Aug. 19, 1930. F. A. DOWNES 1,773,576

BAR SCREEN

Filed March 16, 1926 3 Sheets-Sheet 1

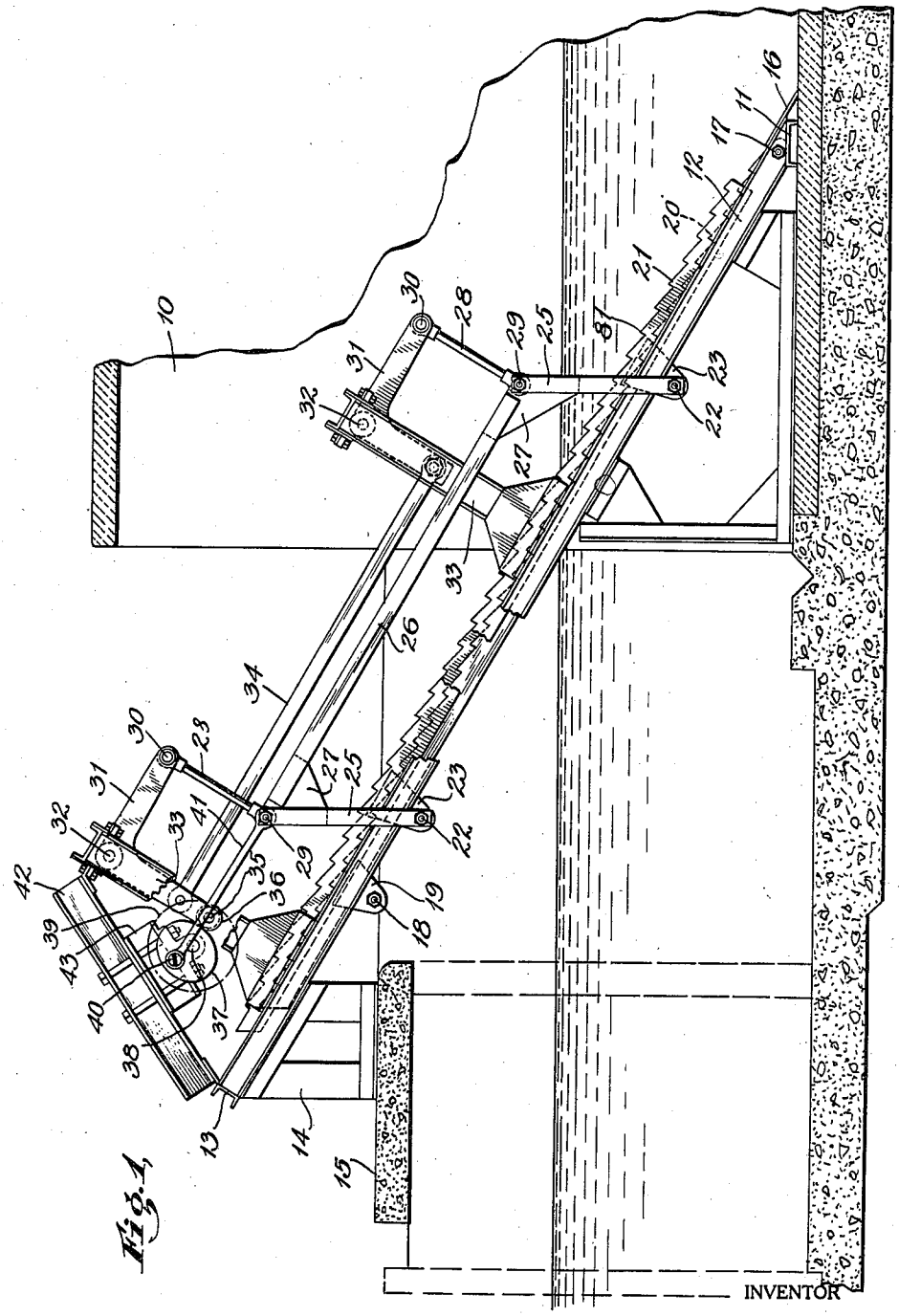


Fig. 1.

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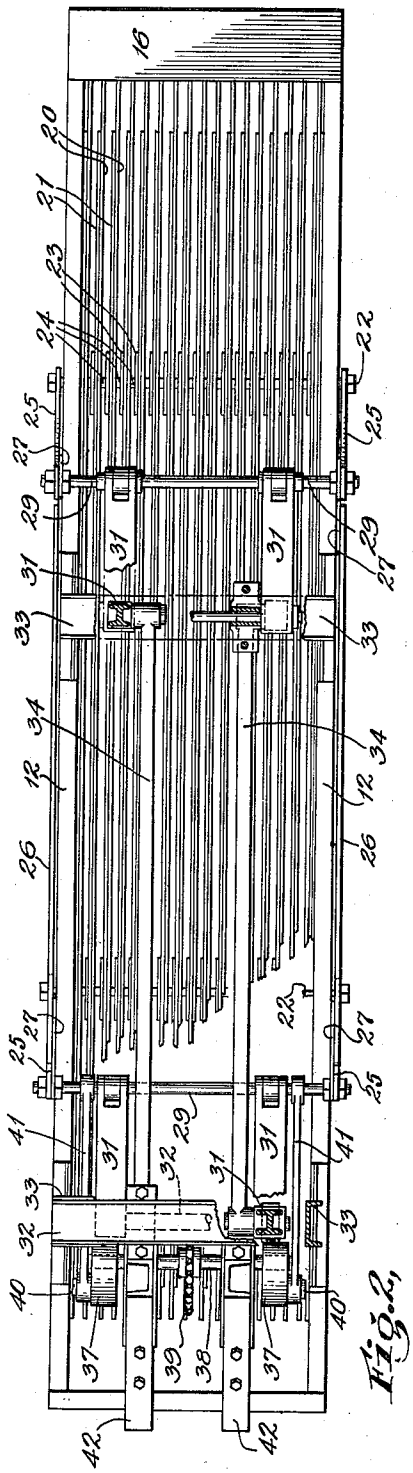


Fig. 2.

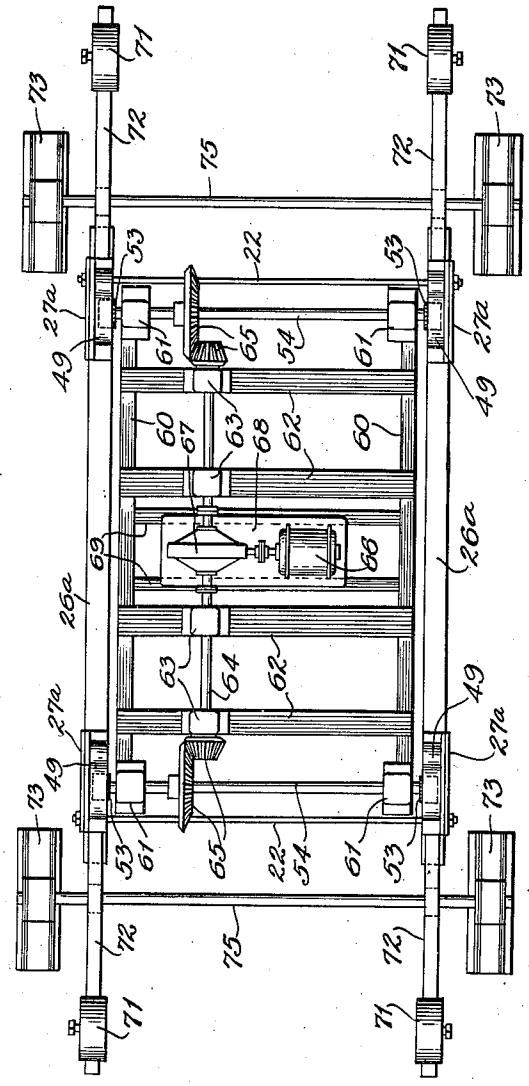


Fig. 4.

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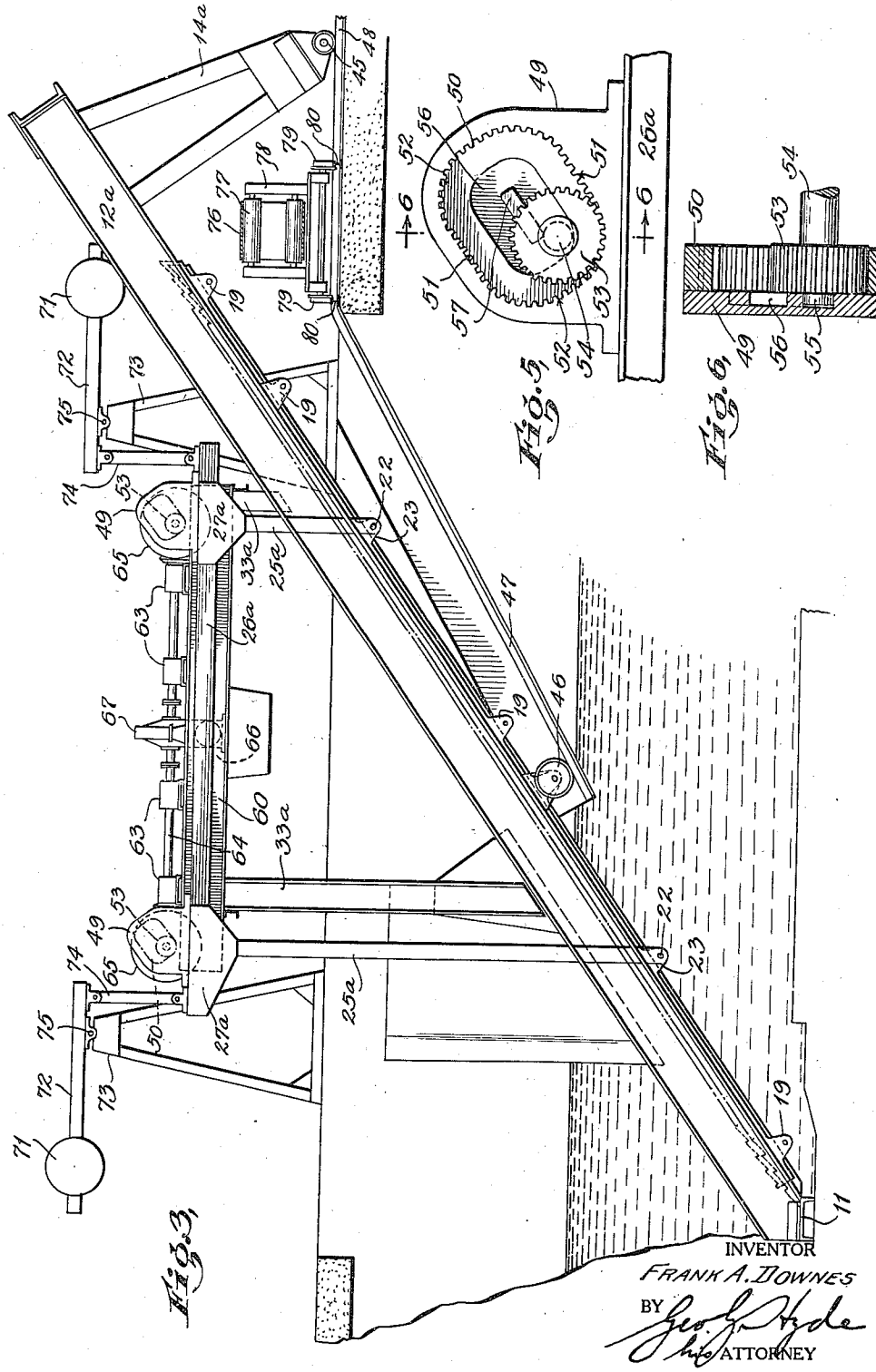


Fig. 3.

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE

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BAR SCREEN

Application filed March 16, 1926. Serial No. 95,024.

This invention relates to improvements in bar screens of the type employed for removing comparatively large bodies from flowing fluids, and is especially suitable for sewage treatment where devices of this kind are sometimes called animal stops. Their function in this field is to remove from the raw sewage the larger floating or suspended objects such as sticks and rags, preliminary to sewage treatment operations in which such articles would be objectionable and usually dangerous to the treatment apparatus. Bar screens of this type are usually employed in advance of fine screens to prevent mechanical damage to the latter.

The general object of this invention is to provide a bar screen with automatic cleaning means. Self-cleaning screens have been developed heretofore, but have not been sufficiently satisfactory to replace the usual hand-cleaned screen, some of the previous screens being too heavy and expensive and most of them including swinging or revolving parts that extend into the air far above the liquid level, requiring considerable space, and being particularly offensive to visitors, a factor that is of primary commercial importance because of the demand by managing sanitary engineers that sewage treatment devices be free from offense to the visiting public. The cleaning mechanism of such devices is also generally complicated, and has bearings or parts moving on one another beneath the surface of the sewage.

These objectionable features have been eliminated in the present invention, the screen disclosed herein being compact, extending but slightly above the necessary elevation of the screenings receptacle, having a rigid screening unit with simple drive mechanism of approved type requiring little power; and having no submerged bearings or friction. The parts are also arranged to eliminate entirely accumulation of solids on exposed portions of machines, a very difficult problem since the ordinary vertical rods placed in sewage of the type handled by this screen will ordinarily accumulate a heavy layer of solids within an hour. The device is also compact which facilitates its use in relatively restricted spaces, such as the sewer discharge at the entrance to treatment plants, where it may be impossible to use former types which extend high into the air. Other objects and advantages will be apparent from the following description, taken in connection with the accompanying drawings, in which

Fig. 1 is a side elevation of a preferred form, the supporting concrete and sewer wall being broken away,

Fig. 2 is a plan view of the same, parts being broken away,

Fig. 3 is a side elevation similar to Fig. 1 of a modified form,

Fig. 4 is a plan view of the actuating mechanism for same, and

Figs. 5 and 6 are detailed views of the drive gearing of the modified form.

Referring to Figs. 1 and 2, the bar screen as shown is mounted at the discharge end of a sewer 10, as at the entrance to a fine screening plant. The machine is supported at its lower end at the bottom of the sewer, the particular arrangement shown including a transverse channel 11 carrying the lower ends of side channels 12 extending along the sides of the sewer and connected at their upper ends by channel 13, the upper end being supported by a suitable frame 14 on the concrete beam 15 extending across the sewage channel, and providing space for any suitable receptacle for the discharged solids (not shown). A suitable apron 16 prevents the solids from passing under the screen.

A plurality of fixed screen bars 20 are suitably mounted on the frame composed of channels 11, 12 and 13, and extend in parallel position lengthwise of the frame. These bars which are preferably rectangular in section may be thus mounted by means of bolt 17 extending through their lower ends and the side channels 12, with suitable spacers thereon, and bolt 18 extending through lugs or extensions 19 on the fixed bars and the side channels 12. These lugs are employed to locate bolt 18 out of the path of the moving bars as will hereafter become apparent, while bolt 17 is located below the path of travel of said bars. Bars 20 therefore comprise a fixed grid.

A plurality of movable bars 21, are located between the fixed bars 20, being likewise rectangular in section and relatively flat, and preferably each movable bar is located immediately adjacent a fixed bar, so that said fixed bar and its associated movable bar in practice constitute a single bar element or unit in screening the liquid. It is desirable to have each movable bar as close as possible to its associated fixed bar while avoiding any actual frictional contact, to prevent solids from getting between the bars, but of course under proper circumstances the associated bars may be in frictional engagement.

The moving bars 21 are likewise interconnected to form a rigid grid, as by means of bolts 22 passing through suitable lugs or extensions 23 on each of the moving bars 21, with suitable spacers 24 between the lugs. At the ends of bolts 22 are suitable hangers 25 connected by tie rods 26 to which the hangers are rigidly connected by webs 27, forming a rigid unitary grid of moving bars supported by the hangers.

Suitable means is provided for imparting to the grid of moving bars a movement which will feed upwardly along the screen solids lodging on the upstream face thereof, this movement including reciprocation of the moving bars longitudinally of the fixed bars, and preferably with depression of the moving bars below the upper face of the fixed bars at the end of the forward or feed stroke and raising the movable bars to or above the level of the upper face of the fixed bars at the end of the return or non-feeding stroke. In the arrangement shown the movable bars are raised above the level of the fixed bars for the feed stroke and depressed below their level at the return stroke.

Various mechanisms suitable for imparting this motion are known and may be employed. The particular form shown is selected partly because it has proved itself efficient and durable in connection with classifiers. In this arrangement the hangers 25 are supported by links 28, pivoted at their lower ends to bolts 29 which pass through the ends of each pair of hangers, the links being connected at their upper ends by rods 30 pivoted in the ends of the upper arms of bellcranks 31 which in turn are pivotally mounted on rods 32 carried by the supporting frames 33 mounted on the side rails 12. The lower arms of bellcranks 31 are connected by links 34 pivoted thereto; and the lower ends of the cranks at the upper or head end of the machine are connected by a rod 35 carrying rollers 36 bearing against cams 37 on drive shaft 38, driven by any suitable means, such as sprocket 39 connected to a suitable source of power not shown.

It will be apparent that by suitably contouring cam 37 the bell cranks will be rocked periodically at the desired time and to the desired extent to give the movable bars the necessary up and down movement at the beginning and end of the feed stroke respectively.

For imparting to the movable bars their longitudinal feed and return movements, suitable crank pins 40 are mounted on cams 37 and connected by pitman 41 to bars 29. The position of the crank pins and the contour of cams 37 are so designed that the movable bars 21 will have a practically straight line feed movement with their upper surface slightly above the upper surface of the fixed bars 20, a relatively rapid descent at the end of the feed stroke to a position with their upper surface below the upper surface of the fixed bars, a movement during which this depressed position is maintained, and a relatively sharp upward movement of the movable bars when they reach the lowermost position, to their normal feed stroke location.

The drive shaft 38 is supported by suitable channels 42 mounted at their upper and lower ends on channel 13 and the upper frame 33 respectively, and carrying suitable bearings 43 for the drive shaft.

Referring now to the modified form shown in Figs. 3 to 6, particularly Fig. 3, the general construction of the fixed grid and its framework is substantially the same, though the entire screen unit and mechanism, carried by the framework is arranged for convenient withdrawal from the stream for cleaning, replacement and the like. This is accomplished by providing rollers 45 on the lower end of the framework 14^a supporting the upper end of the screen frame, and rollers 46 on the side channels 12, resting on tracks 47 at the sides of the stream channel, so that the entire screen and mechanism can be rolled along the tracks 47 and the tracks 48 under rollers 45 for removal from the stream channel.

In the modified construction the moving rakes are supported by hangers 25^a connected by tie rods 26^a with brace plates 27^a, the hangers having head blocks 49 (Figs. 5 and 6) mounted on their upper ends, each block carrying an ordinary gear or rack 50 composed of opposite straight sections 51 and connecting end sections 52 having a substantially straight central portion and a curved portion connecting with the side sections. A suitable pinion 53 engages the rack 50, the pinion shaft 54 having a hub 55 extending into a suitable channel 56 in the head 49, serving as a guide for the pinion and with a central boss 57 which by engagement with the hub 55 maintains pinion 53 in engagement with the rake 50. There are two shafts 54, each carrying at both ends a pinion engaging a head block 49. The shafts 53 are mounted on a suitable framework (see Fig. 4) carried by supports 33^a mounted on the side channels 12^a of the bar frame, including side rails 60

mounted on said supports, and carrying bearings 61 for the shafts 53. Cross rails 62 are mounted on the side rail 60 and carry bearings 63 for a drive shaft 64 which drives shafts 53 through beveled gears 55. Shaft 64 is driven by motor 66 through reduction gearing 67, both mounted on a platform 68 supported by cross pieces 69 connected to the side rail 60.

The weight of the moving bar unit may be counter-balanced in any desired way as by means of weights 71, on levers 72, pivotally mounted on supports 73 on the side of the channel, the ends of levers 72 being connected to the moving bar unit by links 74 which in the form shown are pivoted on the ends of the rear brace plates 27ª and the front ends of rods 26ª respectively. For convenience during removal of the entire mechanism from the stream, the pivots of levers 72 may comprise rods 75 resting removably upon support 73 so that the weight assembly can be laid over the drive frame.

Fig. 3 also shows one convenient method for continuously removing the screenings, comprising an endless belt 76 mounted on the usual rollers 77 carried by frame 78, the portion of said frame underlying the ends of the bars being mounted on wheels 79 resting on tracks 80 to facilitate moving the belt out of the way of the screen when same is withdrawn from the stream.

The upper edges of the screen bars 20 and 21 may be provided with suitable serrations or roughened surfaces to facilitate the feeding action. They preferably are provided with teeth 81 on both fixed and movable bars; the teeth having a long face at the lower side and a short face at the upper side substantially transverse to the direction of feeding movement. The length of each tooth in the direction of feeding movement, or the corresponding length of a number of successive teeth, should be the same as or slightly less than the length of the active feeding stroke; while the height of the teeth in a direction transverse to the feeding movement should be adjusted in connection with the amplitude of the raising and lowering of the moving bars by the bellcranks 31 so that during the feeding movement the base of the notches between teeth 21 shall clear the peaks of the teeth 20 on the fixed bars; while on the return stroke the apices of the teeth 21 will be below the notches between teeth 20.

In operation it has been found practical to obtain excellent results with the relatively low speed of movement for the moving rakes, rates as low as one stroke a minute being effective. The solids from the sewage which are smaller than the space between each screen unit (comprised of one fixed and one movable bar) pass through the screen while larger solids rest upon the up-stream faces of the fixed bars if the movable bars are on the lower or return stroke. The movable bars then rise, engaging and lifting, either partially or completely, the solids resting on the fixed bars, and carry them upward, together with such other solids as may lodge during the upward movement on the moving bars; and at the end of the movement the moving bars drop below the level of the fixed bars, depositing the solids on the latter at a higher point. This operation when repeated will obviously carry the solids in a succession of stages upwardly along the fixed bars until the solids drop over the upper ends thereof onto belt 76 or into any suitable receptacle or platform. By proportioning the teeth as above described and having the teeth substantially in transverse register during the rising movement of the bars solids will be carried the maximum distance from tooth to tooth on the fixed bars.

It has been found in practice, while the apparatus will be operative to a certain extent with the movable bars substantially spaced from both adjacent fixed bars, that with this arrangement flexible solids such as rags, and also short pieces such as short sticks, will not be carried upward uniformly but tend to remain in place, simply swinging back and forth as the bars move; while such solids, when lodging at all upon units composed of pairs of fixed and movable bars so close together as to act substantially as a single bar in removing the solids, will be positively and uniformly carried up the grid of fixed bars.

It will be apparent that the apparatus occupies substantially no more space in height or width than would a fixed bar arrangement of similar slope, and is readily substituted for the latter now in use. Furthermore, while the solids during the travel upwardly above the water level are in view, it has been found in practice that since each solid object is removed as soon as it encounters the screen, the total amount of solids visible on the screen at any one time is so slight as to be negligible; while no parts of the mechanism which pass below the surface during operation and on which unsightly solids might accumulate, are brought above the surface by the operation of the machine.

I claim:

1. The combination with a sewage channel of a plurality of fixed parallel aligned bars extending across the channel to form a screen inclined upwardly in the direction of sewage flow, a grid of parallel bars each associated with a fixed bar forming a unitary screening element, a rigid frame connected to the grid and extending to the sewage level; supporting and actuating means connected to said grid and frame for imparting an oscillating movement relative to the fixed bars comprising an upward advance movement above the upper face of the fixed bars and a return movement below said face, the con-

struction being such that all bearings of the supporting and actuating means are located above the sewage level and constitute the sole support for said grid; and upwardly directed teeth on the upper faces of the bars having a depth less than the amplitude of movement of the grid transversely to the fixed bars.

2. A bar screen comprised of aligned bars, including a movable bar unit comprised of a plurality of said bars and a supporting framework; means constituting the sole supporting and actuating means for said unit movably engaging the unit for imparting thereto a reciprocatory movement longitudinally of the bars adapted to convey material upwardly along the bars, and means for retaining the screen in a channel inclining upwardly and extending above the liquid level in the channel, the movable engagement between the supporting and actuating means and the unit being located entirely above the liquid level.

3. A bar screen comprised of a plurality of fixed bars, a plurality of intermediate moving bars, a frame connecting said moving bars to form a rigid unit, means constituting the sole supporting and actuating means for said unit movably engaging the unit for imparting thereto a reciprocatory movement longitudinally of the bars adapted to convey material upwardly along the bars, and means for retaining the screen in a channel inclining upwardly and extending above the liquid level in the channel, the movable engagement between the supporting and actuating means and the unit being located entirely above the liquid level.

4. A bar screen comprised of a plurality of fixed bars, a plurality of intermediate moving bars each substantially spaced from one adjacent fixed bar and closely aligned with the other adjacent fixed bar to provide a unitary screening element with the latter; a framework connecting the moving bars to form a rigid unit; means constituting the sole supporting and actuating means for said unit movably engaging the unit for imparting thereto a reciprocatory movement of the bars adapted to convey material upwardly along the bars, and means for retaining the screen in a channel inclining upwardly and extending above the liquid level in the channel, the movable engagement between the supporting and actuating means and the unit being located entirely above the liquid level.

5. The combination with a sewage channel of a bar screen extending across the channel and composed of a plurality of pairs of parallel bars extending upwardly above the level of liquid in the channel, the bars of each pair being located immediately adjacent each other to prevent passage of solid material between them and forming a screening unit, means for imparting to one bar of each pair a longitudinal reciprocating feed movement for conveying upwardly along the pair of bars solids lodged thereon, said movement comprising an upward feed stroke in which the upper surface of the moving bar is above the surface of the other bar throughout its entire length, and a return stroke in which said surface of the moving bar is below the upper surface of the other bar throughout its entire length, with suitable translational movement at the end and beginning of the upward feed stroke; and upwardly directed teeth on the upper surfaces of said bars, the length of said teeth being greater than the length of the feed and return strokes, and the depth of the teeth being not more than the extent of said translational movement.

In testimony whereof I affix my signature.

FRANK A. DOWNES.