May 7, 1940. A. C. DURDIN, JR 2,199,788

COMMINUTOR

Filed Dec. 24, 1934

4 Sheets-Sheet 1

Fig. 1.

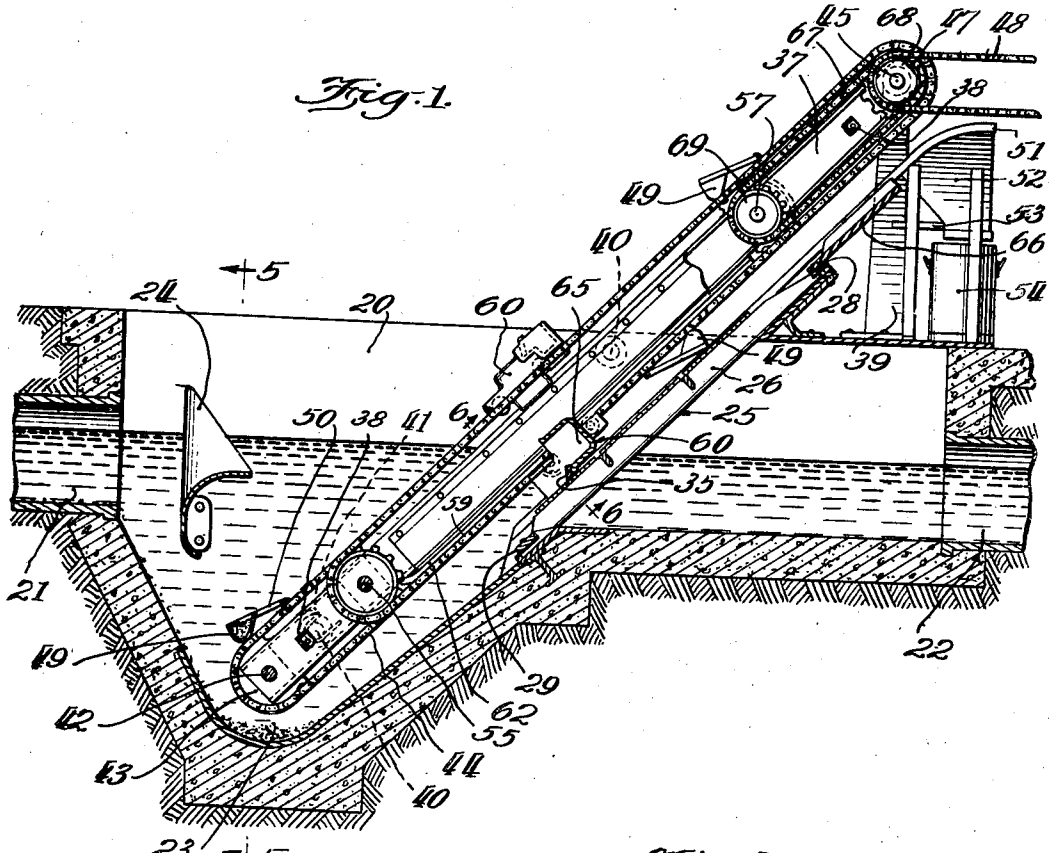
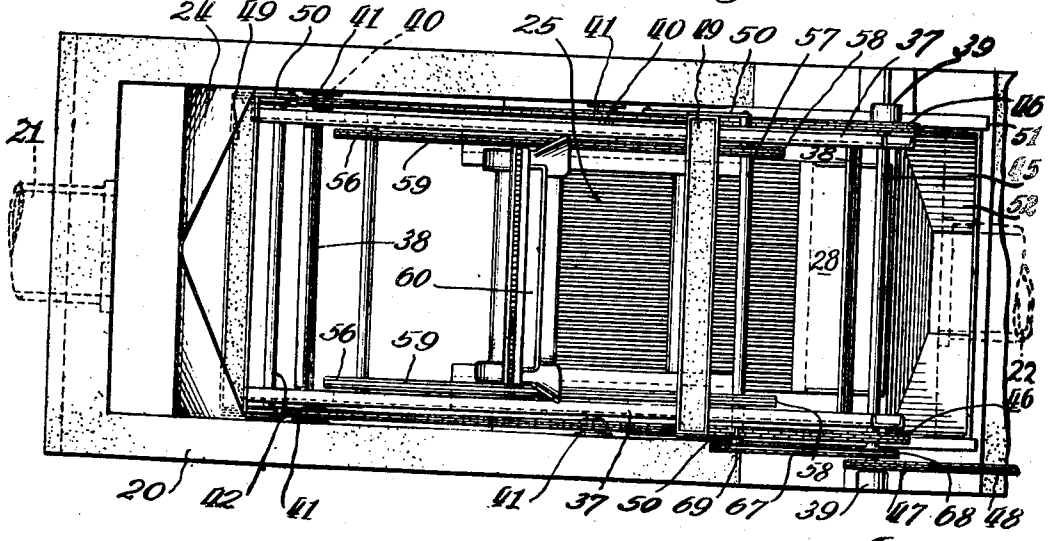


Fig. 2



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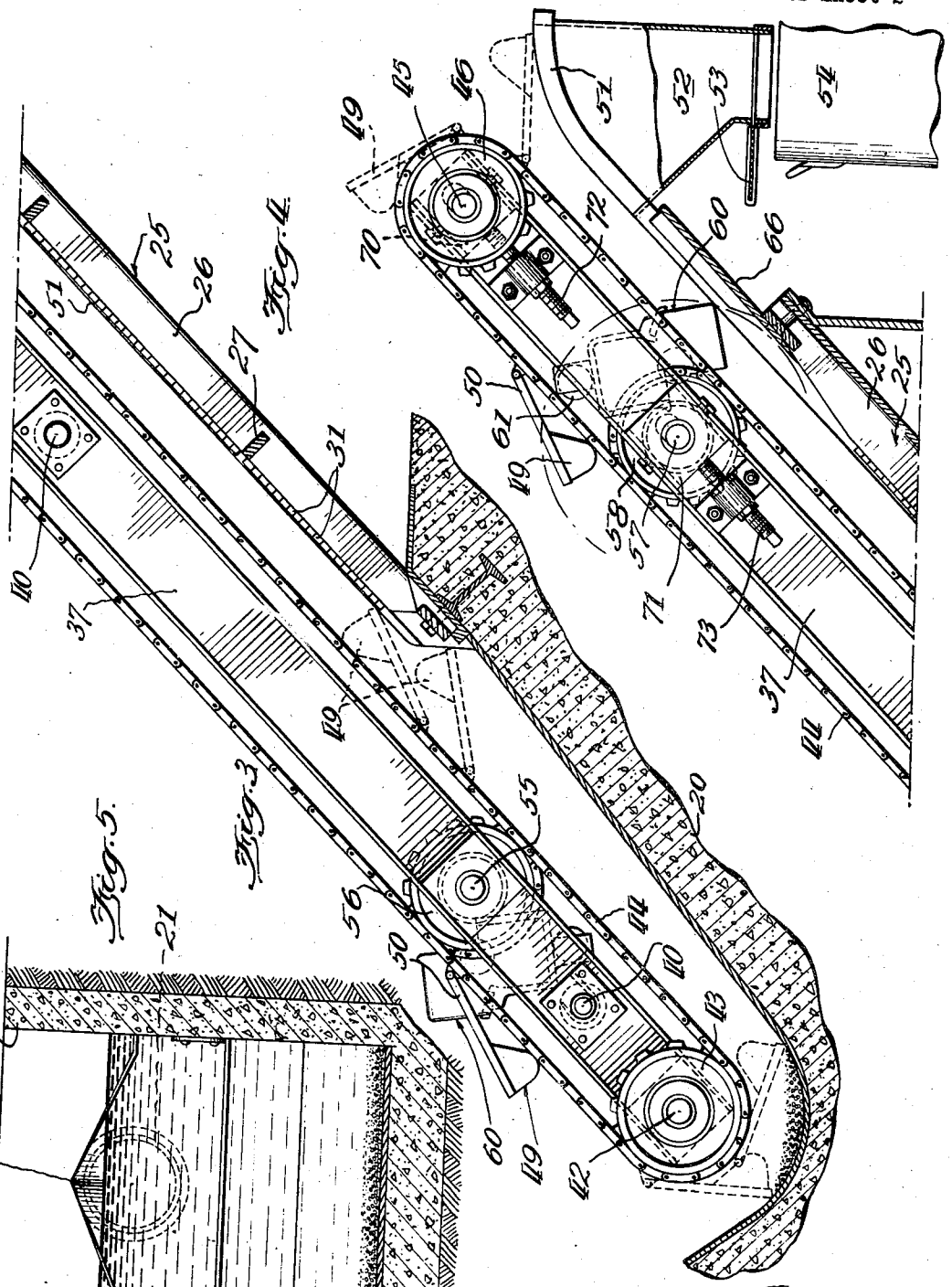
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Fig. 6.

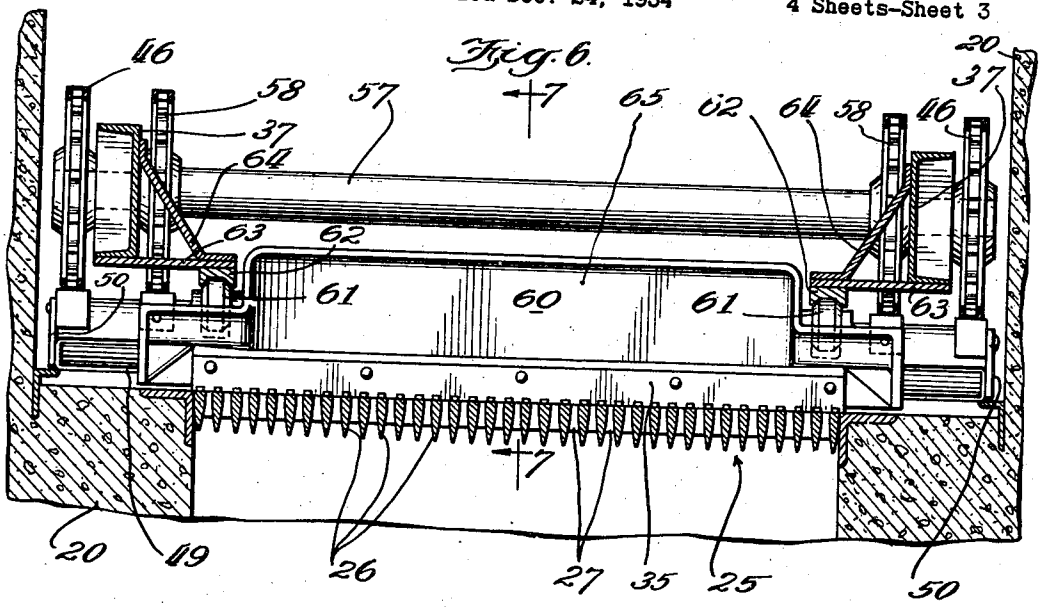


Fig. 7.

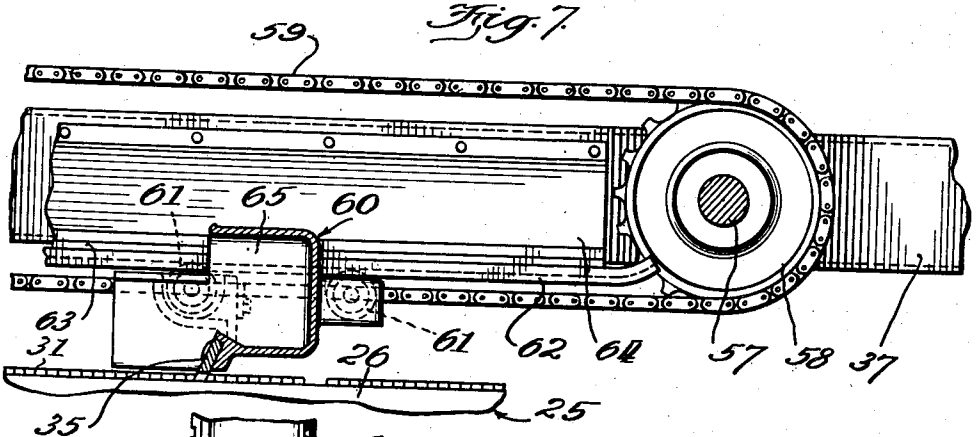
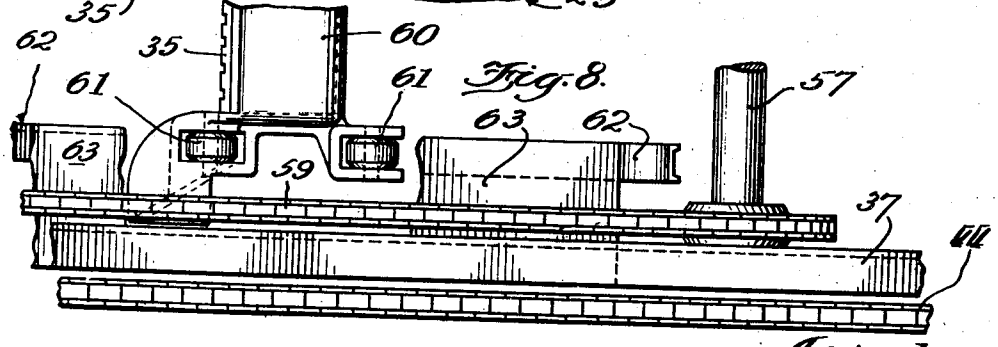


Fig. 8.



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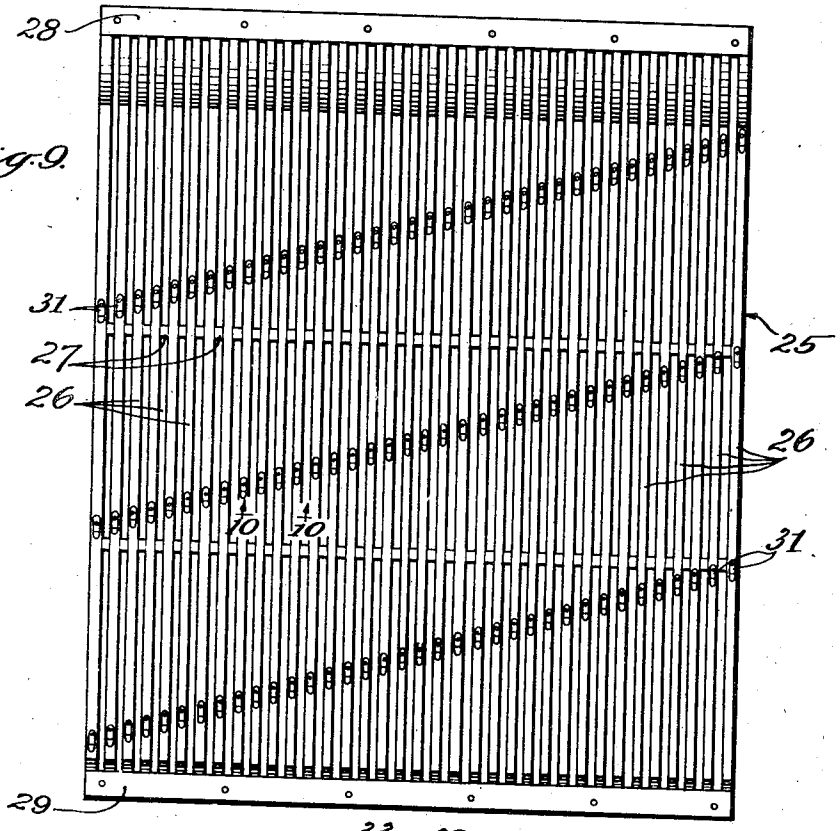


Fig. 9.

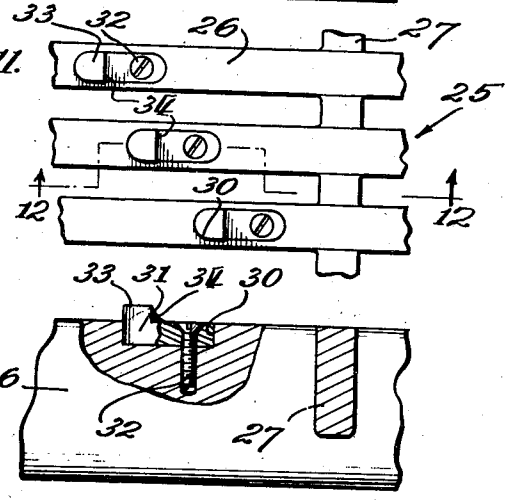


Fig. 11.

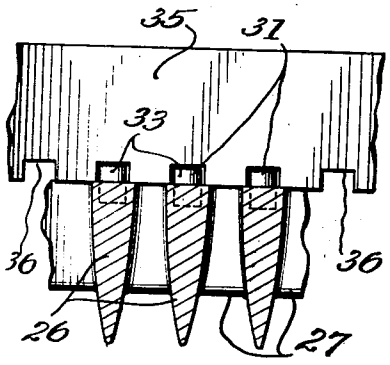


Fig. 10.

Fig. 12.

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UNITED STATES PATENT OFFICE

2,199,788

COMMINUTOR

Augustus C. Durdin, Jr., Chicago, Ill., assignor to Chicago Pump Company, Chicago, Ill., a corporation of Illinois

Application December 24, 1934, Serial No. 759,042

16 Claims. (Cl. 210—176)

This invention relates to comminutors and particularly to comminutors for comminuting debris, trash and other material carried in a floating or suspended condition in sewage. Before such material is admitted with sewage into treatment tanks, it is preferably comminuted or cut into small pieces so that it may be treated and rendered innocuous with the rest of the sewage.

In the preferred embodiment of my invention the comminutor is associated with the so-called "grit chamber" in which sand, gravel and heavy material generally is precipitated by gravity out of the sewage.

The invention will readily be understood from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which

Figure 1 is a longitudinal sectional view through a grit chamber equipped with my improved comminutor;

Fig. 2 is a plan view thereof;

Fig. 3 is a fragmentary sectional view on an enlarged scale, showing the lower end of the grit chamber and the mechanism associated therewith.

Fig. 4 is a similar view showing the upper end of said mechanism;

Fig. 5 is a transverse view of the grit chamber, taken on the line 5—5 of Fig. 1;

Fig. 6 is a sectional view on a larger scale, taken on the line 6—6 of Fig. 1, showing the comminuting screen and the cutter bar associated therewith;

Fig. 7 is a fragmentary sectional view taken on the line 7—7 of Fig. 6, showing the cutter bar in operation;

Fig. 8 is a fragmentary plan view corresponding to Fig. 7;

Fig. 9 is a front elevation of the comminuting screen;

Fig. 10 is a fragmentary sectional view taken on the line 10—10 of Fig. 9, showing the comminuting bar and teeth on a larger scale;

Fig. 11 is a fragmentary elevational view of the comminuting screen, on a similar scale, and

Fig. 12 is a fragmentary sectional detail view, taken on the broken line 12—12 of Fig. 11.

Referring to the drawings, and particularly to Fig. 1, the reference numeral 20 indicates the grit chamber. The sewage enters this chamber through a pipe 21 and discharges therefrom through a pipe 22. The grit chamber, as shown in Fig. 2, is relatively wide so that the velocity of the liquid passing therethrough is very much reduced. As a result, sand, gravel and other heavy material fall into a well 23 in the forward part of the grit chamber. The well 23 is of V-shape section so that the elevating apparatus, hereinafter described, may extend thereinto at an easy angle.

Immediately in front of the inlet pipe 21 I provide a baffle 24 for the purpose of spreading the flow and preventing any tendency for the stream to flow straight through the center of the grit chamber 20 or pipe 21 to pipe 22. As best seen in Fig. 5, the baffle 24 extends across the grit chamber 20 and completely occupies the natural path of the stream issuing from the pipe 21, with the result that this stream is diverted below and over the baffle 24. The baffle 24 is provided with a rearwardly curved horizontal bottom edge. The upper part of the plate 24 is bent rearwardly in the form of two rolls, one on each side of the vertical center line of the plate. These rolls are arranged so as to provide a central apex, as best seen in Fig. 5. This construction enables floating material to pass the baffle plate 24 in spite of variation in quantity of sewage entering by the pipe 21. For example, when the supply of sewage is relatively small, and the liquid level in the grit chamber 20 is low, a condition shown in Fig. 5, floating debris can pass the baffle plate 24 adjacent the side walls of the grit chamber 20.

The floating trash or debris are carried by the stream towards the comminuting screen 25. The small particles or pieces pass freely through the screen, but the larger pieces are detained by the screen and comminuted in the manner hereinafter described. The comminuting screen 25 comprises a series of longitudinal bars 26 which have right angle corners at their front face, and rearwardly extending sides which are gently curved to provide the bars with a rearward taper. The result is that any piece of material small enough to enter between the front faces of the bars 26 is able to move freely past the bars.

The bars 26 are interconnected at suitable positions along their length by means of transverse elements 27 which are welded in position between adjacent bars. The transverse elements are preferably located in horizontal alignment, as will best be seen in Fig. 9, and they have front faces which are flush with the front faces of the bars 26. As will best be seen in Fig. 1, the upper ends of the bars 26 are cut to a rather gradual taper and their extremities are held together by a cross bar 28 welded thereto. The lower ends of the bars 26 are also tapered and are connected

by a transverse bar 29 also welded to the bars 26. The screen 25 is mounted in a generally sloping direction, forming, in general, the continuation of the rear sloping wall of the well 23. The screen lies in the path of the stream flowing from pipe 21 to pipe 22, and as indicated above arrests all floating material which does not pass freely between adjacent bars 26.

The bars 26 are provided with cutting teeth which are illustrated in detail in Figs. 10, 11 and 12. On the front face of the bars 26 is formed a seat 30 of generally elongated form and relatively shallow. Each tooth element 31 conforms to the shape of the seat or recess 30 and is held therein by a flat-headed screw 32 which is flush with the major portion of the tooth member 31 and with the front face of the bar 26. The tooth member 31 comprises a portion 33 which projects above this surface and its upper face 34 is flat. The teeth 31 are staggered out of the horizontal direction upon the bars 26. As best seen in Fig. 9, it is preferred to arrange the teeth in a plurality of series, each series lying in a line which is oblique with respect to the horizontal. It is preferred that these series do not overlap. The result of this arrangement is that cutting is effected on the teeth 31 at different times and an excessive load at any time upon the driving mechanism is avoided.

A cutting bar 35 cooperates with the teeth 31. As best seen in Fig. 10, the cutting bar 35 has a forward edge which normally lies in the plane of the front faces of the bars 26. The forward edge of the cutting bar 35 is provided with recesses 36 which are adapted to pass over the projecting portions 33 of the teeth 31 with a free working fit. The cutting bar 35 and the means for actuating it will hereinafter be described.

A rigid frame comprising two long channel members 37 and suitable cross members 38 connecting them rigidly together, is mounted in a direction parallel to the screen 25, as best seen in Fig. 1. The frame extends from a point adjacent the bottom of the well 23 to a point substantially above the grit chamber 20. At its upper end this frame is supported by posts 39 and at points along its length it is provided with trunnions 40 which enter sockets 41 carried by the side walls of the grit chamber. Adjacent the lower ends of the channel members 37 is rotatably mounted a shaft 42, which is provided with bearings in the channel members. On the outer side of the channel members this shaft carries sprocket wheels 43 over which pass suitable chains 44. A shaft 45 is similarly mounted near the upper ends of the channel members 37 and is provided on the outer side of these channel members with sprocket wheels 46 in alignment with the sprocket wheels 43, and the sprocket chains 44 pass over the wheels 43 and 46. The shaft 45 also carries a sprocket wheel 47 which is driven by a chain 48 from any suitable source of power.

Suitable hoppers 49 are mounted at appropriate intervals upon the chains 44. The hoppers 49 extend substantially the whole way across the grit chamber and ride around the bottom of the well 23, abstracting therefrom any solid matter which has sunk to the bottom of the well. The hoppers 49 are made of perforated material so that water may drain from them as they move upwardly above the surface of the liquid in the grit chamber 20. The hoppers are pivotally mounted on the chains 44 by means of arms 50 at each side. As each hopper moves around the upper sprocket wheels 46 it falls over and its ends collide against rails 51. A hopper 52 is arranged between the rails 51 to receive the material discharged from the hoppers 49, which discharge is aided by the impact of these hoppers against the rails 51. The hopper 52 can be closed by a sliding door 53 and its contents may be discharged into a receptacle 54 by appropriate manipulation of the door 53. The rails 51 extend downwardly into the well 23 and terminate at a point below the screen 25. These rails are located slightly higher than the outer ends of the teeth 31 so that the hoppers 49 are held out of contact with these teeth while they are passing downwardly. Somewhat above the shaft 42, a shaft 55 is mounted in the channel members 37. The shaft 55 carries sprocket wheels 56 located on the inner sides of the channels. A similar shaft 57 is mounted in the channels at a position somewhat below the shaft 45. The shaft 57 is provided with sprocket wheels 58 located in alignment with the sprocket wheels 56. Chains 59 pass over the sprocket wheels 56 and 58.

On these chains are mounted carriages 60 which extend transversely between said chains. Each carriage is provided at each side with a pair of wheels 61 which bear against rails 62 as the carriage moves downwardly. The rails 62 are carried by plates 63 and channels 64 from the channels 37, as best shown in Fig. 6, and the rails 62 are so located that the cutter bar 35, which is mounted on the carriage 60, is held in proper relation with respect to the comminuting screen 25. As best seen in Fig. 6, the rails 62 are preferably grooved and the wheels 61 are of corresponding shape so that the carriage is effectively guided while it passes downwardly. The carriage 60 also comprises a scoop or hopper 65 which is adapted to collect debris from the surface of the liquid while the hopper is moving upwardly. When the carriage 60 passes around the upper sprockets 58, the contents of the hopper 65 are discharged upon an apron 66 from which they fall downwardly until they are caught by certain of the teeth 31 of the bars 26. In this position they are engaged by the cutting bar 35 and are comminuted by being cut to pieces as the bar passes the teeth in series. The small pieces are carried into the water and those of sufficiently small size pass between the bars 26. The larger pieces float and are drawn up against the bars 26 by the outward flow of liquid and they are again engaged by the cutting bar 35 and drawn downwardly below the water and are cut successively against the submerged teeth 31. A certain amount of cutting is also effected between the cutting bar 35 and the transverse elements 27, the cutting bar shearing off any portions of debris which extend partly into the openings between adjacent bars 26. This cutting action is continued until the pieces of floating material are comminuted or cut into pieces sufficiently small to pass between the bars 26.

By the provision of the hoppers 65 I am enabled to employ substantially all of the cutting teeth on the screen 25, irrespective of the level of the liquid in the grit chamber 20. This has the valuable result of equalizing the load and avoiding overloads at any part of the cycle. The chains 59 are driven in unison with the chains 44, for example, by means of a chain 67 and sprocket wheels 68 and 69 on the shafts 45 and 57 respectively. By interconnecting the drive

in this manner, the carriages 60 and hoppers 49 may be maintained in spaced relation.

Means are preferably provided for adjusting the tension of the chains 44 and 59. For this purpose the shafts 45 and 57 may be mounted in blocks 70 and 71 respectively, which blocks are slidably mounted on the channels 37, being adjusted thereon by means of screws 72 and 73 respectively.

Although the invention has been disclosed in connection with the specific details of a preferred embodiment thereof, it must be understood that such details are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a grit chamber, a screen therein, a frame extending into said chamber, an elevator mounted on said frame having hoppers for lifting materials beyond the screen, a cutter bar mounted on said frame for movement in cutting relation over said screen, elevating means associated with the cutter bar for elevating material on to said screen, said hoppers, cutter bar and associated elevating means passing through a common path, and drive means for driving said elevator, cutter bar and associated elevating means simultaneously, said drive means including a drive connection between said elevator and cutter bar and the associated elevating means, said elevator, said cutter bar and associated elevating means, and said drive connection being correlated to maintain the cutter bar and associated elevating means in spaced relation to said hoppers.

2. In combination, a grit chamber, an inlet and outlet, a screen in the grit chamber, and a deflector between said inlet and outlet, said deflector having a lower edge substantially spaced from the bottom of the chamber and an oblique upper edge part of which is submerged at normal operating liquid levels whereby free passage is provided for floating material while a substantial part of the flow is directed downwardly.

3. A comminutor comprising a chamber through which a stream passes, a screen partly submerged in said stream for retaining floating debris, cutting teeth on said screen, a cutter bar cooperating with the cutting teeth on said screen to comminute said debris, and means for elevating debris from the stream on to an unsubmerged part of the screen.

4. A comminutor comprising a chamber through which a stream passes, a stationary screen in said stream and extending thereabove for retaining floating debris, cutting teeth on said screen, a cutter bar movable upwardly and downwardly and cooperating with the cutting teeth on said screen to comminute said debris, and a hopper movable with said bar for elevating debris from the stream to the upper part of said screen.

5. A comminutor comprising a chamber through which a stream passes, a stationary screen across said stream located obliquely and extending to a substantial distance above said stream, cutting teeth on said screen, above and below the liquid level, a cutter bar movable upwardly and downwardly and cooperating with the screen to comminute said debris, and a hopper movable out of the liquid and adapted to elevate debris therefrom onto a portion of the screen above the liquid level.

6. In a comminutor, a cutting screen having bars with flat faces, said bars having elongated recessed seats, and tooth elements having base portions having a snug peripheral fit in said seats and movable thereinto, and a single screw in each toothed element securing said tooth elements to said bars, the seats preventing rotation of the base portion, said tooth elements comprising cutting portions projecting beyond the surfaces of the bars provided with cutting faces intermediate the lengths of the recesses and the base portions received therein.

7. In a comminutor, a screen comprising longitudinal bars having flat front faces, transverse elements connecting adjacent bars and having front faces flush with the front faces of the bars, teeth projecting from said longitudinal bars, and a cutter bar contacting front surfaces of said bars and provided with recesses to enable the cutter bar to pass said teeth.

8. A comminutor screen comprising longitudinal bars having flat front faces and rearwardly tapering in cross-section, transverse elements connecting adjacent bars and having front faces flush with the front faces of the bars, and cutting teeth on said bars staggered out of transverse alignment.

9. In combination, a comminutor screen comprising longitudinal bars having flat front faces, cutting teeth on said bars narrower than said bars, and a cutting bar adapted to bear against said flat faces and having openings for the passage of the bar past the teeth.

10. A comminutor comprising a screen formed by parallel bars, teeth on said bars, a cutting bar adapted to move over the screen and cooperate with said teeth, said teeth being smaller than the spaces between the bars whereby comminuted material may pass between said bars.

11. A comminutor comprising a chamber through which passes a stream, a screen in said stream extending thereabove, teeth on said screen, a frame mounted parallel to the screen, a conveyor system mounted on the frame, and a cutter-bar mounted on said system adapted to cooperate with said teeth to comminute material floating in said chamber.

12. A comminutor comprising a chamber through which passes a stream, a screen in said stream extending thereabove, teeth on said screen, a frame mounted parallel to the screen, a conveyor system mounted on the frame, a carriage comprising a hopper and a cutter-bar on said carriage, wheels on said carriage, and rails on said frame on which said wheels run, said cutter-bar being adapted to cooperate with said teeth to comminute material floating in said chamber.

13. A comminutor comprising a relatively wide chamber, a deflector therein, a grit well therein, a screen extending across said chamber rearwardly of the grit well and projecting upwardly above the liquid level in the chamber, teeth on said screen, a frame mounted in said chamber with its lower end near the bottom of said well and its upper end substantially above the upper end of the screen, a conveyor system mounted on the frame and adapted to elevate and remove grit from said well, a second conveyor system within the first conveyor system, a carriage comprising a hopper and a cutter-bar on last said conveyor system, wheels on said carriage, and rails on said frame on which said wheels run, said cutter-bar being adapted to cooperate with said teeth to comminute material floating in said chamber, said hopper being adapted to discharge

floating debris upon the screen and the first said conveying system being adapted to discharge grit at a higher position.

14. The method of treating a stream which comprises passing the stream through a screen, elevating solid material from the stream onto the screen above the stream, cutting solid material on the screen above the liquid level, and returning the cut pieces to the stream.

15. The method of treating a stream which comprises passing the stream through a screen, elevating solid material from the stream onto the screen above the stream, cutting solid material on the screen above the liquid level, returning the cut pieces to the stream, and cutting solid material on the screen below the liquid level.

16. A device for cutting solid material in sewage comprising; a series of parallel screen bars; bar teeth projecting from the upstream edges of said bars; a rake member; teeth on said rake member positioned to project between said bar teeth; and means for moving said rake member so as to cause said rake teeth to coact with said bar teeth to cut material against said bar teeth.

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