

Dec. 16, 1969

F. WELLMAN

3,483,673

AUTOMATIC DRAIN DEVICE FOR DELIQUESCENT GAS DRYERS

Filed June 21, 1967

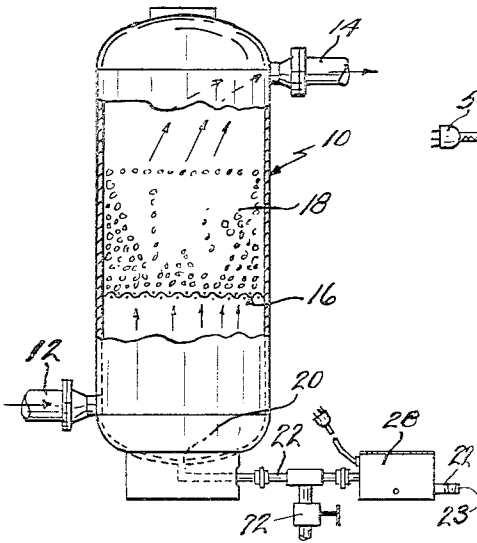


FIG. 1

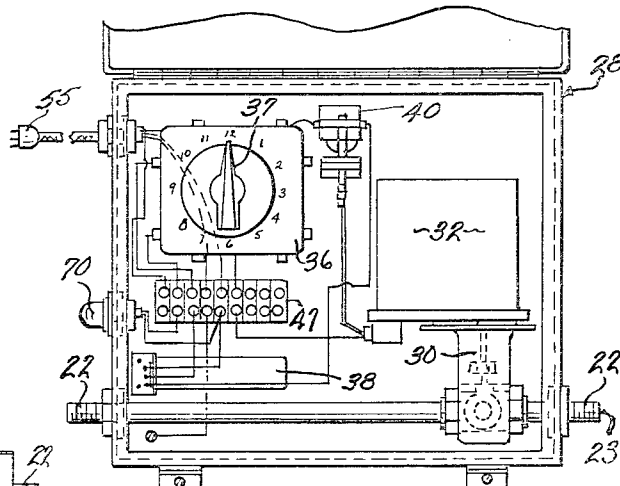


FIG. 2

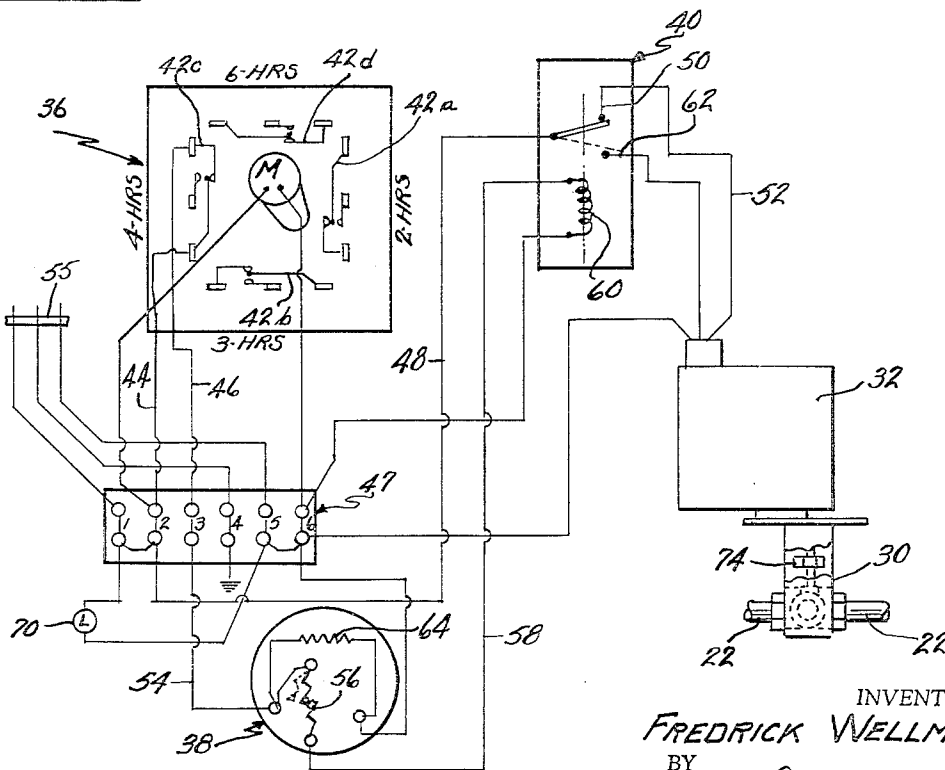


FIG. 3

INVENTOR.
FREDRICK WELLMAN
BY

Baldwin, Doran & Egan
ATTORNEYS

1

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AUTOMATIC DRAIN DEVICE FOR DELIQUESCENT GAS DRYERS

Fredrick Wellman, Fairview, Pa., assignor to Van-Air
Incorporated, Erie, Pa., a corporation of Pennsylvania
Filed June 21, 1967, Ser. No. 647,764
Int. Cl. B01d 53/28

U.S. Cl. 55—218

11 Claims

ABSTRACT OF THE DISCLOSURE

The automatic drain device is for use, for instance, in automatically draining desiccant solution from a deliquescent desiccant-type air or gas dryer, the latter comprising an enclosure or tank containing a bed of deliquescent desiccant which is adapted to remove moisture from pressurized air or gas upon passing of the latter into contact with the desiccant. The desiccant deliquesces and drops to the bottom of the enclosure as liquid, and the automatic drainage device is adapted to periodically drain the liquid from the enclosure. The drainage device comprises a motor-operated valve disposed in the drainage line leading from the enclosure, and with such motor-operated valve being automatically actuated at predetermined periods by an electronic control circuit, whereby the desiccant liquid is drained from the dryer, and then the valve is automatically reclosed until the next actuation thereof to once again drain liquid from the dryer. The control for the drainage valve comprises a motor-actuated timer coupled in circuit with an operating relay and a delay relay, so that the valve is opened at predetermined intervals for a predetermined amount of time, and then reclosed. The device can also be expeditiously used in many other arrangements of liquid level control systems.

This invention relates to liquid level control devices, such as drainage devices, and more particularly to an automatic drainage device adapted to automatically remove the drain solution from a deliquescent type air and/or gas drying device at periodic intervals, and in a highly reliable manner. Heretofore, drainage mechanisms for deliquescent gas dryers have generally been manually actuated and controlled.

Accordingly an object of the invention is to provide a novel automatic device adapted for emptying or filling a predetermined amount of solution or liquid into or from an enclosure at predetermined intervals.

Another object of the invention is to provide a novel automatic drainage device for use with a deliquescent type of air or gas dryer, for automatically draining solution coming from the desiccant in the dryer, from the dryer enclosure.

A further object of the invention is to provide a drainage device for a deliquescent type air dryer comprising a valve mechanism adapted for disposal in the drain line of the dryer, actuator means for actuating the valve mechanism, and control means for controlling the actuation of the valve actuator means at predetermined intervals, so that the liquid solution in the dryer is periodically and automatically removed from the dryer.

A still further object of the invention is to provide in combination a deliquescent type air and/or gas drying device comprising an enclosure adapted to hold a quantity of deliquescent chemical desiccant therein, which desiccant is adapted to remove moisture from air and/or gas placed in contact with the desiccant, and an automatic drain device, and wherein the drain device comprises a power-actuated valve means disposed in communication with the dryer enclosure, for controlling the egress of the drain solution from the dryer enclosure, and with such

2

power-actuated valve means being controlled by a timer which is selectively set for actuating the valve means at predetermined intervals, and with the control means for the drainage device including a delay-producing device for maintaining the valve means open for a predetermined amount of time before closure thereof, whereby the drainage solution from the desiccant in the dryer can be effectively expelled from the dryer.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a diagrammatic, partially-broken, elevational view of a compressed air and/or gas dryer with the automatic drainage device of the invention coupled thereto for removal of the desiccant solution from the dryer.

FIGURE 2 is an enlarged top-plan view of the drainage device showing the location of the various parts including the motor actuated valve, the timer, the delay relay and the relay control for the device.

FIGURE 3 is a schematic illustration of the automatic drainage device.

Referring again to the drawings and particularly to FIGURE 1, the gas dryer illustrated comprises an enclosure or tank 10, having an air or gas inlet 12 through which pressurized inlet air or gas to be dried is inserted into the enclosure and an air or gas outlet 14 through which the gas is withdrawn from the enclosure. Hereinafter the use of the term gas will be understood to also include air, since the latter is of course a gas.

Disposed intermediate the inlet 12 and the outlet 14 may be foraminous or gas pervious supporting means 16, on which is disposed a bed of deliquescent desiccant 18. The deliquescent desiccant is a chemical composition which is adapted to attract moisture from the air or gas as the latter engages the bed, and such attracted moisture causes dissolving or liquefying of the desiccant material in the bed, such liquid dropping or flowing down through the bed into the bottom of the dryer enclosure where it is adapted to be removed periodically through the drain opening 20 in the dryer enclosure.

Drain opening 20 may be coupled to a drain line 22 and then at its outlet 23 to, for instance, a sewer system or any other suitable disposal area for disposing of the drain solution. The gas entering the dryer is under pressure and passes through the desiccant bed 18 and out the outlet 14 as dry, clean gas. Reference may be had to U.S. Patent 3,246,453, issued Apr. 19, 1966 in the name of Phillip S. Becker for a disclosure of a deliquescent type of gas dryer of the general above discussed type.

In prior deliquescent type of gas dryers, such solution has usually been removed from the dryer enclosure by periodic operation of a manually-controlled valve and sometimes, due to forgetfulness on the part of maintenance personnel, the solution has not been adequately removed from the dryer as often as desirable or necessary, and the solution builds up in the dryer enclosure to adversely affect the operation of the dryer.

The present invention provides an automatically-controlled drainage mechanism which, as shown in FIGURE 1, may be disposed in the drain line 22 of the dryer for automatically and periodically removing the drainage solution from the dryer.

Such drainage mechanism in the embodiment illustrated comprises a preferably water tight enclosure 28 through which passes the drain line 22, and with a power operated valve means 30 being disposed in the drain line 22, for controlling the egress of the fluid from the dryer enclosure through line 22. Such valve means 30 may comprise a ball valve of known construction, with such ball valve being adapted to be actuated by an electric motor actuator 32 coupled to the valve 30. This portion of the mechanism

may be commercially available units. A suitable commercial unit for actuator 32 has been found to be one known as a Ramcon Electrical Actuator, Model 8BWP, manufactured by the Ramcon Corporation of Elgin, Ill. Such actuator basically consists of a limit switch, an electric motor, a magnetic-mechanical brake, a gear train, and an output shaft with cam, for actuation of the valving mechanism 30. The actuator unit is fast acting, cycling through 90 degrees in approximately two seconds, depending of course on torque load. The motor of such units all have overload protection and automatic reset, and are manually rotatable with power off.

The control mechanism for the actuator 32 may comprise a motor-driven timer 36 coupled in circuit with a time delay relay means 38, and a control relay 40. The timer may be advanced manually, as by means of control knob 37. The motor-driven timer 36 in the embodiment illustrated has four timing positions, and more respectively, two hours, three hours, four hours, and six hours; and is of the repeat-cycle type, consisting essentially of a motor-driven shaft on which are mounted cams that actuate switches 42a, 42b, 42c and 42d as the shaft rotates. While in the embodiment illustrated the timer 36 has four time periods, or more specifically the aforementioned two hours, three hours, four hours, and six hours, it will be understood that a greater or lesser number of periods and different lengths of time periods, may be had with the proper construction of motor timer. The timer control 36 has been illustrated as being set for actuation every four hours and it will be understood that the contacts 42c of the control, which correspond to the four-hour period of the control, are normally open and are adapted to be closed, as illustrated, upon energization by the proper cam on the motor shaft. If it is desired to change the actuation time for the timer 36, the lead wires 44, 46 leading to contacts 42c at the four hour period are merely changed to the corresponding contact positions for the other selected timer period, and clip means may be provided on the timer in the conventional manner for readily changing the lead wires.

The lead wires 44, 46 from contacts 42c may extend down to terminals 2 and 3 respectively in junction block 47. From junction block 47, line 44 is coupled via line 48 to normally closed contacts 50 in electro-responsive control relay 40, which controls the actuation of actuator 32 for operating valve mechanism 30. Normally closed contacts 50 of relay 40 are connected to the motorized actuator 32 for the valve means 30 as by line 52. Aforementioned terminal 3 of the junction of block 47 is coupled as by line 54 to thermostatic time delay relay 38. Junction block 47 may be coupled by plug 55 to a conventional 110 volt 60 cycle supply of current. Normally closed contacts 56 of delay relay 38 are in turn coupled as by means of line 58 in circuit with the operating coil 60 of control relay 40, for opening normally closed contacts 50 and closing normally open contacts 62 of relay 40 thereby causing actuation of the valve actuator 32.

Operation of the mechanism may be as follows: Say, for instance, it is desired to automatically drain the desiccant solution from the dryer mechanism every four hours. The timer 36 may be placed in circuit as shown in FIGURE 3, so that the contacts 42c are in circuit with the control relay 40 and the delay relay 38. As the cam on the motor-driven shaft of the timer 36 rotates to cause closing of contacts 42c (or in other words as illustrated) the circuit to the delay relay 38 is completed thereby causing the normally "off" heater element 64 of the delay relay 38 to be energized, and causing energization of relay coil 60, thereby opening contacts 50 and closing contacts 62. Opening of contacts 50 and closure of normally open contacts 62 of control relay 40, energizes actuator 32 of valve mechanism 30 causing the latter to be moved from full closed to full open position. Meanwhile energized heater 64 of delay relay 38 causes normally closed contacts 56 thereof to open, thereby den-

gizing coil 60 of relay 40, thus causing contacts 62 to open and contacts 50 to close, and thereby causing actuation of actuator 32 to reclose valve 30. The delay relay 38 causes actuation of the valve mechanism from full close to full open and back to full close for an elapsed period of approximately six seconds in the embodiment illustrated. However, it will be understood that other time cycles may be readily provided for by changing the delay relay. Actuation of actuator 32 to cause rotation of the ball valve mechanism 30 to open position, opens the drain line 22, and since the dryer is conventionally under pressure of greater than atmospheric pressure, say for instance, 100 p.s.i. any solution in the bottom of the tank 10 is quickly expelled from the dryer tank through line 22. At 100 p.s.i., approximately 3½ to 4 gallons of desiccant solution may be discharged with a one inch drain pipe in the aforesaid six second period during which the valve mechanism moves from closed to open and back to closed positions. Approximately 15 minutes after the timer contacts 42c are closed, the cam has rotated to a position permitting contacts 42c to reopen thereby opening the circuit to delay relay 38 and putting the unit in readiness for another cycle. The line 22 will remain closed until the selected cycle time expires when the cam on the motor shaft of timer 36 once again rotates into actuating engagement with the contacts 42c of the four hour pole to cause closing of the contacts.

A light or glow lamp 70 may be provided and indicates that the power is "on" to the unit. It will be seen that a power failure will stop operation of the timer 36, and when power is resumed, the timer 36 will automatically restart from where it left off.

Referring to FIGURE 1, a manually-controlled valve 7 may be provided in line 22 upstream from the automatic drain valve means 28, for manually draining the desiccant solution and gas from the dryer enclosure, in the event of the need for servicing the dryer. A manually operable means 74 (FIG. 3) which is accessible from exteriorly of the valve mechanism 30, may also be provided for manual actuation of the valve mechanism 30 when the power supply is off. Means 74 in the embodiment shown is a coupling nut between actuator 32 and the stem of the ball valve 30, and adapted for actuation with a wrench.

While the liquid level control device has been illustrated as an automatic drain for a deliquescent air or gas dryer, it may also be effectively applied to other mechanisms, such as receiver tanks in compressed air or gas systems, and may be used for automatic control of filling an enclosure as well as draining an enclosure.

From the foregoing discussion and accompanying drawings, it will be seen that the invention provides a novel automatic liquid level control means for automatically controlling the flow of a fluid, and when used as a drain mechanism, for removing liquid concentrate from an enclosure, such as a dryer mechanism, and wherein such control mechanism includes a valving means adapted for insertion in a fluid transmission line, such as the drain line of a dryer, with the valving means including a motor-operated actuator controlled by a timer, a delay relay and an operating relay.

The terms and expressions which have been used are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown or described, or portions thereof, and it is recognized that various modifications are possible within the scope of the invention claimed.

I claim:

1. In a compact automatic mechanism for controlling the flow of fluid into or from a vessel comprising, a fluid conveying line having an inlet end and an outlet end, valve means communicating with said conveying line intermediate said inlet end and said outlet end for controlling the flow of fluid through said fluid conveying line,

5

electrically powered actuating means for moving said valve means from a normally closed position to an open position upon energization of said actuating means, and from said open position back to said normally closed position upon reenergization of said actuating means, timer means adapted for continuous operation for periodically providing an electrical signal for a predetermined interval of time for initiating a cycle of operation of said mechanism, electro-responsive control means coupled to said actuating means and responsive to said electrical signal from said timer means for causing energization of said actuating means as determined by said timer means to move said valve means from said normally closed position to said open position, time delay means operatively coupled to said control means and to said timer means and being responsive to said signal from said timer means for causing deenergization of said control means after a predetermined time lapse and reenergization of said actuating means whereby the latter moves said valve means from said open position back to said closed position, said time lapse of said time delay means being less than said predetermined interval of time of said electrical signal, and wherein said timer means comprises an electrical motor-actuated timer including means for selectively changing the length of time between the periods of said signal from said timer means.

2. A mechanism in accordance with claim 1 including a housing enclosing said mechanism, said housing including openable means providing access to the interior of said housing, and means making said housing water-tight.

3. A mechanism in accordance with claim 1 wherein said valve means includes means adapted for manual actuation for manually energizing said valve means to turn the latter either to an open or to a closed position.

4. A mechanism in accordance with claim 1 wherein said time delay means comprises a thermostatic relay.

5. A mechanism in accordance with claim 1 wherein said valve means comprises a ball valve rotatable through approximately a 90° range of movement, said ball valve being operably coupled to said actuating means.

6. A mechanism in accordance with claim 1 wherein said mechanism includes a housing enclosing said mechanism, said inlet and outlet ends extending through said housing to the exterior thereof.

7. A mechanism in accordance with claim 6 wherein said housing includes openable closure means for providing accessibility to the interior of said housing.

8. A mechanism in accordance with claim 1 including the combination therewith of a vessel, gas pervious means

6

in said vessel adapted to receive a bed of deliquescent chemical material for removing moisture from pressurized gas passed through said bed, said vessel having a drain opening in the lower portion thereof through which is adapted to pass solution coming from the bed of deliquescent material, said automatic mechanism being coupled to said drain opening and being adapted to control the egress of solution at predetermined intervals from said vessel.

9. A mechanism in accordance with claim 8 wherein said vessel has a gas inlet disposed below said gas pervious means and a gas outlet disposed above said gas pervious means.

10. A mechanism in accordance with claim 1 and in combination with a pressurized vessel for controlling the draining of liquid from said vessel, said time delay means comprising a delay relay including heater means coupled in circuit with said timer means, said heater means being adapted for energization by said timer means upon receipt of said signal from said timer means, said control means comprising an electro-responsive control relay operably coupled to said delay relay and to said actuating means for energization of said control relay and thus energization of said actuating means to open said valve means upon receipt of said signal from said timer means and associated energization of said heater means by said timer means, and said heater means after said predetermined time lapse causing deactuation of said control relay thus causing reenergization of said actuating means to cause closing of said valve means, said predetermined interval of time of said signal being materially greater than said time lapse.

11. A mechanism in accordance with claim 10 including means for manually advancing said timer means.

References Cited

UNITED STATES PATENTS

2,599,862	6/1952	Ray	137—624.13
2,783,547	3/1957	Bieger et al.	55—162
2,939,953	6/1960	Parsons et al.	137—624.13
3,067,762	12/1962	Parsons	137—203
3,312,041	4/1967	Hill	55—388

REUBEN FRIEDMAN, Primary Examiner

C. N. HART, Assistant Examiner

U.S. Cl. X.R.

55—281; 137—203, 624.13