

Sept. 26, 1944.

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2,358,841

SEWAGE SCREENING SYSTEM

Filed March 4, 1940

2 Sheets-Sheet 1

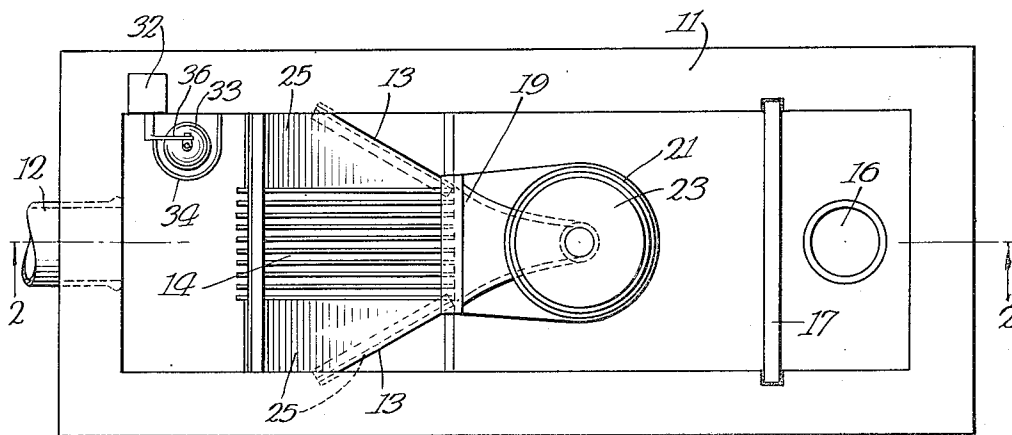


Fig. 1

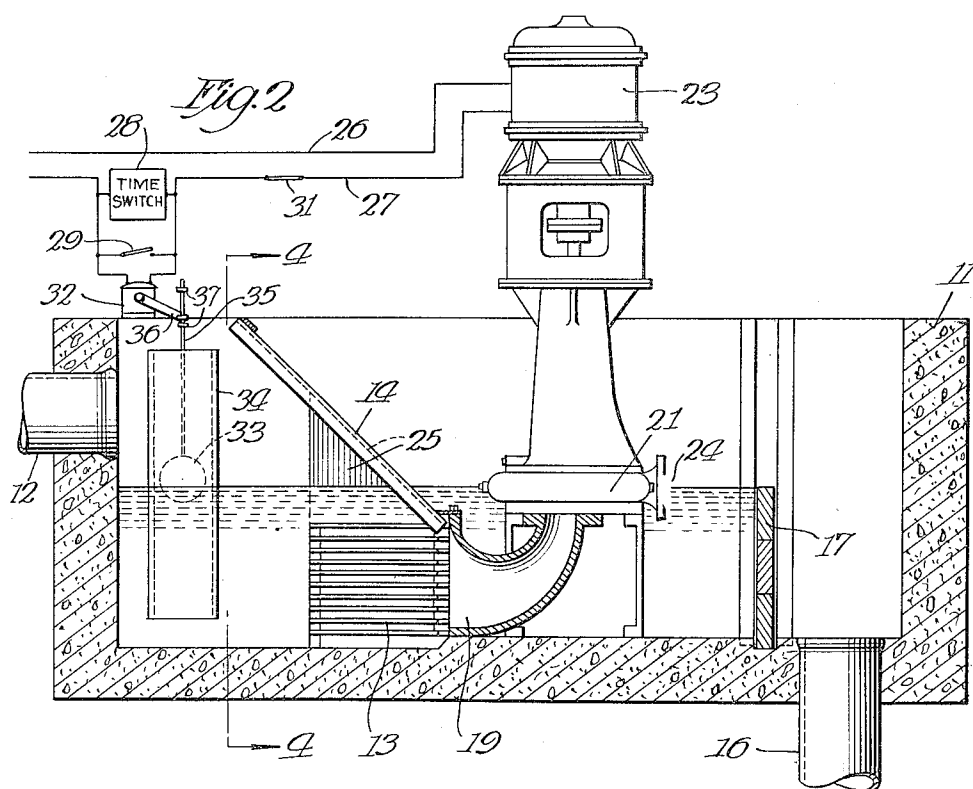


Fig. 2

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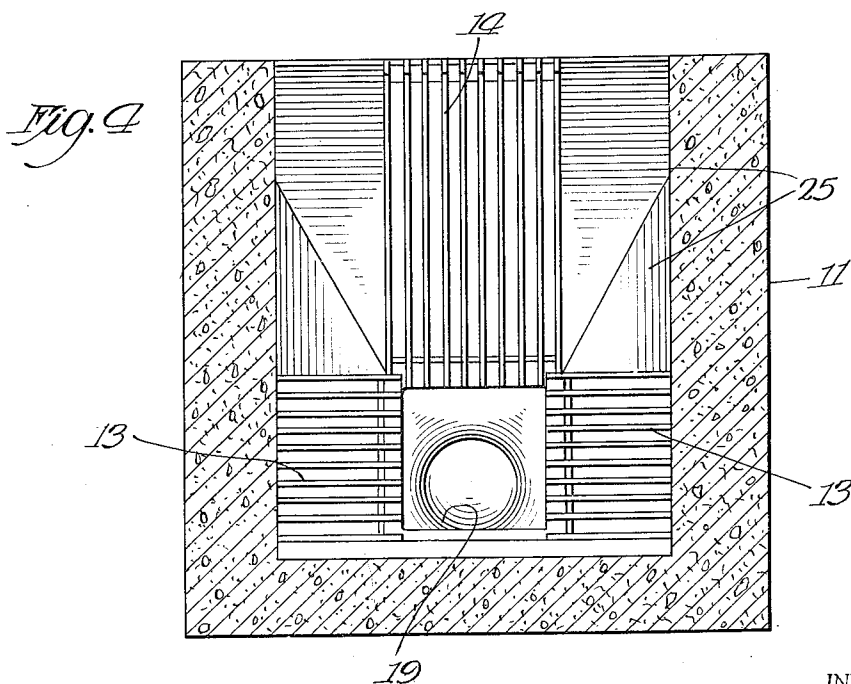
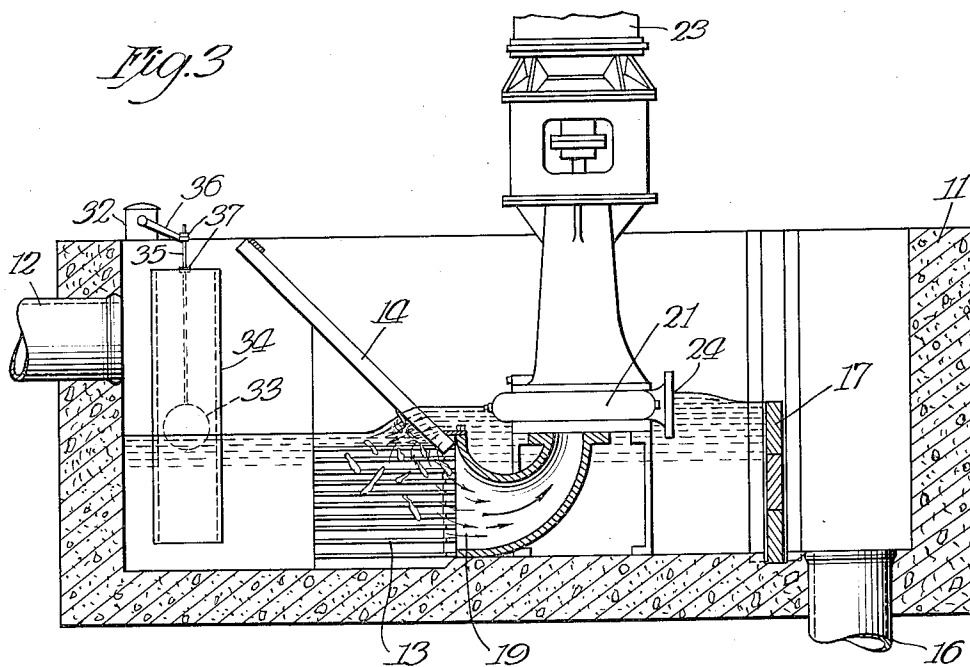
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UNITED STATES PATENT OFFICE

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SEWAGE SCREENING SYSTEM

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9 Claims. (CL 210—152)

In sewage disposal plants it is common practice to provide screens for initially screening out objects which will not go through the plant satisfactorily. For example, fibrous or rubbery objects are likely to jam the pumps. Unless special pumps are used, many of these objects will not dissolve. These same insoluble objects, however, are likely to clog the screens which are provided for removing them. Accordingly, it is a practice to clean these screens at fairly frequent intervals with a hand rake or the like. Although machinery has been provided for cleaning the screens mechanically, it is very expensive and is likely to be troublesome and undependable.

According to the present invention a simple system is provided in which the screens are automatically cleaned periodically by means of causing a backwash of the sewage liquors which wash the insoluble particles from the screen. They are preferably simultaneously drawn into a pump which serves to cut them up and pass them into the sewage in an unobjectionable form.

Additional objects and advantages of the invention will be apparent from the following description and from the drawings, in which:

Fig. 1 is a plan view of the apparatus chosen for illustration of this invention.

Fig. 2 is a vertical longitudinal sectional view therethrough taken approximately on the line 2—2 of Fig. 1 and showing the circuit connection diagrammatically.

Fig. 3 is a view corresponding to Fig. 2, showing the screens being flushed while Fig. 2 shows them partly obstructed.

Fig. 4 is a transverse sectional view taken approximately on the line 4—4 of Fig. 2.

A preferred form of the invention has been chosen for illustration and description, in compliance with section 4888 of the Revised Statutes, but persons skilled in the art will readily perceive other means utilizing the inventive concepts covered by the claims for accomplishing the same results.

The invention has been illustrated in connection with a screening tank 11 into which the sewage flows through a pipe 12. The tank may include a plurality of screens 13 and 14 positioned between the inlet 12 and an outlet 16. The outlet 16 may be positioned at a height to maintain the liquor at the desired level, or preferably a wall 17 will be provided for this purpose. The sewage will normally flow into the tank through the pipe 12, through the screens 13 and 14 which will remove foreign objects therefrom, and then over the wall 17 to the outlet 16. As

seen from Fig. 1, two screens 13 lie in vertical planes and are inclined toward a pump inlet 19. As seen from Fig. 2, the top screen 14 is inclined downwardly and toward the pump inlet 19. The inlet 19 communicates with a comminuting pump 21 which is preferably of the type disclosed in the application of Knute Hartman, Serial No. 256,117; now Patent No. 2,245,035, issued June 10, 1941. This pump has the advantage that it will cut foreign objects into small bits so that they may pass through the sewage plant with the sewage without causing any trouble. When it is used to pump all of the sewage, it is not essential to screen the sewage, but in that event the pump must be run continuously. According to the present invention the screens 13 and 14 are used so that ordinarily the sewage may flow through them by gravity and the pump 21 is used only periodically to flush out the screens 13 and 14, incidentally comminuting the insoluble objects.

As sewage flows through the screens 13 and 14 the solid objects will catch on the bars of the screen. It has long been the practice to use parallel bars without cross bars so as to minimize this effect and to facilitate cleaning. However, the particles will catch nevertheless and frequent cleaning has always been necessary.

According to the present invention this cleaning is accomplished by periodically starting a motor 23 which drives the pump 21. This draws the liquor rapidly from the inlet side of screens 13 and 14 and expels it on the outlet side thereof through outlet 24. This lowers the liquor level on the inlet side and may slightly raise it on the outlet side. In thus lowering the level in advance of the screens it causes a backflow of liquor through the screens, as suggested by Fig. 3, and this backflow cleans the foreign objects from the screens. When thus washed from the screens, they are drawn with the liquor into the pump 21 and are cut up by the pump and discharged in harmless bits into the sewage.

Although it is very desirable to use a comminuting pump 21 so as to cut the objects into small enough pieces so that they will be unobjectionable, this is not necessary for the purpose of cleaning the screens. In fact, it is evident that anything that suddenly lowers the level of the liquor in advance of the screens so that backflushing occurs would accomplish the same results in so far as cleaning the screens is concerned.

Although the side screens 13 would ordinarily provide sufficient flow area, provision of the additional screen 14 serves as a safeguard against

the flow of unscreened sewage if the screens 13 should become so obstructed as to cause a substantial rise in the liquor level. Heretofore when screens have been positioned so that the bars thereof extend from below the liquor level to above the liquor level, a mass of foreign objects have accumulated on the screen above the liquor level. It is apparent that if this were the case in the present instance the backwash would be below the level of these foreign objects and hence they would not be washed off. This trouble is avoided by inclining the screen downwardly in the direction of flow of the sewage instead of upwardly in the direction of flow as heretofore. Heretofore the movement of the sewage has washed the foreign objects upwardly along the screen bars, whereas according to the present invention it washes them downwardly along the screen bars, being aided in this by gravity. Many of these foreign objects will be washed to the ends of bars of screen 14 and then will drop off the bars and settle adjacent to the intake nozzle 19 of the pump. This is not necessary, however, since they will at least be washed far enough along the bars of screens 14 so that the backwash will remove them from the screens so that they can be drawn into the nozzle 19. The spaces between the screens 13 and 14 are of course obstructed, as by plates 25. These plates may each conveniently have one wall, as seen in Fig. 2, in alignment with a screen 13, and the other wall, seen in Fig. 1, in alignment with the screen 14. The two walls may be formed from a single plate or by separate plates joined together.

The path through the pump 21 is sufficiently tortuous and narrow so that, unless the pump is operated, there will be little or no flow through it. Flow through it between operations could be prevented by positioning its outlet above the highest level of the sewage in advance of the screens. It may be noted, incidentally, that the outlet 24 may open in any direction. It is preferred not to have it directed onto the screen 14, however, because if it is directed in some other direction there will be a larger proportion of screened sewage flowing back through the screens in backwashing. On the other hand, if any difficulty were encountered in cleaning a particular screen 14, the outlet 24 could be directed thereon to clean the screen more thoroughly.

In Fig. 2 the circuit for the motor 23 has been diagrammatically indicated. From a suitable source of power, not shown, one lead 26 may go directly to the motor while the other lead 27 may be connected to the source of power through a suitable time switch 28. This time switch will turn on the motor 23 as frequently as may be found necessary and for such periods as may be found necessary. Five minutes in every two or three hours is believed to be adequate, although individual operators may prefer more frequent backflushing of the screens. With as long a period as this it may be desirable to provide a hand switch 29 so that if the attendant notices that the screens are becoming clogged in a shorter interval, he can operate the motor by hand. Of course, a hand switch would usually be provided in any event, simply to take care of emergency. Likewise, a normally closed hand switch 31 will be provided for preventing operation of the motor 23 when this section of the plant is shut down.

As an added safeguard or in place of the time switch 28 it may be desirable to provide a float-controlled switch 32. This switch will be con-

nected in parallel with the time switch and manual switch 29 and will operate to close the circuit and run the motor 23 whenever the liquor level in advance of the screens 13 and 14 is above a predetermined point. Thus, if the screens 13 and 14 should become so obstructed as to create a dangerous or objectionable condition, the level of the liquor in advance of the screen would rise. In rising it would raise a float 33 which may be protected by a shield 34. This float carries a rod 35 which slides through a hole in operating arm 36 of switch 32. Collars 37 are adjustably positioned on rod 35. When the liquor level rises to a predetermined point, the lower collar 37 will raise the arm 36 and turn on the switch 32. The pump would then start and pump the sewage from the inlet side of the screens 13 and 14 until the liquor level on the inlet side of the screens has been lowered enough for the upper collar 37 to shift the arm 36 to the "off" position, the switch 32 of course being a snap type switch. By positioning the upper collar 37 to permit the liquor level to be lowered nearly as low as possible, backflushing will be obtained and the screens will be adequately cleaned.

In view of the foregoing description, a brief explanation of the operation will be sufficient. Sewage flows in through the inlet 12 and normally flows through the screens 13 and 14, over the wall 17 and out the outlet 16. Objectionable foreign objects will be caught on the screens 13 and 14. Periodically, either by operation of the time switch 28, the manual switch 29, or the float-controlled switch 32, motor 23 will be started and it will drive the impeller in the pump 21. This will draw liquor into the intake 19 sufficiently rapidly to lower the level of the sewage in advance of (on the inlet side of) screens 13 and 14 until it is lower than the top of the wall 17. The sewage beyond the screens 13 and 14 will then backwash through the screens 13 and 14, thus flushing from them the foreign objects which have been caught thereon. These foreign objects will be drawn into the pump 21 with the sewage flowing through the pump inlet 19 and will be comminuted by this pump into pieces too small to cause trouble or to be objectionable. After a time interval sufficient to thoroughly clean the screens 13 and 14 the motor 23 and pump 21 will be stopped by operation of the time switch 28, manual switch 29, or float controlled switch 32. If both the time switch 28 and float controlled switch 32 are provided, only the time switch will ordinarily operate, the float controlled switch operating only in the event of exceptional conditions causing obstruction of the screen and a severe rise of the liquor within the normal idle period of the motor 23 and pump 21.

From the foregoing it is seen that a sewage screening system has been provided in which the screens are automatically cleaned by backflushing and the objects flushed therefrom are comminuted so as to be rendered harmless and unobjectionable. The system permits gravitational flow of the sewage normally, the pump being used only for a short time at rare intervals to flush the screens. It is evident, therefore, that the power consumed by the pump is negligible, although all of the foreign objects which do not pass through the screens are comminuted by the pump. With an operating cost less than that required for keeping screens cleaned heretofore, the screens are cleaned and in addition the foreign objects caught thereby are cut up into small harmless pieces.

Even without the backwash, the pump 21 would do a good job of cleaning the screens since the flow of water along the screens into intake nozzle 19 would wash the screenings into the nozzle 19, particularly in view of the fact that the spaces between the screen bars are unobstructed at their ends, the support members being secured to these screen bars along their rear sides. Likewise, if a portion of the sewage, or all of the sewage periodically, were allowed to flow through a conduit in the place of the pump intake 19, the screenings would gradually be washed along the bars and off of them at their ends. Thus, they could be diverted permanently from the main stream or comminuted other than by the pump 21 and returned to the sewage leaving the outlet 16.

I claim:

1. Screening apparatus for sewage and analogous liquors, including a generally horizontal conduit, a screen across said conduit, means for maintaining a normal level of liquor flowing generally horizontally through the screen, a pump having an intake communicating with the upstream side of the screen for drawing liquor off without its passing through the screen to lower the liquor level on the upstream side of the screen so that liquor which has already passed through the screen will flow back through the screen again, flushing from the screen objects which have been caught thereon, a time switch for automatically causing the occasional operation of said pump, and an independently effective switch responsive to the level of the liquor on the upstream side of the screen for causing the operation of the pump.
2. Screening apparatus for use in a system for treating sewage and analogous liquors, including a screen, means for maintaining a normal level of liquor flowing through the screen, a pump having an intake communicating with the upstream side of the screen for occasionally drawing liquor off without its passing through the screen to lower the liquor level on the upstream side of the screen so that liquor which has already passed through the screen will flow back through the screen again, flushing from the screen objects which have been caught thereon, said pump including cutting means to cut the objects into small bits which may pass through the sewage system without causing trouble, discharge means for delivering the cut up objects and liquor back into the system from the pump, and means for controlling the pump to cause it to operate for only a short period at infrequent intervals.
3. Screening apparatus for sewage and analogous liquors, including a generally horizontal conduit, a screen across said conduit, means for maintaining a normal level of liquor flowing generally horizontally through the screen, means having an intake communicating with the upstream side of the screen for drawing liquor off without its passing through the screen to lower the liquor level on the upstream side of the screen so that liquor which has already passed through the screen will flow back through the screen again flushing from the screen objects which have been caught thereon, and means for controlling the operation of said liquor draw-off means automatically at predetermined intervals of time and in response to a predetermined rise of the liquor level on the upstream side of the screen.
4. Screening apparatus for use in a system for treating sewage and analogous liquors, including a generally horizontal conduit, a screen across said conduit, means for maintaining a normal level of

liquor flowing generally horizontally through the screen, and a pump having an intake communicating with the upstream side of the screen for occasionally drawing liquor off without its passing through the screen to lower the liquor level on the upstream side of the screen and having an outlet for discharging the liquor back into the system so that liquor which has already passed through the screen will flow back through the screen again, flushing from the screen objects which have been caught thereon, the screen sloping toward the inlet to the pump whereby the normal movement of the liquor through the screen tends to move the foreign objects to the pump inlet; said pump inlet being constantly open.

5. Sewage screening apparatus for use in a sewage treating system, including a screen, an influent conduit normally open to the screen, an effluent conduit from the other side of the screen disposed for horizontal flow of the sewage through the screen and so constructed and arranged as to form a reservoir of substantial volume adjacent the screen, an outlet for the effluent conduit, and a pump having an intake on the influent side of the screen and near the bottom of the screen an outlet discharging back into the system, and having sufficient pumping capacity to cause a substantial stream to flow from the reservoir backwards through the screen and into the pump, whereby substantially all of the solids caught by said screen can be washed into the pump while maintaining a pool of liquor above the pump intake; said apparatus including means for so treating the sewage drawn into the intake that the liquor discharged through its outlet will be substantially free from large screenings.

6. Sewage screening apparatus including a screen, an influent conduit normally open to the front of the screen with the screen disposed thereacross, an effluent conduit from the rear of the screen disposed for horizontal flow of the sewage through the screen, and cutting and recirculating means including a pump having an outlet at the rear of the screen, so positioned that a substantial portion of the liquor discharged therefrom can pass through the screen from rear to front, and an intake at the front of the screen and near the bottom of the screen, and having sufficient pumping capacity to cause a substantial stream to flow and recirculate backwards through the screen and through the pump while the influent conduit is open, whereby substantially all of the solids caught by said screen can be washed into the pump while maintaining a pool of liquor above the pump intake; said apparatus including means for so treating the sewage drawn into the intake that the liquor discharged through its outlet will be substantially free from large screenings.

7. Sewage screening apparatus including a screen, an influent conduit at the front of the screen, an effluent conduit from the rear of the screen, and recirculating means including a pump having an outlet at the rear of the screen, so positioned that a substantial portion of the liquor discharged therefrom can pass through the screen from rear to front, and an intake at the front of the screen and near the bottom of the screen, and having sufficient pumping capacity to cause a substantial stream to flow and recirculate backwards through the screen and through the pump whereby substantially all of the solids caught by said screen can be washed into the pump while maintaining a pool of liquor above the pump intake; said apparatus including cutting means as-

sociated with said recirculating means for cutting up any large solids drawn into said intake.

8. Sewage screening apparatus including a conduit through which sewage flows substantially horizontally, a screen across said conduit, a pump having an intake on the upstream side of the screen and adjacent the screen, and adapted to draw liquor and screenings entrained in said liquor from the main stream through the screen and having an outlet adapted to discharge said liquor and screenings back into the main stream, said apparatus including means for cutting up any large solids drawn into said intake before they are discharged back into the stream, and automatic control means for operating the pump and cutting means only infrequently whereby only a

very small portion of the liquor in the main stream flows through said pump.

9. Sewage screening apparatus including a conduit through which sewage flows substantially horizontally, a screen across said conduit, a pump having an intake on the upstream side of the screen and adjacent the screen, and adapted to draw liquor and screenings entrained in said liquor from the main stream through the screen and having an outlet adapted to discharge said liquor and screenings back into the main stream, said apparatus including means for cutting up any large solids drawn into said intake before they are discharged back into the stream.

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