

April 15, 1958

G. L. BORELL ET AL

2,830,615

SELF LIMITING LIQUID FEED DEVICE

Filed May 4, 1955

2 Sheets-Sheet 1

Fig. 1.

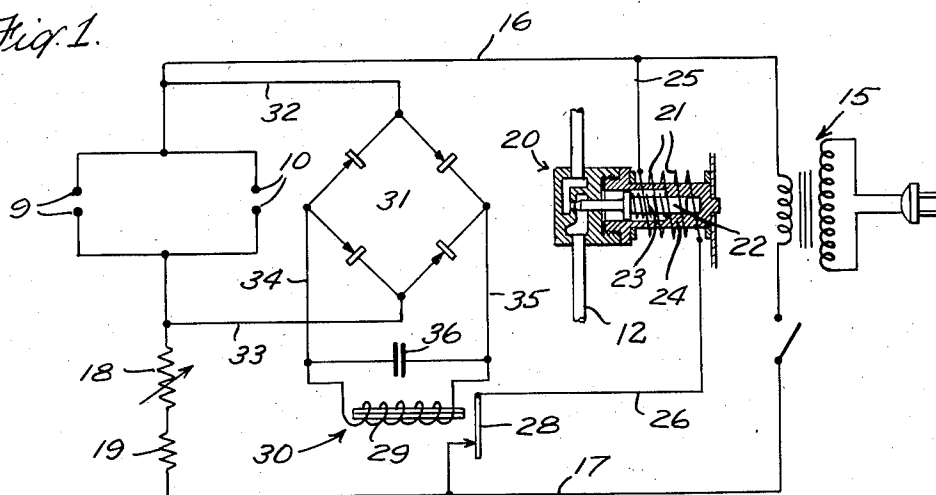
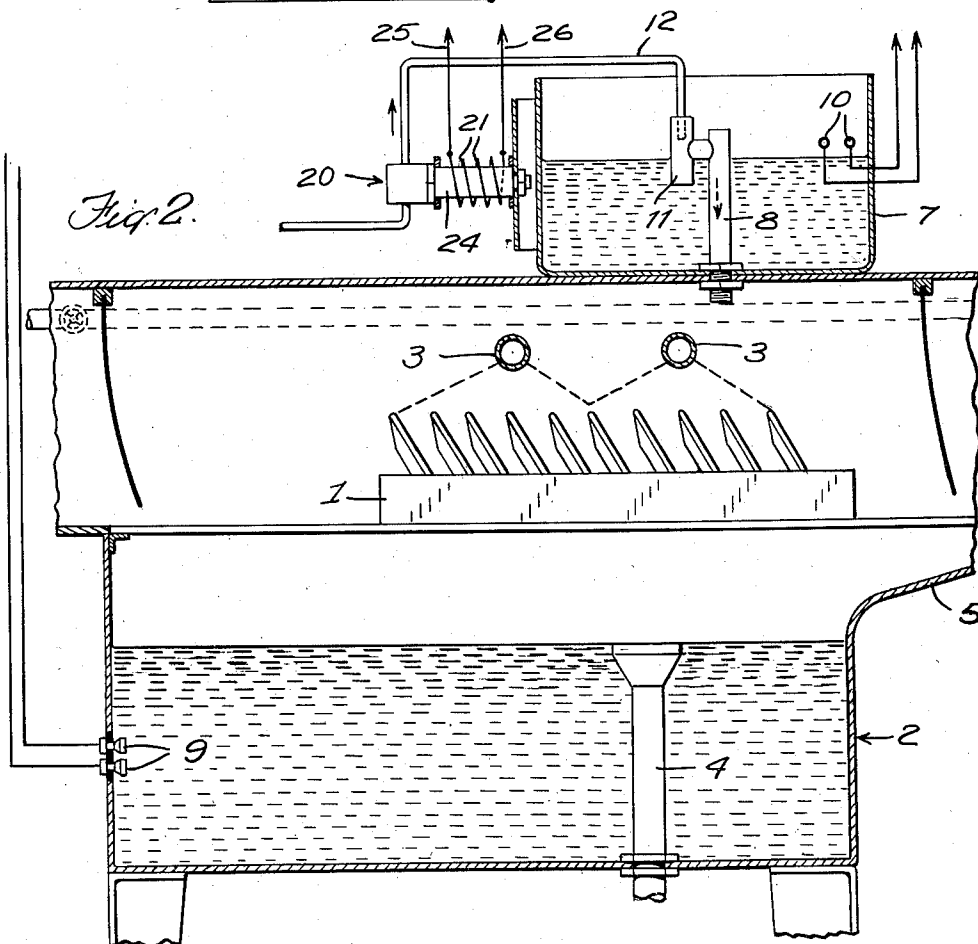


Fig. 2.



April 15, 1958

G. L. BORELL ET AL

2,830,615

SELF LIMITING LIQUID FEED DEVICE

Filed May 4, 1955

2 Sheets-Sheet 2

Fig. 3

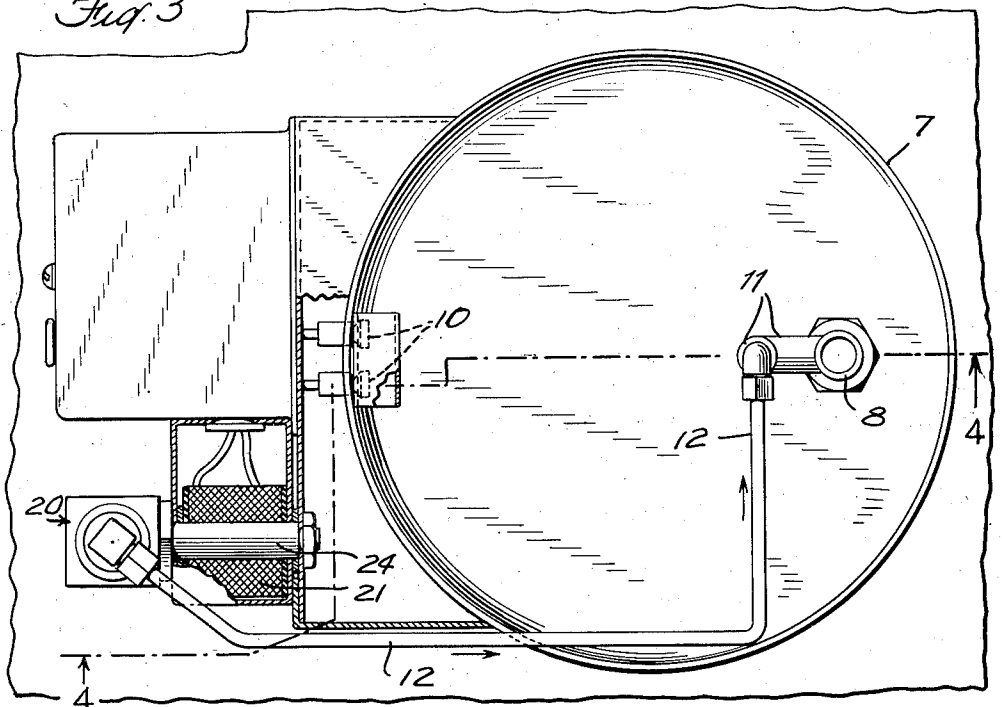
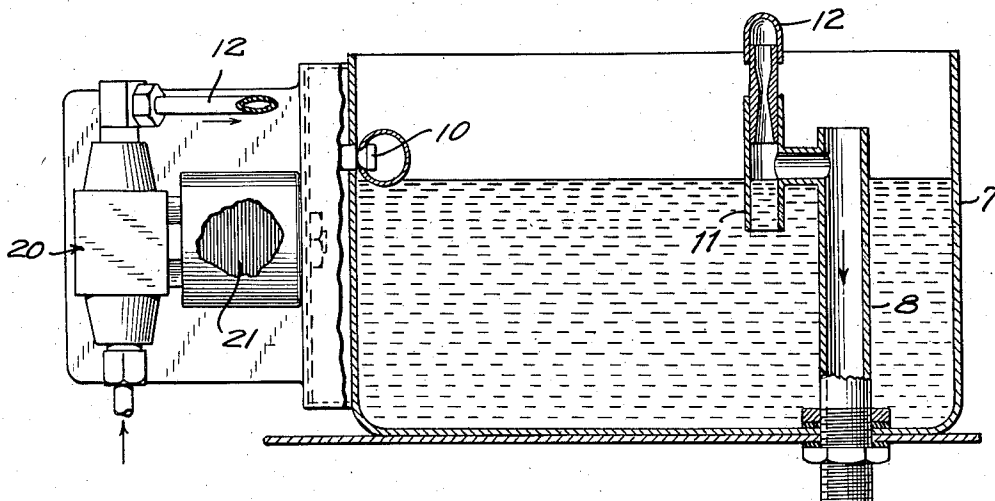


Fig. 4

INVENTORS
GEORGE L. BORELL
OTTO W. JAEGER, JR.

BY *Victor D. Borst*
ATTORNEY

1

2,830,615

SELF LIMITING LIQUID FEED DEVICE

George L. Borell, Glen Rock, and Otto W. Jaeger, Jr.,
Upper Montclair, N. J.

Application May 4, 1955, Serial No. 506,051

7 Claims. (Cl. 137—392)

This invention relates generally to the class of liquid feed devices having an automatic shut-off after the feeding of a predetermined quantity. The invention has a special though by no means exclusive utility in replenishing a constituent of a processing liquid which is consumed and becomes depleted in carrying out the process and it will be explained in connection with such special use.

An example of such special use is with large dishwashing machines in which the detergent in the wash water becomes progressively less concentrated and must be replenished when it reaches a certain degree of dilution.

A dispensing container for highly concentrated detergent solution is disposed over the wash tank and when the dish water calls for more detergent a valve is opened and water is admitted to the container which causes the contents to overflow into a standpipe and run down into the wash tank. The rush of the incoming water dissolves more of the solid detergent in the container and thus the concentration is maintained. When the requirement of the wash water is satisfied the sensing device which caused the valve to open will cause it to close.

In the application of George L. Borell, Serial No. 497,897, filed March 30, 1955, there is disclosed a construction of this character in which the valve is closed in response to signal from sensing means in the dispenser container. In other words, there is a dual type of control in response to conditions in the wash tank and in the detergent container, in which the signal from the wash tank causes the valve in the water feed line to open and the signal from the detergent container shuts off the valve when the in-flow equals the desired effluence.

It is necessary with such an arrangement that means be provided to measure the in-flow, and the present invention relates to such means. Also it is desirable that the operator be informed when the concentration of the detergent solution in the container is low.

It is therefore the purpose of this invention to provide sensing means in the container responsive both to the quantity of added liquid admitted into the container and to the detergent strength of the solution, together with means for preventing an out-flow from the container until the sensing means responds to the increase in quantity and to the quality of the solution and shuts off the in-flow, whereupon an amount equal to the amount admitted flows out.

The invention therefore comprehends means associated with the discharge standpipe of the container which will prevent any out-flow while there is an in-flow up to the predetermined amount of in-flow, and when the sensing means stops the in-flow will permit just the amount that came in to run out.

For this purpose the standpipe is provided with a side orifice with preferably a stub pipe extending laterally from the orifice. The incoming water is directed across the entrance to the stub pipe so as to keep the surface depressed at that point, below the bottom of the stub pipe. Such incoming stream should be confined and

2

specifically therefore the invention contemplates a T-shape tubular attachment on the side of the standpipe with the stem attached at the orifice and the cross head vertical. When no stream is entering the solution will run out to the bottom of the stem, but with the nozzle attached to the top end of the cross head, the solution will be forced down below the stem in the cross head by a forceful incoming stream. The level outside the cross head will of course rise and when it reaches the sensing means the water will be shut off. In other words for that part of the function the sensing means are responsive to the level of the solution in the container.

In order that the sensing means may also detect undue depletion of the detergent in the solution in the container, the invention contemplates electrically conductive sensing means in a circuit the resistance of which will vary inversely with the detergent concentration. For example, it is proposed to use two adjacent electrodes in the container and disposed in an electric circuit in such a manner that the relay in control of the water supply valve will be activated in accordance with the voltage drop across the electrodes. When the solution in the container is of proper concentration the voltage drop across the electrodes is small when they become immersed in the solution and the relay is cut out and the valve is closed. If the concentration is too low in detergent content the drop does not become small enough to cut out the relay and the water continues to run in until the level gets up to the top of the standpipe when the liquid will overflow into the open top. This of course is undesirable and in the said pending application signal means are shown to indicate the condition and notify the operator that more detergent is needed in the container.

The invention has other features and advantages which will appear from the following description of the embodiment of the invention shown in the accompanying drawings in which—

Fig. 1 is an electrical diagram of a system in which the invention is embodied;

Fig. 2 is a sectional elevation of a portion of a dishwashing machine embodying the invention;

Fig. 3 is a plan, partially in section, on enlarged scale, of the detergent container and attached parts; and

Fig. 4 is a fragmentary section on line 4—4 of Fig. 3.

A tray of dishes 1 is shown in the wash section of a dishwashing machine, on a conveyor which carries the tray to the rinse section on the right (not shown). Water is pumped from the wash tank 2 and delivered forcibly upon the dishes through spray means 3. An overflow pipe 4 determines the level of the water in tank 2. A drain board 5 leads the water which is delivered to the rinse section into tank 2.

This constant addition of clean water to the wash tank dilutes the detergent concentration and periodically more detergent has to be added to the wash water. This is done automatically from a container 7 disposed above the wash tank and delivering through discharge standpipe 8 into the wash tank.

To detect or sense the conditions both in the wash tank 2 and in the container 7, each has a pair of closely spaced electrodes which are exposed to the contents and will be conductively bridged by the liquid which will afford a resistance which will vary inversely with the alkaline or detergent content of the liquid.

The electrodes 9 in the tank 2 are suitably insulated and supported in the wall well below the top of overflow pipe 4 so as always to be immersed in the wash water. The electrodes 10 for the detergent container 7 are also suitably insulated and secured in the wall of the container in horizontal alinement at a height relative to the standpipe 8 which is important as will now be explained.

Whenever the conductivity of the wash water reaches a certain minimum degree, it causes a valve to open, as we shall see, to admit water to container 7. More solid detergent in the bottom of the container is dissolved and the level of the detergent solution rises in the container until it reaches the electrodes 10 whereupon the resistance across the electrodes is reduced and the water is shut off. This of course depends upon the detergent concentration in the container, and if the operator has allowed the detergent to become exhausted, the conductivity will not be sufficient to close the valve. In such case a continuous signal is given.

The construction is such that the discharge from the container 7 does not begin until the valve is closed and then if the valve is not again immediately opened an amount of detergent solution exactly equal to the amount of water admitted will run out into the wash tank. Thus the effluence is limited to a definite amount which, as we shall see, is determined by the height of electrodes 10.

In addition to the open top end of standpipe 8 it has a side opening a certain distance below the end in which is secured the leg of a T-shape tubular member 11 the head of which is disposed vertically. Both the head and leg are tubular and they communicate, the head being open at both ends. Therefore liquid in the container can rise in the head and escape through the leg into the standpipe. The water inlet pipe 12 has its nozzle entered into the top end of the head of the T-member 11 and the entering stream will therefore be confined by the head and directed past the entrance to the tubular leg and out the other end of the head. It is obvious therefore that if unopposed, the bottom of the leg will determine the level of the contents. If however a stream of sufficient force is directed through the head of the T-member it will impinge upon the surface of the liquid and force it down in the head below the bottom of the leg and even to the very bottom of the head. Meanwhile of course the level outside the head is rising and will continue to do so until the water is shut off, whereupon the liquid will again rise in the head and run out of the tubular leg and side orifice into the standpipe until the natural level is again reached.

It is the electrodes 10 which determine when the water is shut off. As shown, they are located in a plane between the bottom of the leg and the top of the standpipe, and when the solution rises to that plane it conductively bridges the electrodes and the valve is closed. Then the effluence begins and thus its amount is determined.

The electrical circuit by which this joint control by the wash water and the detergent solution in the container is effected is diagrammatically shown in Fig. 1.

It is a low voltage system fed by a low voltage transformer 15, the output voltage being, for example, twenty-one volts comparable to that of an ordinary domestic bell-current transformer. This of course makes for easy and relatively inexpensive installation.

Wires 16 and 17 constitute the two sides of the supply line and electrodes 9 and 10 are connected in parallel across the line in series with resistances 18 and 19 which determine the distribution of the voltage drop in the connection across the line including the electrodes. The resistance 18 is variable and will be adjusted so that the drop across the electrodes 9 when the detergent need of the wash water is satisfied will be slightly less than that required to energize the controlling relay to open the valve. Hence under that condition no water is being admitted into container 7.

The water pipe 12 has in it a valve 20 which is controlled by a solenoid 21. The valve has a solenoid controlled plunger 22 which is withdrawn by the solenoid to open the valve against the tension of coil spring 23. The solenoid winding 21 surrounds a hollow core 24 which is closed at the end remote from the valve to form

a bottom for the plunger to strike when the solenoid is energized.

The solenoid winding is connected across the wires 16 and 17 by wires 25 and 26, the latter including relay contact 28.

The control relay 30 includes the electro-magnet 29 and the contact 28. It is connected across the electrodes 9 and 10 through a full wave rectifier 31, wire 32 connecting the rectifier to one side of electrodes 9 and 10 and wire 33 connecting the rectifier to the other side of the electrodes. Wires 34 and 35 connect the other two connections of the rectifier to the opposite ends of the coil of electro-magnet 29. A condenser 36 is connected in shunt with the electro-magnet to smooth out the pulsating rectified voltage.

It will now be clear how the two pairs of sensing electrodes jointly control the energization of the relay 30 and hence the energization of the solenoid 21 and the opening and closing of the valve 20.

Let it be assumed that the detergent requirement of the wash water is satisfied. The voltage drop across electrodes 9 is low, the major portion of the drop between wires 16 and 17 being across the resistors 18 and 19. Under such condition electrodes 10 are above the level of the solution in container 7 and they play no part in determining the operation of the relay. The voltage drop between wires 32 and 33 is too low to produce a contact closing energization of relay 30.

As the wash water is diluted it increases the drop across electrodes 9 until the voltage on wires 32 and 33 is sufficient to activate the relay and close contact 28. Solenoid 21 is thereby energized, the plunger 22 is retracted and the valve 20 is opened and water starts to flow into the head of the T-member 11. The level in the container rises with no effluence into standpipe 8 until the solution bridges electrodes 10, whereupon the drop between the connections of wires 32 and 33 falls and the relay allows contact 28 to open by gravity or under the usual spring action. Spring 23 moves the plunger 22 to valve closing position and the water is shut off. Thereupon there is an effluence from container 7 through the lateral orifice until the natural level at the bottom of the leg is again reached.

It will be seen, therefore, that in operation, there is a succession of "shots" of a small quantity of detergent delivered into the wash water until an alkaline condition is reached where the drop across electrodes 9 is no longer sufficient to energize the relay and open the valve. Where a succession of shots are required the drop across the electrodes 9 continues within the relay energizing range and as soon as the level in container 7 falls so as to uncover electrodes 10, the electrodes 9 immediately become effective to reopen the valve and start the water flowing again before the level in the container reaches its natural level. Therefore the successive "shots" will be less than the quantity represented by the difference between the natural level in container 7 and the level of electrodes 10. Not until electrodes 9 cease causing a signal for more detergent will the valve stay closed and the solution in container 7 run out until its natural level is reached.

As above stated and as is obvious, if the detergent concentration of the solution in the container 7 is too low, the bridging of the electrodes 10 will not reduce the drop sufficiently to open contact 28 and close valve 20. In that event the liquid level will rise until it flows into the top of standpipe 8 and the wash tank will be getting clear water instead of detergent. The operator should, of course, be apprised of such untoward condition, and signals for that purpose are provided.

While the particular embodiment which has been above described and is shown in the drawings has proven satisfactory, the invention may be otherwise embodied without departing from its scope as defined in the following claims.

What is claimed is:

1. Means for producing a limited effluence from a container comprising in combination with a container having two outlet openings at different heights, an inlet pipe having its discharge end directed to deliver a stream at high velocity across the lower outlet opening in immediate proximity thereto and thereby prevent the entrance of liquid from the container into said lower outlet, a valve in the outlet pipe biased to closed position, a solenoid operative when energized to open the valve, a relay in control of the solenoid, and means in control of the relay circuit including a pair of electrodes in the container disposed at a level intermediate those of the two orifices.

2. Means as defined in claim 1 together with an electric supply line, the electrodes and the relay being connected in shunt across the line.

3. Means as defined in claim 2 in which the two outlet openings are in a discharge standpipe and the lower orifice has a tubular T-shape member connected to it with the discharge end of the inlet pipe directed into one end of the cross head of the T-shape member.

4. A self limiting liquid feed device comprising a dispensing container having a discharge standpipe therein provided with a side orifice, a tubular T-shape member having its stem attached to the standpipe at the orifice with the cross head vertical, an inlet pipe having its discharge end directed to deliver a stream at high velocity into the top end of the cross head, a valve in the inlet pipe, and liquid sensing means in control of the valve and disposed in the container above the bottom of the orifice.

5. A self limiting liquid feed device as defined in claim 4 together with a valve operating solenoid, a relay in control of the solenoid, an electric supply line, and a pair of electrodes constituting the liquid sensing means and connected across the line in shunt with the relay.

6. A self limiting liquid feed device comprising a dispensing container having a discharge standpipe therein

provided with two orifices at different heights, conduit means attached to the standpipe at the lower orifice and having a lateral passage communicating with the orifice and a vertical passage intersecting the lateral passage and extending below the orifice, an inlet pipe having its discharge end directed to deliver a stream at high velocity into the top of the vertical passage, a valve in the inlet pipe, a relay in control of the valve, means external of the container for energizing the relay and opening the valve, and an electric circuit including a pair of electrodes in the container disposed at a level between the two orifices and arranged to be conductively connected by the liquid in the container, the relay being connected in shunt with the electrodes, whereby the relay voltage drops and closes the valve when the electrodes are conductively bridged by the liquid.

7. A self limiting liquid feed device comprising a dispensing container having a discharge standpipe therein open at its top end and having a side orifice relatively near its top end, a tubular T-shape member having its stem attached to the standpipe at the orifice with its cross head vertical, an inlet pipe having its discharge end directed to deliver a stream at high velocity into the top end of the cross head, a normally closed valve in the inlet pipe, a normally open electric circuit including a solenoid adapted when energized to open the valve, a relay adapted when energized to close the solenoid circuit, means external of the container for energizing the relay, and an electric circuit including a pair of electrodes in the container disposed at a level between the side orifice and top end of the standpipe and arranged to be conductively connected by the liquid in the container, the relay being connected in shunt with the electrodes.

References Cited in the file of this patent

UNITED STATES PATENTS

2,593,825 Albrecht ----- Apr. 22, 1952