United States Patent

[11] 3,583,412

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[45] Patented **June 8, 1971**

[54] **AUTOMATIC WASHING UNIT FOR STORAGE TANK OR THE LIKE**
2 Claims, 7 Drawing Figs.

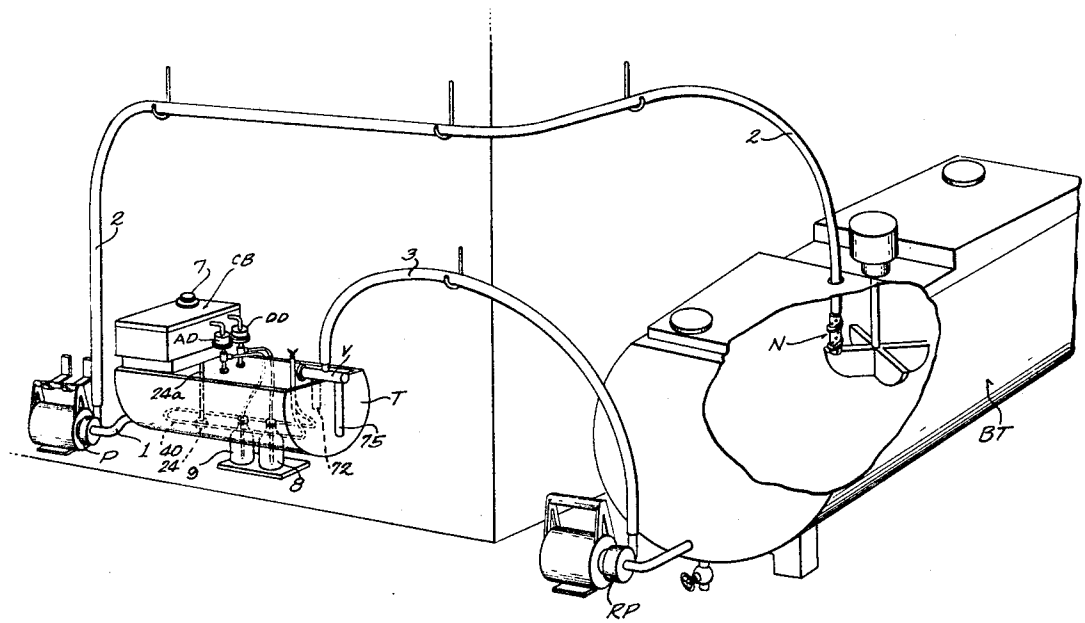
[52] **U.S. Cl.** **134/57,** 134/168
[51] **Int. Cl.** **B08b 3/02,** B08b 9/08
[50] **Field of Search** 134/57, 58, 168, 176

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ABSTRACT: Washing equipment for automatically washing storage tanks, for example, such as milk storage tanks used in the dairy industry. The equipment includes automatic controls for providing a series of cycles for washing the tanks, such as a first rinse cycle, a detergent washing cycle, and a final rinse cycle. The equipment continually passes either the rinse water or the washing solution through the vessel being cleaned and does not at any time store such cleaning liquid in the tank during the cleaning operation.



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SHEET 1 OF 3

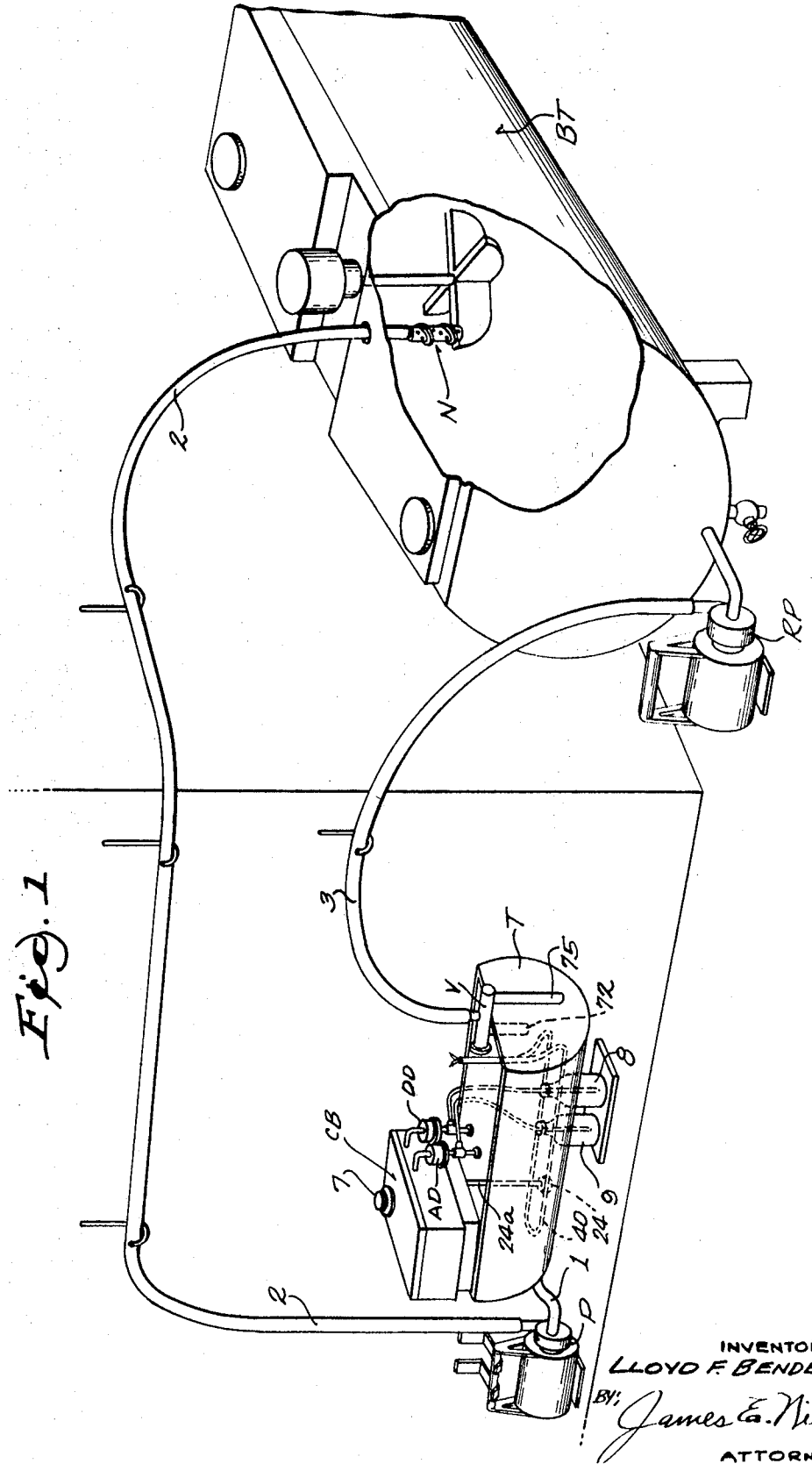


Fig. 1

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Fig. 2

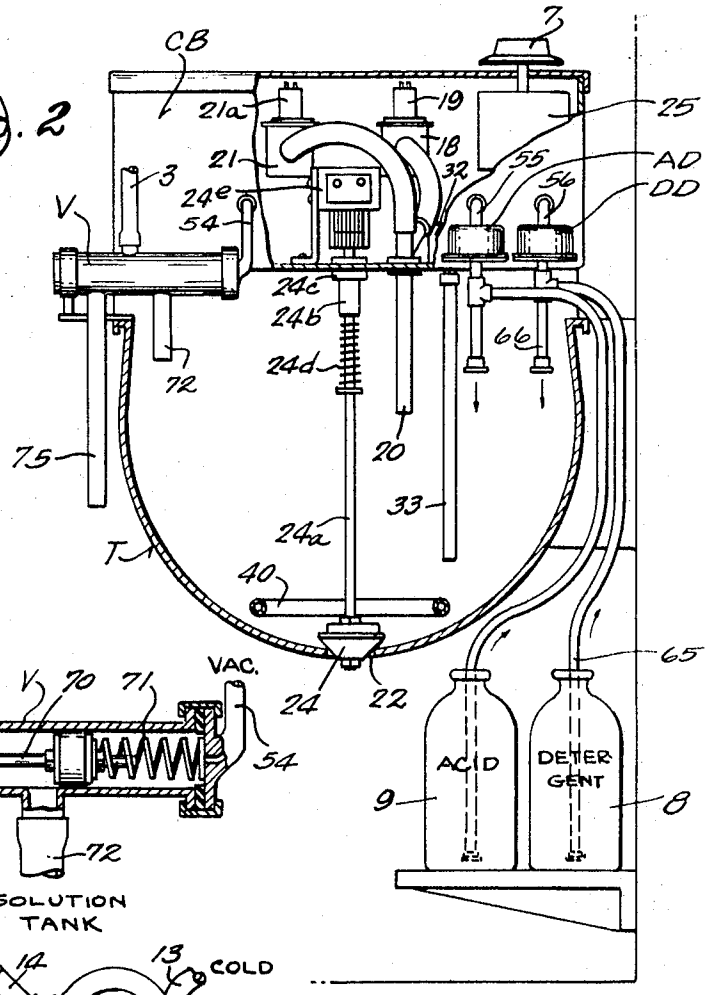


Fig. 3

Fig. 4

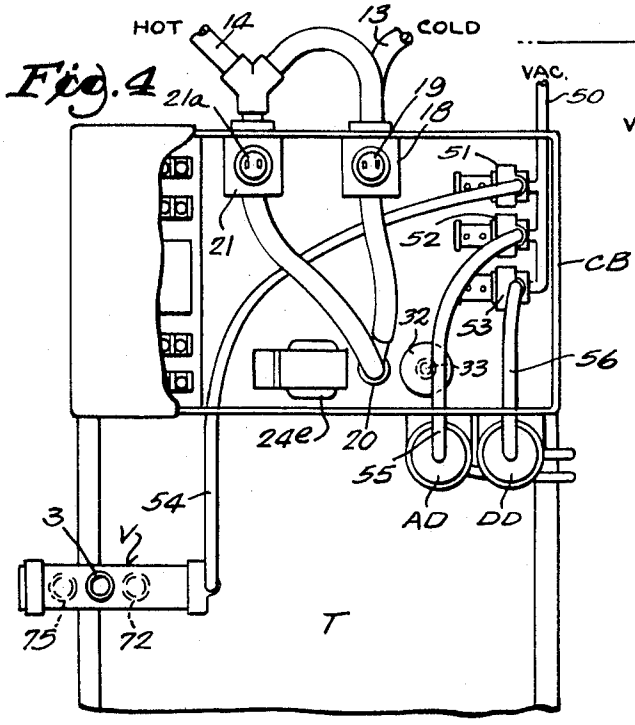
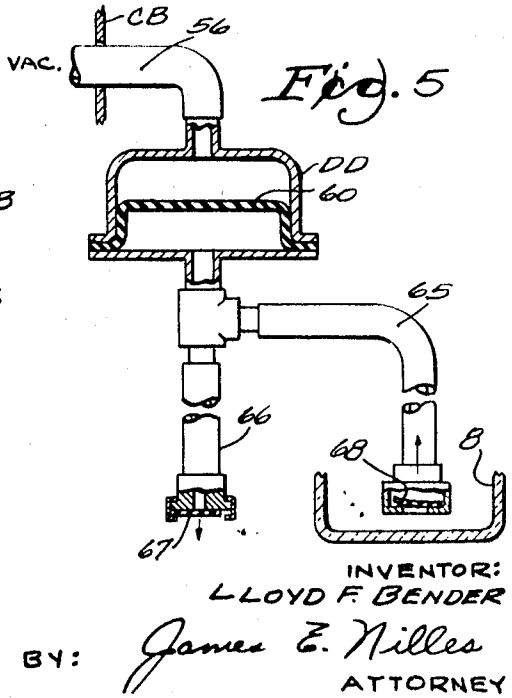


Fig. 5



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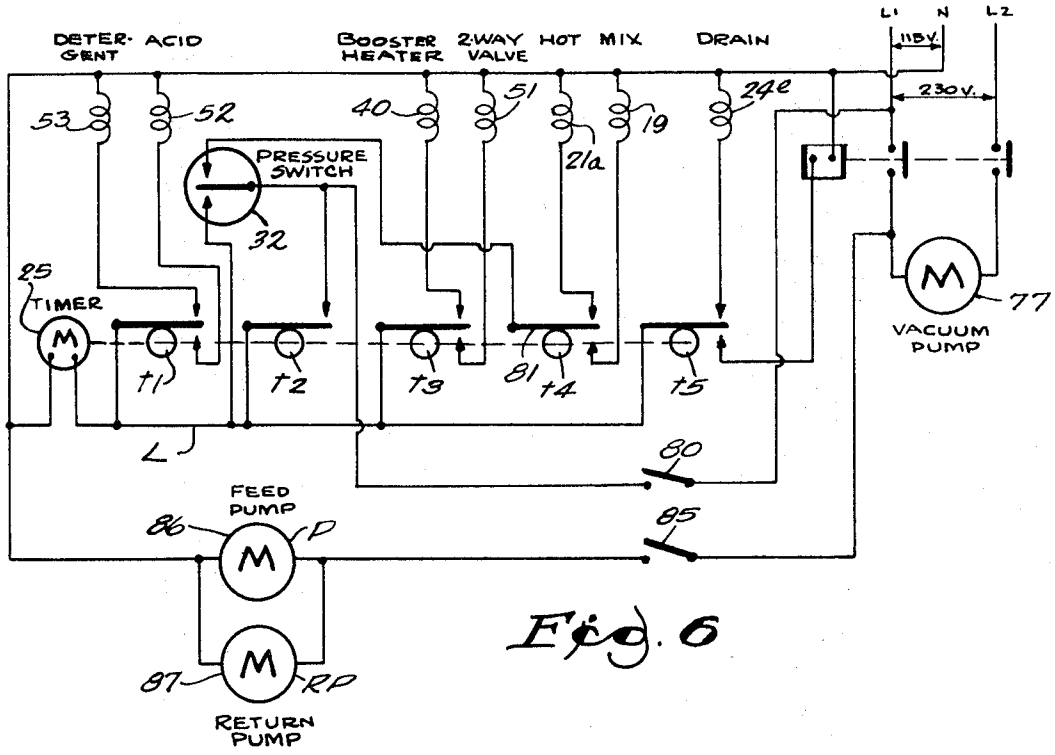


Fig. 6

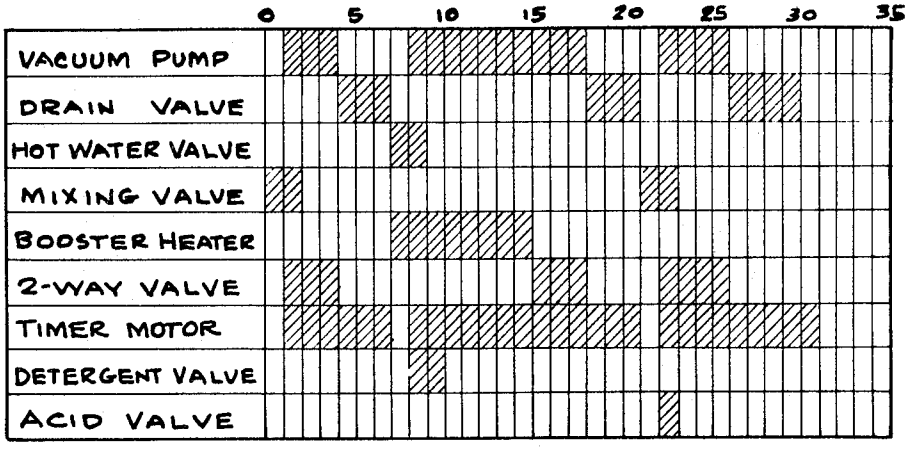


Fig. 7

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AUTOMATIC WASHING UNIT FOR STORAGE TANK OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to means for cleaning bulk tanks for the storage of liquid such as milk, and more particularly it relates to means for providing automatic washing of such a tank without attention on the part of the operator.

Many prior-art devices of this general character have been proposed, but most of them have been very complex, required numerous parts to be serviced and cleaned, and furthermore did not provide a thorough and sanitary cleaning action.

The present invention is in the nature of an improvement over by copending U.S. Pat. application, Ser. No. 638,413, filed May 15, 1967 for "Portable, Automatic Washing Unit for Tanks," which issued as U.S. Pat. No. 3,448,742 on June 10, 1969.

While the device of my said copending application did work satisfactorily it operated on the principle of storing the cleaning solution in the tank being cleaned, and while the tank was being cleaned. That is to say, instead of continually flushing the cleaning solution through the tank as the latter was being cleaned, that device continued to hold the solution in the tank while the cleaning spray was introduced into it. At a later time the tank was drained. This arrangement tended under some circumstances to leave a scum line at the liquid level in the tank.

SUMMARY OF THE INVENTION

The present invention provided an automatic cleaning system for storage tanks, in which the cleaning fluid is automatically cycled through the tank in different washing and rinsing cycles. The arrangement is such that the rinsing or washing fluid is continually being moved through the storage tank. For example, the cleaning solution is continually routed from the tank being cleaned back to a solution tank and then again to the tank being cleaned in a continuous circuit. The rinsing cycles are such that the fluid is also continually purged or moved through the tank being cleaned as the rinsing water is removed from the tank being cleaned, it is dumped directly to drain and not recirculated.

A particularly efficient cleaning operation is thus provided with the present invention.

These and other objects and advantages of the present invention will appear as this disclosure progresses, reference being had to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a washing system made according to the present invention;

FIG. 2 is an elevational cross-sectional view of the solution tank and controls as shown in FIG. 1, but on an enlarged scale, and with parts broken away, and the position of the two-way diverter valve changed for clarity;

FIG. 3 is an enlarged cross-sectional view of the two-way diverter valve shown in FIG. 2;

FIG. 4 is a plan view of the controls shown in FIG. 2, with the cover broken away for clarity in the drawing;

FIG. 5 is an enlarged, cross-sectional view of either of the acid or detergent dispensers which are shown in FIG. 2;

FIG. 6 is an electrical circuit used with the present invention;

FIG. 7 is a time chart showing the various functions and cycles that occur during a washing operation.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The general organization of the system is shown in FIG. 1 and includes a bulk tank BT which is to be cleaned by the present apparatus. A washing solution tank T having an open top is used as a means for storing the cleaning solution when the bulk tank BT is being cleaned by having the cleaning solution circulated from the solution tank, to the bulk tank, and then back to the solution tank. To provide this circulatory path of the fluid, a feed pump P is connected by conduit 1 to the solution tank T and acts to pump fluid through the conduit 2 and to the spinning nozzle N located in the bulk tank BT. Thus as the fluid is pumped out of the nozzle, the nozzle spins to thoroughly clean the interior of the bulk tank. While the bulk tank is being cleaned, the fluid is then simultaneously pumped out of the bulk tank by the return pump RP, and through conduit 3 to a two-way diverter valve V. The diverter valve is operated by a solenoid so as to either dump the solution to a drain on the floor via outlet 75 or alternatively to return the cleaning solution, for example, to the tank T.

The general organization shown in FIG. 1 also includes a control box CB mounted on top of the tank T and this includes a timer knob 7 which is manually settable by the operator. A detergent dispenser DD is provided above the tank T and an acid dispenser AD is similarly supported above tank T. At the appropriate time the detergent dispenser is activated to dispense a certain amount of detergent from bottle 8 into the solution tank T, and at the final stages of the washing cycle the acid dispenser AD is activated to dispense a certain amount of acid from bottle 9 and into the bulk tank along with the rinse water.

Referring now in more detail to the drawings, and particularly FIG. 2 and 4, a pair of water hoses 13 and 14 extend from the control box for detachable connection to conventional spigots (not shown), respectively, of conventional cold and hot waterlines which furnish the necessary water. The general flow path of the water is from the supply spigots, through a mixer valve 18 which is operated by solenoid 19, and then down a liquid feeder tube 20 and into the tank T. Water from the hot waterline 14 can also be diverted (as will later appear) by a hot water valve 21 which is operated by the electric solenoid 21*a*.

A drain valve stopper 24 (FIG. 1 and 2) is connected to the lower end of a stopper rod 24*a*, and the rod 24*a* extends upwardly and is vertically shiftable in a bushing 24*b* fixed by a locknut 24*c* to the bottom of the control box. A spring 24*d* biases the rod downwardly. The rod and stopper are raised, thus opening the drain hole 22 of the tank, by the action of the electric solenoid 24*e* connected to the top end of the rod. Drain solenoid 24*e* is energized by a timer 25.

The timer 25 includes conventional cams *t*1, *t*2, *t*3, *t*4, and *t*5 (FIG. 6) for operating various components located in the control box, as will hereinafter appear. The timer 25 is set by the control knot 7 at the top of the control box.

Means are provided for regulating the level of the fluid in the tank T, and this takes the form of a normally closed pressure switch 32 (FIG. 2, 4 and 6). This switch causes the closing of the solenoid-operated water valve and the switch is actuated by the height of the water in a pressure tube 33 which extends from the pressure switch 32 downwardly into the tank T. The Switch 32 thus regulates the water valves and consequently, the flow of water into tank T.

As shown in FIG. 1, 2 and 6, a booster heater coil 40 is located in tank T and serves to maintain the water in tank T hot during certain periods of the washing operation, as will presently appear.

A vacuum line 50 is provided which furnishes a constant source of vacuum, through the solenoid-operated valves 51, 52 and 53, and conduits 54, 55 and 56 respectively of the two-way diverter valve V, the acid dispenser AD, and the detergent dispenser DD. As shown in FIG. 5 in connection with either the detergent dispenser or the acid dispenser, when the solenoid is energized to permit a vacuum to be drawn to the upper side of the bellows diaphragm 60, the detergent, for example, is drawn up from its bottle 8 via conduit 65 and then dispensed out conduit 66, through the one-way valve 67 and into the tank T. A one-way flap valve 68 is provided at the lower end of conduit 65 and in the bottle 8. The operation of the acid dispenser, when the solenoid valve 52 is operated at the appropriate time, is similar.

In connection with the two-way diverter valve V, when vacuum is applied, due to actuation of its solenoid 51, the shiftable valve spool 70 (FIG. 3) is urged to the right as viewed in the drawing against the bias of the spring 71, to the position shown in FIG. 3 where fluid delivered from the pump RP via conduit 3 is diverted into the solution tank T via the conduit 72. When the solenoid is not energized, the spring 71 urges the spool 70 to the left as viewed in FIG. 3, thus permitting the fluid to be diverted via conduit 75 to the drain in the floor, for example.

The valve V is operated to divert fluid to the tank T when the detergent washing solution is being used, that is when the tank BT is being cleaned by the washing solution circulated between tank BT and tank T by means of the two pumps P and RP.

The valve V is actuated to divert fluid from the pump directly to drain during rinsing cycles of the tank BT as will presently appear in connection with a more complete description of the operating cycle.

The pump for operating the source of vacuum as shown in FIG. 6 is number 77.

Referring now to the operating cycle of the washing and rinsing operations, particular reference will be made to FIG. 6 and 7. Assume the tank T is empty and to initiate the cycle, a toggle switch 80 is turned on, to thereby cause current to go through the pressure switch 32 and to the cam operated switch 81. The cam *t4* of the switch 81 has been stopped at a position so that the mix coil 19 is energized. The solution tank T then fills. This then causes pressure switch 32 to close, to thereby energize the electrical line L and thus all of the switches are "hot."

Another toggle switch 85 is then closed to energize the feed pump motor 86 and also the return pump motor 87. Then the timer cams operate the vacuum pump motor 77, the feed pump motor 86, and the return pump motor 87 for a given time, that is for the first wash cycle which is shown in the timing chart (FIG. 7) as being for 3 minutes. During this time the two-way diverter valve V diverts the dirty water to the drain on the floor and this drain cycle, for example, is 3 minutes. After this 3-minute period, the drain valve stopper 24 (FIG. 2) is lifted, due to the cam *t5* energizing the solenoid 24*e*. This permits complete draining of the tank, and drain valve stopper 24 is then lowered to close.

The second cycle of operation is as follows. The pressure switch 32 energizes the hot-water valve and solenoid 21 and the solution tank T fills with clear hot water. When the tank is filled, the cam *t5* of the timer starts the vacuum pump 77. The feed pump P and the return pump RP both start again in an interval of about ten minutes. However, during the first 7 minutes of these 10 minutes, the booster heater 40 is turned on to heat the water in the solution tank T. This hot water is important to insure that complete cleaning is provided, and this auxiliary heating is necessary because the water otherwise cools down from the tap to a point where sufficient heat is not present during the washing cycle.

Thus after the first 7 minutes of the washing operation, the two-way valve V is energized for the next 3 minutes and this diverts dirty water to the floor drain.

In summary then, during the first 7 minutes of the washing operation, dirty water is not stored in the tank BT but instead is kept circulating, and then during the last 3 minutes of the washing operation, the dirty water is dumped to the drain. Therefore, a good cleaning action is provided because there is no standing water level to permit formation of a scum line in the tank BT.

At the time the vacuum pump 77 starts, the detergent cam *t1* permits energization of the detergent solenoid 53 for a set time, say 2 minutes. Thus the detergent dispenser DD supplies detergent to the tank T via conduit 66.

Then the tank is drained by opening valve 24 at the bottom of the tank due to the fact that the drain valve solenoid 24*e* is energized by its cam *t5*, as previously mentioned in connection with the first cycle.

Then another rinse cycle is commenced. The pressure switch has been on and has had current to it all during the above time. Thus, the filling of the tank T is the same as described in connection with the first cycle. However, during this rinsing cycle, acid is dispensed by the dispenser AD and the acid rinse cycle is for about 4 minutes as shown in chart of FIG. 7. The drain stopper 24 is then shifted to open the solution tank T, and the two-way valve V is opened so that the water is diverted to the waste drain on the floor.

RESUME

The automatic washing apparatus provided by the present invention is capable of performing several cycles sequentially. The first cycle is a rinse cycle and the water used for rinsing is continuously passed through the bulk tank and then dumped to the waste drain by the diverter valve. After this 3-minute rinse cycle, the solution tank T is drained.

The rinse cycle is a hot detergent washing cycle in which the detergent fluid is continually circulated between the tanks and at no time is any fluid stored in the bulk tank BT so as to permit formation of a scum line. The booster heater operates during the first portion of this washing cycle to assure a good cleaning action.

During the last portion of the hot detergent washing cycle, the diverter valve diverts the dirty water to drain, completely emptying the bulk tank.

Another rinse cycle is then commenced and during this rinse cycle, acid may be dispensed so as to completely clean the interior of the bulk tank. After the bulk tank is drained, the stopper in the solution tank is lifted to also drain the solution tank.

I claim:

1. Automatic washing apparatus for washing a storage tank or the like and comprising, a liquid solution tank having an outlet, a two-way valve adjacent and operatively associated with said solution tank for selectively diverting fluid to said solution tank or to a waste drain, a feed pump connected in fluid communication with and between said solution tank outlet and said storage tank for pumping fluid from said solution tank to said storage tank for cleaning the later, a return pump connected in fluid communication with and between said storage tank and said two-way valve for selectively pumping liquid from said storage tank to said solution tank or to said waste drain, a booster heater in said solution tank for heating fluid which is circulated between said tanks, and an electric circuit including an automatic control means having an electric timer and connected with and for operating said pumps and said two-way valve to thereby circulate rinse water from said solution tank to said bulk tank and then to said waste drain, and for circulating washing fluid from said solution tank to said bulk tank and back to said solution tank in a closed circuit.

2. Apparatus as defined in claim 1 further characterized in that said solution tank has an outlet and drain hole, and including a shiftable stopper valve for opening and closing said drain hole, said shiftable stopper valve having electric solenoid means for causing actuation thereof, said solenoid means being located in said electric circuit and operated under the influence of said timer.