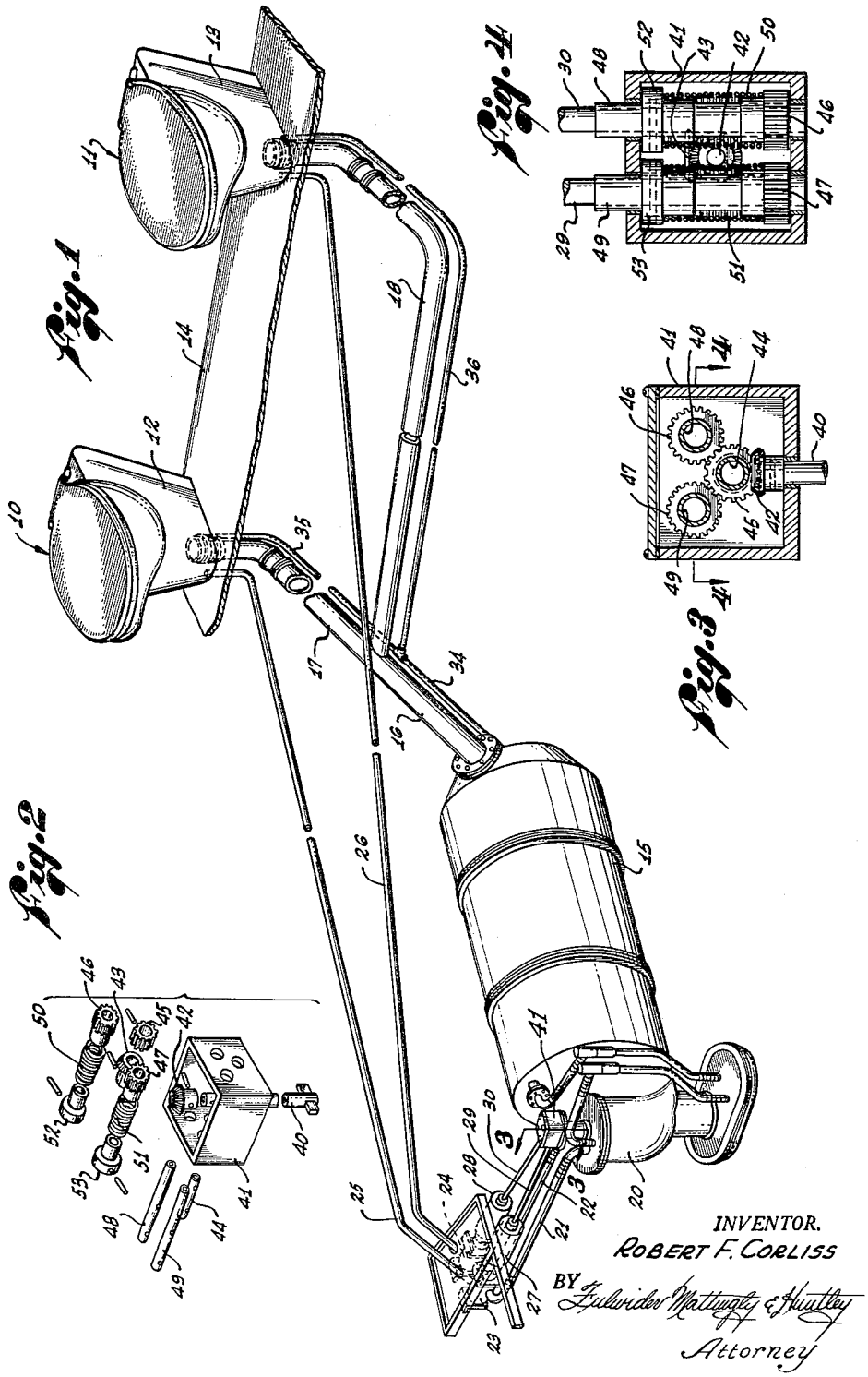
March 5, 1963 R. F. CORLISS 3,079,612

SEWAGE HANDLING APPARATUS

Filed July 6, 1959 4 Sheets-Sheet 1



INVENTOR.
ROBERT F. CORLISS
BY Fulwider Mattingly & Huntley
Attorney

March 5, 1963 R. F. CORLISS 3,079,612

SEWAGE HANDLING APPARATUS

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Fig. 11

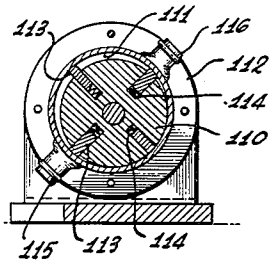
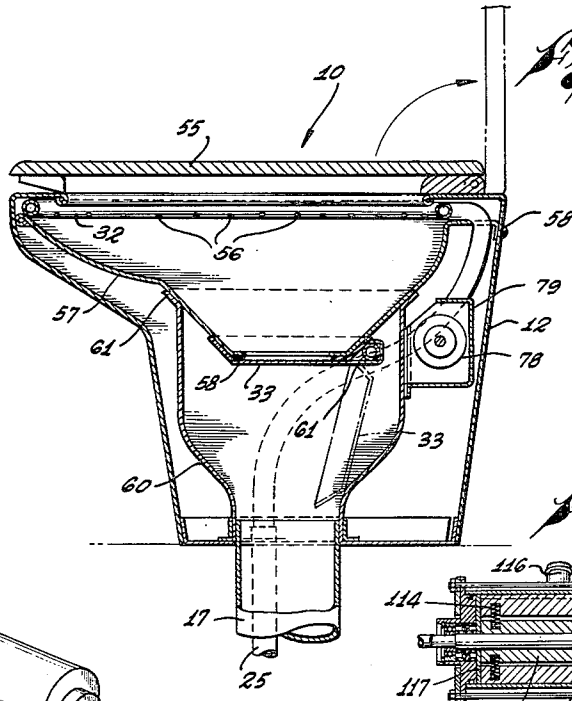


Fig. 5



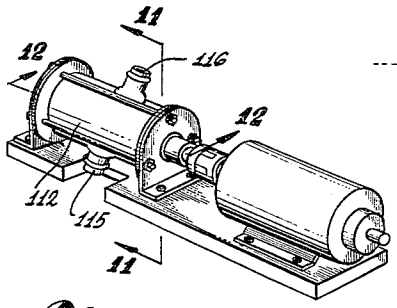


Fig. 10

Fig. 12

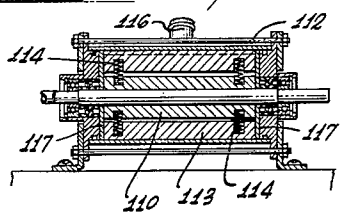
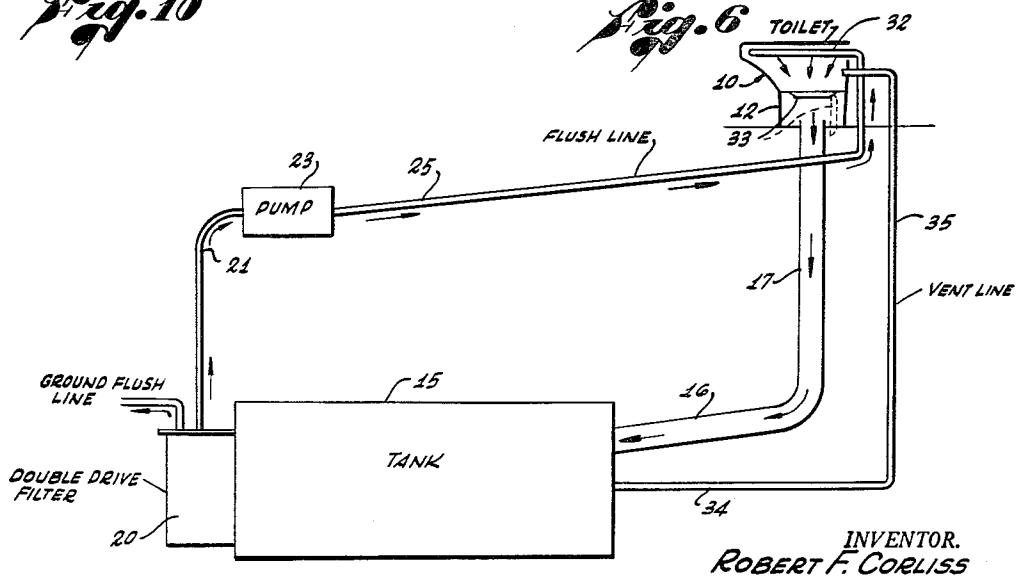


Fig. 6



INVENTOR.
ROBERT F. CORLISS

BY Fulwider Mattingly & Huntley

Attorneys

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SEWAGE HANDLING APPARATUS

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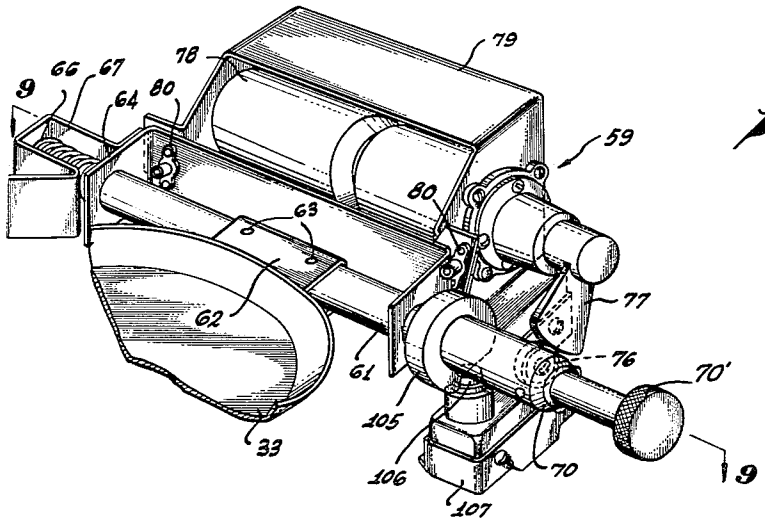


Fig. 7

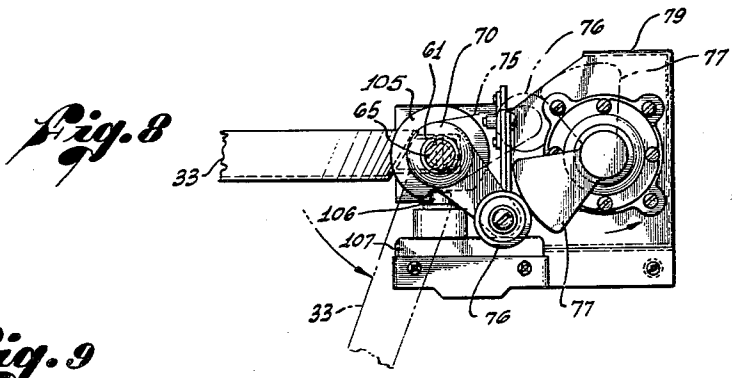
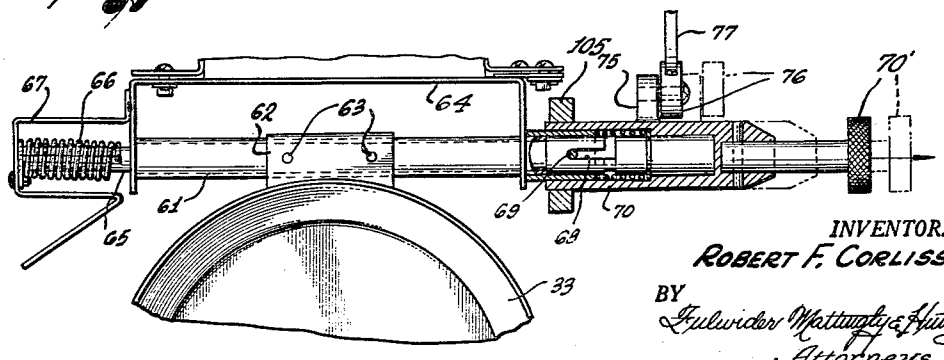


Fig. 8

Fig. 9



INVENTOR.
ROBERT F. CORLISS
BY
Fulwider Mattingly & Huntley
Attorneys

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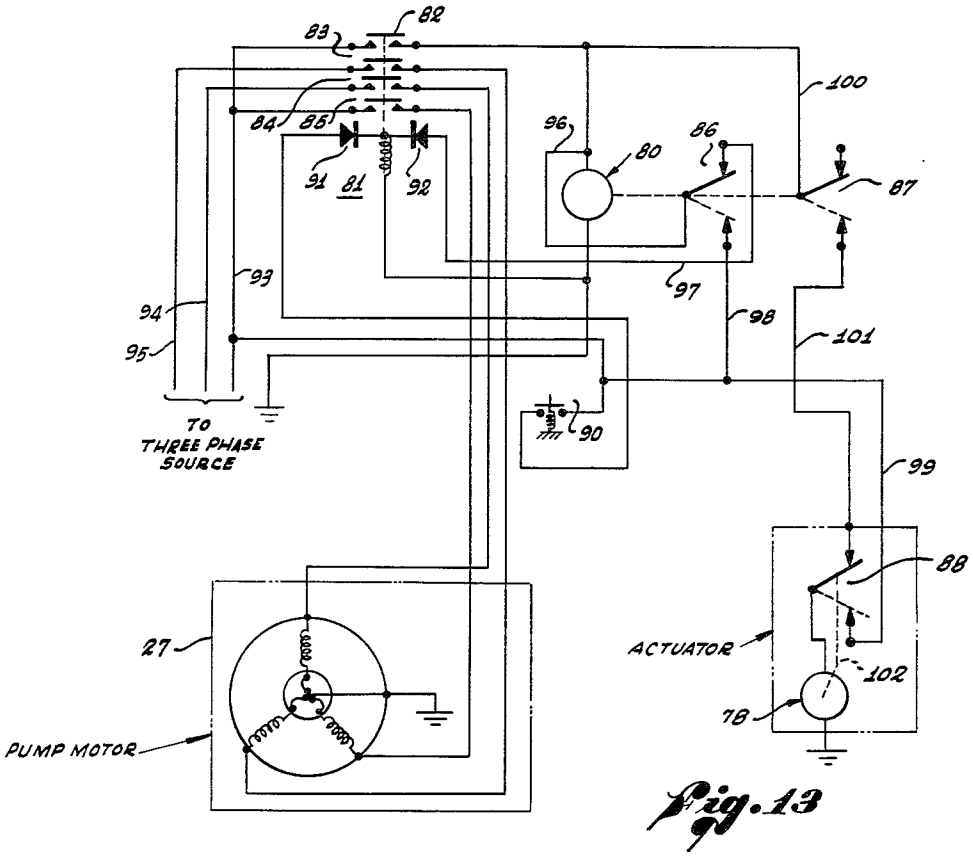


Fig. 13

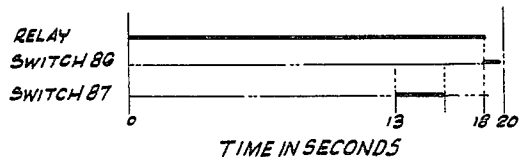


Fig. 14

INVENTOR.
ROBERT F. CORLISS
BY Fulwider Mattingly & Huntley
Attorneys

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3,079,612

SEWAGE HANDLING APPARATUS

Robert F. Corliss, Pasadena, Calif., assignor to Monogram Precision Industries, Inc., Culver City, Calif., a corporation of California

Filed July 6, 1959, Ser. No. 825,111
5 Claims. (Cl. 4—10)

This invention relates to sanitation systems, and more particularly to an improved recirculating sewage system.

More specifically, this invention relates to improvements in sewage handling apparatus of the type employed in vehicles such as trains, aircraft, and the like. Such systems are of the self-contained type, wherein waste matter is retained in the system during a trip. In this connection, chemicals are added to the system for disinfectant and deodorizing purposes. Upon arrival at an appropriate stop, the system is drained and supplied with a fresh supply of water and chemicals.

In sanitation systems heretofore employed in trains and aircraft, there is for each toilet a complete assembly of a tank, filter and pump, wherein the pump forces fluid to be drawn from the tank through the filter and into the toilet bowl, from which the fluid flushes waste matter into the tank. Such apparatus is generally satisfactory from the standpoint of sanitation, but is objectionable on various other grounds.

In a typical construction, the toilet assembly, tank, and associated filter and pump devices are built into a complete unit and installed in the lavatory compartment. Such units are bulky and occupy an undesirable amount of space, which of course is at a premium in trains and aircraft.

Compartment space provided for restrooms is generally small, and therefore the number of toilet units that can be accommodated in a compartment is restricted, and it is often found that the few units are insufficient to accommodate the number of passengers requiring the use of a restroom.

It is an object of this invention to provide an improved sanitation system for aircraft, trains and the like, which occupies a minimum of space.

Another object of this invention is to provide a closed loop sanitation system in which two or more toilet assemblies are operated by respective pumps all connected to a common tank and filter arrangement.

It is a further object of this invention to provide, for a sanitation system, a unique self-priming pump.

A still further object of this invention is to provide a sanitation system having a plurality of toilet assemblies connected to a common fluid supply, having unique means for timing the operation of each pump and toilet assembly.

The above and other objects and advantages of this invention will become apparent from the following description taken in conjunction with the accompanying drawings of an illustrative embodiment thereof, in which:

FIGURE 1 is a partial perspective view of a pair of toilet bowl assemblies in fluid connection with a common fluid supply, showing the arrangement of respective pumps for actuating a common filter preparatory to forcing fluid into the toilet bowls;

FIGURE 2 is an exploded view of the parts of the filter drive mechanism;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 1, showing the driving connection from each of the pump motors to the shaft for operating the filter;

FIGURE 4 is a sectional view taken along the line 4—4 of FIGURE 3, showing how the driving connections from the pump motors are adapted for slipping

engagement to insure operation of the filter whether one or both motors are operating;

FIGURE 5 is a sectional side view of the toilet bowl assembly, showing the arrangement therein of the cam-operated pan for allowing build up of fluid in the toilet bowl preparatory to flushing;

FIGURE 6 is a flow diagram showing the principle of operation of my sanitation system;

FIGURE 7 is a perspective view of the actuator for the pan, showing the arrangement of the cam for allowing the pan to drop and then raising it to the horizontal position following the flushing cycle;

FIGURE 8 is an end elevation view of the actuator assembly, showing more clearly how the cam controls the position of the pan about its pivot;

FIGURE 9 is a longitudinal sectional view taken along the line 9—9 of FIGURE 7, showing the spring biasing means for the shaft on which the pan is mounted, and also showing the arrangement of a manual release knob for positioning the shaft against operation by the cam, thereby to permit the pan to remain in a lowered position;

FIGURE 10 is a perspective view of the motor and pump assembly used in the system;

FIGURE 11 is a sectional view taken along the line 11—11 of FIGURE 10, showing outwardly biased radially slidable vanes in the rotor;

FIGURE 12 is a longitudinal sectional view taken along the line 12—12 of FIGURE 10, showing the mounting of discs in abutment with the end faces of the rotor for effecting self-priming action of the pump;

FIGURE 13 is a schematic diagram of electrical control means for timing the operations of the motor and actuator assemblies; and

FIGURE 14 is a chart which illustrates the on and off conditions and periods of operation of certain relays and switches of the control circuit of FIGURE 13, to aid in explaining the operation of the system of my invention.

Referring to FIGURE 1, there is shown a pair of toilet assemblies 10, 11, having housings 12, 13 secured to a platform 14. Disposed below the platform 14 is a tank 15 having a pipe connection 16 at one end with which the housings 12, 13 are in fluid communication, as by means of connections 17, 18. At the opposite end of the tank 15 is a filter 20 having fluid connections 21, 22 to a pair of pumps 23, 24, such pumps having respective flush lines or pipe connections 25, 26 to the interiors of the toilet housings 12, 13. The pumps 23, 24 are adapted for operation by respective motors 27, 28, which also have shaft connections 29, 30 to a gear box 41 for driving or operating the filter 20.

The flow diagram of FIGURE 6 illustrates the operation of my system, reference being made to parts associated with the toilet assembly 10 by way of example. When it is desired to flush the toilet, a switch (to be described hereinafter) is actuated to start the pump 23. The pump draws fluid from the filter 20 and forces it through the flush line 25 where it enters a flush ring, generally indicated at 32, in the upper portion of the housing 12. Disposed within the housing 12 is a pan 33 which is normally in a closed position wherein to prevent fluid entering the upper portion of the housing 12 from passing to the lower portion thereof.

After a predetermined length of time, when a quantity of fluid has accumulated in the upper portion of the housing 12, the pan 33 is opened so as to permit the fluid and waste material to pass through the bottom portion of the housing 12 and the connections 17 and 16 to the tank 15. After an additional short period of time to permit additional fluid passing through the flush line 25 to

thoroughly rinse the interior of the housing 12, the pan 33 is closed.

As shown in both FIGURES 1 and 6, a vent line 34 from the tank 15 is connected, as by a connection 35, to the upper portion of the housing 12. In a similar manner, a connection 36 is provided between the connection 34 and the upper portion of the housing 13.

FIGURES 1 and 6 illustrate still another advantage of my system, which is that the fluid carrying lines 16, 17, 21, 25, are all oriented below the toilets so that whenever the toilets are not in use, the fluid drains from all the lines and pumps into the tank 15. In this regard, the weight of the fluid in the lines 25, 26 above the pumps 23, 24 would drive the pumps backwards to accomplish draining when the motors 27, 28 are not operating. By virtue of such arrangement, I am able to locate the tank 15 beneath the floor 14 of the compartment, i.e., to remove the tank 15 altogether from the interior of the quarters within which the toilets 10, 11 are located. This means, for example, I can locate the tank 15 below the passenger compartments in train coaches and aircraft; due to the gravity feed of fluid in the lines back to the tank 15, no freezing can occur (as in cold weather) which might cause the lines to burst. Due to the considerable quantity or mass of fluid and waste matter in the tank 15, fluid in the tank does not freeze.

An additional advantage to being able to locate the tank below the floor of the compartment, and also being able to operate two or more toilets from the common tank, is that my system is considerably less expensive than prior art sanitation systems. In the coach of a train, for example, I provide one tank 15 below the floor of the passenger compartment, and make connections therefrom to toilets located at both ends of the coach, or to toilets located in adjacent compartments.

The filter 20 is a mechanical, self-cleansing type filter, typical of which is the so-called Cuno filter. This type of filter is one in which a plurality of spaced rotatable discs and stationary cleaner blades co-act to grind waste matter to extremely small particles, e.g., less than 300 micron. The drive shaft for the filter 20 is shown at 40 in FIGURES 2 and 3. The upper end of the shaft 40 extends into a gear box housing 41, and a miter gear 42 is secured to the upper end of the shaft 40. The miter gear 42 is in meshing engagement with another miter gear 43 that is mounted on a horizontal shaft element 44 centrally located within the housing 41. Also supported on the shaft element 44 is a gear 45 which is in meshing engagement with two gears 46, 47 mounted on respective horizontal shaft elements 48, 49 supported in the housing 41. Also mounted on the shaft elements 48, 49 are compression springs 50, 51 and driving sleeve elements 52, 53.

As shown in FIGURE 4, the shaft connections 29, 30 from the motors 27, 28 are inserted in the ends of the shaft elements 48, 49 for driving such elements. The opposite ends of the springs 50, 51 abut the gears and driving sleeve elements mounted thereon, and force such elements apart, i.e., against the walls of the housing 41 at the opposite ends of the shaft elements 48, 49. By virtue of the spring elements, any rotation of the associated driving sleeve element is transmitted through the spring to the gear, thereby effecting rotation of the gear 45. Such rotation of the gear 45 imparts rotation to the shaft 40 through the miter gears 42, 43.

The above-described filter drive assembly has the unique advantage that operation of only one of the motors 27, 28 effects rotation of the filter drive shaft 40. Referring to FIGURE 4, if the shaft 29 is turning and the shaft 30 is stationary, rotation of the gear 45 due to turning of the gear 47 effects rotation of the gear 46. However, there is no interaction between the gear 46 and the shaft 30, because the spring 51 slips with respect to the associated sleeve element. Thus, operation of the motor 27 effects turning of the filter shaft 40 without any interference. In a similar manner, rotation of only the shaft 30 effects operation of the gear shaft 40 without imparting any rotation to the shaft 29.

Additionally, my unique filter drive assembly permits operation of the filter 20 when both the motors 27, 28 are operating, but without any interaction between the two. Again referring to FIGURE 4, assume that both of the shafts 29, 30 are rotating; the shaft having the initial angular movement imparted thereto imparts rotation to the filter shaft 40 in the manner previously described, and the spring associated with the other shaft and driving element merely slips with respect to the associated gear. Thus, it will be seen that both of the toilet assemblies 10, 11 can be set into operation simultaneously, and the filter 20 is operated properly. Since each of the pumps 23, 24 is connected to the filter 20, they simultaneously draw fluid from the filter for flushing the associated toilet assembly.

The construction of the toilet assembly of my invention is shown more clearly in FIGURE 5, which illustrates the details of the toilet assembly 10. The flush ring 32 previously mentioned in connection with FIGURE 6 is located in the upper portion of the housing 12 below the lid 55. The ring 32 is provided with a plurality of openings 56 through which fluid forced through the flush line 25 passes, such openings 56 being dimensioned and oriented so as to direct the fluid with considerable force at an angle against the sides of a bowl element 57 which is anchored, as at 58, to the housing 12. This imparts a vigorous swirling motion to the fluid as it accumulates in the bowl, which has the effect of aerating the fluid and making it foamy or bubbly. This foaming helps to give the liquid a light appearance. In addition, if desired, a dye may be mixed with fluid in the tank to give the fluid in the bowl a more pleasing color.

The pan 33, previously mentioned in connection with FIGURE 6, is shown in FIGURE 5 to be disposed below the lower end of the bowl 57. The opening at the lower end of the bowl 57 is its smallest dimension, whereby to insure that fluid passing into the bowl 57 from the flush ring 32 is caused to cover the entire inner surface of the bowl 57 and wash off any waste particles.

The pan 33 in one position, as shown in solid lines in FIGURE 5, forms a closure element for the lower end of the bowl 57. The pan 33 is disposed below the lower end of the bowl 57, and, when in closure position against such lower end, abuts a ring seal 58 secured to the lower end of the bowl 57. With this seal arrangement, I prevent inadvertent leakage of fluid from the bowl 57 into the lower portion of the housing 12. Also, the seal 58 serves as an odor trap, to prevent any offensive odors from the tank passing up into the bowl 57.

Disposed in the lower portion of the housing 12 is a funnel element 60 which has an enlarged upper end extending above the pan 33 and abutting the outer surface of the bowl 57. The smaller end of the funnel element 60 is adapted to receive the upper end of the discharge pipe connection 17 to the tank.

The pan 33 is secured to a shaft 61 which is adapted for angular movement (counterclockwise in FIGURE 5) to move the pan clear of the lower end of the bowl 57 so as to permit fluid and waste in the bowl to flow through the funnel element and connection 17 into the tank. In this connection, I employ control means to be described hereinafter for holding the pan 33 in the closure position until a predetermined quantity of fluid from the flush ring 32 has accumulated in the bowl, and then suddenly moving the pan 33 away from its closure position to allow all the fluid and waste matter to pass through the funnel element 60. The abrupt opening of the lower end of the bowl 57 results in a swirling action of the fluid, which aids in moving the waste matter to the center of the opening. Such control means also keeps the pan 33 in the open position for a predetermined period of time while fluid continues to pass into the bowl from the flush ring 32, for additional flushing and cleansing of the in-

terior of the bowl 57. Thereafter, the pan 33 is moved back to the closed position.

FIGURES 7–9 show an actuator mechanism 59 for positioning the pan 33. Referring to FIGURES 7–9 along with FIGURE 5, a shaft 61 to which the pan 33 is secured is a hollow sleeve element which is disposed within the upper portion of the funnel element 60. As shown, the pan 33 is provided with an integral strap 62 which is secured as by pins 63, to the sleeve 61. The sleeve 61 is supported at its ends in a U-shaped bracket 64.

Extending through the sleeve 61 is a shaft rod 65, which at one end (the left-hand end as seen in FIGURE 9) is slotted to receive one end of a coil spring 66. The other end of the coil spring 66 is secured in fixed spaced relation to the bracket 64, as by being connected to a small bracket element 67 integral with the bracket 64. Adjacent its opposite end, the shaft 65 is provided with a right-angle slot 68 to receive a pin 69 which is fixed within a short sleeve element 70 that surrounds the shaft 65. When the pin 69 is in the axial portion of the slot 68, the sleeve 70 is locked to the shaft. When the sleeve 70 is moved to the right, as indicated by the dotted line positions in FIGURE 9, to locate the pin at the transverse portion of the slot 68, the sleeve 70 is freed from locking engagement with the shaft 65. A handle or knob 70' on the sleeve 70 is provided for moving the sleeve between these positions.

Normally the spring 66 urges the shaft 65 in a direction which would move the pan 33 to the open position, and when the sleeve 70 is not locked to the shaft 65, the weight of the pan and the tension of the spring 66 function to quickly drop the pan to the open position.

To effect operation of the sleeve 70 to control movement of the shaft 65, I provide the sleeve 70 with an integral arm 75 and a bearing element 76 rotatably mounted on the end of the arm 75. When the sleeve 70 is locked to the shaft 65, the arm 75 is in a position wherein a fan-shaped cam element 77 engages the bearing 76. The cam 77 (see FIGURE 7) is mounted for rotation by a motor 78 which is supported in a housing 79 immediately behind the bracket 64. As shown, the bracket 64 is secured to the housing 79.

Referring to FIGURE 8, the cam 77 is arranged so that when the center portion thereof engages the periphery of the bearing 76, the pan 33 is in the closed position; the arm 75 and bearing 76 are disposed below the horizontal in this position of the pan. The motor 78 rotates the cam 77 in a direction (counterclockwise in FIGURE 8), and when the cam clears the bearing element 76, the pan 33 is freed to be dropped to the open position, due to the action of the spring 66. In the open position of the pan 33, the arm 75 and the bearing 76 are above the horizontal. Continued rotation of the cam 77 eventually results in one edge thereof engaging the bearing 76 so as to effect clockwise movement of the bearing 76, the arm 75, the sleeve 70, the shaft 65, and the sleeve 61, thereby causing the pan 33 to move upwardly toward the closed position. Continued movement of the cam 77 to the position shown in FIGURE 8, wherein its center portion engages the bearing member 76, effects complete closeure of lower end of the bowl 57 by the pan 33.

As previously mentioned, the pan 33 is held in the closed position during the flushing cycle until a predetermined quantity of fluid has been injected into the upper portion of the bowl 57, and then the pan 33 is dropped to the open position. To this end, I synchronize the operations of the pump motor and the actuator motor 78 by control circuit means as illustrated in FIGURE 13.

Referring to FIGURE 13, I show the pump motor 27 as adapted to be driven from a three-phase source of voltage, and the actuator motor 78 adapted to be driven from a single phase source. Control of the complete flushing cycle is effected through a timer motor 80, a relay 81 having four sets of contacts 82—85, a pair of switches 86, 87 operated by the timer motor 80, and a switch 88 operated by the actuator.

A pushbutton switch 90 is provided to start the flushing cycle. When the pushbutton switch is momentarily closed, power is supplied to the pump motor 27. To this end, the coil of the relay 81 is connected between the junction of a pair of back-to-back diodes 91, 92 and ground, with one of the diodes 91 connected in the forward direction between one lead 93, of three output leads 93, 94, 95 from a three-phase source, and one end of relay coil; the other end of the relay coil is connected to ground.

Thus, closing the pushbutton switch 90 causes the relay 81 to be energized, whereupon its various sets of contacts 82—85 are closed. The closure of the relay contacts 83, 84, 85, connects the output leads 93, 94, 95 from the three-phase source to the pump motor 27 to effect its operation. Closure of the pair of relay contacts 82 causes the timer motor, which as shown has a ground connection, to be set into operation.

In my control circuit, the relay 81 is kept energized, so as to keep the pump motor 27 and the timer motor 80 operating after the pushbutton switch 90 is released. To this end, I provide a connection 96 between the timer motor and the movable arm of the switch 86. As shown, the arm of the switch 86 is normally in engagement with a contact that is connected, as through a lead 97, in circuit between the diode 92 and the coil of the relay 81. Thus, upon closure of the pair of switch contacts 82, the circuit for maintaining the coil of the relay 81 energized is traceable through the lead 93, the switch contacts 82, the lead 96, the switch 86, the lead 97, the diode 92, and the coil of the relay to ground.

In the control circuit of my invention, switch 86 has a contact connection 98 directly to the voltage lead 93. The switch 88 also has a contact connection 99 directly to the voltage lead 93. The switch 87 has a contact connection 100 to the switch contacts 82, and the switches 87, 88 have a common contact connection 101. When the switch 87 is in the dotted line position, the switch 88 is in the solid line position shown, whereby the actuator motor 78, which is connected between the switch arm of the switch 88 and ground, is connected between the signal lead 93 and ground. For moving the switches 86, 87 to either of their positions, the timer motor 80 may be provided with respective cams (not shown) for operating the contact arms.

The switch 87 is moved to the dotted line position by the timer 80 at a predetermined instant following the beginning of the flushing cycle. This establishes operation of the actuator motor 78, which, as indicated at 102, is mechanically coupled to the arm of the switch 88 to move it to the dotted line position shown, thereby to directly connect the motor 78 to the signal lead 93 through the connection 99.

After a predetermined interval of time, the switch 87 is again opened, and at a subsequent period or instant of time the switch 86 is moved to its dotted line position. In this position of the switch 86, a direct connection is established between the lead 96 and the signal lead 93. This is necessary in order to keep the timer 80 operating, because movement of the switch 86 to its dotted line position breaks the circuit connection through the relay 81, thereby de-energizing the relay and opening the several pairs of contacts 82—85.

The timer 80 and the actuator motor 78 continue to operate for a brief interval of time to the end of the flushing cycle, at which time the timer 80 returns the switch 86 from the dotted line position to the solid line position shown, and the actuator motor 78 permits the switch 88 to return to its solid line position. As will be seen, the return of the switches 86, 88, to the solid line positions break the connection from the signal lead 93 to both the timer motor 80 and the actuator motor 78.

FIGURE 14 illustrates the timing cycle above de-

scribed in connection with the circuit of FIGURE 13. The timer motor **80** is set to operate for a predetermined period of time, e.g., twenty seconds. Immediately upon actuating the pushbutton switch **90**, the relay **81** is energized, and remains energized for a period of approximately 18 seconds. After thirteen seconds past the start of the flushing cycle, the switch **87** is actuated to establish operation of the actuator motor **78**. Referring to FIGURE 7 along with FIGURES 13 and 14, this causes the cam **77** to rotate free of the bearing **76**, thereby to allow the pan **33** to swing abruptly downwardly to the open position. At the end of 18 seconds, the relay drops out and the switch **86** is actuated to keep the timer motor operating along with the actuator motor **78**. By the end of the twenty seconds time interval, the cam **77** has reached the position on the bearing element **76** in which the pan **33** is in the closed position.

As previously indicated, the actuator motor **78** effects operation of the switch **88**. How this is accomplished is shown most clearly in FIGURES 7 and 8. As shown in FIGURE 7, a cam element **105** is secured on the sleeve **70** adjacent the bracket **64**, and a pushbutton **106** extending from a switch housing **107**, is positioned directly beneath the cam **105**. In the closed position of the pan **33**, the cam **105** is in a position such that the pushbutton **106** is biased outwardly. In this position of the pushbutton **106**, the switch **88** (see FIGURE 13) is in the solid line position. When the cam **77** clears the bearing **76** so as to permit the pan **33** to drop to the open position, the consequent rotation of the sleeve **70** effects rotation of the cam **105** so as to depress the pushbutton **106**. In its depressed position, the pushbutton **106** actuates the switch **88** so as to place it in the dotted line position shown in FIGURE 13.

As previously mentioned, the pumps **23**, **24** are self-printing. Referring to FIGURES 10–12, which show the details of construction of one of the pumps **23**, the pump rotor **110** is mounted on an axis parallel to the axis of the cylindrical opening **111** within the pump housing **112**. The rotor **110** has two pairs of diametrically opposed radial slots therein, in which respective impeller blades **113** are slidably mounted. Each of the impeller blades **113** is biased outwardly against the inner wall of the housing, as by springs **114**. With such arrangement, I insure against any fluid or particles passing around the outer edges of the impellers **113**, and also provide that any fluid entering the housing, as at a lower port **115**, and carried around between the adjacent blades **113** to an upper port **116**, will not be lost or allowed to flow around the outer edges of the blades **113**. However, when the rotor **110** is not being driven by a motor, as when the toilets are not in use, the weight of the fluid draining back through the upper port **116** is sufficient to overcome frictional drag and rotate the rotor to permit fluid drainage through the lower port **115**.

To make the pumps self-priming, I also insure against any equalization of pressures between different pairs of impeller blades, by preventing the flow of any fluid around the ends of the rotor **110**. To this end, and referring to FIGURE 12, the end faces of the rotor are made smooth, and I provide disc elements **117** with smooth surfaces in frictional engagement with the end faces of the rotor **110**. Furthermore, the discs **117** are of the diameter of the opening **111** in the housing **112**. By such arrangement, there is no fluid communication around the end faces of the rotor **110**, between spaces defined by different pairs of impellers, so that immediately upon any slight rotation of the rotor **110**, there is a positive pressure differential between different chambers. Thus, the pump structure of my invention begins to operate immediately upon rotation of the rotor **110**. By thus avoiding delay of the desired functioning of a pump, as is occasioned with the use of prior art pump constructions, I am able to maintain an accurately controlled timing cycle for my sanitary systems.

While the foregoing describes a particular embodiment of my invention, it will be appreciated that various modifications can be made therein without departing from the spirit and scope of my invention. Accordingly, I do not intend that my invention be limited, except as by the appended claims.

I claim:

1. A closed loop sanitation system comprising: a reservoir for fluid containing a disinfectant; a receptacle having an opening into which sewage may be deposited, said receptacle having an outlet connection to said reservoir; a movable partition in said receptacle being movable to a first position to prevent sewage passing to said outlet connection, and to a second position wherein sewage can pass to said outlet connection; means for positioning said partition in either of said positions; means for drawing fluid from said reservoir and forcing it into said receptacle; and control means for causing said positioning means to normally hold said partition in said first position and to move said partition to said second position after a predetermined time period has elapsed since entry of fluid into said receptacle, so that sewage deposited in said receptacle is quickly washed into said reservoir, said control means also controlling said fluid drawing means for causing fluid to continue to flow into said receptacle for a predetermined length of time following movement of said partition to said second position.

2. In a toilet structure having a receptacle mounted in the upper end of the toilet housing, and a closure element to be moved between a first position of closure against the lower end of the receptacle and a second position wherein it is clear of such lower end, an actuator for the element comprising: a sleeve secured to the closure element; a shaft extending through said sleeve, said shaft and sleeve being adapted for unitary angular movement; a shaft control element releasably keyed to said shaft; a cam normally engaging said shaft control element so that said shaft and sleeve are held in a position wherein the closure element is in its first position; and time-controlled means for driving said cam to effect angular movement of said shaft and sleeve to position the closure element in its second position.

3. In a toilet structure having a receptacle mounted in the upper end of the toilet housing, and a closure element to be moved between a first position of closure against the lower end of the receptacle and a second position wherein it is clear of such lower end, an actuator for the element comprising: a sleeve secured to the closure element; a shaft extending through said sleeve, said shaft and sleeve being adapted for unitary angular movement; a shaft control element releasably keyed to said shaft; a cam normally engaging said shaft control element so that said shaft and sleeve are held in a position wherein the closure element is in its first position; means for driving said came to effect angular movement of said shaft and sleeve to position the closure element in its second position; and timing means for said driving means to cause said cam to actuate said shaft control element so as to return the closure element to its first position after a predetermined period of time in its second position.

4. In a sediment filter having a shaft for operating the filter, means for operating the shaft from a pair of motors comprising: a housing into which the end of the shaft extends; a first gear on said end of the shaft; a second gear in mesh with said first gear, said second gear being mounted on a first shaft in said housing; a pair of shafts in said housing parallel to said first shaft; a second gear on said first shaft; a gear on each of said pair of shafts in mesh with said second gear; a driving element on each of said pair of shafts for connection to a respective motor; and spring means intermediate each driving element and the associated gear for transmitting rotation of the driving element to such gear, the spring means for each driving element being adapted to slip with respect to its gear when its driving element is not operating and the other driving element is operating.

5. A closed loop sanitation system comprising: a single reservoir for fluid containing a disinfectant; a plurality of units into which sewage may be deposited, each of said units being connected to said single reservoir; a pumping means for each unit for drawing fluid from said reservoir and forcing it into the respective unit so as to flush sewage deposited in said unit into said reservoir; a single filter means intermediate said plurality of pumping means and said reservoir for converting sewage present in the fluid drawn from said reservoir into minute particles, said filter means including a drive shaft, a housing into which the end of said drive shaft extends, a first gear on the end of said drive shaft, a second gear enmeshed with said first gear, said second gear being mounted on a first shaft within said housing, a plurality of shafts in said housing parallel to said first shaft, a second gear on said first shaft, a gear on each of said plurality of shafts enmeshed with said second gear, a driving element on each of said plurality of shafts for connection to a respective pump motor, and spring means intermediate each driving element and the associated gear for transmitting rotation of the driving element to

such gear, the spring means for each driving element being adapted to slip with respect to its gear when its driving element is not operating and at least one of the other driving elements is operating; and a plurality of motors for operating said pumping means and said filter means.

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