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WASTE-FLOW SCREENING APPARATUS

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2 Sheets-Sheet 1

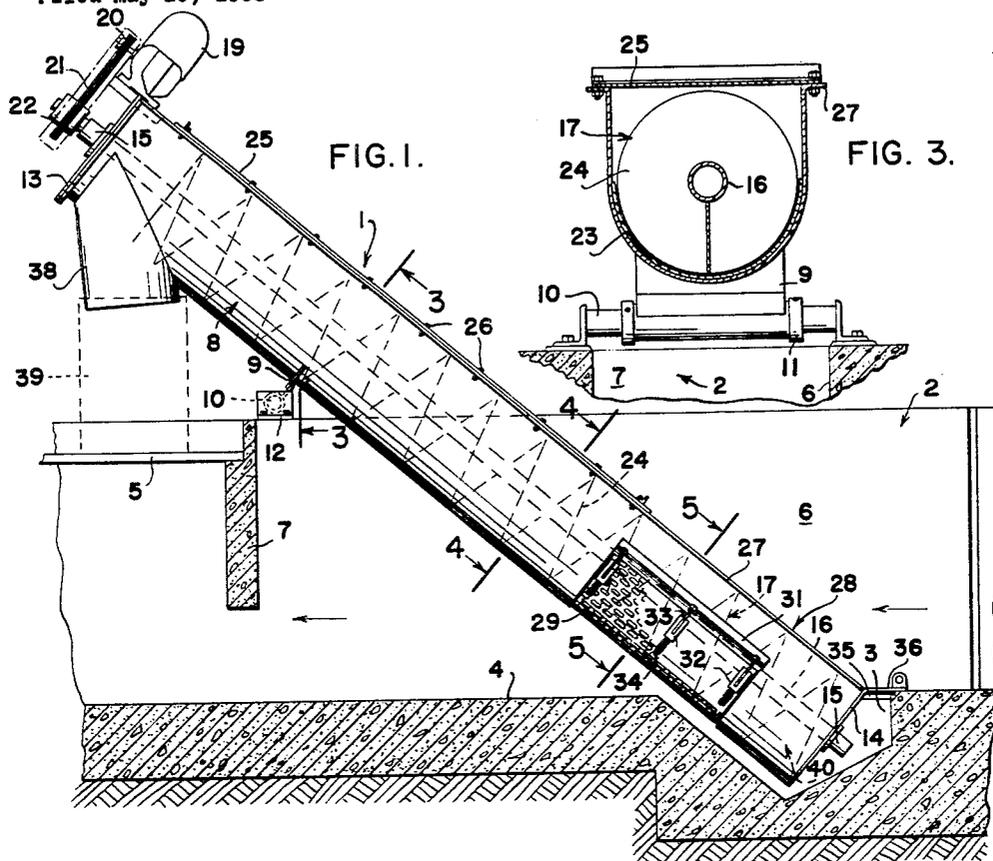


FIG. 1.

FIG. 3.

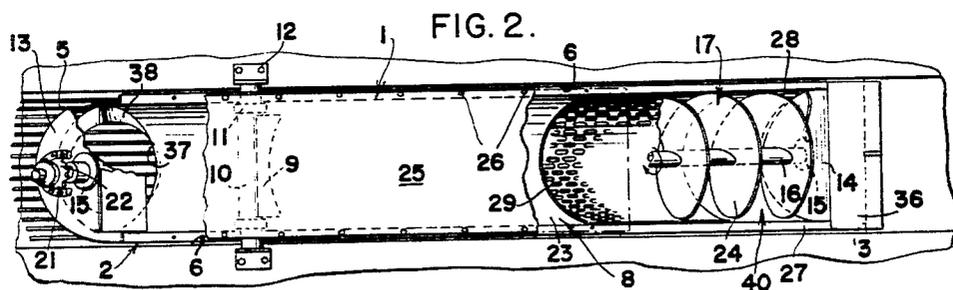


FIG. 2.

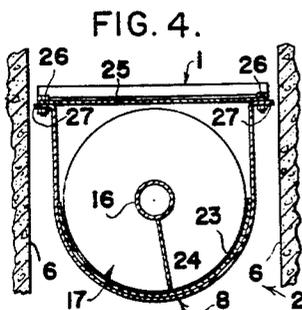


FIG. 4.

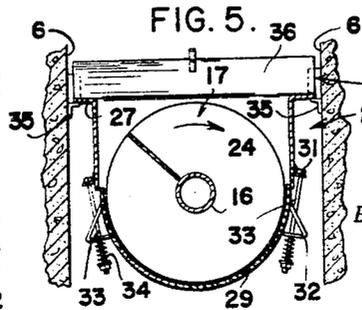


FIG. 5.

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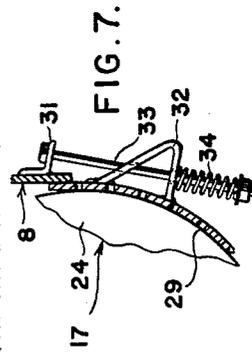
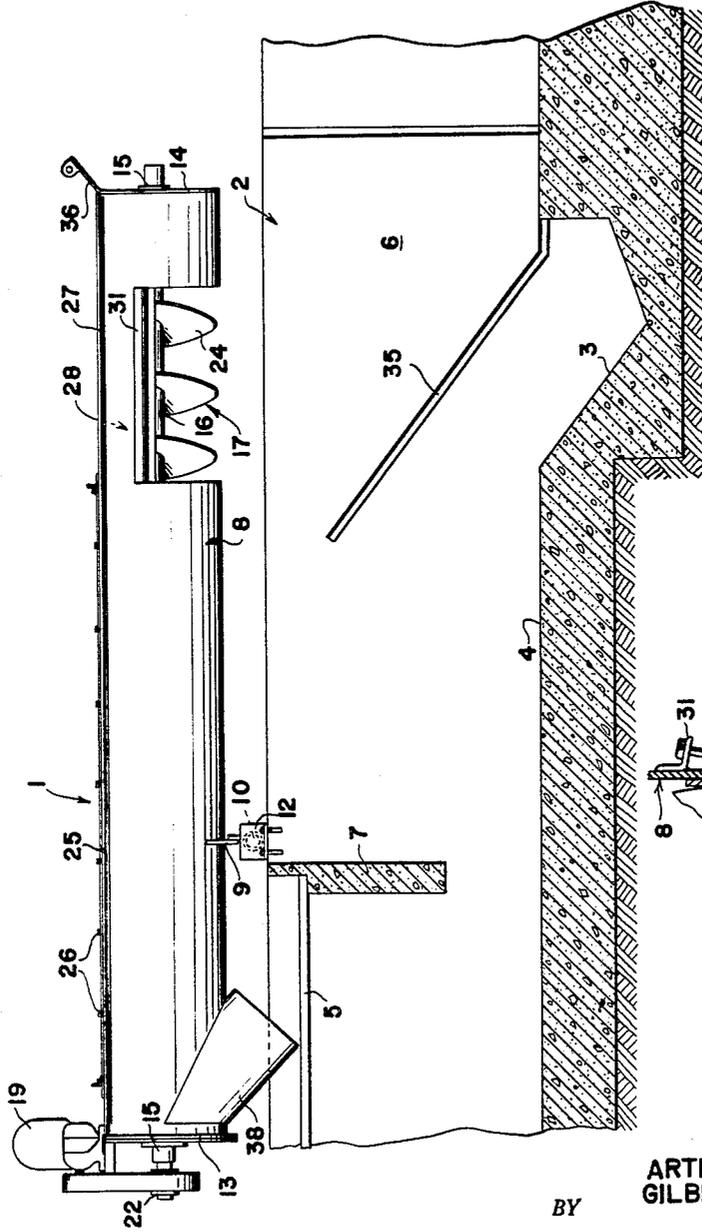
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WASTE-FLOW SCREENING APPARATUS

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FIG. 6.



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WASTE-FLOW SCREENING APPARATUS

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6 Claims. (Cl. 210—158)

This invention relates to screening apparatus for removing suspended solids, debris and other objects from a stream.

The invention is particularly adapted for relatively small flows of industrial waste water, for example, where a small compact and easily serviced screen is required for intermittent duty, although units embodying the invention are, of course, fully capable of continuous operation.

According to the invention, the screen comprises a semi-cylindrical grille or perforate plate which forms a part of the housing of a screw-conveyor unit. The unit is inclined for operation with the lower part including the screen disposed in the stream channel.

In operation, the foreign matter collecting on the screen is removed by the conveyor screw and is conveyed upwardly within the housing to the upper end of the conveyor from which it is discharged into a suitable receptacle for handling and disposal. The conveyor unit is pivotally disposed so that it can be readily lifted from the channel either when not in use or for servicing or adjustment.

A principal object of the invention is to provide a self-cleaning screen which is less subject to clogging by rags which are a frequent problem of industrial waste.

Another object is to provide a self-cleaning screen which is readily subject to inspection and cleaning and can be adjusted to allow for wearing between the screen and the conveyor screw.

Another object is to provide a readily replaceable screen so that screens of different mesh or hole size may be employed at different times or to determine by test the minimum hole size necessary to provide the desired solids removal. The replaceable screen also allows the replacement of worn screens if and when that should become necessary.

Another object is to provide for cleaning of the screen with a positive wiping action by the conveyor screw despite any wearing of the conveyor screw which may occur.

The drawings furnished herewith illustrate the best mode of carrying out the invention as presently contemplated and set forth hereinafter.

In the drawings:

Figure 1 is a side elevation of the unit as disposed for operation in a channel shown in section;

Fig. 2 is a top plan view of the unit with parts thereof broken away and sectioned to show the screen and discharge opening;

Fig. 3 is a cross-section of the unit taken on line 3—3 of Fig. 1;

Fig. 4 is a cross-section taken on line 4—4 of Fig. 1;

Fig. 5 is a section taken on line 5—5 of Fig. 1;

Fig. 6 is a view similar to Fig. 1 showing the unit lifted from the channel from inspection or servicing and with the screen removed; and

Fig. 7 is an enlarged view of the adjustable spring device which holds the screen against the conveyor screw.

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The waste collector 1 is shown in the drawings as installed in the concrete channel 2 set in the ground to carry waste or wash water as from a series of catch basins to a sewer, or collecting tank. Such a channel generally has a depth of 2 or 3 feet and a width of about 1 foot to provide sufficient velocity to carry the solids and suspended matter in the waste without settling or separation in the channel. Ordinarily, however, it is desirable or necessary that large solids be removed as soon as possible or at least before reaching the sewer or tank. Such large solids include sand and grit and, in many instances, paper and rags which would clog any ordinary screening. Present mechanically-cleaned screens are not practicable because of their size and cost although they would fully serve the purpose except as to the features of the present invention to be described.

The lower end of collector 1 is disposed in the recess 3, in the bottom 4 of channel 2. The upper end of collector 1 is located above the grill 5 supported by the side walls 6 of channel 2 and the cross wall 7. The housing 8 of collector 1 which is fitted with the bracket 9 is pivotally mounted on the bar 10 between the collars 11. Bar 10 extends across channel 2 just ahead of the cross-wall 7 and is fixed to the top faces of walls 6 of channel 2 by the support brackets 12.

The upper and lower plates 13 and 14 closing the upper and lower ends of housing 8 are fitted with the bearings 15 which support the corresponding upper and lower ends of the shaft 16 of conveyor screw 17 operating within the housing. The motor and variable gear reduction unit 19 carried by the upper end of housing 8 is fitted with the drive sprocket 20 and operatively drives conveyor screw 17 through the chain 21 operating on drive sprocket 20 and the driven sprocket 22 mounted on the upper end of shaft 16 of conveyor screw 17.

Housing 8 comprises a piece of sheet metal of U-section and includes the semi-cylindrical mantle or other liner 23 which is dimensioned with respect to the flights 24 of conveyor screw 17 so that screw 17 is effective to transport the solids upwardly within the housing. The cover plate 25 closing the upper part of housing 8 is fixed along each side by the bolts 26 to the oppositely extending marginal flanges 27 of housing 8 and extends from upper end plate 13 to the surface of the channel flow.

Housing 8 is open between the lower edge of cover plate 25 and the lower end plate 14 of the housing for the entry of the flow through channel 2.

In the operation of the unit, the flow entering inlet 28 of housing 8 passes over flights 24 and through the perforate semi-circular section of the housing comprised by the screen 29 which is disposed oppositely of inlet opening 28. Screen 29 is of semi-cylindrical form having square ends and fits in a corresponding opening of housing 8 which includes liner 23. The thickness of screen 29 corresponds with that of liner 23 so that the straight and flat edge portions of screen 29 fit between conveyor screw 17 and housing 8 in sliding relation allowing screen 29 movement toward the axis of conveyor screw 17. The projecting flanges 31 and 32 respectively fixed to housing 8 and screen 29 extend in parallel relation exteriorly of housing 8 and the flanges on each side of the housing are connected by the bolts 33 which carry the springs 34. Springs 34 are disposed to bias the screen 29 against flights 24 of conveyor screw 17 and are adjustable by tightening or loosening the bolts 33.

Collector 1 is disposed for operation with the lower end of housing 8 within the recess 3 of channel 2 and is supported at each side by a bracket 35 fixed to a side wall 6 of channel 2 to engage a corresponding flange 27 of housing 8. Each bracket 35 extends to the forward edge of recess 3 of bottom 4 of channel 2. The lower projecting flange 36 at the lower end of housing 8

seats on bottom 4 of channel 2 ahead of recess 3 and flange 36 and brackets 35 seal the collector within the channel so that water cannot pass around housing 8.

The waste water which enters opening 28 of housing 8 and passes over the rotating flights 24 of conveyor screw 17 to pass through screen 29 is separated of solids having a size larger than the holes of screen 29. Such solids collecting on the screen are conveyed by flights 24 upwardly within housing 8 to the upper opening 37 of housing 8 to fall through the chute 38 into the receptacle 39 (shown in dotted lines) placed to stand on the grill 5 just below the upper end of the collector.

Generally, it is not desired that semi-solids such as greases and fats be removed with solids and debris although they tend to collect on any small-mesh screen. Mechanical cleaning of the screen then includes removal of the greater part of such semi-solids which may be undesirable, particularly because of their generally putrescible nature.

According to the present invention, collected solids are turned over an indefinite number of times as they are transported vertically by flights 24 so that the water passing through the collector washes the collected solids of the less dense portions. The material which is finally lifted out of the flow is thus relatively free of such putrescible solids and is then more easily disposed of.

A particular problem also solved by the present invention is that of clogging of the screen by rags of any size. It is known that rags can and do blanket and close a large area of the screen so that the remaining open screen soon becomes clogged as well. The stream will then overflow the channel to pass the screen unless the rags are removed and the screen reopened. According to the present invention, the wiping action of the conveyor screw over the screen gathers the rag in a bundle with the other material. If a part of the rag and particularly if a smaller piece becomes lodged in any of the holes of the screen, the edge of the flight periodically turning over the hole either chews or severs the rag so that it can either pass through the hole or can be carried up with the other material.

The wiping of the edge of the flight over the screen has the effect of sharpening the edge of the flight to make it effective for such cutting. The wearing which occurs is compensated by springs 34 which move screen 29 towards the axis of conveyor screw 17 as the wearing takes place. Springs 34 also allow screen 29 some movement in the event a piece of wood or the like were somehow to become caught between the flight and the screen.

The size of the holes to be provided in screen 29 and their shape and orientation with respect to the movement of the flights 24 of screw 17 depend upon the nature of the waste. Generally, the smaller the holes the better unless the holes are so easily clogged by the suspended matter that they cannot be kept clear by whatever means is provided. The most efficient size and spacing of holes depends entirely upon the nature of the solids being carried and can only be determined by trial which takes into account the rate of flow, periods of overloading and other factors.

The present invention provides a screening unit which can be readily elevated out of the channel by lifting the lower end of the unit so that bracket 9 pivots on bar 10 and the housing is horizontally disposed above the channel as shown in the drawings. In such position bolts 26 may be removed and screen 29 replaced with any one of others, not shown, of different hole size or configuration.

The brackets or flanges 32 are spaced and fixed to screen 29 to push the screen into engagement with the periphery of flights 24 of conveyor screw 17 and to effect a curvature of the screen to correspond with the reduction in the diameter of the flights due to wear.

Cleaning, servicing and inspection of the unit may

be done with the unit entirely out of the channel where it is entirely accessible. A unit similar to that shown in the drawings is in operation and has a housing fifteen feet in length and weighs over a thousand pounds. The location of bracket 9 is sufficiently near the center of gravity of the unit so that it is readily lifted out of the channel and reloaded by one man. This feature alone is regarded as of considerable advantage in small plants which would not have several maintenance men available at any times that some maintenance is required.

When the unit is reloaded into the channel, the unbalanced weight of the unit is supported by brackets 35 and shelf 36 which seal the housing in the channel so that no packing or the like is required. Shelf 36 is disposed flush with the bottom 4 of channel 2 so that material settling out of the flow ahead of the unit and carried along the bottom can pass over the shelf and into the lower portion housing 8. Such material may collect until the unit is operated and will then be removed by the conveyor screw 17 with the material from the screens. The grit and sand of the mesh smaller than the openings of the screen will pass therethrough and resettle in the channel if the flow conditions allow. Such resettling can be provided for together with a collection sump or trap, not shown, which will allow collection of the classified grit which may be useable for ground fill without other treatment.

The unit is readily installed without extensive modification of existing channels and does not require any special foundation.

Various modes of carrying out the invention are contemplated as within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

We claim:

1. A self-cleaning screen unit for installation in a channel and removing solids from the channel flow comprising a conveyor screw, a trough for said screw and having means normally supporting the same and the screw in an inclined position with the lower end thereof disposed in the channel and ahead of the upper end having reference to the direction of channel flow, said trough having two parallel sides and a semi-circular bottom fitting the periphery of the conveyor screw, said bottom having an upper discharge opening and a lower screen opening, a screen having a semi-cylindrical perforate section movable into engagement with the periphery of the conveyor screw and having ends in abutting relation with the corresponding edges of said lower opening and having straight sides in sliding relation with the sides of the trough and interiorly thereof, fastening means located exteriorly of and connecting the sides of the trough and the straight sides of the screen and including screws providing adjustment of the screen relative to the conveyor screw to take up wear therebetween, said supporting means including a pivot bracket to be supported by the channel with the pivot above and crosswise of the channel for partial support of the trough and screw in a horizontal position, said supporting means further including flanges to be secured to the sides of the trough and to seat in sealing engagement with corresponding parts of the channel for normally closing the channel except for the flow through the screen when the trough is in the inclined position referred to, and drive means fixed to the conveyor trough and operatively connected to the upper end of the conveyor screw to rotate the latter in the direction in which the screw scrapes the screen in an upwardly direction to remove the solids therefrom and transports such solids upwardly in the trough to the discharge opening.

2. The invention of claim 1 wherein the trough includes a liner of wear resistant metal extending from the screen opening to the discharge opening and of a thickness approximately that of the screen to provide clearance for the straight sides of the screen which are

in sliding relation with the sides of the trough and interiorly thereof.

3. The invention of claim 1 wherein the flanges are formed integrally with the sides of the trough and a plate closes the upper part of the trough which is above the level of the channel flow.

4. A device of the class described for removal of solids from a waste stream flowing in an open channel, comprising a conveyor screw, a housing for said screw having a lower open section and including a semi-cylindrical screen opposite said open section, means supporting the housing in an inclined position with the screen below the open section and downstream thereof and said means with said housing normally closing the channel except for the flow allowed into the open section and through the screen, said housing having an upper discharge opening, and drive means connected to said conveyor screw to rotate the same in the direction which transports the solids collecting on the screen to the upper discharge opening, said screen comprising a curved element formed separately of the housing and including fastening means securing the screen with respect to the housing for contact with the periphery of the screw whereby the wiping-action of the periphery of the screw over the screen together with the flow of the stream keeps both the screw and the screen free of refuse such as rags and the like.

5. A device of the class described for removal of solids from a waste stream flowing in an open channel, comprising a conveyor screw, a housing for said screw having a lower open section and including a semi-cylindrical screen opposite said open section, means

supporting the housing in an inclined position with the screen below the open section and downstream thereof and said means with said housing normally closing the channel except for the flow allowed into the open section and through the screen, said housing having an upper discharge opening, and drive means connected to said conveyor screw to rotate the same in the direction which transports the solids collecting on the screen to the upper discharge opening, said screen comprising a curved element formed separately of the housing and including fastening means securing the screen with respect to the housing for contact with the periphery of the screw whereby the wiping-action of the periphery of the screw over the screen together with the flow of the stream keeps both the screw and the screen free of refuse such as rags and the like, said fastening means being adjustable for effecting movement of the screen toward the axis of the conveyor screw to take up the wear therebetween.

6. The invention of claim 5 wherein the means supporting the housing and normally closing the channel includes a pivot above and cross-wise of the channel and wherein said means allows the housing to be moved pivotally to raise said screen out of the stream for adjustment of said fastening means.

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