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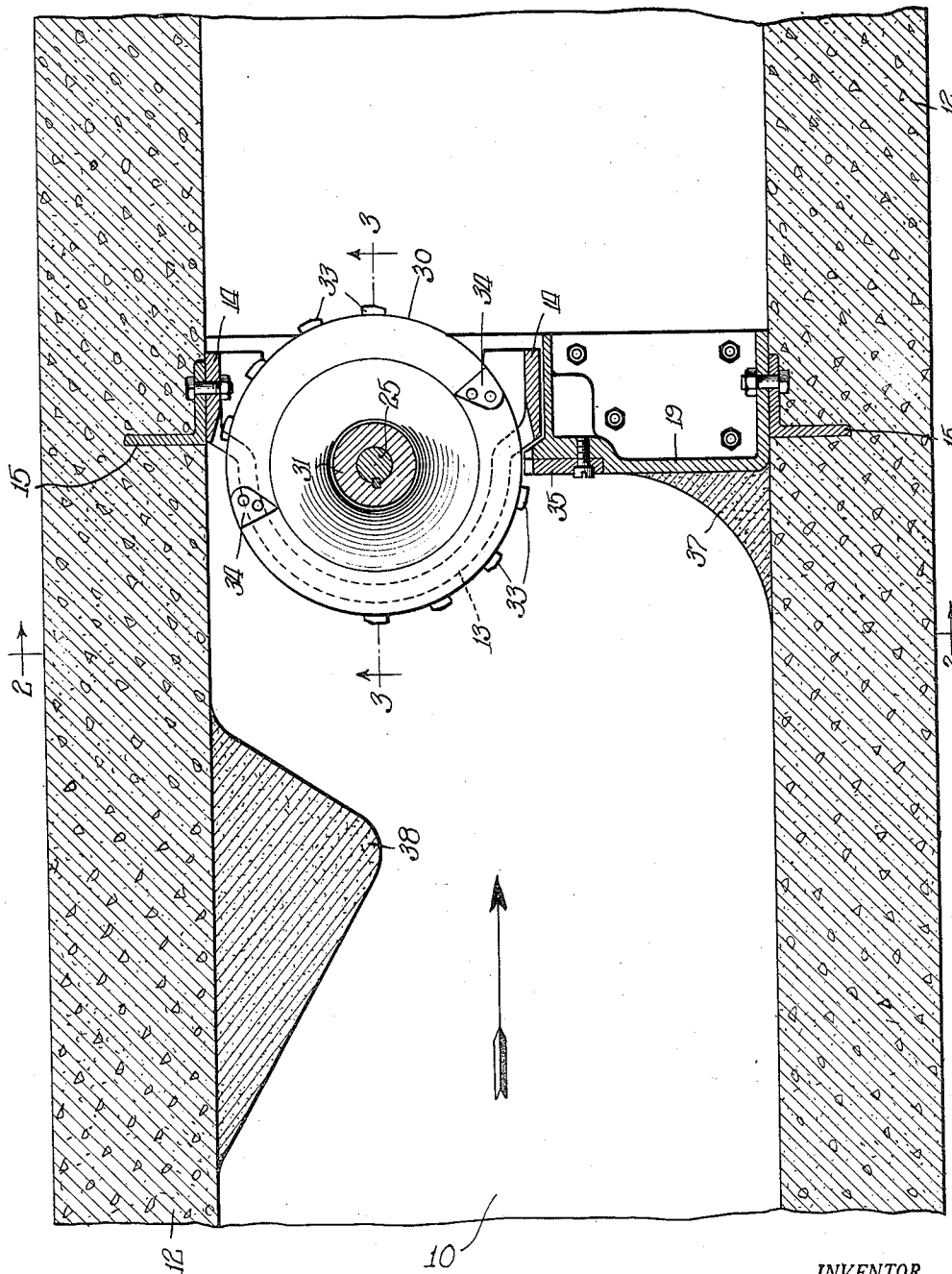
W. H. GREEN

2,389,306

SEWAGE COMMINUTOR

Filed Oct. 4, 1943

3 Sheets-Sheet 1



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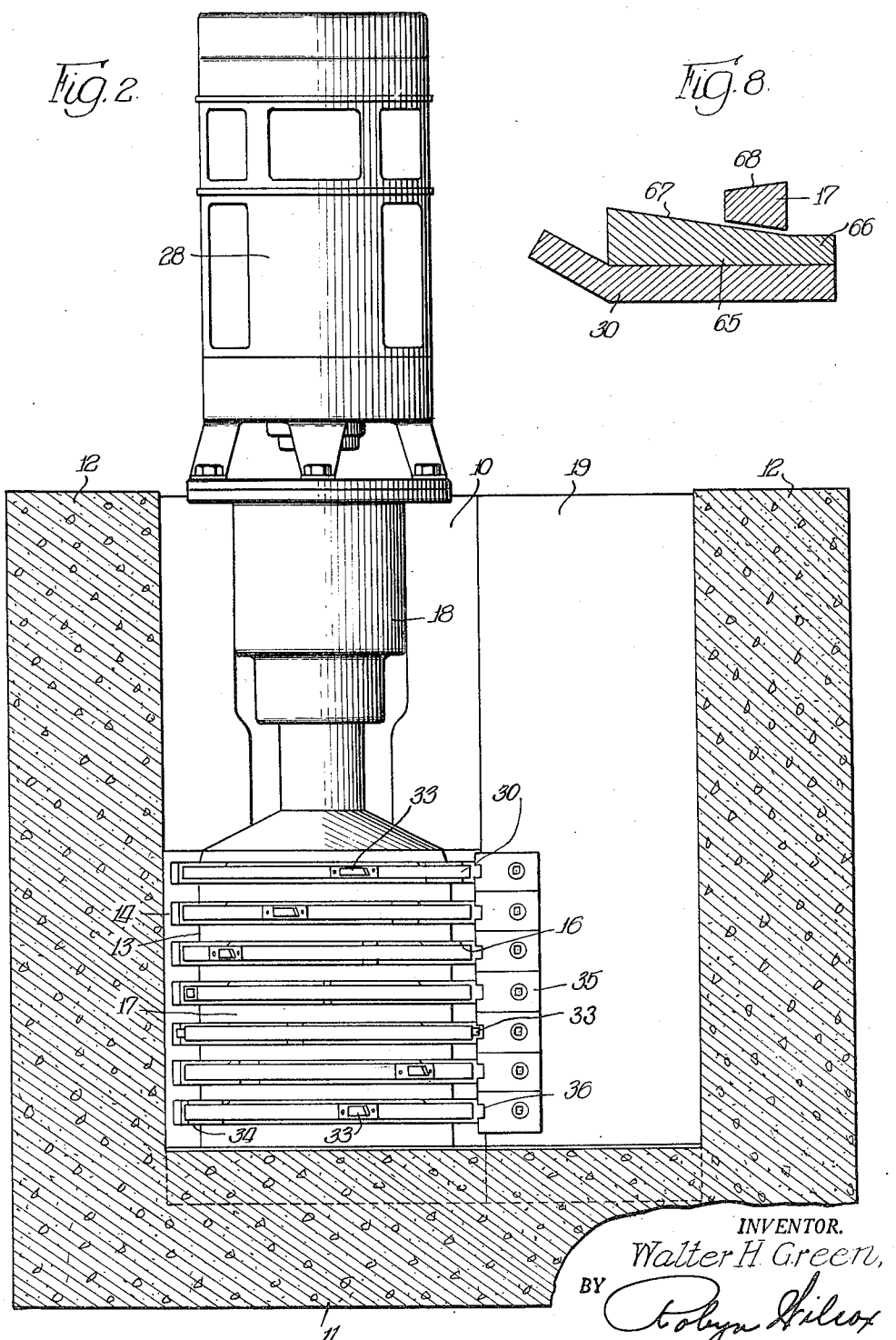
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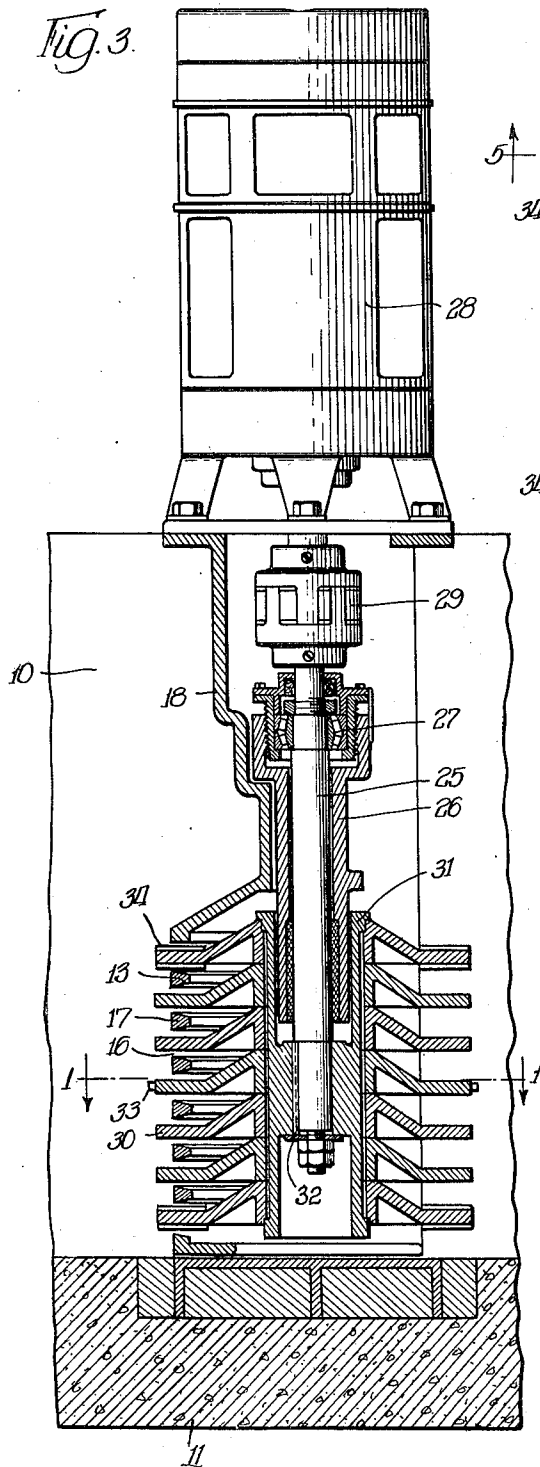
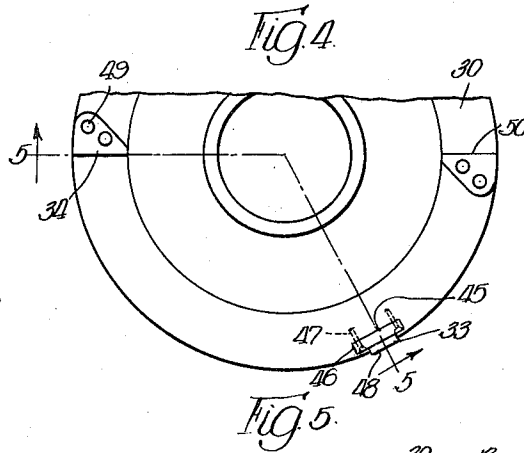
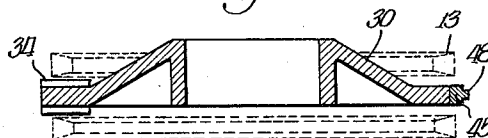
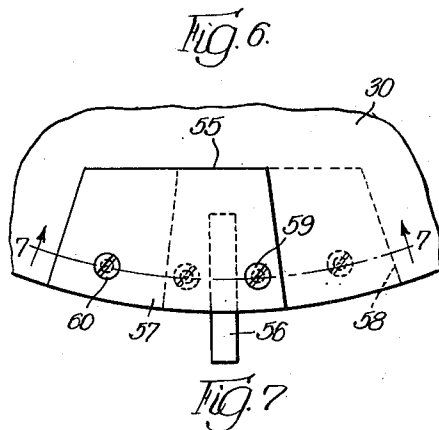
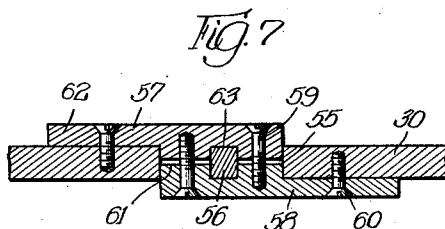
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SEWAGE COMMINUTOR

Filed Oct. 4, 1943

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,389,306

SEWAGE COMMINUTOR

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Application October 4, 1943, Serial No. 504,979

7 Claims. (Cl. 210—152)

This invention relates to comminutors employed for screening and cutting solids carried by liquids such as sewage.

The principal object of my invention is to provide an improved sewage screening and cutting device.

A further object of the invention is to provide a self-cleaning comminuting device.

Another object of the invention is to provide an improved comminutor in which the solids to be comminuted are more positively carried to the cutting bar.

Another object of my invention is to provide an improved and adjustable cutting tooth in a solids cutting device.

A further object of my invention is to provide a solids comminuting device in which the small particles cut from large objects are positively carried through the screening and cutting device.

A still further object of my invention is to provide a comminutor which provides a two stage screening effect, in which larger solids are held back by a rotating screen provided with cutting teeth and the finer materials formed by the interaction of the cutting teeth with a stationary cutting bar are given a secondary screening through a fixed screen or grid.

Another object is to provide a comminutor in which there will be no change of direction of flow through the device with consequent loss of head.

These and other objects and advantages of the invention will appear in the description and claims which follow.

Sewage, as an example, contains many materials, such as large floatable solids, rags, and the like, which interfere with efficient operation of the sewage treating plant, and which, therefore, must be removed or reduced in size prior to the regular sewage treatment. In the early art, fixed bar screens were inserted in the stream of sewage to catch the larger of such solids, such as boards, vegetables and the like. The materials so caught on the fixed bar screen were manually removed from time to time and manually disposed of. In view of the nature of the material being removed and the liquid, this was a very disagreeable task. An improvement was later made by providing mechanical means for raking the screened solids up above the flow of liquid and dumping them into a disposal device of some sort. More recently the use of devices has become prevalent in which the larger floating solids are chopped in the sewage into small particles which can be handled by the sewage treatment plant and separated in the subsequent clarification

steps. This not only avoids the necessity of manually handling obnoxious material, but obviates the necessity of removing such material from the flowing stream. My present invention deals with an improved kind of apparatus of this type.

Heretofore such devices have usually comprised a rotating screen provided with cutting teeth and an associated cutting bar or comb with notches in the path of the cutting teeth. In this form the finer particles and sewage flow into the rotating screen and are generally withdrawn downwardly therefrom. Another form of a comminuting device comprises a fixed semi-cylindrical screen extending across the path of flow of sewage, the screen being in the form of a grid with a plurality of horizontal slots across the stream. Rotating plates or discs extend into the slots, and carry cutting teeth on their peripheries. A cutting bar extends vertically alongside of the fixed grid and is provided with notches in the paths of the cutting teeth. In this form the flow of sewage is horizontally through the apparatus and solids punched out by the teeth are pushed through the cutting bar and into the flow of sewage on the downstream side of the device. It is with this latter type of comminuting apparatus that my invention deals.

Heretofore in this fixed grid type the rotating plates have been of the same radius as the grid, the cutting teeth on the peripheral edge extending beyond the outer face of the grid. I have discovered that if the discs are made of a larger radius than that of the cylindrical wall of the fixed grid, so that the discs extend through the slots of the grid a short distance, preferably as much as one-half inch or more, several improved results are secured. One of the important improvements is the more positive carrying of solid materials by the rotating discs and cutting teeth to the cutting bar, thereby providing more rapid and efficient reduction of the solids. I have also found that if the cutter plates are provided with one or more radial vanes adjacent their periphery local and temporary outward currents are formed by which materials such as strings, rags and other fibrous material that tend to adhere to the fixed grid are washed loose, thereby providing for non-clogging and more efficient operation of the apparatus as a whole.

It will be understood that these devices while mostly used in the treatment of sewage, can be used in the screening and reduction of solids in any liquid. Therefore, the reference to cutting solids in sewage is to be taken as an example of the use of such devices, and not as a limitation.

Preferred embodiments of the present invention are shown in the accompanying drawings which form a part of this specification and in which like reference characters in the several figures designate similar elements.

Figure 1 is a plan view of the apparatus of my invention taken at the horizontal plane indicated by the line 1—1 of Figure 3.

Figure 2 is a front, or upstream, view of the comminutor of my invention.

Figure 3 is a sectional side view of the apparatus of my invention, taken along the vertical plane indicated by the line 3—3 in Figure 1.

Figure 4 is an enlarged plan view of one embodiment of the improved cutting disc and cleaning vanes of my invention.

Figure 5 is a vertical sectional view of the improved device of Figure 4, taken along the bisecting vertical planes indicated by the lines 5—5 of Figure 4.

Figure 6 is a partial plan view of a cutter disc showing an alternative method of mounting the cutter teeth and cleaning vanes.

Figure 7 is a vertical cross-sectional view of the cutting disc shown in Figure 6, taken along the curved vertical plane indicated by the line 7—7 of Figure 6.

Figure 8 is another form of cleaning vane of my invention.

The apparatus of my invention is designed to be placed in a horizontally moving stream of water or sewage such as that confined in a trough or open conduit 10 with floor 11 and sidewalls 12. A semi-cylindrical grid or coarse screen 13 is placed across the channel 10 with the curvature or convex side pointing upstream, as shown. The grid may extend the full width of the channel 10, but ordinarily in order to provide a device of the necessary cutting capacity, may extend only part way across as is shown in Figure 1, in which event the balance of the chamber is dammed by a suitable obstruction, such as plate 19. The grid 13 comprises standards 14, one at each side of the channel, which may be bolted or otherwise rigidly secured to suitable means, such as angles 15 set in the sidewalls 12 of the channel. The grid 13 is provided with a plurality of horizontal slots 16 extending substantially from side to side of the grid. The grid therefore provides a plurality of horizontal bars 17 extending horizontally across the flowing stream of sewage. In most installations the grid need only extend vertically for a portion of the depth of the flow channel 10 corresponding to the normal maximum flow depth, as shown in Figures 2 and 3. In that event the upper portion of the rotating cutter may be enclosed in a casing 18 extending upwardly from the uppermost bar 17 in order to protect the upper part of the drive shaft mechanism hereafter to be described. This casing 18 may extend entirely across the upper portion of the comminutor device, as shown, or simply around the shaft.

A shaft 25 is vertically mounted within the semi-cylindrical grid 13, usually at the axis of the cylinder formed thereby. The shaft may be enclosed in a housing 26 and supported by a suitable thrust bearing 27. The shaft is rotated by a suitable motor, and gear reducer 28 mounted above the channel and connected to the shaft by any suitable means, such as through a coupling 29. A plurality of cutter plates, or discs 30 are rigidly mounted on the shaft by any suitable means as by frame 31 keyed to the shaft 25 by key 32. Heretofore in apparatus of this type it

has been customary to use cutter discs with a radius the same as that of the outer edge of the stationary semi-cylindrical grid, so that the stationary grid and rotating cutter plate formed a substantially semi-cylindrical wall. I have found that improved results are secured if the radius of the plate is somewhat greater than that of the stationary grid, so that the peripheries of the rotating discs, or cutter plates, are beyond the wall formed by the stationary grid, as shown in Figures 1 and 3. This construction more positively carries the solids to be comminuted to the cutter bar hereinafter to be described and also has the advantage of forming what may be spoken of as an outer grid or screen with wider openings by which larger pieces of floating matter are kept away from the narrower inner slots. Such larger pieces are gradually reduced by the nibbling action of the cutter teeth.

A plurality of removable cutter teeth 33 are affixed to the peripheral edges of the rotating cutter discs, or plates 30. These teeth may take a variety of forms, as is shown in Figures 4 through 7 inclusive, to be described more in detail hereafter. Preferably the cutter teeth will be vertically misaligned on the respective discs so as to present a staggered relationship of one to another, which provides for continuous cutting and eliminates large shock loads. I also provide a plurality of radial vanes 34, preferably extending from adjacent the periphery of the cutter disc, or plate 30, inwardly for a distance at least within the inner edge of the stationary bars 17. These vanes are necessarily of slight thickness as customarily the space between the rotating disc 30 and the fixed bar 17 is of the order of about $\frac{1}{4}$ " to $\frac{1}{2}$ " depending upon the size to which it is desired to reduce the material, but should be as thick as the space between the bar and the cutter disc permits. These vanes, due to the rotation of the cutter plate 30, act in the nature of a centrifugal pump to cause a periodical backflow or swirl of liquid from the fixed stationary bar 17, and away therefrom. Such pumping action washes away rags, strings and similar fibrous materials which may tend to wrap around the bars of the grid, thus automatically keeping the bars clean of such material.

A vertical cutter bar 35 is set into the wall of the conduit, and extends vertically along the periphery of the cutter plates 30, as shown in Figure 2. The bar may comprise a single piece of metal or may be divided into removable segments bolted to the wall, as shown in Figure 2. The cutter bar 35 is provided with a plurality of notches 36, each lying in the path of travel of a corresponding cutter tooth 33. It will be obvious that as solids contained in the stream of sewage are caught by the rotating screen formed by the disc 30, they will tend to be held by the cutter teeth 33, and as a solid comes against the cutter bar 35, small pieces will be punched from the solid and pushed through by the teeth into the flowing stream of sewage. This action can be accentuated by the use of proper grouts or baffles such as 37 and 38 shown in Figure 1 which tend to cause a minor circulation in the angle between the cutter bar and rotating plate. In this manner larger solids are gradually reduced in size until they can pass through the screen formed by the rotating disc and the fixed or stationary grid.

Figures 4 and 5 show one method of mounting the cutter teeth and cleaning vanes of my invention. The cutter teeth 33 comprise a base piece 45, which is set into a corresponding recess 46,

formed in the periphery of the cutter plate 30. The teeth are rigidly held in the periphery of the rotating disc 30 by any suitable means such as machine screws 47. On the outer edge of the base piece 45 is a small projection or tooth 48. The tooth 48 may be formed of the same material as the base, or may be welded thereto, and preferably is formed of a hard material, such as stellite. In this embodiment the cleaning vane 34 is shown as a small plate mounted on the faces of the cutter plate at the periphery, as shown in Figure 4, and rigidly held thereon as by any suitable means such as machine screws 49. As shown in Figure 4, it is desired that the front face 50 be placed substantially radially on the disc so as to provide a vane having somewhat the effect of the vanes of a centrifugal pump. As shown in Figures 4 and 5 the teeth 33 and the cleaning vane 34 may be placed at spaced points around the periphery of the rotating disc 30. As will be seen in connection with the description of Figures 6 and 7, the two may be assembled together but this is not material as good results are secured when the cutter teeth 33 and cleaning vane 34 are at spaced points around the periphery of the rotating disc 30.

Figures 6 and 7 show another and preferred embodiment or method of mounting the cutter teeth 33. In this embodiment the cutter teeth and the cleaning vanes form an assembly which is mounted in a recess on the periphery of the cutter plate 30. As in the other embodiment the periphery of the disc 30 is provided with a plurality of recesses 55 for the insertion of the cutter tooth and cleaning vane assembly. The assembly of cutter tooth and cleaning vanes comprises a tooth 56 which may be a rectangular bar of stellite or such material, rigidly clamped between an upper clamping member 57 and a lower clamping member 58 which are rigidly held together by any suitable means, such as machine screws 59. The clamping members have a projecting portion 61 which fits into the recess 55 and a vane portion 62 which extends along the cutter disc beyond said recess. A depression 63 is placed in the projecting portion 61 to hold the tooth 56 the depth of the depression in each plate being less than one-half the thickness of the tooth, so the latter may be firmly clamped and held. The clamping members are also rigidly secured to the rotating disc 30 by any suitable means, such as machine screws 60. As shown in Figure 7, it is not necessary that the front edges of the upper and lower vanes lie in the same vertical plane but preferably they can be arranged, as shown in Figure 7, so that the two clamping members are inserted in the disc slot 55 in overlapping relationship. This construction provides a rigidly held but easily adjustable cutter tooth. Upon loosening the screws 59 and 60 the cutter tooth can be moved inwardly or outwardly as desired. This provides for easy adjustment of the cutter tooth so that it will always fit properly with the notches in the cutter bar and also that any wear may be taken up.

Figure 8 illustrates a further embodiment or form of the cleaning vane of my invention. In the embodiments heretofore discussed, the cleaning vanes have been of substantially uniform thickness from periphery to inner edge thereof. In the embodiment shown in Figure 8 however, the interior portion of the vane 65 is shaped to form a surface substantially parallel to the surfaces of the stationary bar 17 of the grid which are ordinarily and preferably made wedge shaped.

Such construction of the fixed bars is usually preferred in order to provide openings of increasing width inwardly to facilitate passage of solids therethrough. In this embodiment the vane 65 may have a portion 66 of uniform thickness between the peripheral edge of the stationary bar 17 and the periphery of the disc 30. The interior portion of the vane is wedge shaped to provide a surface 67 substantially parallel to the adjacent receding surfaces 68 of the bar. Such construction will sometimes be preferred as it provides for greater pumping action upon rotation of the plate 30 due to the vane fitting closer to the walls of the fixed bar.

The operation of the apparatus of my invention will be obvious. Some of the larger solids in the sewage are first caught or held by the upstream segments of the rotating plate which extend outwardly beyond the bars of the fixed grid, and will be nibbled by the rotating teeth or washed or carried over to the cutter bar. There such solids are caught between the cutting teeth and the cutting bar and small portions are punched through the cutter bar and into the downstream flow of sewage. In this manner the larger solids are gradually reduced in size until all portions can pass through the comminutor. The solids small enough to pass through a slot between a rotating disc and the adjacent bar of the stationary grid will obviously pass through the comminutor without change. Solids small enough to pass between adjacent plates but not small enough to pass through the space between those plates and a stationary bar 17 will be passed to the cutter bar and there will be caught by the rotating teeth and pieces punched out and through to the downstream side. This structure provides for a double screening or classification of solids in the sewage protecting the inner grid from coarse material. Also the cleaning vanes, due to their action, periodically cause a small backflow or swirl of water outwardly from the stationary grid thereby removing threads, strings, rags and other fibrous materials, which tend to wrap around the screen members of prior devices. At the same time the combined effect of the vanes and of the rotating discs prevent the wedging of small solids in the slots. I thus provide a device which automatically cleans itself and which readily and effectively comminutes the solids contained in the sewage until they are of a satisfactory small size.

Examples given above are embodiments of my invention but obviously there are many modifications which would be obvious to those skilled in the art. I therefore do not wish to limit myself precisely to the details shown since manifestly they may be varied without departing from the spirit of my invention.

I claim:

1. A sewage solids cutting and straining device comprising a semi-cylindrical grid adapted to be interposed across a flowing stream of sewage, a plurality of horizontal slots extending circumferentially of said grid, a plurality of rotatable discs extending through said slots to the upstream side of said grid, a prime mover connected to said discs, cutting teeth on the peripheries of said discs, a stationary cutter bar adjacent to the peripheries of said discs, and notches in said cutter bar interposed in the path of travel of said cutting teeth.

2. The apparatus of claim 1 including also a plurality of radial vanes adjacent the peripheries of said discs and extending into said slots.

3. A comminutor comprising a rotatable ver-

tical shaft, a plurality of circular spaced discs mounted on said shaft, a plurality of cutting teeth mounted on the peripheries of said discs, a stationary screen extending between said discs and internally of the peripheries thereof, and a stationary notched cutting bar disposed adjacent the peripheries of said discs and parallel to said shaft, the notches on said bar being disposed in the path of travel of said cutting teeth.

4. A comminutor adapted to be interposed in a stream of flowing sewage comprising a rotatable vertically extending shaft, a plurality of horizontally extending spaced circular discs mounted on said shaft, cutting teeth mounted on the peripheries of said discs, vanes mounted on said discs, a stationary semi-cylindrical straining member extending horizontally across said stream between adjacent discs, said straining member being curved with a radius smaller than the radius of said discs, a stationary cutting bar extending parallel to said shaft immediately adjacent the peripheries of said discs, and notches in said cutting bar disposed in the paths of travel of the cutting teeth.

5. A device of the character described comprising a channel for the flow of a liquid containing suspended solids, a vertical stationary semi-cylindrical grid interposed across said channel, with its convex curvature upstream, a plurality of slots extending horizontally across said grid, a rotatable vertical shaft co-axially mounted within said grid, a plurality of discs mounted on said shaft, said discs having a radius greater than the radius of said grid and so mounted on said shaft that a disc is interposed in each slot of said grid, a plurality of cutting teeth mounted on the peripheries of said discs, a stationary cutter bar extending parallel to said shaft immediately adjacent the peripheries of said discs, and notches in said cut-

ter bar disposed in the paths of travel of said teeth.

6. In a comminutor adapted to be interposed in a stream of flowing sewage comprising a rotatable vertically extending shaft, a plurality of horizontally extending spaced circular discs mounted on said shaft, cutting teeth mounted on the peripheries of said discs, a stationary straining member extending across said stream, said straining member having curved horizontal bars in the spaces between said discs and lying substantially concentric to the peripheries of said discs, a stationary cutting bar extending parallel to said shaft immediately adjacent the peripheries of said discs, and notches in said cutting bar disposed in the paths of travel of the cutting teeth, vertically extending vanes mounted on said discs adjacent the periphery thereof, said vanes having a height less than the height of the spaces between the discs and the adjacent bars and extending inwardly from the periphery of the discs to a point inside the inner face of the bars.

7. In a comminutor comprising a rotatable vertical shaft, a plurality of circular spaced discs mounted on said shaft, a plurality of recesses in the peripheries of said discs, a stationary screen extending between said discs and a stationary notched cutting bar disposed adjacent the peripheries of said discs and parallel to said shaft, an improved cutting and cleaning assembly comprising upper and lower clamping members, said clamping members having a projecting portion of such size as to fit in said recesses and a vane portion extending along the disc beyond the area of said recesses, a depression in said projecting portion, a cutting tooth in said depression, fastening means to hold said clamping members together and additional fastening means for affixing said clamping members to said discs.

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