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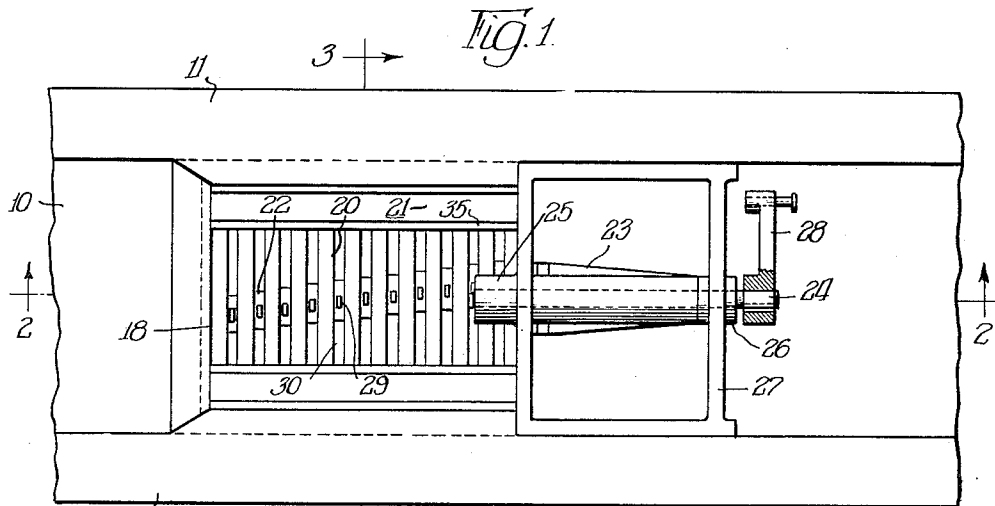
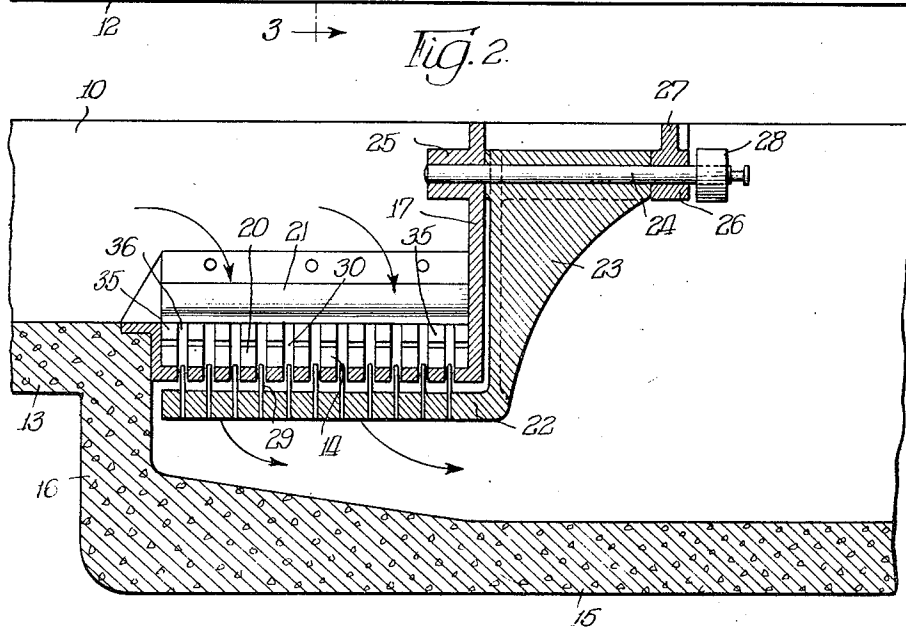
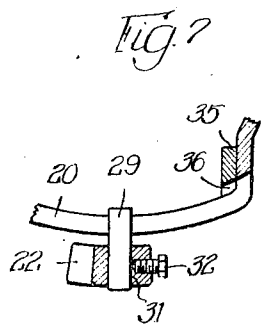
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2,391,704

SEWAGE COMMUNITING APPARATUS

Filed Oct. 11, 1943

3 Sheets-Sheet 1



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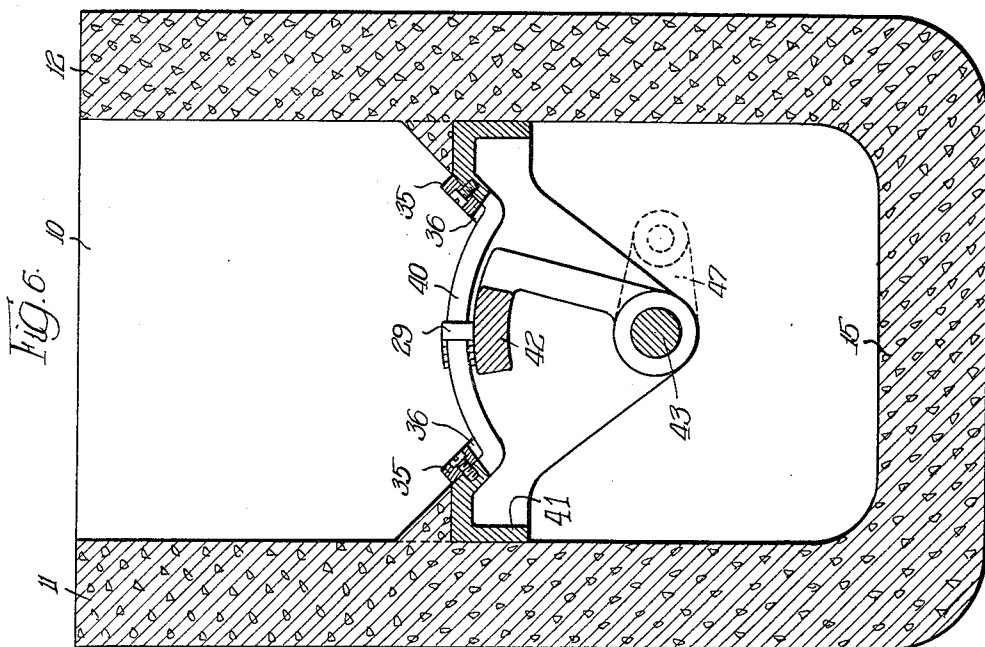
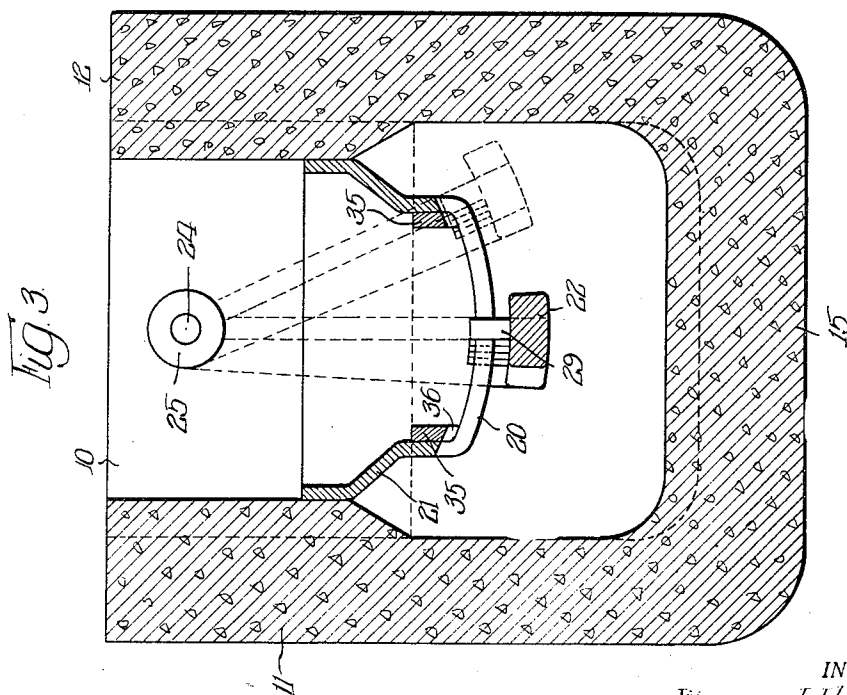
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SEWAGE COMMINUTING APPARATUS

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3 Sheets-Sheet 2



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SEWAGE COMMINUTING APPARATUS

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3 Sheets-Sheet 3

Fig. 4

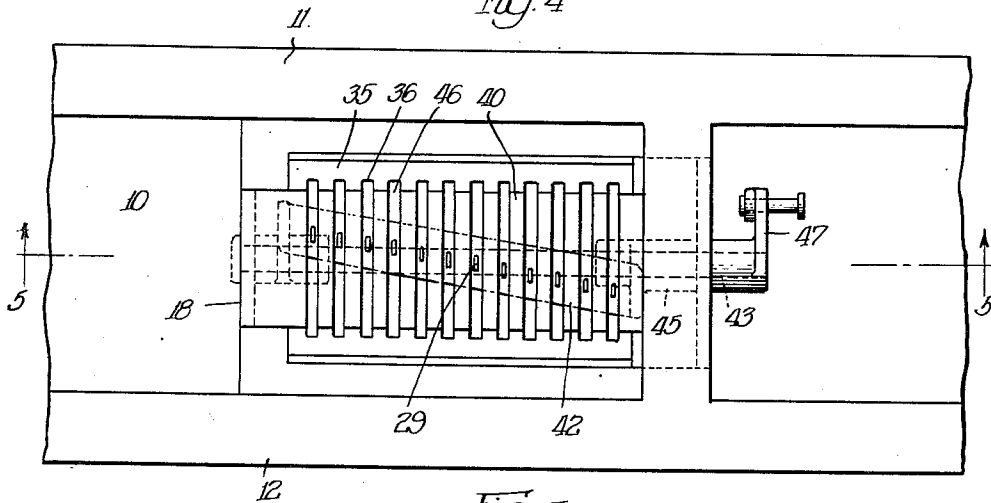
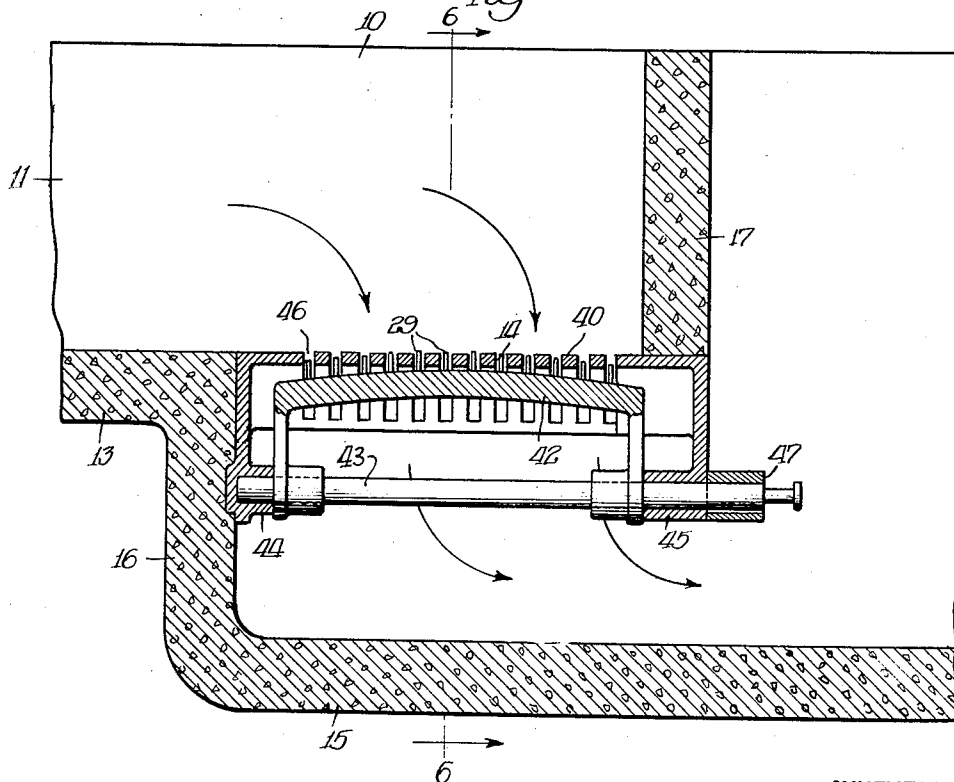


Fig. 5



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UNITED STATES PATENT OFFICE

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SEWAGE COMMINUTING APPARATUS

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11 Claims. (Cl. 210—152)

This invention relates to cutting devices of the type designed to screen and comminute solids contained in a liquid such as sewage.

One of the objects of this invention is to provide an improved comminuting device in which the cutting load is substantially uniform.

One of the principal objects of this invention is to provide a solids comminuting or chopping device cutting in two directions, which is automatically self-cleaning, and in which the uncut particles are swept from side to side to prevent clogging of the device or the "channel cuts" through material held against the cutter bar inherent in devices cutting in one direction.

Another object of this invention is to provide a comminutor in which the head of liquid passing therethrough is substantially the same in all parts thereof.

Another object of this invention is to provide a solids comminuting apparatus in which solids of different specific gravities may be cut at all portions of the screen.

Another object of this invention is to provide a solids screening and cutting device in which small particles cut from larger ones are forcibly delivered through the screen and discharged into the outgoing sewage below the screen.

Another object of this invention is to provide a comminutor wherein the loss of head due to passage of sewage therethrough is materially decreased.

These and other objects of the invention will be apparent from the description and claims which follow.

Heretofore comminutors have been ordinarily constructed in the form of cylindrical screens having vertical axes with horizontal slots extending across the flow of sewage. Thus the head on the bottom slot will be considerably greater than that at the top, where it is zero. For example, in a ten inch flow of sewage the head of the liquid passing through the screen will vary from zero at the upper surface to a head of ten inches adjacent the floor. This variation in pressure is undesirable as it will obviously vary the conditions under which various parts of the apparatus are working. One of the objects of my invention is to equalize the pressure over the various portions of the comminutor screen.

Another defect of prior cutting devices was that lighter solids floated on the surface of the liquid and were cut by the teeth and cutting bar at that level while heavier solids, usually containing harder material, were adjacent the bottom of the flowing stream, thereby providing an unequal load

on various parts of the apparatus with the result that the lower portion tended to wear out prior to the upper one. Another of the objects is to provide a comminuting apparatus in which the load will be more evenly distributed over the surface thereof.

Another object of my invention is to provide a screening and cutting apparatus provided with not less than two cutter bars so that the cutting of large solids into small pieces can be done at more than one location in the comminutor.

Sewage, for example, contains many solids which must be removed or reduced for efficient operation of the sewage treating plant. In the early art, fixed bar screens were inserted across the stream of sewage to catch the larger of such solids such as boards, leaves, branches, rags 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 in which they were contained, this was a very obnoxious 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 apparatus has been designed in which the solid materials are chopped in the stream of sewage into small particles which can be handled by the sewage treatment plant and separated in the subsequent clarification steps. This avoids the necessity of disposing of a very obnoxious material. My present invention deals with an improved screening and cutting device of this type.

Heretofore such apparatus has usually been of one of two types: (a) a rotating screen provided with cutting teeth and an associated cutting bar or comb, or (b) a fixed semi-cylindrical slotted screen extending across the path of flow of sewage, a plurality of rotating toothed cutter plates extending into the slots, and a cutting bar extending vertically alongside of the fixed screen. In the former type the comminuted particles and sewage are withdrawn downwardly on the inside of the screen, and in the latter the flow of sewage is horizontally through the comminutor and solids punched out by the teeth are pushed through the cutting bar and into the flow of sewage on the downstream side thereof.

In the apparatus of my invention, I place in the bottom of the flow channel a screen or grid in the form of a segment of a cylinder with its axis extending horizontally. I use two notched cutter bars one placed on each side of the chan-

nel. A tooth carrying member, preferably in the form of a segment of a spiral, reciprocates along the under side of the grid and has teeth extending through the slots thereof and cooperating with the cutter bars to cut small pieces from solids contained in the flowing stream. By providing the screen in the bottom of the flow channel and passing the liquid downwardly there-through the liquid is distributed throughout the entire area of the screen, or grid, so that the head or pressure on all parts of it are substantially the same. Also, lighter and heavier solids are distributed throughout the area of the apparatus so that all portions are subjected to equal wear. By warping the tooth carrying member, that is, forming it in the shape of a segment of a spiral, it is possible to provide for longitudinal misalignment of the cutting teeth with a consequent uniformity of force required for cutting solids.

It will be understood that these units, while generally used in the treatment of sewage, can be used in the screening and comminuting of any solids in any liquid and that the reference to the cutting of solids in sewage is to be taken as an example and not as a limitation.

My invention will be more readily understood by reference to the drawings which form a part hereof and in which like reference characters designate similar elements in the different figures.

Figure 1 is a plan view of one embodiment of my invention.

Figure 2 is a vertical cross-sectional view taken along the axis of the conduit, as designated by the line 2—2 of Figure 1.

Figure 3 is a transverse vertical cross-sectional view taken along the plane designated by the line 3—3 of Figure 1.

Figure 4 is a plan view of another embodiment of my invention.

Figure 5 is a vertical cross-sectional view taken along the axis of the conduit, as designated by the line 5—5 of Figure 4.

Figure 6 is a transverse vertical cross-sectional view of the embodiment shown in Figure 4, taken along the plane designated by the line 6—6 of Figure 5.

Figure 7 is an enlarged detail view of a cutting tooth and holder and its associated cutting bar.

The apparatus of my invention is designed to be placed in a flow channel, 10, enclosed within side walls, 11 and 12. As shown in Figures 2 and 5, the floor, 13, of the conduit above the comminutor, 14, is at a higher elevation than the floor, 15, on the downstream side thereof. The two floors are connected by a short vertical wall, 16. The portions of the flow channel, 10, upstream and downstream from the comminutor, 14, are further separated by a transverse wall, 17, extending across the upper part of the flow channel from above the liquid level therein down to a level adjacent the comminutor, 14, thus leaving a horizontal opening, 18, between the upper and lower levels of the flow channel, 10.

The comminutor, 14, of my invention is designed to fit in the horizontal opening, 18, and comprises a series of curved bars forming a curved grid or screen covering the horizontal opening, 18. A tooth carrying member reciprocates along the under surface of these bars and carries a plurality of cutter teeth, at least one extending into each space between adjacent bars. In the form of apparatus shown in Figures 1, 2 and 3, the screen or grid is formed by curved

bars, 20, placed laterally across the opening, 18, with their convex curvature pointing downwardly. Obviously all bars should have the same curvature so as to form a grid or screen of uniformly curved shape, preferably parallel to the axis of the conduit, 10. The bars are affixed to a support, 21, at each end, which in turn is supported by the walls, 11 and 12, of the channel, and as shown are so shaped as to permit the cutter teeth hereafter described to pass beyond the ends of the curved portion, as shown in Figure 3. A tooth carrier bar, 22, is mounted to pass with a swinging or reciprocating motion closely adjacent to the underside of the screen formed by the fixed bars, 20. Preferably this tooth carrier bar will be warped in the shape of a segment of a spiral, or helix, in order that its upper surface may be closely adjacent the lower edge of the bars, 20, and its longitudinal axis will be at an angle with the axis of the channel, as is shown in Figure 1. One end of the bar is mounted on a bracket, 23, which in turn is mounted on a horizontal shaft, 24, coaxially aligned with the axis of the curved screen or bars, 20, on the downstream side of vertical separating wall, 17. Preferably the shaft will be supported by a bearing, 25, in the vertical separating wall, 17, and a second bearing, 26, mounted on any suitable means such as transverse bar, 27. A partial reciprocating rotary motion is imparted to the shaft, 24, by any suitable means such as crank, 28, connected to any suitable prime mover, not shown.

The tooth carrier bar, 22, is provided with a plurality of cutting teeth, 29, preferably adjustably mounted in said carrier bar, 22, and extending upwardly therefrom through the spaces, 30, between adjacent bars, 20. As shown in Figure 7, the teeth may comprise bars inserted through holes, 31, in the carrier bar and rigidly held by a set screw, 32. Obviously the upper edge of the teeth, 29, will extend a short distance, such as about $\frac{1}{4}$ ", above the upper edge of the screen formed by the bars, 20.

A cutter bar, 35, is rigidly mounted on the bar support, 21, preferably one on each side of the flow channel, 10, and immediately adjacent the upper surface of the screening bars, 20. The cutter bars, 35, are provided with notches, 36, in the path of travel of each tooth, so that as the teeth reciprocate they pass through the notches, 36, thereby cutting small pieces out of solids which are held against the cutter bars, 35.

In the operation of the comminutor of my invention, the sewage liquid passes through the screen formed by the screening bars, 20, and carries with it the small solids of a size suitable to pass through the spaces, 30, between the bars. Larger solids are screened from the sewage by the bars and are chopped, or comminuted, into small pieces by the reciprocating teeth and the cutter bars. In operation the shaft, 24, is given a slight reciprocal turning motion thereby oscillating the tooth carrier bar, 22, backwards and forwards along the lower surface of the screening bars, 20. The teeth, 29, which extend above the upper surface of the screening bars, 20, catch solids and sweep them to the cutter bar, 35. Such solids are caught between the cutter bar, 35, and the teeth, 29, and as the teeth are carried beyond the cutter bar, as shown in the dotted lines of Figure 3, small particles are punched or chopped out of the larger solids and carried through to the underside of the screen. On the return stroke, the larger mass of uncut matter is dis-

lodged from the cutter bar and swept to the opposite one, the back and forth sweeping tending to prevent the "channel cuts" and clogging inherent in comminutors cutting only in one direction. Obviously it is desirable to longitudinally misalign the cutter teeth on the carrier bar so as to provide a more uniform cutting action and the avoidance of shock loads. This is accomplished by warping the tooth carrier bar, 22, into a segment of a helix, as shown, and by staggering the teeth therealong.

It will be understood that while generally it is better to have the tooth carrier bar below the grid and the teeth extending upwardly through the grid, it is also possible to mount the carrier bar above the grid and have the teeth projecting downwardly through the grid. Also, the axis of the grid, while always horizontal, can be either crosswise or lengthwise of the axis of the conduit in which it is placed.

Figures 4, 5 and 6 disclose another embodiment of my invention. In this embodiment the curved screening bars are arched across the horizontal opening, 18, to present their concave surface downwardly as shown in Figure 6. In this embodiment a plurality of curved screening bars, 40, are arched across the horizontal opening, 18, and supported by brackets, 41, affixed to the side walls, 11 and 12. The bars, 40, are spaced apart to provide transverse slots, 46. A helically shaped cutter bar, 42, is mounted for reciprocating or oscillating movement underneath the screen, 40, such as upon shaft, 43, which is journaled in bearing, 44, on the connecting wall, 16, and bearing, 45, supported by the separating wall, 17. A crank, 47, is rigidly secured to the shaft, 43, and is operated by any suitable means, not shown. A plurality of cutting teeth, 29, are mounted in the tooth carrying bar, 42, each tooth extending upwardly through the space between adjacent cutter bars as shown in Figures 5 and 6.

A pair of cutter bars, 35, one on each side, are rigidly secured to the brackets, 41, and are provided with notches, 36, through which the teeth, 29, may pass.

The operation of this embodiment of my invention is similar to that shown in Figures 1, 2 and 3.

The embodiments shown and described are practical adaptations of my invention, but other modifications will 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 the invention defined in the appended claims.

I claim:

1. A sewage solids cutting and straining device comprising a semi-cylindrical grid adapted to be placed horizontally and longitudinally across an opening in the bottom of a sewage flow channel, a plurality of transverse slots extending circumferentially of said grid, a tooth carrying bar reciprocable along the underside of said grid, means for reciprocating said carrying bar, cutting teeth on the upper side of said carrying bar and extending through said slots, a cutter bar adjacent the end of said slots, and notches in said cutter bar interposed in the path of travel of said cutting teeth.

2. A solids comminuting device comprising a horizontal shaft, means to reciprocally turn said shaft, a tooth carrier bar mounted on said shaft, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar, a curved stationary

screen comprising bars having a curvature concentric to said shaft, said bars being so located as to lie between adjacent teeth and intermediate the free ends of said teeth and the tooth carrier bar, and a stationary notched cutting bar disposed adjacent a side of said screen, the notches on said cutting bar being disposed in the path of travel of said cutting teeth.

3. A device of the character described comprising a channel for the flow of liquid containing suspended solids, a second channel for the flow of liquid containing suspended solids at a lower elevation than said first channel, said channels communicating through an opening in the floor of said first channel, a longitudinal stationary semi-cylindrical grid interposed across said opening, a plurality of slots extending transversely across said grid, a rotatable horizontal shaft coaxially mounted with respect to said grid, a tooth carrier bar mounted on said shaft for reciprocation underneath said grid, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar and extending through said transverse slots, a cutter bar extending parallel to said shaft immediately adjacent the sides of said grid and notches in said cutter bar disposed in the path of travel of said teeth.

4. A device of the character described comprising a channel for the flow of a liquid containing suspended solids, a second channel for the flow of liquid containing suspended solids at a lower elevation than said first channel, said channels communicating through an opening in the floor of said first channel, a longitudinal stationary curved grid interposed across said opening, said grid having its concave side downwardly, a plurality of slots extending transversely across said grid, a rotatable horizontal shaft coaxially mounted with respect to such grid, a tooth carrier bar mounted on said shaft for reciprocation underneath said grid, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar and extending through said transverse slots, a cutter bar extending parallel to said shaft immediately adjacent to the side of said grid, and notches in said cutter bar disposed in the path of travel of said teeth.

5. A device of the character described comprising a channel for the flow of a liquid containing suspended solids, a second channel for the flow of liquid containing suspended solids at a lower elevation than said first channel, said channels communicating through an opening in the floor of said first channel, a longitudinal stationary curved grid interposed across said opening, said grid having its convex side downwardly, a plurality of slots extending transversely across said grid, a rotatable horizontal shaft coaxially mounted with respect to such grid, a tooth carrier bar mounted on said shaft for reciprocation underneath said grid, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar and extending through said transverse slots, a cutter bar extending parallel to said shaft immediately adjacent to the side of said grid, and notches in said cutter bar disposed in the path of travel of said teeth.

6. A device of the character described comprising a channel for the flow of liquid containing suspended solids, a second channel for the flow of liquid containing suspended solids at a lower elevation than said first channel, said channels communicating through an opening in the floor of said first channel, a longitudinal stationary curved grid interposed across said opening, a

plurality of slots extending transversely across said grid, a rotatable horizontal shaft coaxially mounted with respect to said grid, a tooth carrier bar mounted on said shaft for reciprocation underneath said grid, said tooth carrier bar being formed in the shape of a segment of a helix and extending along the underside of said grid at an angle to the axis of said grid, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar and extending through said transverse slots, a cutter bar extending parallel to said shaft immediately adjacent the sides of said grid, and notches in said cutter bar disposed in the path of travel of said teeth.

7. A device of the character described comprising a channel for the flow of liquid containing suspended solids, a second channel for the flow of liquid containing suspended solids at a lower elevation than said first channel, said channels communicating through an opening in the floor of said first channel, a longitudinal stationary curved grid interposed across said opening, a plurality of slots extending transversely across said grid, a rotatable horizontal shaft coaxially mounted with respect to said grid, a tooth carrier bar mounted on said shaft for reciprocation underneath said grid, a plurality of cutting teeth mounted on the upper side of said tooth carrier bar and extending through said transverse slots, said teeth being longitudinally misaligned with respect to the axis of said tooth carrying bar, a cutter bar extending parallel to said shaft immediately adjacent the side of said grid, and notches in said cutter bar disposed in the path of travel of said teeth.

8. A solids cutting and straining device comprising a grid adapted to be placed horizontally across an opening in the bottom of a channel, a plurality of slots in said grid, a notched cutter bar adjacent the ends of said slots, cutting members reciprocable through said slots and the notches of said bar, and means to reciprocate said cutting members.

9. A comminutor comprising a horizontal grid adapted to bridge an opening in the bottom of a sewage flow channel, said grid having a plurality of curved spaced bars, a cutter bar adjacent the ends of said bars, a plurality of notches in said cutter bar aligned with the spaces between said grid bars, reciprocably mounted cutting members extending into said spaces, and means to reciprocate said cutting members through said spaces and notches.

10. In a sewage channel having a relatively shallow inflow portion and a relatively deep end portion and a wall leading downwardly from the bottom of said inflow portion and connecting it to the bottom of said end portion, a second wall mounted within the deep portion spaced from the bottom thereof and from said first wall and leading upwardly to above the liquid level, a grid horizontally mounted across the passage formed by said walls in said channel, said grid comprising a plurality of spaced transverse bars, a cutter bar mounted adjacent the ends of said grid bars, notches in said cutter bar aligned with the slots separating said transverse bars, cutting members reciprocable through said slots and notches, and means to reciprocate said cutting members.

11. A solids comminuting device comprising a stationary curved screen adapted to be placed horizontally across an opening in the bottom of a flow channel, a plurality of transverse slots extending circumferentially of the said screen, a horizontal shaft coaxially mounted with respect to the curvature of said screen, means to reciprocally turn said shaft, a tooth carrier bar mounted on said shaft and so placed as to reciprocate transversely along such screen, a plurality of cutting teeth mounted on said tooth carrier bar and so located as to extend into said transverse slots, and a stationary notched cutting bar disposed in the path of travel of said cutting teeth.

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