

S. J. S. MILLS.
 APPARATUS FOR DISTRIBUTING SEWAGE OR SEWAGE EFFLUENT UPON THE SURFACES OF
 FILTER BEDS.

APPLICATION FILED JAN. 4, 1911.

1,064,848.

Patented June 17, 1913.

3 SHEETS-SHEET 1.

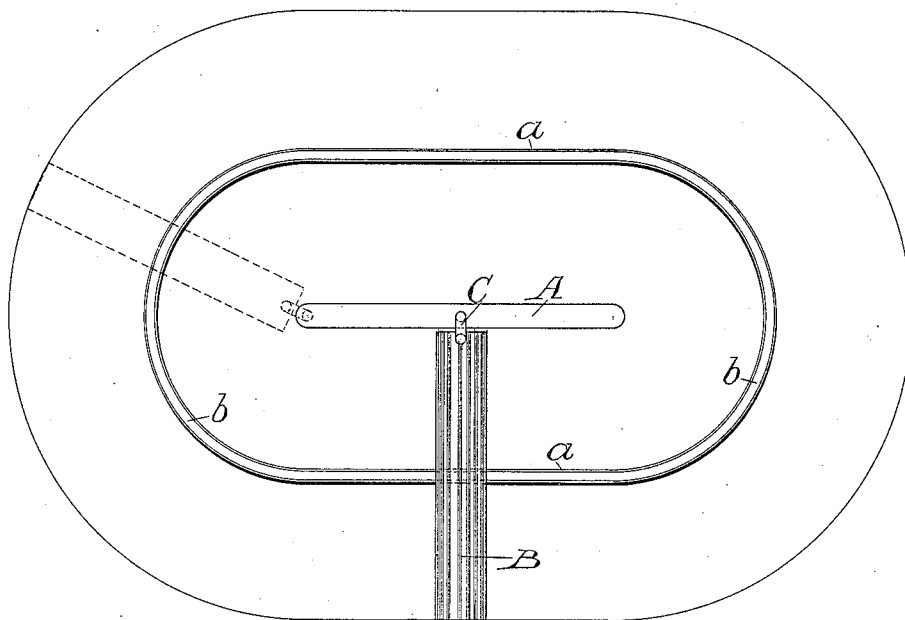


Fig. 1.

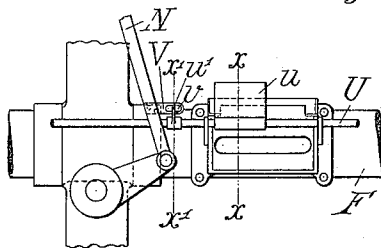


Fig. 7.

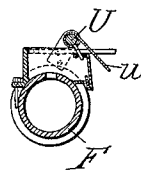


Fig. 8.

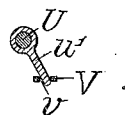


Fig. 9.

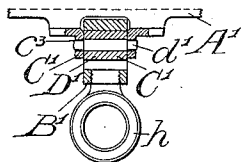


Fig. 11.

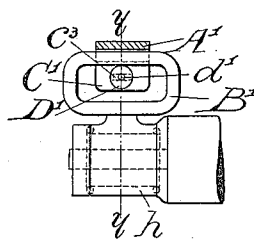


Fig. 10.

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3 SHEETS—SHEET 3.

1,064,848.

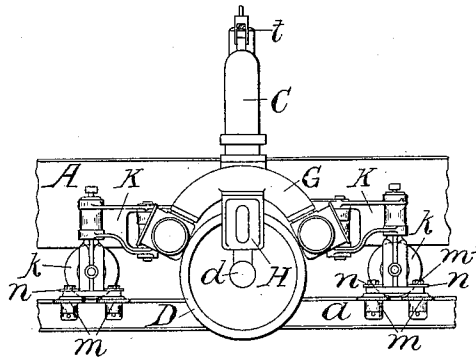


Fig. 4.

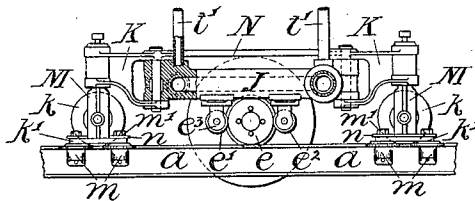


Fig. 5.

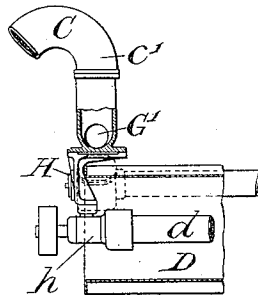


Fig. 6

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DISTRIBUTING SEWAGE OR SEWAGE EFFLUENT UPON THE SURFACES OF FILTER-BEDS.

1,064,848.

Specification of Letters Patent.

Patented June 17, 1913.

Application filed January 4, 1911. Serial No. 600,810.

To all whom it may concern:

Be it known that I, SAMUEL JOHN SIGISMUND MILLS, a subject of the King of Great Britain, and resident of Stourbridge, England, have invented certain new and useful Improvements in Apparatus for Distributing Sewage or Sewage Effluent Upon the Surfaces of Filter-Beds, of which the following is a specification.

This invention relates to the type of distributor, for sewage or sewage effluent, which is caused to traverse over the surface upon which the sewage or effluent is to be distributed by the operation of the sewage or effluent upon a water-wheel.

Now, this invention has for its main objects, to insure a succession of rest intervals, each of substantially the same duration, for every portion of the surface over which a distributor travels, of a filter bed which has two of its sides parallel, and to reduce the cost of installing a distributor whether for use for a bed which has two of its sides parallel or is of circular shape.

The main features of the invention, by which the above objects are accomplished, are the use of a continuous mono-rail (or mid track) on which the distributor runs, and a wheel, which is in position about midway between the ends of a water-wheel (the water-wheel being divided by a space at its middle) and runs upon the mono-rail and is driven by the water-wheel, the entire weight of the distributor being approximately balanced on the rail. The wheel which runs upon the mono-rail is conveniently carried by the water-wheel axle. When the mono-rail (or mid track) is used for a filter bed having two of its sides parallel, the bed is formed with semi-circular ends, and a supply trough for feeding the sewage or sewage effluent through a siphon to the distributor runs along over the middle of the bed parallel with the two parallel sides and is of about the same length as the sides. The mono-rail has two parallel lengths which run over the filter bed at the required height and about midway, respectively, between the outer side of the bed and the corresponding side of the trough, and two semi-circular lengths which join together the ends of the parallel lengths and are, respectively, concentric with the semi-

circular ends of the filter bed. When the mono-rail is used for a circular filter bed, it is itself circular and concentric with the bed and runs around thereover about midway between a central supply pipe and the outside of the filter bed. Whichever form of filter bed the distributor is to be used for, it is substantially balanced on the mono-rail, the divided water-wheel driving a wheel which runs upon the mono-rail and supports the weight of the water-wheel, and the framing of the distributor which comprises the weir pipe is carried upon the mono-rail by means of leading and trailing wheels which run upon such rail, and is substantially balanced upon such rail. The ends of the water-wheel axle are carried in bearings (preferably ball bearings) which are suspended from the framing. The distributor runs continuously in the same direction, that is to say, in a continuous circular direction in the case of the circular filter bed, and continuously, in the case of the non-circular filter bed, over one straight piece of rail then over one semi-circular portion thereof, then over the other straight piece of rail, then over the other semi-circular portion thereof, and so on during the whole time it is in operation. In the case of the non-circular filter bed, the framing is guided by sets of leading and trailing guide wheels which, together with the leading and trailing bearing wheels, are mounted in carriers which are swiveled to arms which project forward and rearward, respectively, of the frame, and are pivoted thereto at their inner ends. These arms have each a shorter arm which projects at an angle therewith from the pivot axis of the principal arm. These shorter arms project, one of them from one side of the corresponding principal arm and the other from the opposite side of the other principal arm, and the outer ends of these shorter arms are connected together by a link, so that if one of the arms turns to one side, the other arm must turn to the same side also. Thus, as one of the sets of guide wheels comes to a curved portion of the track, the arm which carries them will turn in relation to the frame and will correspondingly turn the other arm, and the arms will both remain turned more or less until both the leading and trailing guide

wheels have passed again to a straight portion of the track. The purpose of this arrangement is to enable the distributor to remain central over the rail both when running along a straight and also along a curved portion thereof.

When using the distributor for a circular filter bed, the weir pipe may be formed to fit down substantially water-tight over a turned spigot end of a central supply pipe, and in such case the distributor is overbalanced at its inner end so as to bear down somewhat upon the spigot; but in the case of the non-circular filter bed, the weir pipe is connected with a siphon which dips down into the supply trough, and the supply trough is formed with an outward flange around its upper edge, upon which the inner end of the distributor is supported, through the medium of a roller, and in this case also, the inner end of the distributor is somewhat overbalanced to insure that the roller will run upon the flange, but to guard against its tilting up, a roller which is mounted upon the axis of the water-wheel shaft, comes beneath the underside of the trough sufficiently near thereto to insure that should the distributor tilt up at the inner end it can do so but very slightly. The frame, both in the case of the circular and non-circular filter bed, may be driven from the water-wheel entirely through the axle bearings; but it is preferred, as giving a smoother action, to drive at the middle also, by arranging for the wheel which is driven by the water-wheel to run against a wheel which is carried by the frame immediately in front thereof.

The use of a mono-rail reduces the number of columns required for supporting the track, and generally reduces the cost of an installation, and the trough used, in the case of the non-circular filter bed, is considerably shorter than a trough which would be required for a filter bed of the same length in which the distributor ran backward and forward. Moreover, the use of a mono-rail avoids the serious trouble which has been encountered in the use of two or three parallel tracks, which arises from the liability of the distributor to get somewhat crosswise in traveling, due to the driving wheel or wheels on one track wearing slightly smaller than that or those of another track, or to the accumulation of dirt or grease altering the effective diameter of the wheel or wheels of one track in relation to that or those of another track. The result has been to set up strains, or that one buffer has caught before the other, and several breakages have occurred in consequence. It has been found extremely difficult to get distributors running to-and-fro over rectangular filter beds to run without one end advancing somewhat beyond the other.

To counteract the effect of the wind pressure on a single distributor two distributors or a distributor and a wind screen, both running on the same mono-rail, may be employed opposite to one another and be connected with one another by wire ropes or the like which are guided by suitable guide pulleys.

In order that the invention may be clearly understood and readily carried out, I will proceed to describe, by reference to the drawings herewith, a practical form of the same which is illustrated as applied for the purpose of a filter bed having two sides parallel and the ends semi-circular.

Of these drawings:—Figure 1 shows, to a smaller scale than the remaining figures, a general arrangement of the apparatus. Fig. 2 is a side elevation of the distributor, and a section through the feed trough. Fig. 3 is a plan view of the distributor and one end of the feed trough. Fig. 4 is a view of the apparatus shown by Figs. 1 and 2, as seen looking toward the outer end of the distributor. Fig. 5 is a section taken chiefly in the plane indicated by line $x x$ of Fig. 2, looking toward the trough, a portion of the section being taken in the plane indicated by line $x' x'$ of Fig. 2. Fig. 6 is a longitudinal sectional view of the inner end of the water-wheel, and a side elevation of the bearing at the same end and of a portion of the siphon, showing the lower portion of the siphon in section. Fig. 7 is a plan view to an enlarged scale showing convenient means for automatically varying the widths of the weirs. Fig. 8 is a transverse section taken on line $x x$ of Fig. 7 but is drawn to a still larger scale. Fig. 9 is a transverse section taken on line $x' x'$ of Fig. 7 but simply shows details which are not clearly brought out in Fig. 8. Fig. 10 is a side elevation, partly in section, showing convenient means of slidably mounting the frame in relation to the driving wheel, and; Fig. 11 is a view of such means chiefly in section taken on line $y y$ of Fig. 10.

Referring first to Fig. 1, $a a$ are straight and parallel portions of the mono-rail on which the distributor runs, and $b b$ are semi-circular lengths of the mono-rail which join, respectively, into the ends of the straight portions a . A is the trough to which the sewage or effluent is continuously supplied (through a vertical pipe from below). The trough runs along over the middle of the filter bed, and its ends are shown as semi-circular and concentric with the semi-circular portions b of the mono-rail. B is the distributor or traveling portion of the apparatus, which is carried by suitable wheels which run upon the mono-rail, and is substantially balanced upon such rail. The distributor is shown by full lines as upon a

straight portion of the mono-rail, and by broken lines as upon a curved portion thereof. The distributor is supplied with sewage or effluent through a siphon C which dips down into the trough A.

Referring now to the drawings on Sheets 2 and 3, D D is the water-wheel constructed in two lengths. These lengths have a common axis and are spaced apart somewhat from one another. d is the water-wheel axle which has fixed thereon, in the space between the two lengths of the wheel, a double-flanged wheel e which runs upon the mono-rail $a b$. F is the weir pipe for the water-wheel, and $f f$, etc., the weirs, which are conveniently formed as boxes which are fixed to the weir pipe by means of clip bolts f' . At the opposite side of the water-wheel to that at which the weir pipe F is situated, and parallel therewith, is a pipe E. The pipes F and E connect at each end, respectively, with bridge pipes G G' which are curved to span over the water-wheel D. From the crown of the bridge pipe G' which is at the inner end of the pipes F and E, one leg e' of the siphon C passes up, the other leg e'' of the siphon passing down into the trough A. The pipes F, E, G and G', constitute the main structure of the frame of the distributor. The water-wheel axle d is carried at its ends in bearings h which are fixed to brackets H which are fixed at their upper ends to the bridge-pipes G G', and passing down across the ends of the water-wheel turn in somewhat into the open ends of the wheel. The weight of the water-wheel is thus carried upon the mono-rail through the medium of the double-flanged wheel e , as is also the portion of the weight of the frame which is carried by the axle of the water-wheel. The pipes E and F are connected together at their middles by a transverse member J which is formed with sockets j to receive the ends of the pipes, and the two portions of each pipe communicate with one another through the corresponding sockets. The portion of the member J which connects the sockets at one side of the framing with those at the other, is also preferably formed tubular, so as to give a direct communication therethrough between the pipes E and F. On each end of the member J is pivoted an arm K, and in the outer end of each arm K is swiveled a forked carrier M which carries between its sides a plain wheel k which runs upon the mono-rail. Each carrier M carries also four guide wheels m , two at each side of the rail, which bear against the sides of the rail. These wheels m are conveniently carried by studs m' which are fixed to flanges k' of the lower ends of the fork sides of the corresponding carrier M, and links n are shown as connecting together the opposite sides of the fork as a security against their opening out under

the re-acting pressure of a side of the rail against the guide wheels. As the wheels which are carried by a carrier M pass from a straight portion of the rail to a curved portion thereof, the corresponding arm K turns somewhat inward and the carrier turns somewhat about its swivel axis to allow the guide wheels m to adjust themselves to the curve of the rail. The arms K are connected together, to insure that as one turns inward (or outward again) the other will also turn inward (or outward, as the case may be) to the same degree, by a link N which is pivotally connected at one end with a short arm K' which is rigid with one of the arms K, and projects sidewise from the pivot axis of the arm in a direction slanting backward from the arm, and is pivotally connected at its other end with a corresponding short arm K' of the other arm K, which projects oppositely from the first-mentioned arm K'. Conveniently, the middle portion of the frame is driven by the wheel e of the water-wheel axle through the medium of an anti-friction roller e' which is carried by a hanger e'' of the cross member J of the frame, the periphery of the wheel e rolling against that of the wheel e' ; and in order to insure that the periphery of the wheel e will constantly press against or be close up to the periphery of the wheel e' a wheel e'' , corresponding to the wheel e' , is carried by a hanger from the cross member J immediately at the rear of the wheel e .

The portion of the distributor which is inward of the mono-rail, overbalances the part which is outward thereof. The overbalancing weight is supported by an anti-friction roller P, conveniently carried by a bracket from the leg e' of the siphon, which runs upon the upper edge of the trough A, this edge being preferably widened out to increase its bearing surface. In order to avoid any risk of the apparatus being overbalanced at its outer end, such as by a person mischievously pressing down thereupon, an anti-friction roller P' is carried on an inwardly extending portion of the water-wheel axle d , and prevents any substantial tilting up of the inner end of the distributor by coming against a fillet p' which runs around the under-side of the trough A. Valves R are shown for controlling the flow of sewage or effluent from the siphon to the pipes E and F.

Any suitable provision, such as a valve S which may be raised by side rods s through the medium of a lever s' (which for the purpose may be turned from the position shown by full lines into that shown by broken lines), may be employed for closing the mouth of the siphon when it is desired to stop the apparatus without putting the siphon out of action. The same result may of course be obtained by closing the valves

R, but the use of the valve S is more expeditious, and therefore more convenient if the stop is to be only of short duration.

Any suitable means, such as a valve *t* at the top of the siphon, may be employed for charging it after the siphon has become discharged.

The ends of the distributor are shown as supported from the transverse member J by means of a truss which comprises vertical pillars *t'* and tie-rods *t''*.

To insure an approximately equal distribution of sewage or effluent per unit of area while the distributor is traveling over a curved portion of the rail, it is necessary to alter the proportionate widths of the weirs compared with their proportions when running along a straight portion of the rail. This is automatically effected according to this invention by means of a number of shutters which vary in width and are operated by a bar which is carried by the traveling mechanism and is turned about its axis by the operation of the traveling mechanism in relation to a fixed point, thereby moving the shutters down into positions which in effect narrow the widths of the weirs, or as many of them as required. The operation of narrowing the weirs takes place as the distributor is passing from a straight portion of the rail to a curved portion, and the reverse operation of course takes place as the distributor passes from a curved portion of the rail to a straight portion, this being effected by the reverse action of the traveling mechanism in relation to a fixed point. It may be explained that the middle of the distributor travels slower along the curved portions of the rail than along the straight portions thereof.

Convenient means of automatically varying the widths of the weirs are shown, to an enlarged scale, in plan by Fig. 7, in transverse vertical section, taken on line *v v* of Fig. 7, by Fig. 8, and to a still larger scale, in transverse section taken on line *w' w'* of Fig. 7, by Fig. 9, the last mentioned view simply showing details which are not clearly brought out in Fig. 8.

U is a rod which runs parallel with and is carried from the weir-pipe F. To this rod are fixed shutters, such as *u* which, when the rod is turned in one direction of rotation are brought down partially across the weir openings, leaving the effective openings of the weirs of different widths as required. To the link N before-mentioned is fixed a bracket V through a slot *v* of which passes the outer end of a finger *u'* which is fixed to the rod U. The movement of the link due to the passing of the distributor from a straight portion of the rail to a curved portion moves the finger in a direction which insures that the rod U will turn down the shutters, the reverse movement of the link

due to the passing of the distributor from a curved to a straight portion of the rail insuring the return movement of the rod and the consequent raising of the shutters.

In lieu of the arrangement above described, whereby, in the case of a distributor which is used with a filter bed which is longer one way than the other, the distributor is constantly maintained central upon the rail, the carriages in which are mounted the wheels which directly support the middle of the frame and which also carry the guide wheels, are simply swiveled to parts which are rigid with the frame, and the frame is slidably mounted in relation to the driving wheel which runs upon the rail, so that it can move endwise in relation thereto. This slidable connection is necessary when the said carriages are simply swiveled to parts which are rigid with the frame, owing to the fact that when the distributor is upon a curved portion of the rail the line which passes through the axes of the two swivel joints will be a chord of the curve. This arrangement, however, is not recommended, as that previously described is better.

Convenient means of slidably mounting the frame in relation to the driving wheel are shown, in side elevation, partly in section, by Fig. 10, and, chiefly in section taken on line *y y*, by Fig. 11. A' is a portion of a transverse member of one end of the frame. B' is a bridle or open-sided box which is fixed to one of the bearings *b* of the water-wheel axle and is itself in position between two brackets C' which are fixed to the member A' of the frame. Through the brackets are formed horizontal slots *c'* within which are carried the journals *d'* of an antifriction roller D' which runs against the underside of the upper member of the bridle B'. Both axle bearings are carried in this manner from the ends of the frame, and thus the frame is free to move endwise in relation to the axle bearings, the friction in doing so being minimized by the antifriction rollers.

The invention, as described in its application to a filter bed having parallel sides, is applicable to a case, which sometimes occurs in which the sides of the bed, are not parallel, or if parallel are irregularly curved, or are not parallel and are also irregularly curved. Our improved distributor could be applied with great advantage in such cases, as it could cover the whole or substantially the whole area at a comparatively low cost. In such cases also the widths of the weirs may be automatically regulated, substantially in the manner above described.

Having duly described my invention what I claim and desire to secure by Letters Patent, is:—

1. Apparatus for distributing sewage or sewage effluent upon the surface of a filter

bed, which comprises a continuous mono-rail as the track for the distributor, a water-wheel distributor which is substantially balanced upon the rail, said distributor having
 5 a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously on the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, said mono-rail
 10 running lengthwise of a filter bed which is longer one way than the other, at a distance from one outer edge thereof equal to about half the length of the distributor, then over one end thereof at the said distance from the
 15 outer edge of such end, then back lengthwise of the bed at the said distance from the other side edge of the bed, and then over the other end of the bed at the said distance from the edge of such end, arms pivotally connected
 20 at their inner ends to the frame of the apparatus and wheels connected through the medium of swivels with the outer ends of the arms and bearing against the mono-rail, said arms reversely engaging with one another
 25 whereby as either arm turns in a direction inward or outward the other arm correspondingly turns.

2. Apparatus for distributing sewage or sewage effluent upon the surface of a filter
 30 bed, which comprises a continuous mono-rail as the track for the distributor, and a water-wheel distributor which is substantially balanced upon the rail, said distributor having a conduit through which sewage or
 35 effluent is delivered to the buckets of the water-wheel continuously on the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, said mono-rail running lengthwise of a filter
 40 bed which is longer one way than the other, at a distance from one outer edge thereof equal to about half the length of the distributor, then over one end thereof at the said distance from the outer edge of such
 45 end, then back lengthwise of the bed at the said distance from the other side edge of the bed, and then over the other end of the bed at the said distance from the edge of such end, arms pivotally connected at their inner
 50 ends to the frame of the apparatus, frames pivoted to the outer ends of the arms, wheels mounted in the said frames and running upon the mono-rail, and guide wheels mounted in said frames and bearing against
 55 the sides of the rail, said arms reversely engaging with one another whereby as either arm turns in a direction inward or outward the other arm correspondingly turns.

3. Apparatus for distributing sewage or
 60 sewage effluent upon the surface of a filter bed which comprises, a continuous mono-rail as the track for the distributor, and a water-wheel distributor which is substantially balanced upon the rail, said distributor having
 65 a conduit through which sewage or effluent

is delivered to the buckets of the water-wheel continuously on the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, a driving wheel which runs upon the mono-rail and supports the middle of the water-wheel, and a frame which is independently supported at its middle upon the mono-rail and at its ends supports the water-wheel, said frame being slidably mounted in relation to the
 70 driving wheel. 75

4. Apparatus for distributing sewage or sewage effluent upon the surface of a filter bed which comprises, a continuous mono-rail as the track for the distributor, and a water-wheel distributor which is substantially balanced upon the rail, said distributor having
 80 a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously at the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, a driving wheel which runs upon the mono-rail and supports the middle of the water-wheel, and a frame which is independently supported at
 85 its middle upon the mono-rail and at its ends supports the water-wheel, said frame being slidably mounted in relation to the water-wheel. 90

5. Apparatus for distributing sewage or
 95 sewage effluent upon the surface of a filter bed which comprises, a continuous mono-rail as the track for the distributor, a water-wheel distributor which is substantially balanced upon the rail, said distributor having
 100 a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously at the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, an axle
 105 which carries the water-wheel and is itself supported independently at its middle upon the mono-rail, and a frame which is independently supported as its middle upon the mono-rail and at its ends supports the ends
 110 of said axle.

6. Apparatus for distributing sewage or sewage effluent upon the surface of a filter bed, which comprises a continuous mono-rail as the track for the distributor, a water-wheel distributor which is substantially balanced upon the rail, said distributor having
 115 a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously on the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, said mono-rail running lengthwise of a filter bed which is longer one way than the other, at a distance from one outer edge thereof equal to
 125 about half the length of the distributor, then over one end thereof at the said distance from the outer edge of such end, then back lengthwise of the bed at the said distance from the other side edge of the bed, and then
 130

over the other end of the bed at the said distance from the edge of such end, weirs over which the sewage or effluent flows into the buckets of the water-wheel, and means
5 whereby a substantially even distribution of sewage per unit of area of the filter bed is maintained throughout the entire travel of the distributor.

7. Apparatus for distributing sewage or
10 sewage effluent upon the surface of a filter bed, which comprises, a continuous mono-rail as the track for the distributor, a water-wheel distributor which is substantially balanced upon the rail, said distributor having
15 a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously on the same side thereof, whereby the water-wheel is caused to travel along the mono-rail continuously, said mono-
20 rail running lengthwise of a filter bed which is longer one way than the other, at a distance from one outer edge thereof equal to about half the length of the distributor, then over one end thereof at the said distance
25 from the outer edge of such end, then back lengthwise of the bed at the said distance from the other side edge of the bed and then over the other end of the bed at the said distance from the edge of such end, weirs over
30 which the sewage or effluent flows into the buckets of the water-wheel, regulating devices for controlling the widths of the weirs, and means by which as the distributor deviates in direction the shutters are automati-
35 cally operated to vary the widths of the weir openings.

8. Apparatus for distributing sewage or sewage effluent upon the surface of a filter bed, which comprises a continuous mono-rail

as the track for the distributor, a water-
40 wheel distributor which is substantially balanced upon the rail, said distributor having a conduit through which sewage or effluent is delivered to the buckets of the water-wheel continuously at the same side thereof, where-
45 by the water-wheel is caused to travel along the mono-rail continuously, said water-wheel formed in two lengths with a space between them, and a driving wheel which runs upon the mono-rail and is fixed upon the water-
50 wheel axle in position within said space and is operated by the water-wheel.

9. Apparatus for distributing sewage or tank effluent upon the surface of a filter bed which comprises a mono-rail as the track
55 for the distributor, a water-wheel distributor which is substantially balanced upon the rail, a wheel fixed upon the water-wheel axle and which runs upon the mono-rail and through which the distributor is driven, said
60 distributor having a conduit through which sewage or effluent is delivered to the whole of the buckets of the water-wheel in one operation whereby the water-wheel is caused to travel along the mono-rail, an axle which
65 carries the water-wheel and a frame which is independently supported at its middle upon the mono-rail and at its ends supports the ends of the said axle.

In witness whereof I have hereunto
70 signed my name this 23rd day of December 1910, in the presence of two subscribing witnesses.

SAMUEL JOHN SIGISMUND MILLS.

Witnesses:

ROBERT G. GROVES,
KATHLEEN M. THOMPSON.