

Feb. 25, 1969

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3,429,329

DRAIN APPARATUS FOR AUTOMATICALLY DRAINING CONDENSATE

Filed Oct. 4, 1966

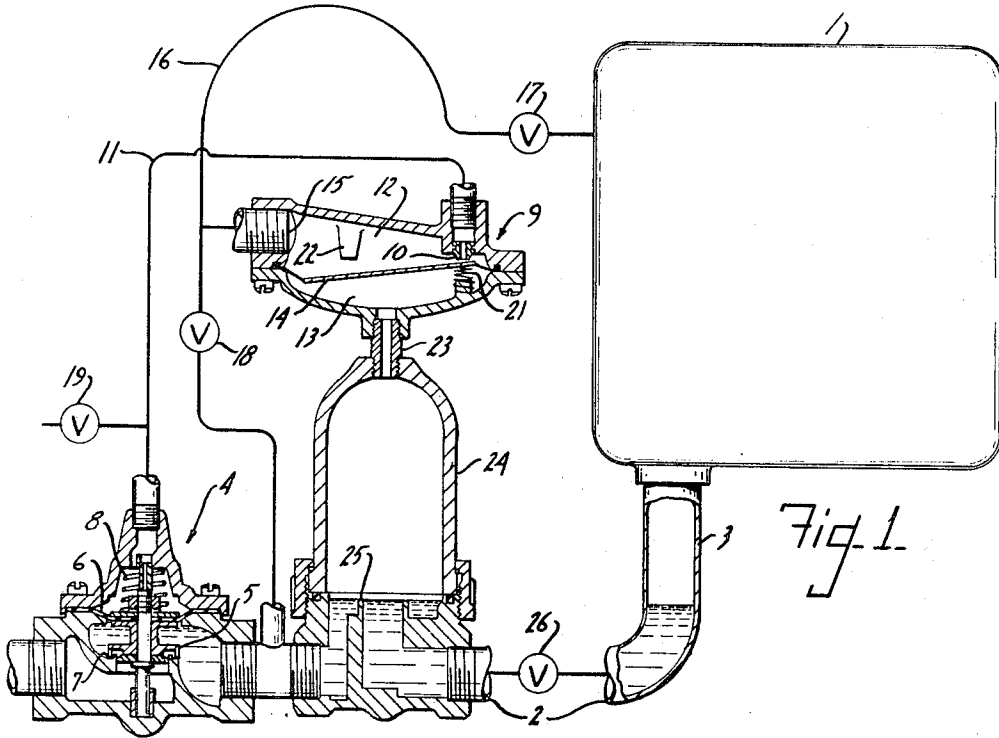


Fig. 1

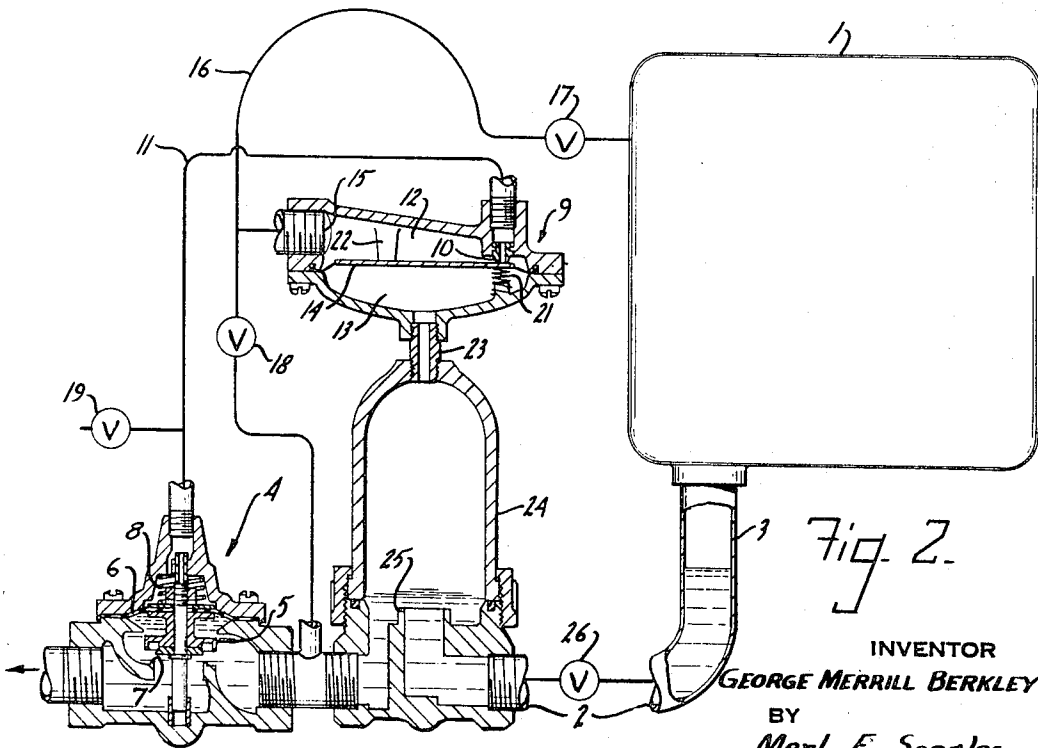


Fig. 2

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DRAIN APPARATUS FOR AUTOMATICALLY DRAINING CONDENSATE

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Filed Oct. 4, 1966, Ser. No. 584,222

U.S. Cl. 137—188

Int. Cl. F16f 1/14

2 Claims

ABSTRACT OF THE DISCLOSURE

The invention relates to automatic drain apparatus to discharge condensate and the like which collects in the condensed water at the bottom of air receivers, after coolers, separators and line traps. An enclosed chamber is connected at one end to a leg of a drain pipe at the bottom of a tank to be drained of condensate and at the other end to one side of a weighted diaphragm in an air pilot valve. The other side of the diaphragm of the air pilot valve is connected on one side to the tank and on the other to the back of a diaphragm in a discharge valve also connected to the drain pipe. When condensate collects on the leg of the drain pipe, the differential head between the leg and chamber exerts pressure on the air trapped in the chamber. The weight of the diaphragm is thus overcome and the air pilot valve closes to shut off flow of compressed air to the discharge valve. The pressure in the discharge valve is reduced and the emulsion and fluid is discharged through the valve.

This invention relates to automatic drain apparatus for draining liquids from a gas storage or supply source and particularly to a drain apparatus to discharge condensate and the like which collects in the condensed water at the bottom of air receivers, after coolers, separators and line traps.

The heavy emulsion condensate discharge from tanks tends to clog the small diameter drain orifices used in many drain valves and the present automatically operated apparatus was developed to effect automatic discharge of the foreign or condensate material through a generally large diameter drain pipe.

The apparatus of the invention is employed with a tank having a generally large diameter discharge orifice so that the condensate collecting in the bottom of the tank in which compressed air is employed is discharged into a generally large diameter drain pipe. The drain pipe is connected to a discharge valve and intermediate the discharge valve and the entrance to the drain pipe is located the apparatus which effects automatic opening and closing of the discharge valve and constitutes the basis of the invention.

The apparatus in question consists of an enclosed chamber which is connected at one end to the drain pipe and at the other to an air pilot valve. The air pilot valve consists of a weighted diaphragm, one side of which is exposed to the trapped air in the chamber and the other side of which is connected by a conduit to the tank and is exposed to the compressed air in the tank. Thus, the pressure on each side of the diaphragm under normal conditions is equal and the diaphragm normally holds the valve open due to the weight in the diaphragm. In this position, compressed air passes through the air pilot valve and thence by a conduit to the back of the drain valve to normally hold the drain valve closed.

As the condensate collects in the entrance leg of the drain pipe, the differential head between the leg and the chamber exerts pressure on the air trapped in the chamber, the weight of the diaphragm is thus overcome and

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the air pilot valve closes to shut off flow of compressed air to the back of the discharge valve. This reduces the pressure on the discharge valve allowing the emulsion and fluid in the drain pipe under the pressure of the compressed air to pass through the valve and thus be drained from the drain pipe. The conduit from the air pilot valve to the discharge valve has a bleeder orifice so that air can bleed therefrom when the supply of compressed air to the discharge valve is shut off to thereby discharge the air in the conduit and permit opening of the discharge valve.

An equalizing line connects the drain pipe to the tank in which the compressed air is contained to insure that the pressure on each side of the diaphragm will be equalized when the apparatus is placed in operation by opening of a manually operated valve in the drain pipe to permit flow of the condensate and foreign material through the drain pipe to the discharge valve.

The use of a large diameter drain pipe and intermittent discharge of condensate and foreign material to drain overcomes the valve clogging problem.

Other objects and advantages will appear in the course of the following description.

The drawings illustrate the best mode presently contemplated of carrying out the invention.

In the drawings:

FIGURE 1 is a sectional view through the apparatus of the invention with parts in elevation and the air pilot valve in open position; and

FIG. 2 is a similar view with the air pilot valve in closed position.

The drawings illustrate the automatic drain apparatus of the invention employed with a tank 1 in which compressed air is stored. As the compressed air is used up and additional air is supplied, moisture and condensate collect in the bottom of tank 1 which it is necessary to discharge to a drain.

The apparatus of the invention for discharge of the condensate, as illustrated in the drawings, consists of a drain pipe 2 connected by the vertical leg 3 at one end to the tank 1 and at the other end to a drain, not shown, through the balanced discharge valve 4. The vertical leg 3 is of relatively large diameter as is the orifice, not shown, in tank 1 with which pipe 2 is connected.

The discharge valve 4 at the drain end of line 2 has a valve 5 actuated by pressure from compressed air supplied or cut off from behind the diaphragm 6 to effect actuation of the valve to or from valve seat 7. In addition, the spring 8 is located between the diaphragm 6 and the valve body and normally holds the valve 5 closed.

The application or release of pressure behind the diaphragm 6 depends upon the build up of condensate in the drain pipe and is effected by means of the opening and closing of the air pilot valve 9.

The housing of air pilot valve 9 has an outlet 10 which is connected to the back of the diaphragm 6 of discharge valve 4 by conduit 11. The inside of valve 9 is separated into an upper chamber 12 and a lower chamber 13 by the weighted diaphragm 14. Compressed air is supplied to the upper chamber 12 through inlet 15 of the valve 9 and by means of conduit 16 which is connected to tank 1 at one end and to drain pipe 2 at the other end and intermediately to inlet 15 of valve 9. Conduit 16 has a manually operated valve 17 therein between the air pilot valve 9 and tank 1 to control the flow of compressed air through the conduit. Conduit 16 also is provided with a check valve 18 located between the air pilot valve 9 and drain pipe 2 to permit flow of compressed air from tank 1 to drain pipe 2 but to check the flow of trapped air from drain pipe 2 to tank 1.

The compressed air supplied to upper chamber 12 flows through the outlet 10 of valve 9 when the outlet is open

and thence through conduit 11 to the back of the diaphragm 6 of discharge valve 4. A bleeder valve 19 is provided in conduit 11 so that air may bleed from conduit 11 when outlet 10 of valve 9 is closed by diaphragm 14. Diaphragm 14 is tensioned toward the outlet 10 by the backing spring 21 but normally rests in a lowermost position by gravity due to the weight in the diaphragm and in such position outlet 10 is open. When the diaphragm 14 is in its uppermost position, it closes outlet 10 under the tension of spring 21 and abuts the stop 22 as can be observed in FIG. 2.

The lower chamber 13 of air pilot valve 9 is connected by conduit 23 to the chamber member 24 which contains trapped air, and chamber member 24 is in turn connected to drain pipe 2. Member 24 is made of transparent plastic material, or the like, so that if condensate is observed to fill the chamber then this is an indication that the diaphragm 14 of air pilot valve 9 has been ruptured.

The passage of condensate from pipe 2 through the lower end of chamber member 24 and then through pipe 2 to discharge valve 4 is interrupted by a partition 25 over which the condensate in pipe 2 must flow to reach discharge valve 4 and which serves as a baffle to direct condensate into chamber 24. In order to shut off the flow of condensate in drain pipe 2 from tank 1, the manually operated valve 26 is located in pipe 2 between tank 1 and the chamber member 24.

The operation of the apparatus of the invention is described hereinafter. Assume that the apparatus has been connected to tank 1 and that tank 1 is under pressure, the manual valve 17 in compressed air conduit 16 is opened first to equalize pressure in all parts of the assembly. Consequently, the pressure on each side of diaphragm 14 will be equal and diaphragm 14 will be in the lower or normally open position as shown in FIGURE 1 due to the weight in the diaphragm and compressed air then passes from conduit 16 to chamber 12 of valve 9 and thence through outlet 10 and conduit 11 to the back of diaphragm 6 of valve 4 to hold valve 5 of discharge valve 4 closed. The check valve 18 in conduit 16 permits the compressed air to pass through conduit 16 to line 2 and thence to chamber member 24.

In the next step, the manual valve 26 in drain pipe 2 is opened and condensate is then free to pass through pipe 2 from tank 1 to discharge valve 4. This results in air being trapped in chamber 24. As the condensate forms and collects in pipe 2 and leg 3, as shown in FIG. 2, a differential head will be developed between the fluid in leg 3 and chamber member 24. Pressure is then exerted on the air trapped in chamber member 24 of a sufficient amount to overcome the weight in diaphragm 14 of air pilot valve 9 and the diaphragm will then move upwardly as may be observed in FIG. 2 and close outlet 10 and cut off the flow of compressed air to discharge valve 4. The air in conduit 11 will bleed out of the bleeder or needle vent valve 19. Since the air pressure on the diaphragm of discharge valve 4 is thus decreased or dissipated, this permits the emulsion and condensate in drain pipe 2 under the compressed air pressure to open valve 5 of discharge valve 4 and discharge the material to drain. The valve 5 of discharge valve 4 can assume a throttling position or go wide open depending upon emulsion thickness, viscosity and consistency of the material discharged.

As the condensate level in drain leg 3 lowers, such as to the position shown in FIGURE 1, the air pilot valve 9 again opens due to the weight in diaphragm 14. Air is then once more supplied to the back of diaphragm 6 of discharge valve 4 to close valve 5 thereof without losing compressed air through the discharge valve 4.

The automatic drain apparatus of the invention has been described with respect to removal of condensate and

foreign material from tanks in which compressed air is confined in an intermittent discharge to substantially eliminate the clogging of the discharge orifice in the tank. However, it has general application in the removal of liquids from a gas supply or gas storage source in which the gas, including compressed air, is located or is flowing.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In automatic drain apparatus for automatically draining liquid from a gas storage and supply source which has a drain pipe with a vertically extending leg secured to said source to receive the liquid collecting in said source, a discharge valve secured to the drain pipe and disposed to open and close to control the discharge of liquid from the pipe, a first conduit connected to said source and to the drain pipe, a pilot valve connected to the first conduit and having a weighted diaphragm therein separating the pilot valve into two chambers with one of the chambers connected to the first conduit and exposing one side of the diaphragm to the gas carried by said conduit from said source, a second conduit connecting the other of said chambers to the drain pipe and exposing said other side of the diaphragm to gas trapped in the second conduit by liquid collected in the drain pipe from said source, an outlet in the pilot valve leading from the chamber connected to the first conduit, a third conduit connecting the outlet of the pilot valve to the discharge valve so that the pressure of gas from said source on the discharge valve maintains the discharge valve closed when the outlet of the pilot valve is open, the gas and trapped gas on each side of the diaphragm normally establishing a balanced pressure condition in the pilot valve so that the weighted diaphragm by gravity opens the outlet to the third conduit leading to the discharge valve for flow of gas thereto supplied by said source, the said pilot valve becoming unbalanced to lift the diaphragm and close the third conduit to the discharge valve and effect opening of the latter for discharge of liquid from the drain pipe when the differential head between the liquid in the leg of the drain pipe and the second conduit connecting the pilot valve to the drain pipe exerts pressure on the trapped gas on the one side of said diaphragm, bleeder means connected to the discharge valve to discharge gas from the latter so that the discharge valve will open under the pressure of the liquid and gas in the drain pipe and effect discharge of said liquid when the air pilot valve is closed, and a check valve in the first conduit between the drain pipe and the pilot valve to permit flow of gas to the drain pipe but checking the flow of liquid and gas from the drain pipe to said source.

2. The structure of claim 1 and including a manually operated valve in the first conduit between the source and the pilot valve, and a manually operated valve in the drain pipe between the source and the pilot valve.

References Cited

UNITED STATES PATENTS

2,877,791	3/1959	Rich	137—188 X
2,907,340	10/1959	Kenney	137—188
2,941,376	6/1960	Messerli	137—188 X
2,949,925	8/1960	Everett	137—195

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U.S. Cl. X.R.

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