Aug. 8, 1961 M. SPIEGEL 2,995,248

COMMINUTING DEVICE

Filed April 28, 1954 3 Sheets-Sheet 1

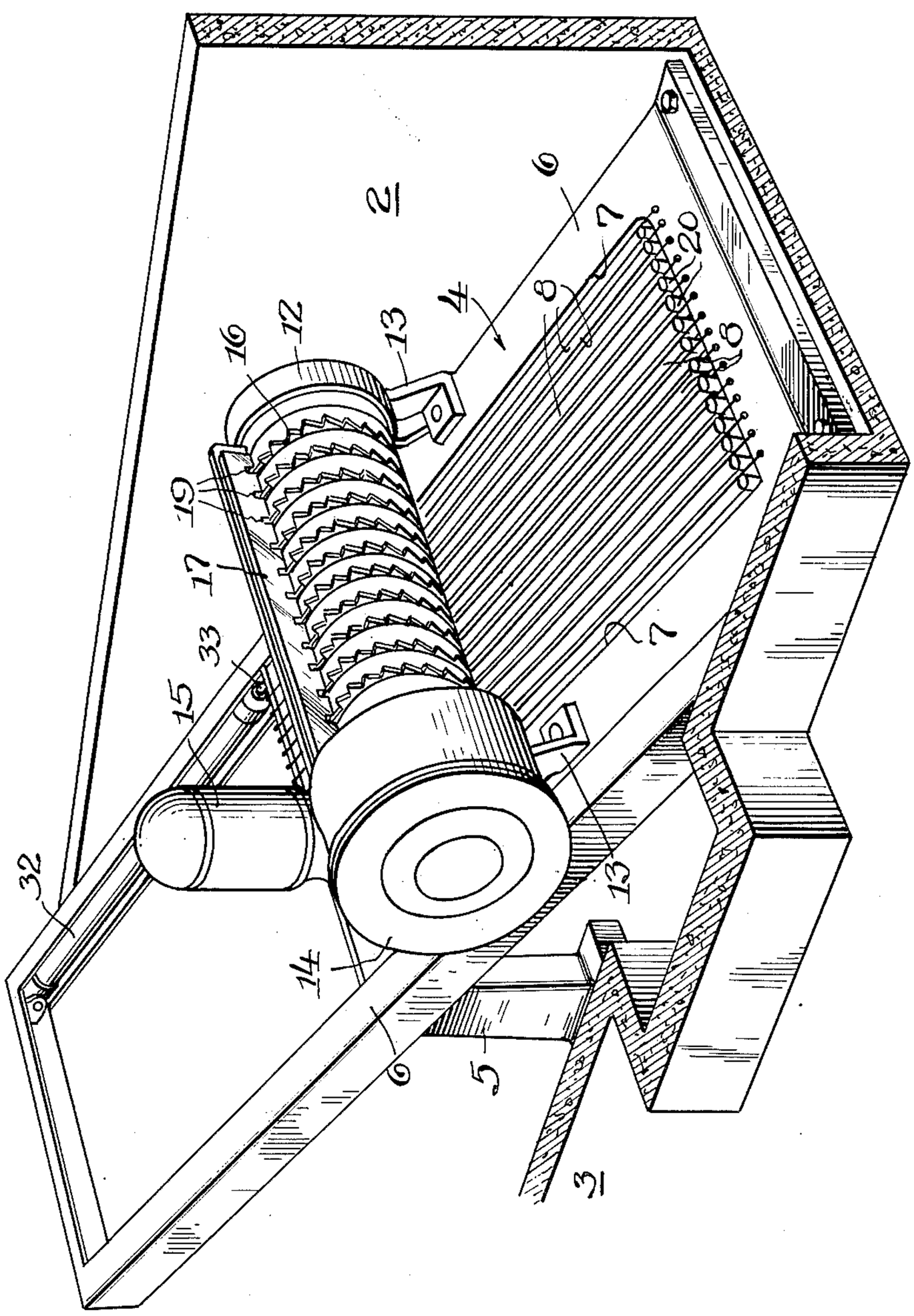

Fig. 1.

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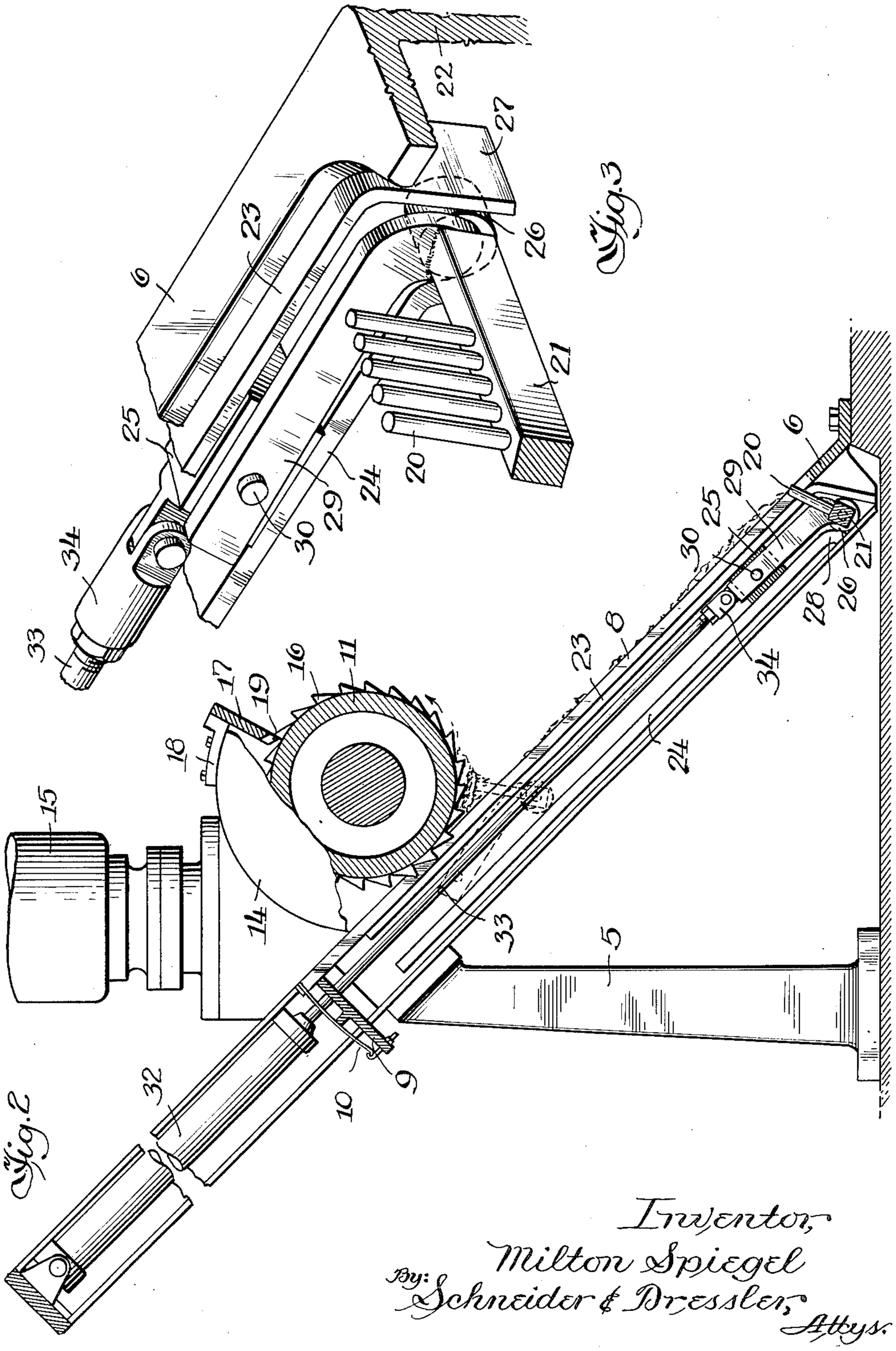

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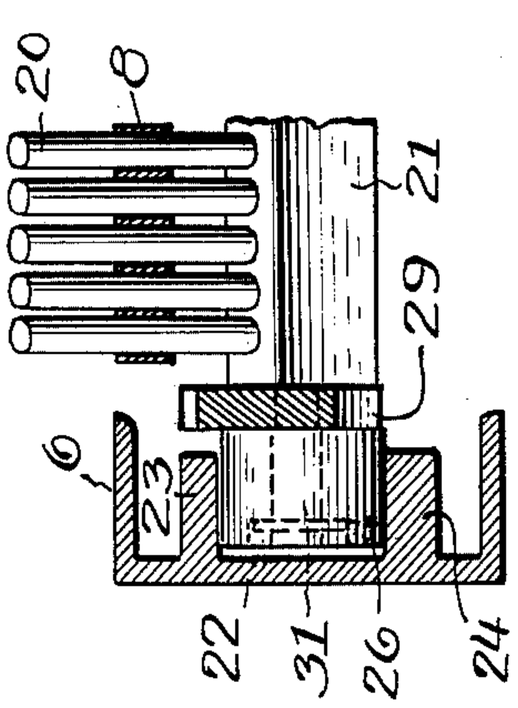

Fig. 5

Fig. 4

Fig. 6

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COMMINUTING DEVICE

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7 Claims. (Cl. 210—67)

This invention relates to a transfer and comminuting device, and more particularly to means for transferring solids intercepted by a screen in a flowing stream of sewage to a comminuting device for comminution.

In accordance with the present invention an inclined screen extending across the influent channel intercepts all solids too large to pass therethrough. A cutting cylinder is rotatably mounted above the screen and in proximity thereto and in the normal sewage flow, adjacent the upper end of the screen. The screen is provided with longitudinally aligned, spaced screen bars and the cylinder is provided with a plurality of series of laterally projecting teeth that are aligned transversely with the spaces between screen bars and are adapted to carry solids from the screen and transfer them to the vicinity of a comb. The teeth cooperate with the comb to comminute the solids that are interengaged by the teeth and comb. The position of the cylinder is fixed relative to the screen and therefore the teeth of the cylinder can reach only the solids that have been intercepted by the screen in immediate proximity to the cylinder. The present invention contemplates the provision of means in combination with the screen to periodically sweep or rake the screen and transfer the intercepted solids directly to the cutting cylinder and in close proximity thereto so that the teeth may reach the solids and carry them to the cutting comb for comminution.

The problem of bringing the cutting cylinder and the solids together has previously been approached from three different angles, insofar as I am aware. One solution is to have the cutting cylinder reciprocate in a longitudinal or horizontal direction adjacent the screen surface so that the entire surface area of the screen is periodically swept by the cutting cylinder. This type of structure has proved to be satisfactory in operation, but is relatively costly to make, operate and maintain and for small operations is generally not feasible.

A second solution is to provide the cutting cylinder with laterally projecting retractable tines which are rotated through the screen to engage solids positioned on the screen at some distance away from the cylinder and to cause the solids to move to the cutting cylinder by gravity as the tines approach vertical position. The mechanism required to retract the tines as they pass the comb is complicated and costly.

The third solution is to provide a hopper beyond and below the upper end of the screen, and to move fingers longitudinally of the screen to push the solids into the hopper. The cutting cylinder forms one wall of the hopper and is adapted to pick the solids from the hopper and transfer them to the comminuting zone.

The present invention contemplates the elimination of the hopper structure and the provision of a simple, inexpensive rake capable of moving solids upwardly along the upper surface of the screen into direct engagement with the cutting cylinder. The teeth of the cylinder are adapted to carry the solids to the area adjacent the comb directly from the screen as the solids are held against the screen by the pressure of the liquid sewage and the pressure exerted by the rake as it moves additional solids towards the cylinder. The device of the present invention is particularly suitable for use in operations such as in towns and small cities where the amounts of sewage to be treated are relatively small.

The structure by which the above mentioned and other advantages of the invention are attained will be described in the following specification, taken in conjunction with the accompanying drawings showing a preferred illustrative embodiment of the invention, in which:

FIG. 1 is a fragmentary perspective view of a channel through which sewage flows, an inclined screen extending across the channel with its screen bars spaced transversely, a rake having posts extending between the screen bars, and a comminuting device mounted adjacent the upper end of the screen, all in accordance with the present invention;

FIG. 2 is a side view, partly in elevation and partly in section, showing the rake and the means for moving it along the screen to bring the solids intercepted by the screen to the cutting cylinder;

FIG. 3 is a fragmentary perspective view of the rake;

FIG. 4 is a fragmentary side elevation of the rake, showing the lowermost position of the rake in dotted lines;

FIG. 5 is a cross sectional view, taken along the line 5—5 of FIG. 4; and

FIG. 6 is a cross sectional view, taken along the line 6—6 of FIG. 4.

In the drawings, reference numeral 2 indicates an influent channel through which flows unscreened sewage carrying solids, and 3 indicates the effluent channel through which the screened sewage flows along with the solids that are comminuted adjacent the upper end of the screen on which they accumulate. Channels 2 and 3 are parts of a single structure, preferably made of concrete.

A screen 4 is supported in inclined position in channel 2 by means of a pair of standards 5 extending upwardly from the bottom of the channel. Any form of screen may be used. The illustrative embodiment of the screen shown in the drawings comprises a plurality of flat metal ribbons disposed on the edges and held in transversely spaced relationship. Suitable supports extending laterally from the side walls of the channel can be used instead of standards 5, if desired. The lower end of the screen can be secured to the bottom of channel 2 in any suitable manner. The screen is illustrated as being inclined at approximately thirty degrees, but it will be understood that this angle may be varied, as desired.

Screen 4 comprises a frame 6 the outer edges of which are flush against the walls of influent channel 2. Frame 6 is provided with a centrally disposed opening 7 across which a plurality of individual screen elements 8 extend. These screen elements are disposed edgewise and longitudinally of the screen, and are transversely spaced across the space between the longitudinal edges of frame 6. A transverse bracket 9 (FIG. 2), secured to the underside of the upper transverse wall of frame 6 supports a plurality of leaf springs 10 which hold the upper ends of screen elements 8 under tension. The tensioning device is fully described and claimed in the copending application of Carl H. Nordell, filed March 26, 1954, under Serial No. 418,944, which issued as Patent No. 2,727,627 on December 20, 1955. The edgewise disposition of individual screen elements in a screen is claimed in the copending application of Carl H. Nordell filed March 27, 1952, under Serial No. 278,822, now abandoned, as a division of application Serial No. 261,973, filed December 17, 1951, which issued as Patent No. 2,750,044 on June 12, 1956.

A cutting cylinder 11, disposed horizontally relative to the screen, is rotatably mounted in bearings 12 supported on brackets 13 secured to the upper surface of frame 6. The cutting cylinder is provided at one end with a housing 14 which contains gears (not shown) operatively connected to a motor 15 for rotating the cylinder. Cylin-

der **11** is provided with a plurality of series of laterally extending teeth **16** which are spaced longitudinally of the cylinder to coincide with the spacing between individual screen elements so that teeth **16** enter the spaces between adjacent screen elements **8** as the cylinder rotates.

A stationary comb **17**, supported by a bracket **18** secured to housing **14**, extends parallel to the longitudinal axis of cutting cylinder **11**, and is positioned adjacent the peripheral surface of the cylinder along a line spaced radially from the line of contact between said cylinder and screen elements **8**. Comb **17** is provided with longitudinally spaced notches or recesses **19** aligned with teeth **16** which cooperate therewith to comminute solids carried by the teeth as they pass through the notches.

The solids that are intercepted by the screen and are engaged by teeth **16** are carried by said teeth along the portion of the periphery of cutting cylinder **11** from the surface of the screen to the comb. The solids remain against the comb until they are forced through notches **19**. In being so forced the solids are comminuted and pass through the screen and into effluent channel **3** along with the flowing sewage stream that has passed through the screen.

A transfer device, adapted to be reciprocated longitudinally of the screen, is provided for the purpose of moving solids that are intercepted by the portion of the screen out of the range of teeth **16**, upwardly along the screen into the range of the teeth. The transfer device comprises a plurality of short posts **20** rigidly secured to a bar **21**. Bar **21** is illustrated as being square in cross section, but it will be understood that it may have any shape. Each post is positioned between adjacent screen elements **8** and is of substantially the same thickness as the distance between adjacent screen elements so that they wipe the screen elements clean as the posts are moved longitudinally of the screen.

The opposite longitudinal edges of screen frame **6** are each provided with a downwardly extending flange **22** fitting against the walls of channel **2**. A pair of ribs **23** and **24** projecting laterally from each flange **22** are spaced vertically to form a guide for a block **25** and a roller **26**. Ribs **23** and **24** are parallel to the screen for most of their length, but turn downwardly sharply adjacent the bottom of the screen, as indicated at **27** and **28**, for a purpose hereinafter described. A link **29** pivotally secured adjacent one end to block **25**, as indicated at **30**, is rigidly secured at its other end to bar **21**. A roller **26** is rotatably secured to each end of bar **21** by a stud **31** which extends through link **29** and into the end of the bar.

A pair of hydraulic cylinders **32**, mounted in any suitable manner adjacent the opposite longitudinal edges of screen frame **6**, each has a piston rod **33** extending therefrom which is connected to block **25** by a clevis **34**. The piston rods are reciprocated in any conventional manner by any suitable hydraulic system or other means, and move both blocks **25** in synchronization so that both ends of bar **21** move uniformly between the lower, foremost position, indicated in FIG. 2, adjacent the lower, forward end of the screen, and the rearmost, upper position, adjacent cutting cylinder **11**, as shown in dotted lines in FIG. 2.

Throughout the major portion of the travel of bar **21**, ribs **23** and **24** maintain rollers **26** and block **25** aligned. In this position of rollers **26**, the posts **20** project above screen elements **8** and are inclined towards the cutting cylinder. Posts **20** engage solids intercepted by the screen and carry them upwardly to the cutting cylinder as the posts are moved upwardly along the screen by the piston rods. The angular disposition of posts **20**, aided by the sewage flow, also causes the solids to slide off the posts and be deposited on the screen as the posts are moved downwardly along the screen. Rollers **26** follow the track or guide formed by inclined portions **27** and **28** of ribs **23** and **24** at the forward end of their path of travel. This sharp angle moves posts **20** below the top surface of screen elements **8**, as shown in dotted lines in FIG. 4. Immediately after the start of the upward movement of the bar **21**, posts **20** are moved upwardly to project above screen elements **8** and start moving solids intercepted by the screen upwardly along the upper surface of the screen. This arrangement prevents any accumulation of solids at the bottom portion of the screen.

Although I have described the transfer device specifically in conjunction with a screen in which the screen elements comprise a plurality of flexible, longitudinally extending, flat metal strips disposed edgewise and held taut in transversely spaced parallel relationship, it will be understood that the invention is not so limited. The transfer device may be used with any planar screen in which the screen elements are disposed in the direction of travel of posts **20** and extend in transversely spaced parallel relation, regardless of the specific cross sectional configuration of the screen elements and whether they are flexible or rigid, provided only that the longitudinally extending spaces between adjacent screen elements are continuous throughout the length of the screen.

The method of operation of the transfer and comminutting device is very simple. The apparatus is disposed in a stream of flowing sewage with the screen inclined upwardly in the direction of the sewage flow. The liquid sewage flows through the screen and through the effluent channel for further treatment. The solids that are too large to pass through the screen are intercepted by it and are held against the front surface of the screen by the force of the liquid sewage flowing through the screen. The posts are inclined upwardly so that as they are moving downwardly towards the lower end of the screen the solids are washed from the posts onto the screen by the incoming sewage.

When the posts reach the bottom limit of their downward movement, as controlled by piston rods **33**, they are lowered below the top of the screen and are then raised so that they may engage the solids that may be at the lower end of the screen. The posts are then moved upwardly along the surface of the screen and in this upward movement the posts, which fit slidably between adjacent screen elements and project thereabove, wipe the screen substantially clean and push the solids intercepted by the screen upwardly along the upper surface of the screen until they reach the area adjacent the cutting cylinder. The dynamic force of the liquid flowing through the screen helps to carry the solids upwardly along the upper surface of the screen.

The teeth of the continuously rotating cutting cylinder pick up the solids and carry them to the comb of the comminuting device. The teeth pass through notches in the comb and operate therewith to comminute the solids. The comminuted solids, which are small enough to pass through the notches in the comb while the teeth are also passing through the same notches, then fall through the screen, and flow through the effluent channel with the screened sewage. The process is continuous as long as the sewage continues to flow through the screen, the cylinder rotates, and the post carrying bar reciprocates.

While I have described a preferred embodiment of my invention in considerable detail, it will be understood that the description thereof is intended to be illustrative, rather than restrictive, as many details may be modified or changed without departing from the spirit or scope of the invention. For example, the posts may be replaced by any suitable means for carrying the solids from the screen to the cutting cylinder. It is also possible to use different mechanism to reciprocate the posts. Accordingly, I do not desire to be restricted to the exact construction described.

I claim:

1. The method of comminuting sewage solids carried by a sewage stream which comprises intercepting solids

carried by the stream on a screen positioned in said stream and associated with a comminuting cylinder rotatably mounted in fixed position in said sewage stream directly above said screen in proximity thereto and adjacent one end thereof, moving the solids along the surface of the screen directly into engagement with the comminuting cylinder rotating said comminuting cylinder in engagement with said solids to lift said solids from the screen, and comminuting said solids in engagement with the comminuting cylinder in the sewage stream out of contact with said screen by moving said solids into engagement with a comb while they are in engagement with said comminuting cylinder, said comb being positioned in the sewage stream in proximity to said communicating cylinder and spaced from said screen.

2. The method of comminuting sewage solids carried by a sewage stream which comprises intercepting solids carried by the stream on a screen positioned in said stream and associated with a comminuting device comprising a rotatable cylinder having teeth projecting laterally from its peripheral surface and a comb mounted in proximity to the peripheral surface of said cylinder in spaced relationship to said screen, said cylinder being rotatably mounted in fixed position in said sewage stream directly above said screen in proximity thereto and adjacent one end thereof, moving the solids along the surface of the screen directly into engagement with the comminuting device, retaining said solids on said screen against said cylinder and rotating said cylinder to cause said teeth to lift said solids and carry them into engagement with said comb and thereby comminute them in the sewage stream for passage with the stream through the screen.

3. In combination, a screen comprising a plurality of longitudinally extending, spaced parallel screen elements adapted to be interposed in a flowing stream of sewage for intercepting solids in said sewage, a comminuting device positioned directly above said screen and adjacent one end of said screen, said comminuting device including a rotatable cylinder positioned in proximity to said screen and a comb above said cylinder and in proximity thereto, and a plurality of members movable longitudinally between said screen elements to transfer said solids from the surface of said screen directly to said rotatable cylinder, said cylinder having a plurality of teeth projecting laterally from its periphery, said teeth entering the spaces between said screen elements upon rotation of said cylinder to engage said solids and carry them to said comb, said teeth and said comb cooperating to comminute said solids.

4. In combination, a screen comprising a plurality of longitudinally extending, spaced parallel screen elements adapted to be interposed in a flowing stream of sewage for intercepting solids in said sewage, a comminuting device positioned directly above said screen and adjacent one end of said screen, said comminuting device including a rotatable cylinder positioned in proximity to said screen and a comb above said cylinder in proximity thereto, and a plurality of members movable longitudinally between said screen elements to transfer said solids from the surface of said screen directly to said rotatable cylinder, said cylinder having a plurality of teeth projecting laterally from its periphery, said teeth entering the spaces between said screen elements upon rotation of said cylinder to engage said solids and carry them to said comb, said teeth and said comb cooperating to comminute said solids, said cylinder being adapted to carry said comminuted solids past said comb and discharge them into said flowing stream of sewage.

5. In combination, a screen comprising a plurality of longitudinally extending, spaced parallel screen elements adapted to be interposed in a flowing stream of sewage for intercepting solids in said sewage, a comminuting device positioned directly above said screen and adjacent one end of said screen, said comminuting device including a rotatable cylinder positioned in proximity to said screen and a comb above said cylinder in proximity thereto, and means to transfer said solids from the surface of said screen directly to said rotatable cylinder, said means comprising a bar extending transversely of said screen, said bar being movable longitudinally of said screen, and a plurality of posts extending from said bar through the spaces between said screen elements.

6. In combination, a screen comprising a plurality of longitudinally extending, spaced parallel screen elements adapted to be interposed in a flowing stream of sewage for intercepting solids in said sewage, a comminuting device positioned directly above said screen and adjacent one end of said screen, said comminuting device including a rotatable cylinder positioned in proximity to said screen and a comb above said cylinder in proximity thereto, a bar positioned beneath said screen and extending transversely thereof, said bar being movable longitudinally of said screen, a plurality of posts extending upwardly from said bar through the spaces between said screen elements to move said solids along the upper surface of said screen directly into engagement with said cylinder upon longitudinal movement of said bar towards said comminuting device, said cylinder having a plurality of teeth projecting laterally from its periphery and adapted to enter the spaces between said screen elements upon rotation of said cylinder to engage said solids and carry them to said comb, said teeth and said comb cooperating to comminute said solids.

7. In combination, a screen comprising a plurality of longitudinally extending, spaced parallel screen elements adapted to be interposed in a flowing stream of sewage for intercepting solids in said sewage, a comminuting device positioned directly above said screen and adjacent one end of said screen, said comminuting device including a rotatable cylinder positioned in proximity to said screen and a comb above said cylinder in proximity thereto, a bar positioned beneath said screen and extending transversely thereof, means for moving said bar longitudinally of said screen, and a plurality of posts secured to said bar, said posts being spaced transversely in alignment with the spaces between adjacent screen elements, said posts extending upwardly above the upper surface of said screen and being inclined upwardly, whereby longitudinal movement of said bar towards said cylinder causes said posts to sweep solids intercepted by said screen along the surface of said screen directly into engagement with said cylinder, and longitudinal movement of said bar away from said cylinder permits said solids to be washed from said posts on to said screen by the oncoming sewage.

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