July 23, 1935. E. R. SCHOFIELD ET AL 2,009,005

CLEANING MEANS FOR BAR SCREENS

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Fig. 1.

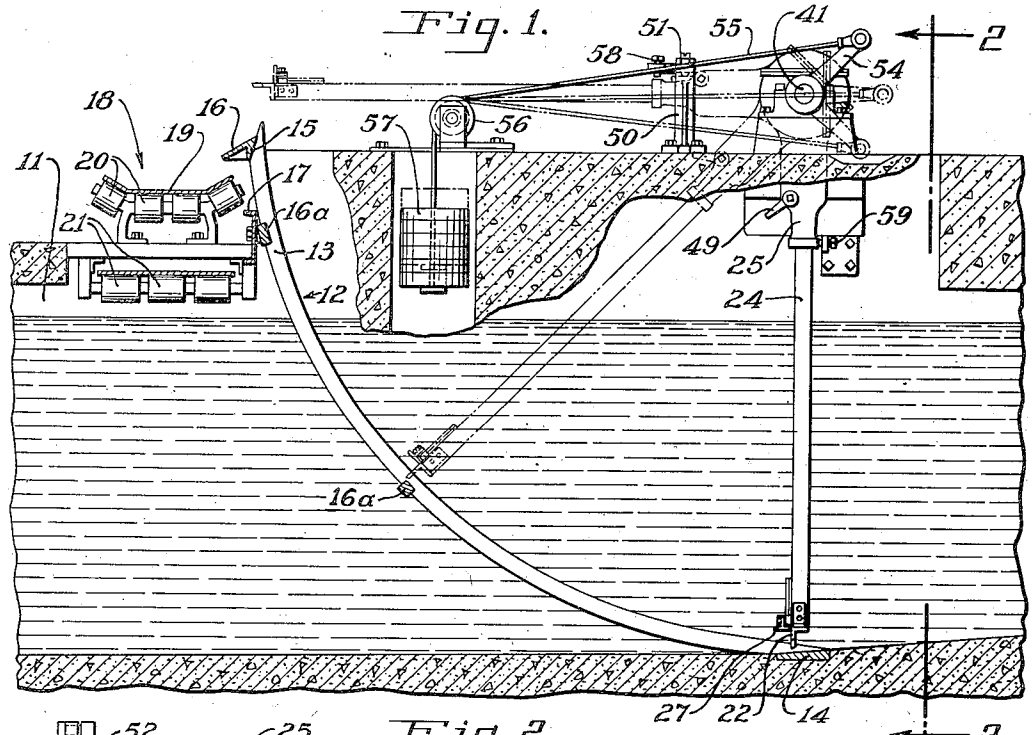
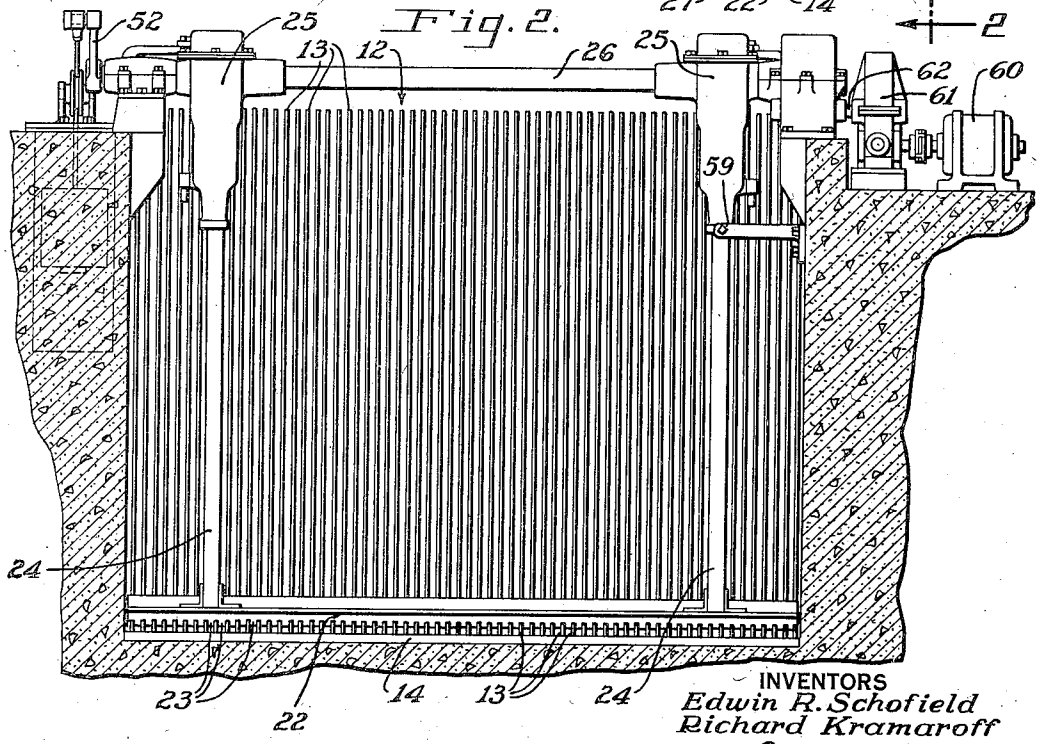


Fig. 2.



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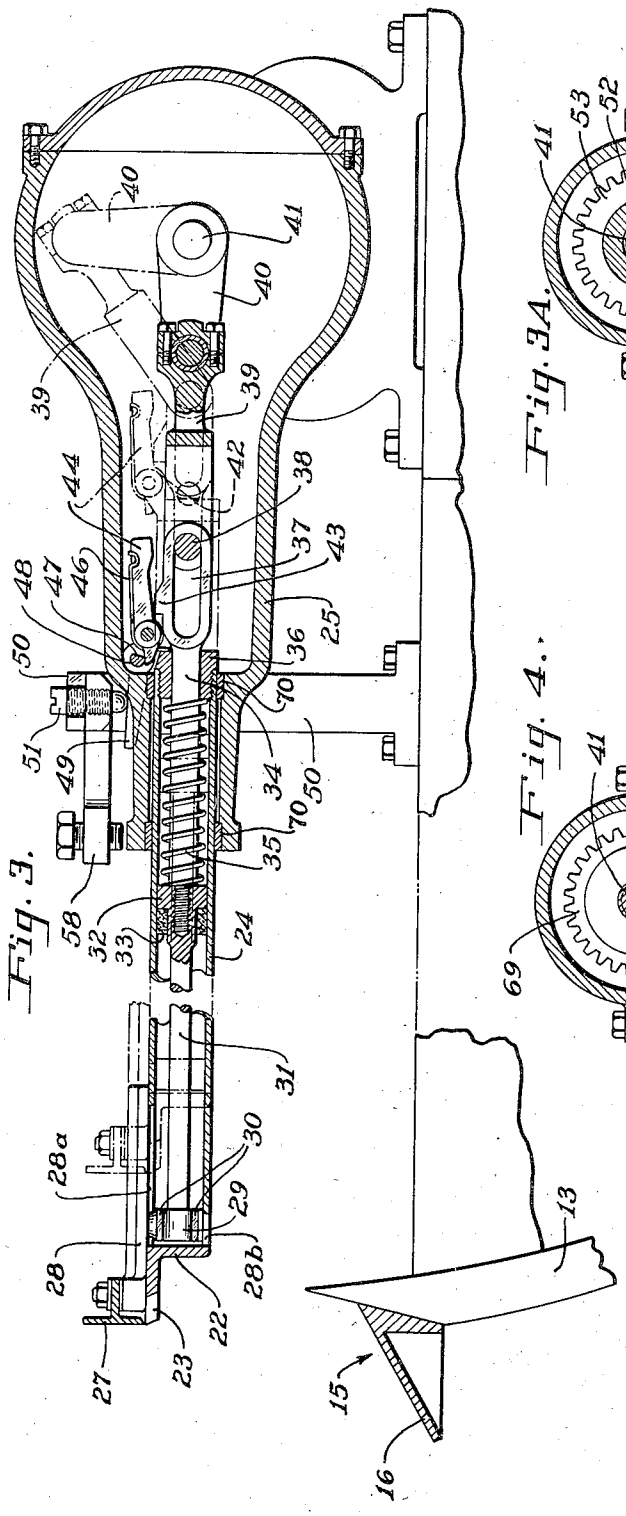

Fig. 3.

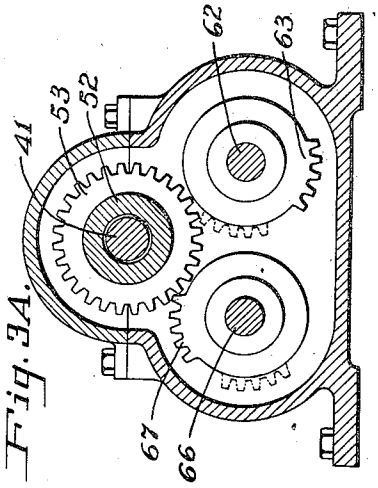

Fig. 3A.

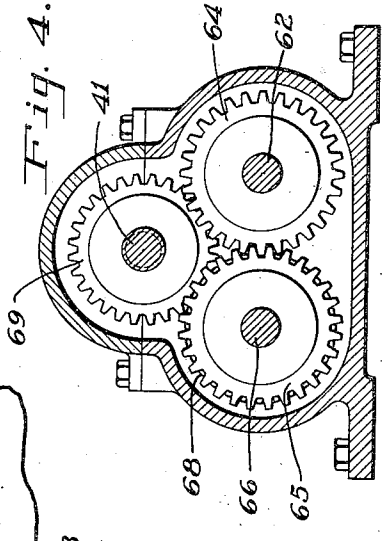

Fig. 4.

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Fig. 5A.

Fig. 5.

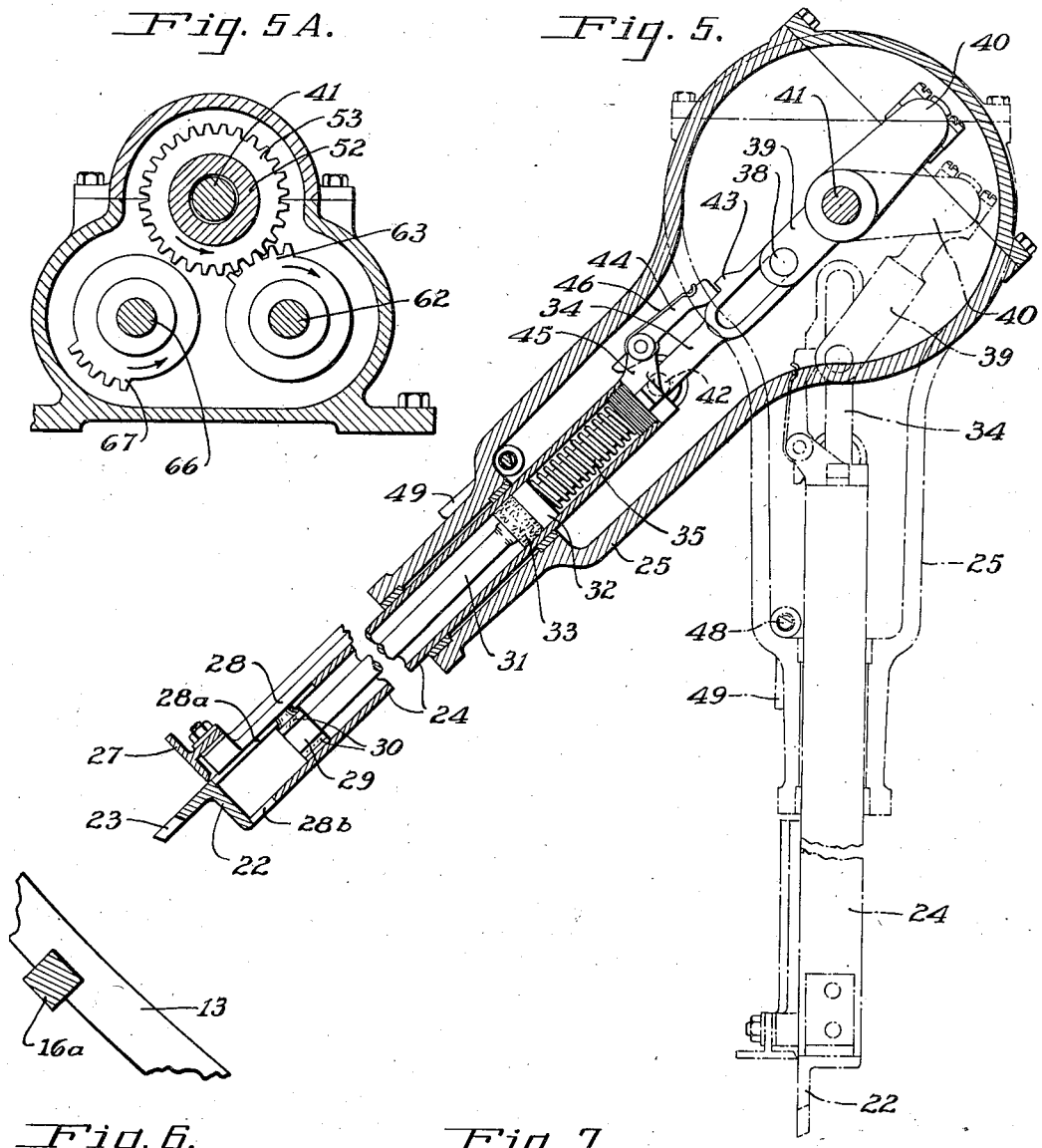


Fig. 6.

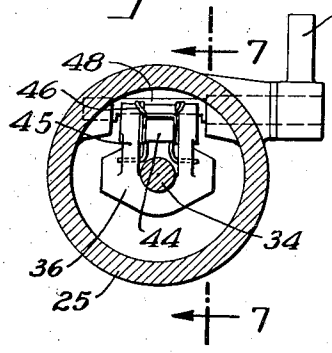
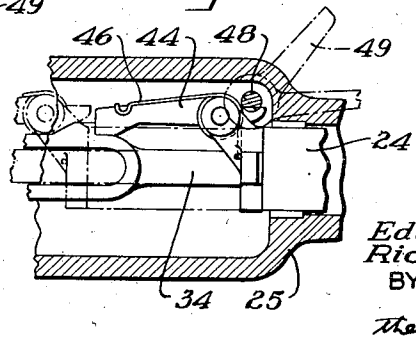


Fig. 7.



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CLEANING MEANS FOR BAR SCREENS

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Fig. 8A.

Fig. 8.

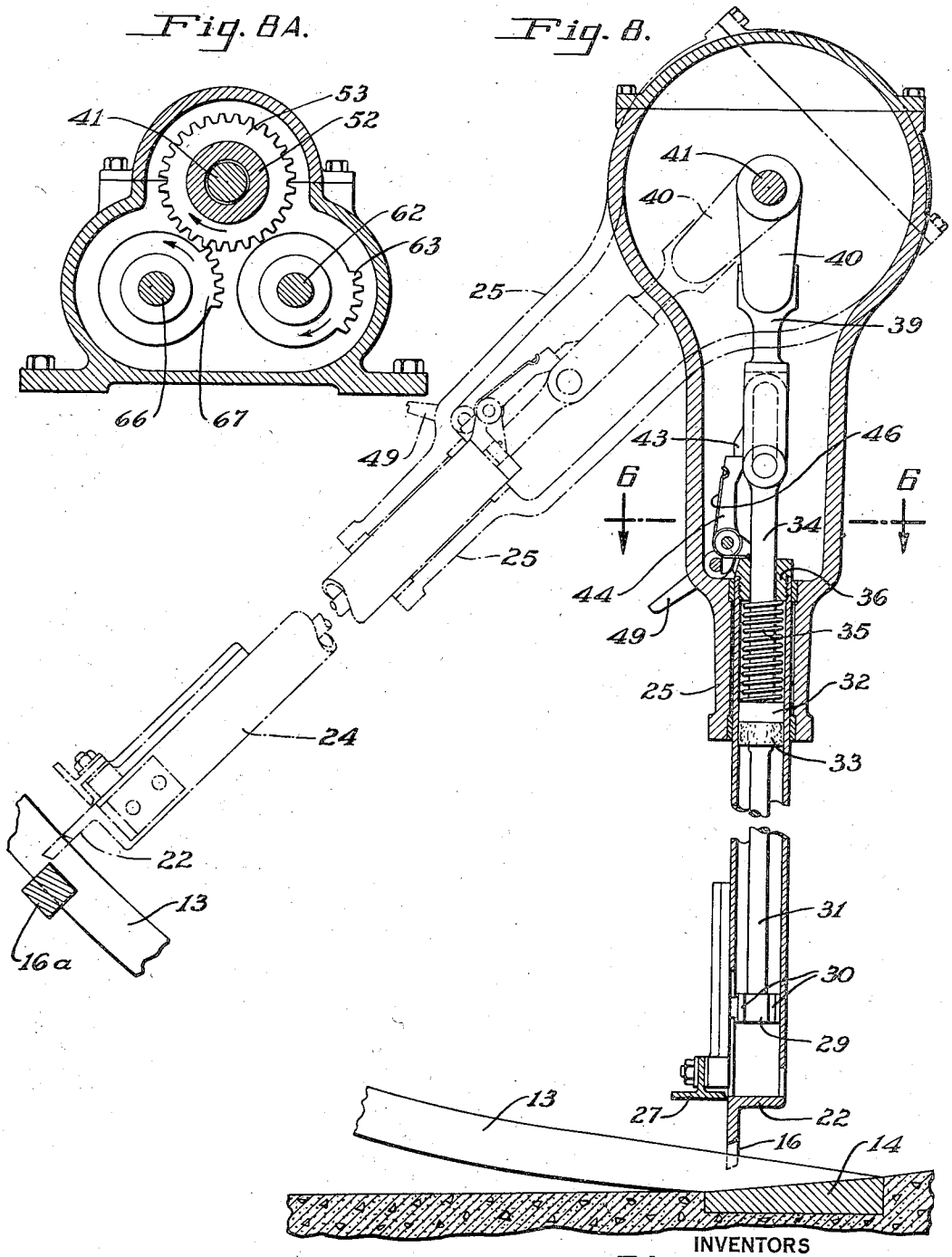

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Fig. 9.

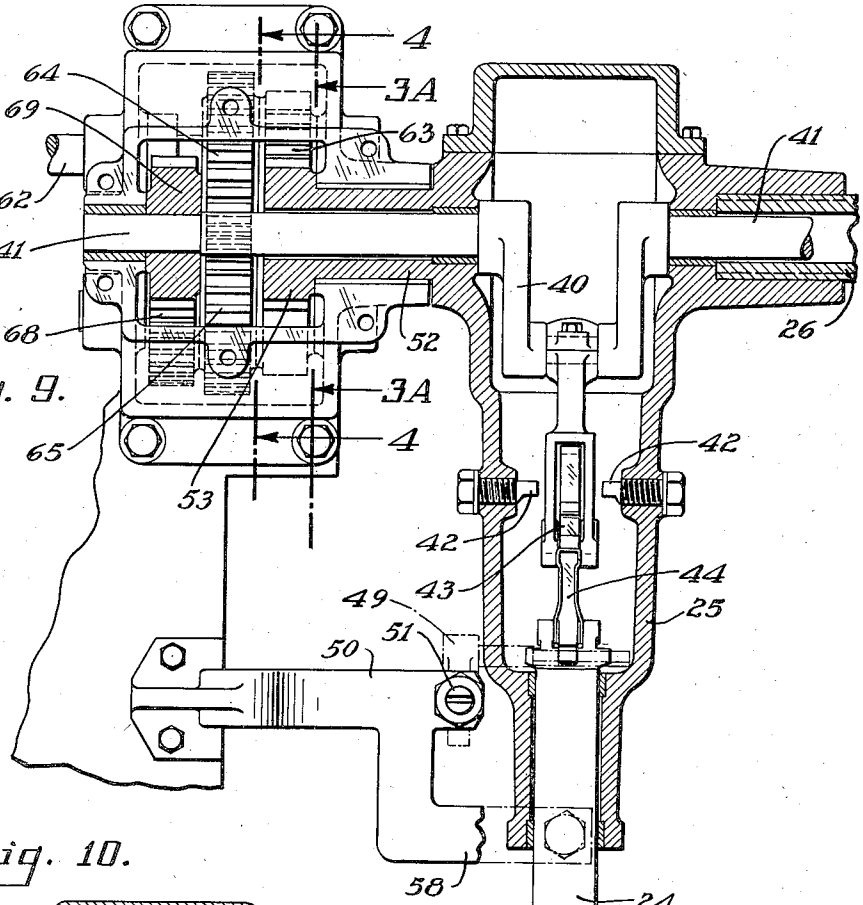
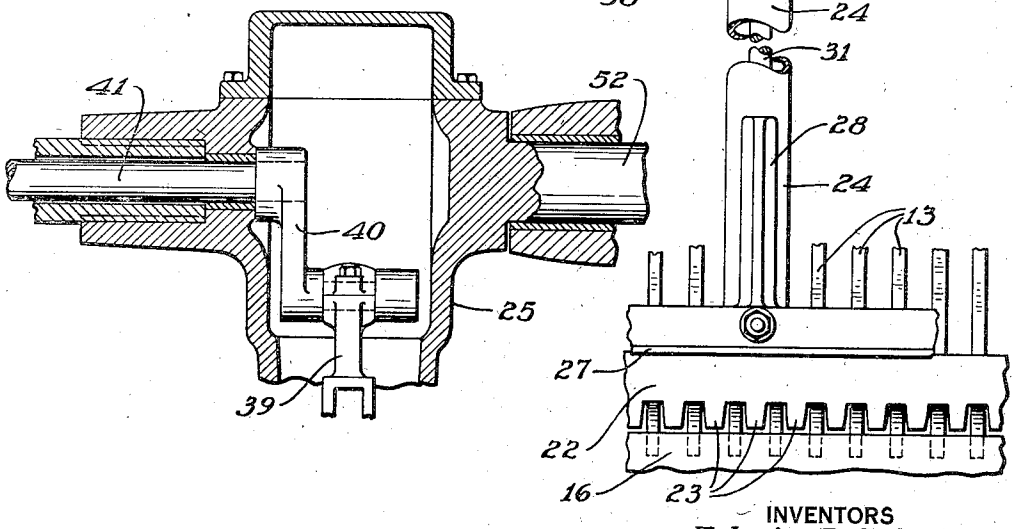


Fig. 10.



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UNITED STATES PATENT OFFICE

2,009,005

CLEANING MEANS FOR BAR SCREENS

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Philadelphia, Pa.

Application February 25, 1933, Serial No. 658,551

16 Claims. (Cl. 210—176)

This invention relates to improvements in cleaning apparatus for the removal of material such as collected detritus from bar screens and the like, such as used in connection with sewage disposal.

An important object of the invention is to provide improved cleaning apparatus of a type in which a cleaning device such as a rake, is moved along the screen bars in one direction while in cooperative relation therewith and is moved in the opposite direction while withdrawn from the screen.

An important feature resides in the means whereby the rake is moved toward or from the bar screen and is maintained in cooperative relation with the screen during the screen cleaning movement or stroke. Another important feature of the invention relates to an arrangement whereby the angle between the rake and the screen bars is always the same, thus enabling effective cleaning at all times during the working stroke of the rake. Another feature relates to the provision of means for counterbalancing the whole apparatus which moves back and forth or oscillates. A further feature relates to the means for discharging the detritus from the rake.

Another feature relates to the arrangement and construction of parts whereby no delicate parts are submerged in the sewage or other liquid to be screened.

Other features, objects and advantages will appear upon consideration of the following description and of the drawings, in which:

Fig. 1 is a view in side elevation, certain parts being in section and parts being broken away to show underlying structure;

Fig. 2 is a section taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view in a vertical plane passing through the axis of the rake arm at the right hand side of Fig. 2;

Fig. 3A is a fragmentary sectional view taken along the line 3A—3A of Fig. 9, showing the segment gears in full lines in positions corresponding to the rake position in Fig. 3 and in dotted lines in positions corresponding to the lowered position of the rake;

Fig. 4 is a section taken along the line 4—4 of Fig. 9;

Fig. 5 is a view similar to Fig. 3 but with the rake in a position substantially midway between its raised and lowered positions;

Fig. 6 is a section taken along the line 6—6 of Fig. 8;

Fig. 7 is a section taken along the line 7—7 of Fig. 6;

Fig. 8 is a view similar to Figs. 3 and 5 but showing the rake in its lowermost position and in position to scrape the bars of the bar screen;

Fig. 8A is a view similar to Fig. 3A but showing the segment gears in the positions assumed by them at the end of the downward movement of the rake supporting structure;

Fig. 9 is a horizontal section taken through the actuating gear train and the adjacent rake arm, the latter being in horizontal position; and

Fig. 10 is a corresponding section at the opposite end of the rake supporting structure.

Referring to the drawings, 11 indicates a conduit such as a sewer including a section open at its top to permit the removal at that point of waste material or detritus collected by a screen 12. As here shown, the screen is made up of a plurality of bars 13 substantially in the shape of circular arcs, a member or bar 14 secured to the lower ends of the bars 13 and positioned at the bottom of the sewer, an angle member 15 connecting the upper ends of the screen bars 13 and providing a lip 16 over which is discharged detritus removed from the screen, and other connecting members 16a. The upper part of the screen is attached and supported by securing the upper connecting member 16a to a channel member 17 which also serves to support one side of a detritus receiver 18 which may include a belt conveyor comprising a belt 19 of which the upper reach is maintained in the form of a trough by means of suitable supporting rollers 20 and the lower reach is supported by rollers 21. At the side opposite to the screen 12 the belt conveyor structure may be supported by the top part of the sewer. The belt conveyor may be used to convey the detritus to any desired position.

To scrape the accumulated detritus from the screen, use may be made of a rake 22 here shown in the form of an angle of which one of the flanges is formed with teeth 23 adapted to be passed down into the spaces between successive screen bars 13. As illustrated, the rake 22 is secured to the ends of tubular members 24 slidable longitudinally in the ends of hollow members or castings 25 connected, as by means including keys, to a hollow shaft 26. The hollow members 25 serve not only to cooperate with tubular members 24 to form collapsible arms but also as casings enclosing means for advancing and retracting the rake 22 and also for controlling the movements of a scraper 27 slidable along the toothed flange of the rake.

The scraper 27 has a central flange extending rearwardly therefrom and bolted to a slide 28 resting upon the upper side of each tubular member 24 and connected through a slot 28a in said tubular member with a member 29 slidable in said tubular member. It will be seen that the slot 28a is always covered by the slide. However, provision may be made of an opening 28b at the opposite side of each tubular member 28 to enable sewage to be drained therefrom. In order to avoid undue resistance to movement of the various parts, the member 29 is so constructed that it does not close the interior of the corresponding tubular member 24 and for this purpose is provided with flanges 30 engaging the inner surface of the tubular member. Each member 29 is connected with a rod 31 provided at its other end with a thrust collar 32 fitting in the tubular member 24. At the side of the collar 32 toward the rake the rod 31 is increased in size to receive a packing washer 33.

At its end adjacent to the thrust collar, the rod 31 is provided with a threaded bore to receive a threaded reduced portion of a rod 34 serving as an extension of the rod 31 and carrying a helical spring 35 interposed between the collar 32 and a tubular member 36 slidably supporting the rod 34 and fixed in the end of the corresponding tubular member 24. It will be evident that the springs 35 in the collapsible arms of the rake supporting structure tend to advance the scraper 27 to the forward limit of its movement. It should be understood that the action is substantially the same at both of the collapsible or telescopic arms and that a description of operation at one side of the apparatus will be sufficient.

Referring to Fig. 3 which shows a section of the collapsible arm at the right of Fig. 2, the rod 34 is provided with a slot 37 receiving a pin 38 or other equivalent member on a connecting member or connector 39 pivoted at its other end on a crank 40 carried by a shaft 41 extending through the hollow shaft 26. It will be seen that, when the crank 40 turns through 90 degrees, in a clockwise direction, from its full line position (Fig. 3), the scraper 27 will be drawn rearwardly and, due to the compression of the spring 35, the corresponding tubular member 24 will be drawn rearwardly to the dot-and-dash position where the movement of the tubular member 24 will be checked by the stops 42. During this movement of the crank the rake will remain in its raised position (Fig. 3).

As the crank 40 turns through an additional 45 degrees the rake will be swung downwardly the same amount (Fig. 5) and the spring 35 will be further compressed, due not only to the turning of the shaft 41 but also to the swinging of the telescopic arms in the opposite direction, and the rod 34 shifted to the limit of its movement in that direction to carry a stop or lug 43 thereon beyond the end of a latch 44 pivoted in arms 45 projecting from the members 36 and urged downwardly by spring 46. The latch 44 then falls back of the lug 43 and holds the scraper in retracted position with reference to the rake. During another 45 degrees the parts will assume the position indicated in dot-and-dash lines in Fig. 5, the only effect of the crank action being to move the pin 38 to the other end of the slot 37, and thus take up the lost motion in this form of lost motion connection between the rod or link 34 and the crank 40.

During the next 45 degree movement of the crank, the collapsible or telescopic arms will remain in their downwardly extending positions and each crank will act to force the rake downwardly into position to cooperate with the bars of the screen (see the full line indication in Fig. 8). At this time the tail end of the latch 44 comes into engagement with a flat 47 on a rock shaft 48 rotatably mounted in the arm member 25 and provided at the outside thereof with a trigger 49. During the next 90 degree movement of the shaft 41, the crank shaft 41 and the hollow shaft will rotate together and the cranks on the shaft 41 will act merely to hold the rake against the screen.

During this upward movement of the rake-supporting arms, the rake 22 scrapes the detritus from the screen and carries it upwardly. As shown in Fig. 1, the screen bars 13 do not continue for a full 90 degrees but lack about 10 degrees thereof. After the rake 22 has left the upper ends of the screen bars and while moving through this 10 degree range of movement, each trigger 49 strikes a trip 50 on the adjacent wall of the sewer and the latch is released. This occurs at both sides of the apparatus and the scraper 27 snaps forwardly; shooting the screenings or detritus for some distance over the lip 16 so as to fall on the conveyor belt 19 which will carry the same away. As illustrated, each trip 50 is provided with an adjustable screw 51 to engage the corresponding trigger, thus making it possible to regulate closely the position of the rake at which the scraper will be released.

The crank 40 at the right hand side (Fig. 2) of the apparatus is in the form of a full crank to enable actuation of the shaft 41 by power applied at such side. The corresponding crank at the opposite side of the cleaning device may obviously be only a half crank. The hollow arm members 25 have outwardly extending projections 52 which are suitably journalled in structures supported by the walls of the sewer, and for the purpose of swinging the rake supporting structure the projection on the right hand member 25 is provided with a gear 53. Journalled in and extending axially through the gear 53 and the projection with which it is connected is an extension of the shaft 41 connected with the outer side of the crank 40.

The swinging movement of the rake supporting and operating structure or frame is effected by means including a set of reversing gear from which it is freed temporarily at the end of each upward movement and at the end of each downward movement. It is therefore necessary to stop and hold the rake structure in definite positions to assure proper meshing of gears preparatory to starting movement of the frame in either direction. It is also desirable to counterbalance the rake-supporting structure so that less power will be required in swinging the structure upwardly. Both of these results as well as others may be obtained in the following manner. The outward projection 52 of the left hand arm member 25 is provided with an arm 54 to the outer end of which is attached a flexible connector 55 passing over a pulley 56 and downwardly therefrom into a well where it is attached to a weight 57.

When the flexible connector is moved in either direction past the axis about which the rake-supporting structure swings, the weight 57 will be lifted to the dotted line position (Fig. 1) and will then descend and act to continue the movement of said structure until the upward movement is terminated by engagement of arm member 25 with stop 58 (Fig. 9) or the downward movement is terminated by stop 59 (Fig. 1). It will be evident

that the same stopping action might be effected by limiting the movement of arm 54 by means of suitable stops. As shown in Fig. 1, the arm 54 swings equal distances above and below the axis of the shaft 41. If, however, it be desired to provide greater counterbalancing for the swinging structure when the rake is raised than when it is lowered, this result may conveniently be attained by changing the position of the arm with respect to the telescopic arms so that it will not swing so high above the axis of shaft 41 but will swing farther down than indicated in Fig. 1 thus increasing the counterbalancing action where needed. Obviously the counterbalancing may be effected by other means, for example by spring means.

As illustrated, the means for swinging the rake supporting structure and for controlling the inward and outward movements of the rake 22 and the scraper 27 includes an electric motor 60 acting through a double worm reducer 61 to drive a shaft 62 (Fig. 6) carrying an intermittent gear 63, with teeth on a 45 degree segment only and the rest of the circumference bald or toothless and cut below the line of the root of the teeth, and a gear 64 meshing with a similar gear 65 on a parallel shaft 66 provided at its forward end with a gear 67 similar to gear 63 and at its rear end with a gear 68 meshing with a gear 69 fixed on the extension of the crank shaft 41. Due to the driving connection between the gears 64 and 65, the shafts 62 and 66 and consequently the intermittent gears 63 and 67 rotate in opposite directions and act alternately on the gear 53 to swing the rake downwardly or upwardly. The toothed segments on the intermittent gears 63 and 67 extend far enough around the circumferences of these gears so that they will act to turn the gear 53 through substantially 90 degrees in opposite directions.

In brief recapitulation, one cycle of operation of the apparatus is substantially as follows: Just at the end of the ejecting movement of the scraper 27, each collapsible arm is in the condition shown in Fig. 3 and the intermittent gears or gear segments 62 and 67 are in the positions indicated in Fig. 3A, the gear segment 67 just passing out of engagement with the gear 53 after actuating it to lift the rake 22 to its uppermost position and the gear segment 63 which turns in the opposite direction being 90 degrees away from the position in which it would engage the gear 53 to swing the rake downwardly. At this time the arm 54 of the counterbalancing device is in its lowermost position so that the counterweight 57 acts to hold the rake supporting structure in its uppermost position determined by the stop 58, and to maintain the gear 53 in the proper position for the gear segment 63 to mesh therewith.

While the collapsible arms are at rest in these positions, the crank shaft 41 continues to rotate and in turning through 90 degrees pulls back both the scraper 27 and the rake 22 until the member 36 attached to the end of the tubular member 24 engages the stops 42 (Fig. 9) and is checked thereby. During this time the toothed segments in Fig. 3A have advanced from their full line positions to the dotted line positions with the segment 63 just engaging the gear 53 to start the downward swinging of the rake. During the next 45 degree movement of the shaft 41, the telescopic arms will be turning in the opposite direction and at the same rate and the two movements will combine to draw back the scraper 27 to the limit of its movement of retraction and cause each latch 44 to come into effective engagement with the corresponding lug 43 to cock the scraper or lock it in retracted position until released by the triggers 49. At this time the arm 54 is at its midway position with the counterweight in raised position, ready to act to urge the downward swinging of the rake.

During the next 45 degree movement of the rake, the arms will swing down to their vertical positions determined by stop 59 where they will be held by the counterbalancing device. At this time the toothed segment 67 will just be leaving the gear 53 and the pin 33 will just have reached the lower end of the slot 37 as indicated in the dot-and-dash lines in Fig. 5. During the next 90 degree movement of the shaft 41 there will be no movement of the telescopic arms about the axis of the shaft 41, but the pins 33 will have pushed the rake 22 down into engagement with the screen bars 13, the various parts then being in the positions indicated in full lines in Fig. 8. At this time the gear segments are in the positions indicated in Fig. 8A, the gear segment 66 being in position to start the upward swinging of the telescopic arms.

During the next 90 degree movement of the shaft 41, the telescopic arms will be swung at the same rate and the crank pins will act to hold the rake down against the screen bars. At the end of this movement the arms will be in their uppermost position just after the tripping of the triggers 49 which permits the forward snap of the scraper 27 under the urging of the springs 35.

It will be seen that the apparatus of the present invention requires a minimum amount of head room, not only because of the compact arrangement of the actuating mechanism but also because the retraction of the rake is in a substantially horizontal direction and is not accompanied by any further upward movement of the rake. Also the holding of the ejector or rake-scraper in retracted position by latching means and the release of the latching means by tripping the latching means facilitates adjustment of the timing of the ejector action.

As disclosed herein, the two parts of each telescopic arm when not under direct control by the crank shaft are held in proper relative position by friction between member 24 and washers 70 in the member 25. It should be understood, however, that other means may, within the scope of the invention, be used for maintaining these parts in proper relative position. In this connection attention is called to the fact that the sealing washers 33 and 70 prevent access by liquid to the main portions of the telescopic arms.

In the illustrative embodiment of the invention disclosed herein, the screen cleaning is done by a so-called rake. It should be understood, however, that within the scope of the invention use may be made for this purpose of any suitable screen cleaning members or screen-scrapers. The term "rake" as used herein should therefore be understood as covering not only members in specific rake form but all other members suitable for the same purpose.

It should be understood that various changes may be made in the construction and arrangement of parts and that various features can be used without others without departing from the true spirit and scope of the invention.

Having thus described our invention, we claim

1. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis

of curvature of said screen, and means for intermittently imparting motion to said frame to move said screen-scraper along said screen in opposite directions and imparting to the screen-scraper substantially radial movement toward the lower part of the screen while the frame is at rest in its lowermost position and substantially radial movement in the opposite direction when the frame is at rest above the upper edge of the screen.

2. In apparatus of the class described, an arcuate screen, a screen-cleaning member, a frame carrying said screen cleaning member and mounted to swing about the axis of curvature of the screen, intermittent-drive mechanism for moving said frame upwardly and downwardly and releasing it between such movements, means for limiting the movement of said frame in both directions to assure cooperation with the intermittent-drive mechanism for subsequent actuation thereby, and counterbalancing means effective after movement of the frame in either direction past a predetermined point to urge it toward the corresponding limit of movement.

3. In apparatus of the class described, an arcuate screen, a swinging frame, a screen-cleaning member movable on said frame toward and from the screen, frame-controlling means for swinging the frame from the lower edge of the screen past the upper edge thereof, holding the frame in its uppermost position, swinging the frame downwardly to the lower edge of the screen and holding it against swinging before starting another cycle of movement, and means for advancing the screen-cleaning member into engagement with the screen while the frame is at rest in its lowermost position and for retracting the screen-cleaning member while the frame is in its uppermost position.

4. In apparatus of the class described, an arcuate screen, a swinging frame, a screen-cleaning member movable on said frame toward and from the screen, means for swinging the frame from the lower edge of the screen past the upper edge thereof, holding the frame against swinging, swinging the frame downwardly to the lower edge of the screen and holding it against swinging before starting another cycle of operation, and means for advancing the screen-cleaning member into engagement with the screen while the frame is at rest in its lowermost position, holding the screen-cleaning member against the screen during the upward swing of the frame, and retracting the screen-cleaning member while the frame is in its uppermost position.

5. In apparatus of the class described, an arcuate screen, a screen-cleaning member, a swinging frame having collapsible arms carrying said screen-cleaning member, means for intermittently swinging said frame to move the screen-cleaning member back and forth between the lower edge of the screen and a position just above the upper edge thereof and for holding the frame against swinging for definite intervals while in its lowermost and uppermost positions, and means for extending said arms while the frame is at rest in its lowermost position and thereby forcing said screen-cleaning member against the screen and for contracting said arms while the frame is at rest in its uppermost position.

6. In apparatus of the class described, an arcuate screen; a frame mounted to swing about the axis of curvature of said screen; a screen-cleaning member movable on said frame toward and from the screen; an ejector on said screen-cleaning member; spring means for advancing the ejector to clean the screen-cleaning member; means for latching the ejector in retracted position; means for swinging the frame from a position opposite the lower edge of the screen to a position just above the upper edge thereof, holding the frame against swinging, swinging the frame in the opposite direction and holding it against swinging movement before starting another cycle; means for advancing the screen-cleaning member into engagement with the screen while the frame is at rest in its lowermost position, retracting the screen-cleaning member and the ejector while the frame is in its uppermost position and retracting the ejector further during the downward movement of the frame so as to be latched in retracted position by said latching means; and means for tripping the latching means just after the screen-cleaning member clears the upper edge of the screen thereby permitting the ejector to snap forwardly and eject the waste collected on the screen-cleaning member over the top of the screen.

7. In apparatus of the class described, a rake, a hollow shaft, a frame comprising two telescopic arms each in two parts one of which is attached to the rake and the other to said hollow shaft, means for swinging said frame, and means for extending and contracting said arms including a crank shaft in said hollow shaft and having cranks in the attached arm parts, members longitudinally movable in said arms and operatively connected with said rake, and a lost motion connection, including a pitman, between each crank and the corresponding longitudinally movable member.

8. In apparatus of the class described, a rake, an ejector movably mounted on said rake, spring means urging the ejector toward the forward edge of the rake, means for latching the ejector in retracted position on the rake, a hollow shaft, a frame comprising two telescopic arms each in two parts one of which is operatively connected with the rake and the other with said hollow shaft, means for swinging said frame, means for tripping the latching means when the frame reaches the discharge end of its swing, and means for extending and contracting said arms and retracting said ejector including a crank shaft in said hollow shaft and having cranks in the attached arm parts, members longitudinally movable in said arms and connected with said ejector, and a lost motion connection between each crank and the corresponding longitudinally movable member permitting the ejector to snap forwardly upon tripping of the latching means.

9. In apparatus of the class described, a screen-scraper, means for swinging said screen-scraper back and forth including a tubular member connected at one end with said screen-scraper and a hollow member mounted to swing about a fixed axis and in which said tubular member is slidable toward and from said axis, an ejector slidable on said rake, a link movable longitudinally in said tubular member and hollow member and connected at one end with said ejector through a slot in said tubular member, a helical compression spring on said link and cooperating at one end with the link and at the other end with the tubular member to urge the ejector forward with reference to the screen-scraper, a stop limiting the rearward movement of said tubular member, a spring controlled latch on said tubular member, a stop on said link for engagement with said latch when the link is drawn

farther to the rear after the tubular member is checked by the corresponding stop, and means for actuating said link including a crank rotatable about said fixed axis and a lost motion connection between the crank and the link.

10. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis of curvature of said screen, means for moving said screen-scraper toward and from the screen, and means for intermittently imparting motion to said frame in opposite directions including a gear coaxial with said frame and turning therewith and two gear segments turning in opposite directions at the same rate and engaging said gear alternately.

11. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis of curvature of said screen, means for moving said screen-scraper toward and from the screen, and means for intermittently imparting motion to said frame in opposite directions including a gear coaxial with said frame, and two gear segments connected to rotate in opposite directions and engage said gear alternately, each of said gear segments being of such length as to turn said gear through substantially 90 degrees.

12. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis of curvature of said screen, means for moving said screen-scraper toward and from the screen, and means for intermittently imparting motion to said screen-scraper in opposite directions including a gear coaxial with said frame and turning with said frame, and two mutilated gears running in opposite directions at the same rate and actuating said gear alternately.

13. The combination with a curved screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about a fixed axis, an ejector on said screen-scraper, means for intermittently imparting motion to said frame in opposite directions including a gear coaxial with said frame and turning therewith and two gear segments turning in opposite directions and engaging said gears alternately, and means for moving said screen-scraper and said ejector toward and from said axis including a shaft coaxial with said gear and having a crank, and connections between the crank and said ejector and screen-scraper.

14. In apparatus of the class described, a curvilinear screen, a scraper therefor, an ejector on said scraper, spring means urging the ejector toward the forward edge of the scraper, means for swinging the scraper and ejector upwardly and downwardly along said screen, latching means for holding said ejector in retracted position on said scraper, means for retracting said scraper and ejector together while raised and further retracting said ejector to cause it to be secured by said latching means, means for advancing the scraper and latched ejector toward the screen at its lower part, and tripping means to release said latching means when the scraper reaches the upper limit of its motion.

15. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis of curvature of said screen, means for intermittently moving said screen-scraper in opposite directions and for moving said screen-scraper toward the screen when at the lower limit of its movement and from the screen at the upper limit of its movement, such moving means for the screen-scraper including an operating member connected with said frame to swing therewith about its axis of movement and two actuating members rotating in opposite directions and acting alternately on said operating member.

16. The combination with an arcuate screen, of a screen-scraper, a frame carrying said screen-scraper and mounted to swing about the axis of curvature of said screen, means for intermittently moving said screen-scraper toward the screen when at the lower limit of its movement and from the screen when at the upper limit of its movement, such moving means including operating means connected with said frame to swing therewith about its axis of movement and two actuating members acting on said operating means alternately to swing said frame in opposite directions.

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