

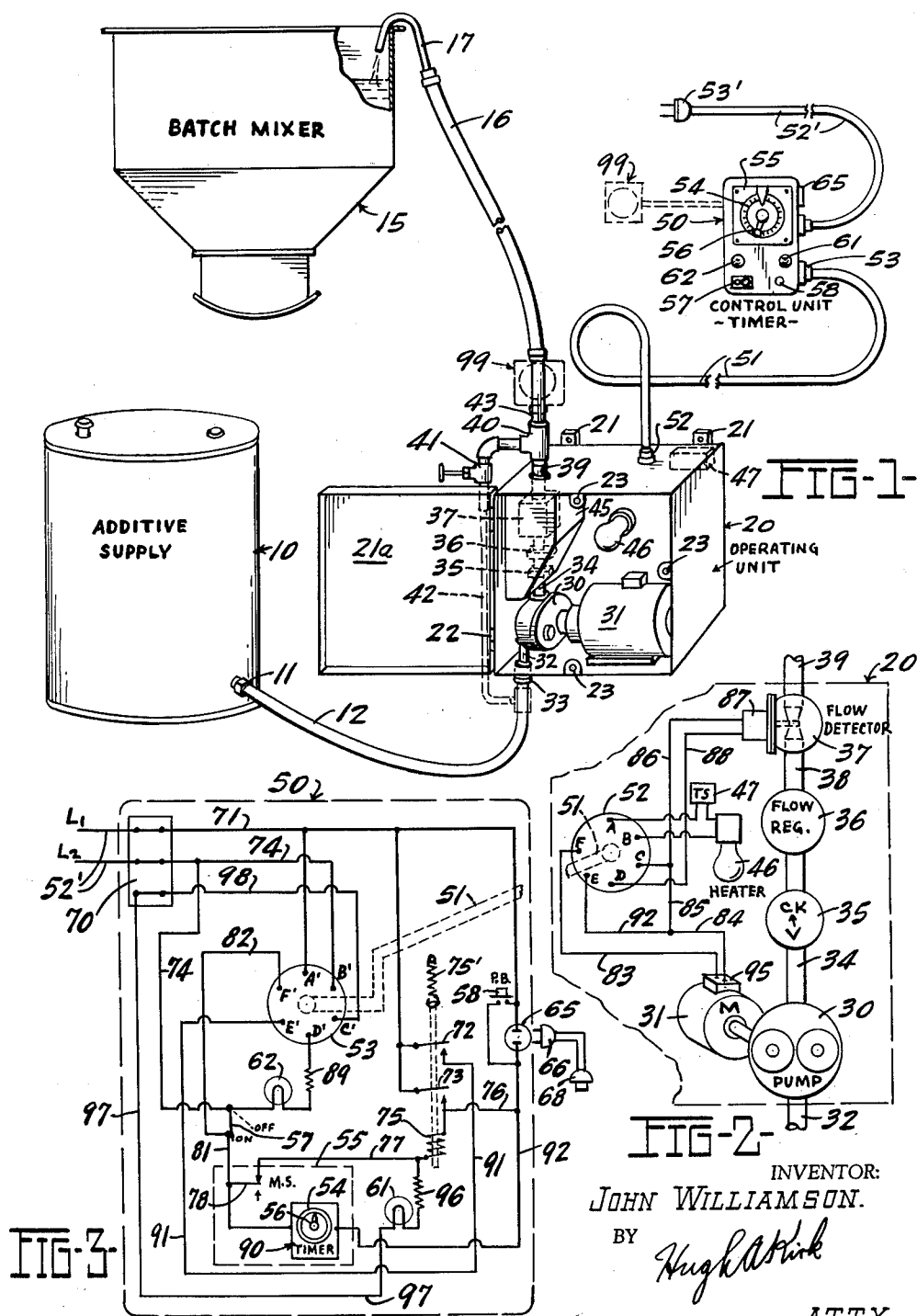
Jan. 30, 1962

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3,018,922

LIQUID DISPENSING SYSTEM

Filed Feb. 7, 1958



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3,018,922

LIQUID DISPENSING SYSTEM

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Filed Feb. 7, 1958, Ser. No. 713,955

11 Claims. (Cl. 222-25)

This invention relates to a system for dispensing liquids to batch mixers. More particularly, it deals with such a system for dispensing relatively small quantities of liquid additives including detergents, disinfectants and agents to wet or dry batch mixers, such as for example, disinfectants to cleaning solutions, additives to a batch of foundry sand including particularly shell moulding compositions, or concrete in its mixing plant, whereby an operator at the mixer may control accurately the addition of a liquid being pumped from a remote point of supply, as well as know when the supply has become exhausted or its delivery is interrupted.

In the mixing of concrete, for example, it has often been the practice to add aqueous solutions of calcium chloride to the batch to control the setting of the cement therein, and since World War II it has become the practice to add other liquid agents to cement batches, such as air entraining agents, water reducing agents, bonding agents, anti-stripping agents, curing agents, water repellents and/or the like in relatively small quantities to improve and vary the quality of the product for different specific purposes. Since a relatively small amount of such additives is required and this amount must be measured quite accurately, it is important to provide a simple and effective means for making these additions which may vary with different batches of concrete having different compositions and/or different uses.

Accordingly, it is an object of this invention to produce an efficient, effective, simple, economic, self-contained accurate and rugged liquid additive device for batch mixing plants.

Another object is to provide such a system which may be electrically controlled and is free from solenoid type valves which may get stuck and are expensive to replace.

Another object is to provide such a system in which an operator at a remote point from the supply of the liquid additive may accurately control the addition of the additive as well as be informed if the system is operating properly or improperly, or has failed or become disconnected or clogged or the supply of the additive has become depleted.

Another object is to provide such a system and a device for practicing it which may be readily adapted to all types of fully automatic batching operations, which is easily installed and duplicated for each different additive to be used in a plant, which requires no special equipment, and which may be connected to a standard 110 volt electric circuit.

Another object is to provide such a device which may be compensated to be unaffected by exposure to low temperatures, and is adapted for metering liquids over a relatively wide quantity range in each successive unit of time as well as being adapted for recording the amounts metered by the device.

Generally speaking, the system of this invention comprises, besides the supply of the liquid additive and the ducts connecting the supply to the batch mixer, an operating unit or dispenser box and a control unit including an electric timer. The operating unit or dispenser box is located along the duct between the supply and the mixer and is preferably located relatively close to the supply. This operating unit or dispenser box comprises an electric motor driven pump for the additive liquid, flow regulating means, and a flow indicating or responsive means, all connected in series in the duct which passes through the operating unit. Adjacent the

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box or operating unit there may be provided a valve for draining the ducts of the system. The control unit or timer may be connected to the operating unit by a multi-conductor cable, and preferably is located at the batch operator station which generally is remote from the additive supply location. This control unit comprises an adjustable electric timer, an off and on switch, a start button with a remote control connection therefor, and indicating lights, such as red and green, to indicate respectively inoperation and proper operation of the system. The flow regulating means are calibrated relative to the pump and the timer so that during each second or other unit of time a definite predetermined quantity of liquid will be pumped through the ducts to the mixer. If desired, other control devices may be added to the system such as a flow recorder, an automatic overload device on the motor in case the duct becomes plugged and a thermostatically controlled heating unit for insuring uniform operation if exposed to cold atmospheric temperatures.

The above mentioned and other features and objects of this invention and the manner of obtaining them will become more apparent and the invention itself will be best understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is a schematic diagram of one embodiment of the device of this invention showing an additive supply reservoir, a batch mixer, ducts between them, and in perspective an operating unit or dispenser box with its cover open, and a control unit or electric timer connected thereto by an electric cable;

FIG. 2 is a schematic fluid flow and electrical diagram of the operating unit or dispenser box shown in FIG. 1; and

FIG. 3 is a wiring diagram of the circuits in the control unit or electric timer located remote therefrom, and connected to the circuit of FIG. 2 by a multi-conductor cable shown along the dotted line connecting the two similar six-terminal connectors shown in FIGS. 2 and 3.

Referring to FIG. 1, there is disclosed a liquid additive supply reservoir such as a barrel or drum 10 having an outlet fitting 11 to which may be connected and disconnected a duct 12 of pipe or hose preferably having a length not greater than about six feet, and a batch mixer 15 remote therefrom into which a liquid duct 16 may discharge its contents either directly or through a gooseneck 17 that may rest over the open upper edge of the mixer container 15. The ducts 12 and/or 16 may be of metal pipe or tubing, or of a plastic or rubber hose. The duct 16, however, is usually of much greater length than the duct 12, in that in the case of a concrete mixing plant the mixer 15 is at least one floor above the ground floor where the additive supply is usually located.

1. The operating unit

Between the adjacent ends of the liquid ducts 12 and 16 there may be provided a box 20 which houses the operating unit of this invention. This box 20 may be provided with means, such as lugs 21, for anchoring it on a support. This box 20 preferably is provided with a cover 21a which may act as a door and be anchored by hinges 22 to one edge of an open side of the box 20, and may be locked or anchored in position by screws threaded into the lugs 23 provided inside the open side edge of the box.

Inside the box 20 there may be mounted a positive acting or gear pump 30 driven directly by an electric motor 31, which pump and motor should be sufficiently powerful to start and stop substantially instantaneously. The inlet duct 32 to the pump 30 may be connected directly through a fitting 33 in the bottom or one side

of the box 20 to which the duct 12 is connected. The outlet duct 34 of the pump 30 may be connected directly in the box 20 to the flow regulating and detecting means which may include first a check valve 35 to prevent the reverse or downward flow of the liquid after it has passed the pump 30 from the duct 12. Adjacent the check valve 35 also in the box 20 is another flow regulating means 36 comprising an orifice which is predetermined or adjustable in size so that with each second of time the pump 30 is operated by the motor 31, a definite known quantity or a constant flow of liquid will be pumped past the orifice in the flow regulator 36. The pump 30 is selected to more than supply sufficient liquid to pass the orifice of said regulator 36 and the size thereof may be varied for a given motor and pump to range from passing less than one ounce of liquid per second up to as high as about fifty ounces per second, however, when using the same motor 31 for such a wide range, it may be necessary to provide a liquid by-pass in the pump 30 itself for the smaller flows to prevent the back pressure created from overloading the motor 31. Next in the box 20 in the outlet duct from the pump 30 beyond the flow regulator 36, there is provided a flow indicator or detector 37 which may comprise a venturi and connecting ducts to a diaphragm which detects slight changes in pressure due to instigation of the flow of liquid through the venturi. A micro-switch may be connected to said diaphragm to be operated thereby, when and as soon as any liquid at all passes through the duct 38 and out through the nipple 39 at the top or outside of the box 20 into the duct 16.

Adjacent the nipple 39, there may be provided a T-duct connection 40, to the branch of which may be connected a draining valve 41 for draining liquid from the line 16. The outlet from the valve 41 may be connected, if desired, with a duct or hose to return the liquid to the reservoir supply 10, or to a duct 42 (shown in dotted lines) by-passing the box 20 and connecting to the duct 12 adjacent the fitting 33. The valve 41, however, is maintained closed during the proper operation of the system. The opposite side of the through portion of the T-duct 40 may be provided with a coupling 43 which may be similar to the fitting 33 for connection to the duct 16.

In order to prevent undesirable tampering of the delicate controls of the check valve 35, flow regulator 36 and flow detector 37, there may be provided a housing 45 inside the box 20 just for these units, as is shown in FIG. 1. Thus access to the box 20 may be had by opening the door 21 to repair the pump and motor without permitting access to the more delicate and pre-adjusted precision parts of the equipment of this system.

A heater 46, such as an electric heat bulb, also may be provided in the box 20 and preferably is located between the pump 30 and motor 31. Connected in series with the electric heater 46 may be a thermostatic switch 47 which preferably is located at a remote corner in the box 20 from that of the heater 46, thereby maintaining a temperature in the box for the equipment within a relatively constant operating range regardless of how cold the atmosphere or climate outside the box may become. Also in this regard to prevent freezing of the liquid in the supply 10 and ducts 12 and 16, an electric resistance heating means may also be provided in and/or around the supply reservoir 10 and around the ducts 12 and 16 which may be connected with the circuit for the heater 46.

II. The control unit

The second or control unit of the system of this invention may be provided in a separate housing 50 connected to the box 20 of the operating unit by means of a multi-conductor cable 51 which may have end plug connections and sockets 52 and 53, such as Army-Navy six wire electric cable connectors for six conductor wire cables,

which fit in the box 20 and housing 50, respectively. The control unit box 50 is provided with a second electrical conductor cable connection 52', which is the electric power connection for the system and may comprise the two wires of a regular 110 volt electric cable with a standard two-prong plug 53' at its outer end for connection to a standard electric power source socket.

On the face of the housing or control unit box 50 there may be provided a circular dial 54 of an electric timer 55 with an adjusting knob 56 which may be manually set to time any number of seconds up to, say sixty, depending upon the construction of the unit. The time settings of this knob 56 may be made according to a predetermined chart for different batches of mix and are equivalent to definite quantities of liquid. In fact, if desired, the dial 54 may be calibrated directly in the quantity of the liquid to be added, or pumped or dispersed by the system. For example, during each second of time set for the operation of the timer 55 in one embodiment of the apparatus of this invention for a concrete mixing plant, the pump 30 pumps $8\frac{1}{2}$ liquid ounces from the goose-neck 17 on the duct 16 into the batch mixer 15.

The control unit housing 50 also may be provided with an off-on electric power source switch 57, a push button start switch 58, and a pair of indicating lights 61 and 62 to indicate respectively operation or inoperation of the system by being connected to the circuits, connections, and micro-switch of flow detector 37 of the system. Thus, as soon as the system is started by pressing the start button 58 the "inoperation" or red warning light 62 is illuminated until the flow starts through the duct 16, and then only the green or "operation" light 61 glows until the timer stops the motor 31. However, if the red or warning light 62 continues to glow after the starting button 58 is pushed, or it comes on during the operation of the timer and motor 31, or flashes when the button 58 is pushed, the operator will immediately know that no more liquid additive is flowing through the line 16 and that the additive supply 10 has either been exhausted, or that the pump 30 is not working, or that a duct 12 or 16 has become plugged, or that the operating device 20 has been disconnected, and that the reason therefor should be immediately investigated. Accordingly, no batch will be unknowingly spoiled by the inoperation or the inadequate addition of the proper additive.

If desired, and/or when the same amount of liquid additive is to be added to a plurality of successive batches, the timer dial knob 56 may be pre-set and the push button 58 may be by-passed by plugging into a socket 65 in the side of the housing 50 an extension 66 (see FIG. 3) with a push button 68 at its end to operate the system from a point remote from the control unit 50. Thus either the push button switch 58 or 68 could control the system, in that they are connected in parallel, as can be seen by the wiring diagram shown in FIG. 3. This extension remote control means enables this system to be connected directly with an automatic batching operation or plant so that, for example, the additive dispensed by this system may be added automatically with the water in the batching operation by closing a switch corresponding to the push button 68 instantaneously when the water cycle is instigated.

III. The operation of the system

Referring now to FIGS. 3 and 2, the electrical controls for the units 50 and 20, respectively, are shown schematically within the dotted line enclosures. The incoming 110 volt electric power conductors 52' entering into the control unit 50 may be connected to a terminal strip 70 from which conductor 71 of the power cable 52' is connected directly to the terminal A' of the connector 53, the switches 72 and 73 of a relay 75, and one side of the push or start button 58 (or 68). The other conductor 74 of the power cable 52' is connected directly to terminal B' of the connector 53, the center terminal of a tog-

gle off-on switch 57 and one terminal of the red warning signal light 62.

The terminals A' and B' of the connector 53 (FIG. 3) which are connected directly to the power conductors 71 and 74, may be directly connected from terminals A and B of the connector 52 (FIG. 2) in the operating unit 20 to the heater 46 and a thermostatic switch 47 in series therewith.

If the off-on switch 57 is in its "off" position and the push button switch 58 (or 68) is closed, the red warning light 62 may be made to flash and the relay 75 to buzz or chatter to indicate that the power supply switch 57 has not been turned on. The circuit producing this visual and audible warning signal may be from power conductor 71, push button 58, conductor 76, coil of relay 75, conductor 77, normally closed timer micro-switch 78, conductors 81 and 82, terminal F' of connector 53, cable 51, terminal F of connector 52 (FIG. 2), conductor 83, through low resistance starting circuit of pump motor 31, conductors 84, 85, 86, normally closed micro-switch 87 of the flow detector 37, conductor 88, terminal D of connector 52, cable 51, terminal D' of connector 53, resistor 89 (say of about 1500 ohms) and red warning light 62 to the center terminal of the off-on switch 57 connected directly to the power conductor 74. However, as soon as the relay 75 is energized by this circuit in series with the warning red light 62, the switch 72 closed by the relay shunts itself out to cause it to become de-energized and return again to the position shown in FIG. 3. This energization and de-energization of the relay 75 continues as long as the push button 58 (or 68) is closed, giving the flashing signal on red light 62 and chatter of relay 75. The circuit shunting the relay 75 as soon as it energizes may be traced from one end of the coil of relay 75, through switches 73 and 72, conductor 91, terminal E' of conductor 53, cable 51, to terminal E of connector 52, conductor 84, the same low resistance starting circuit of pump motor 31, conductor 83, terminal F of connector 52, cable 51, terminal F' of connector 53, and conductors 82 and 81, timer micro-switch 78, conductor 77 back to the other end of coil relay 75.

When the off-on switch 57 is thrown to its "on" position as shown in FIG. 3, the power conductor 74 is then connected through conductor 81 to the micro-switch 78 operated by the timer 55, to the electric motor 90 which runs the timer 55, and through conductor 82 to the F' the other end of coil of relay 75.

As soon as the push button 58 (or 68) is instantaneously operated, a circuit is completed from power conductor 71 through conductor 76 to energize the relay 75 and to start the timer motor 90. The relay 75 holds itself energized from power conductor 71 through its self-holding contact 73 on one side, and on the other side through conductor 77, the normally closed timer micro-switch 78, conductor 81, and switch 57 to power conductor 74. However, as soon as the timer motor 90 completes its timed operation, it opens the switch 78 such as by cam, which de-energizes the relay 75, and in turn opens its switch contacts 72 and 73 to stop the operation of the system through the action of a return spring 75'.

The energization of the relay 75 by operation of push button 58 (or 68) also closes its switch contacts 72 to connect the power conductor 71 to terminal E' of the connector 53 through conductor 91, and thence through cable 51 to the terminal E of connector 52 (in FIG. 2) and through conductors 92 and 84 to the pump motor 31, and back through conductor 83 to terminal F of connector 52, cable 51, terminal F' of connector 53, conductor 82, and the "on" contact of toggle switch 57 to the other power conductor 74 so that the pump motor 31 is started. In or as part of the circuits of the motor 31 there may be provided an overload switch 95 to stop the motor in the event the liquid in the ducts 12, 16, 32, or 34 becomes blocked or the pump 30 becomes jammed.

Furthermore the energization of the relay 75 lights the

"operation" or green light 61 which remains illuminated as long as the motor 31 and timer motor 90 are energized and running, or the relay 75 remains energized. The circuit for lighting this green light may be traced from the power conductor 74 through off-on switch 57, conductor 81, timer switch 78, conductor 77, resistance 96 (say of 1500 ohms) in series with light 61, conductors 97 and 98 through terminal plate 70, terminal C' of connector 53, cable 51, terminal C of connector 52, conductors 85 and 92 in FIG. 2, terminal E of connector 52, back again through cable 51, terminal E' of connector 53, conductor 91, and switch 72 to power conductor 71. The purpose of running this circuit back and forth through cable 51 permits the operator to know, by the absence of illumination of this green light 61, that the cable 51 is not connected to both units 20 and 50, i.e. to indicate that one or both of the connectors 52 and 53 are not connected, or that the cable 51 has been severed.

When the device is first installed, it is preferable to set the timer for a sufficient period of time (usually about ten seconds), to enable filling of the system, and then push the push-button 58 or 68 to start the pump-motor 31 so that the ducts 12 through 16 will become full of liquid. After this occurs, the timer may be re-set to the desired time corresponding to the quantity of liquid to be added to the first batch, and every time thereafter that the push button 58 or 68 is pressed, that particular quantity of liquid will be automatically delivered through the duct 16 and gooseneck 17 into the batch mixer 15.

In the event the system is to be cleaned or a different liquid additive is to be used, the fitting 11 on the duct 12 may be connected to a warm water or rinsing solution supply and the timer placed at its maximum time of say sixty seconds, and the push button 58 or 68 pushed to flush the ducts 12 and 16, the pump 30, and the devices 35, 36, and 37. This flushing may be repeated three or four times after which the ducts may be drained by opening the valve 41 at the lower end of the duct 16.

If more than one liquid additive is to be added to the same batch, separate systems according to this invention may be used for each of the separate liquid additives, with different time setting on each of their timers so that different quantities of each liquid additive may be added to the batch.

It also should be understood that the flow regulating and detecting devices or means of this invention may be re-arranged in series from the order shown herein without departing from the scope of this invention, and the drain valve 41 may be provided at another place in the system. Furthermore, if desired a flow meter and/or recorder 99 may be attached to the timer motor 90, or it may be inserted in the duct 16 responsive directly to the flow of liquid through the system.

While there is described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention.

What is claimed is:

1. In a liquid dispensing device having: a source of liquid to be dispersed, a discharge element for said liquid remote from said source, a duct for said liquid between said source and said discharge, a motor driven pump in said duct for moving said liquid from said source to said discharge through said duct, the improvement comprising means for controlling said pump to discharge a pre-determined quantity of said liquid, said control means comprising: a flow detecting device in said duct between said pump and said discharge, said flow detecting device being responsive to variations of pressure in said duct, a switch operated by said flow detecting device, a timer connected to said motor for said pump for controlling the operation of said pump, means connected to said timer and said motor for initiating said timer and said motor, means con-

nected to said flow detecting device to indicate flow of said liquid in said duct, means connected to said initiating device to indicate the energization of said timer and said motor, and an electric circuit interconnecting said flow detecting device, said timer, said motor, said initiating device, and both said indicating means, and means for connecting said circuit to an electrical power source.

2. An improvement according to claim 1 wherein said dispensing liquid is an additive in a batch mixing plant and wherein a batch mixer is located at said discharge element to receive the liquid discharged.

3. An improvement according to claim 1 including a flow regulating means in said duct on the outlet side of said pump.

4. An improvement according to claim 1 including a check valve in said duct on the outlet side of said pump to prevent reverse flow of said liquid in said duct after it has been metered by said pump.

5. An improvement according to claim 4 including a manually controlled draining means for draining said duct between said check valve and said discharge element when said liquid is to be drained from said duct such as for cleaning said duct and/or changing said liquid.

6. An improvement according to claim 1 including two separate boxes with a multi-conductor electric cable between them, one of said boxes containing said timer, initiating means, and both of said indicating means.

7. An improvement according to claim 6 including an electrical energy source for said circuit connected directly and only to said one box for both said boxes, the other box containing said motor for said pump.

8. An improvement according to claim 7 including connections in said circuit for indicating by one of said indicating means disconnection of said cable between said boxes.

9. An improvement according to claim 7 including an electrical heater connected to said circuit in said other box to prevent the freezing of said liquid when the atmosphere outside said other box is below freezing.

10. An improvement according to claim 7 including a thermostat in said one box and containing a switch in said circuit for controlling said heater.

11. In a liquid dispensing system having: a source of liquid to be dispensed, a discharge for said liquid remote from

said source, a duct for said liquid between said source and said discharge, an electric motor driven pump in said duct for moving said liquid from said source to said discharge through said duct, the improvement comprising means for controlling the pump to discharge a predetermined quantity of said liquid, said means comprising: an operating unit containing said motor driven pump, a control unit separate from said operating unit, and an electrical circuit including a multi-conductor cable interconnecting said units; said operating unit also containing a flow detecting device in said duct between said pump and said discharge, said flow detecting device being responsive to variations in pressure in said duct, a switch in said circuit operated by said flow detecting device; and said control unit containing: a timer to operate a second switch in said circuit connected to said motor for controlling the operation of said motor, a third switch means in said circuit connected to both said timer and said motor for initiating said timer and said motor for driving said pump, a first indicating means connected through said circuit to said flow detecting device to indicate flow of said liquid in said duct, and a second indicating means connected through said circuit to both said timer and said motor to indicate energization of said timer and said motor driving said pump.

References Cited in the file of this patent

UNITED STATES PATENTS

759,449	Kloman	May 10, 1904
1,632,165	Bergmann et al.	June 14, 1927
1,808,804	Baldner et al.	June 9, 1931
2,102,311	Fisher et al.	Dec. 14, 1937
2,279,650	Wood	Apr. 14, 1942
2,320,048	Parson	May 25, 1943
2,339,532	Venable	Jan. 18, 1944
2,507,255	Kaufman	May 9, 1950
2,544,155	Harkenreider	Mar. 6, 1951
2,564,015	Lillig	Aug. 14, 1951
2,626,620	Smith	Jan. 27, 1953
2,659,516	Smith	Nov. 17, 1953
2,671,455	McDonald et al.	Mar. 9, 1954
2,707,961	Geiger et al.	May 10, 1955
2,709,546	Shore	May 31, 1955
2,863,589	Philippovic	Dec. 9, 1958
2,870,941	Steidley	Jan. 29, 1959