse at the said refuse accumulation area where it will not interfere with movement of the rake means.

18. In water treating apparatus, the combination with a trough through which solid containing liquid is adapted to flow, of a stationary upwardly extending screen in said trough and comprising a plurality of spaced bars, upstream extensions of said bars at the bottom of said trough, a rake, draft means for said rake, means for guiding said rake downwardly into the liquid to said bar extensions, the latter being adapted to guide the rake to said screen, and means extending into the liquid to baffle the flow of water in the trough by confining the flow along the bottom of the trough over said extensions and thereby prevent accumulation of sediment at the upstream ends of said extensions so that free movement of the rake as it is guided by said extensions will not be interfered with.

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