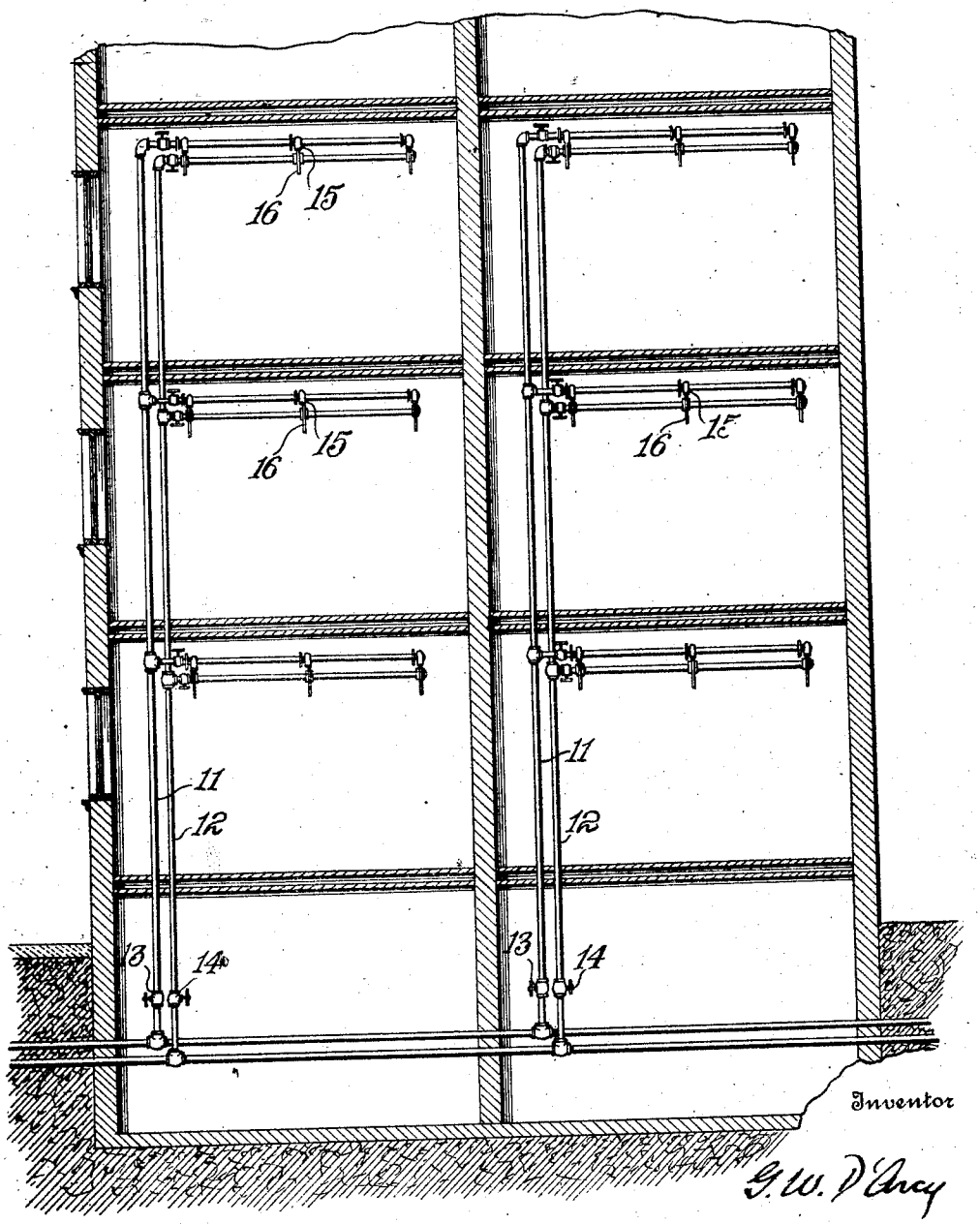
Sept. 15, 1925. 1,553,370

G. W. D'ARCY

HUMIDIFYING APPARATUS

Filed Dec. 20, 1919 2 Sheets-Sheet 1

Fig 1



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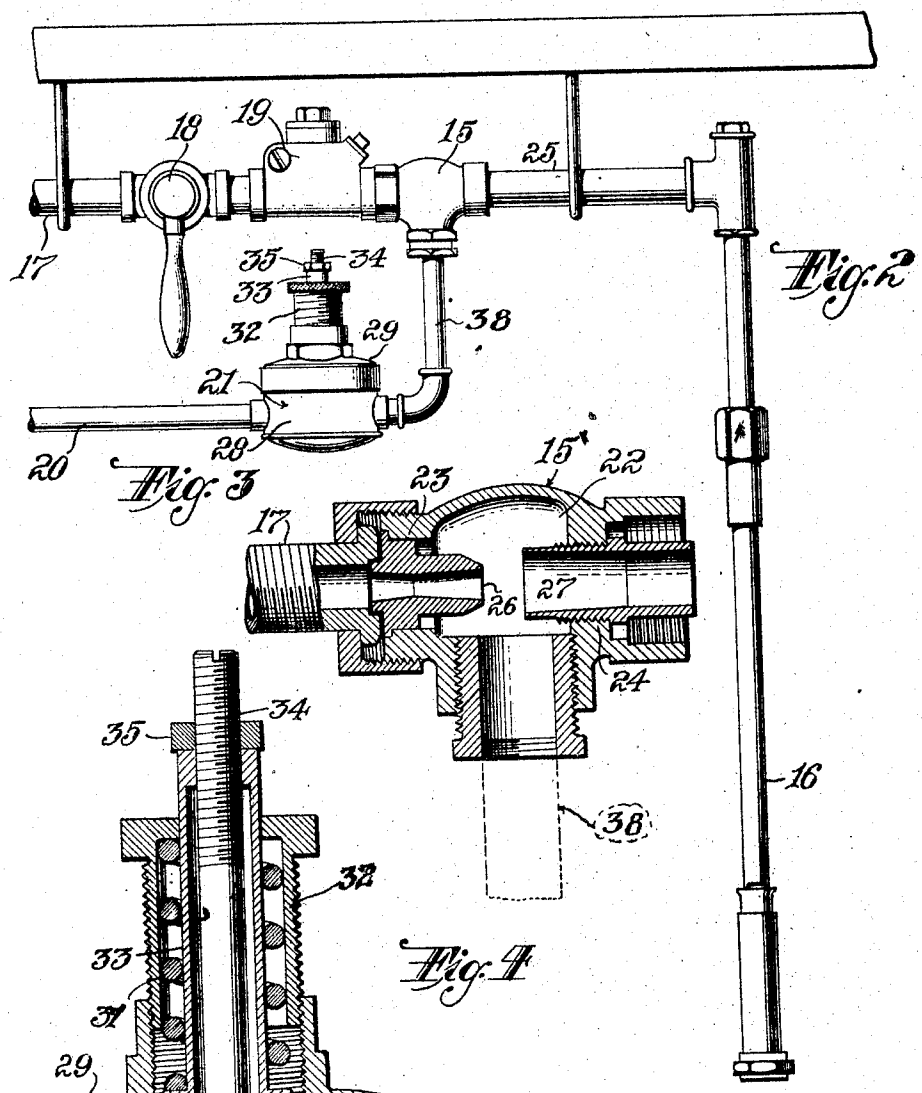
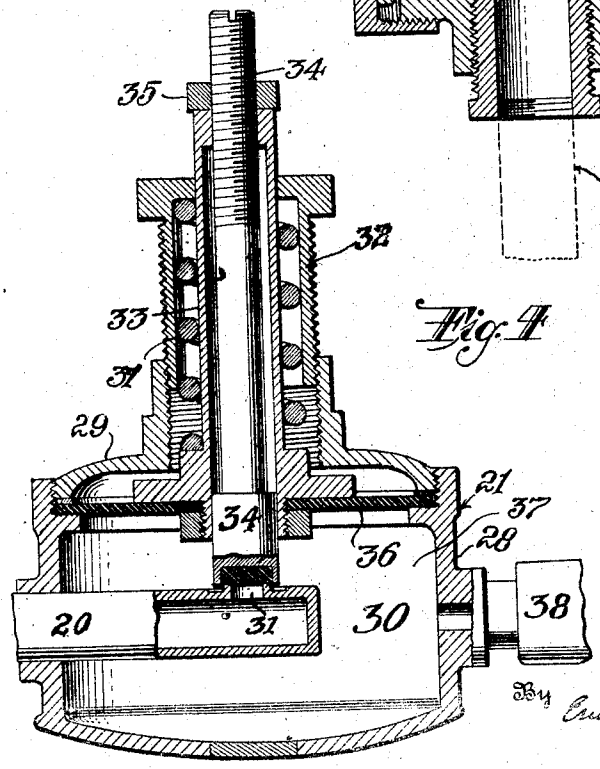


Fig. 2

Fig. 3

Fig. 4



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Patented Sept. 15, 1925. 1,553,370

UNITED STATES PATENT OFFICE.

GEORGE W. D'ARCY, OF BOSTON, MASSACHUSETTS.

HUMIDIFYING APPARATUS.

Application filed December 20, 1919. Serial No. 346,425.

To all whom it may concern.

Be it known that I, GEORGE W. D'ARCY, a citizen of the United States, and a resident of Boston, county of Suffolk, Commonwealth of Massachusetts, have invented an Improvement in Humidifying Apparatus, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention is an improvement in the apparatus shown and described in my prior Patent, No. 1,302,515, dated May 6, 1919. One object of the invention is to provide for controlling the amount of water delivered by the apparatus at different points under varying conditions of pressure and temperature, as on different floors of a building or in different levels or slopes of a mine.

Another object of the invention is to provide for turning on and off and regulating the supply of water to each vaporizing device by controlling the pressure of the steam or air in the pressure pipe, thereby enabling the vaporizing devices to be located at various points along the pressure pipe and to be controlled from a single point, such as the source of pressure supply.

Another object is to cut off the flow of water automatically at each vaporizer upon the failure of the pressure supply from accident or other cause, thereby preventing damage to the premises from overflow at the vaporizing nozzles. Further objects and advantages of the invention appear from the following description.

In order that the manner of constructing and operating the invention may be understood I have shown the same in the accompanying drawings applied to an overhead vaporizing system in a building; but the invention is not restricted to such a system or location nor to the details of construction shown and described.

Referring to the drawings:

Fig. 1 is a diagram showing the arrangement of pipes and location of vaporizing and control apparatus for humidifying the air of a building of several stories;

Fig. 2 is a side elevation of the vaporizing apparatus shown suspended from an overhead support;

Fig. 3 is an axial section through the mixing and churning chamber drawn to a larger scale; and

Fig. 4 is a similar section through the water regulating and shut-off valve.

The system comprises Fig. 1, a source of water pressure and a source of air or steam pressure, both not shown, which may be located at any convenient point on the premises, and which are connected to the water supply pipe 11 and the steam or air pressure pipe 12 through mains and branch pipe lines provided with shut-off valves 13, 14 respectively. The vaporizers 15 are located at suitable points for treating the air in the various parts of the building, mine or other structure reached by the system, each vaporizer being furnished with a suitable spray nozzle 16.

Each vaporizer, Fig. 2 is connected to the fluid pressure pipe 12 by a branch pipe 17 having a shut-off valve 18 and a check valve 19, and to the water supply pipe 11 by a branch pipe 20 provided with an automatic water shut-off and regulator valve 21.

Preferably, Fig. 3, the vaporizer is similar to that shown in my prior Patent No. 1,302,515, consisting of a body having a chamber 22 and provided with openings in its end walls 23, 24 to receive the ends of the pressure pipe 17 and vapor discharge pipe 25, and having an opening in its side or bottom wall to receive the end of the water supply pipe 38 connected with the branch pipe 20. The fluid pressure pipe 17, Fig. 3, discharges into the chamber 22 through a nozzle 26 which opens into the chamber through the end wall 23, and the mixed fluid and water or vapor are discharged through a mixing tube or nozzle 27 which is arranged in preferably substantial axial alignment with the nozzle 26 and extends out of the chamber through the opposite end wall 24. The nozzle 27 is larger than the nozzle 26 in order to accommodate the mixture of air or steam and water, and the inner end of the nozzle 27 is spaced away from the end of the nozzle 26 in order to permit the vaporized water to enter it from the chamber 22.

The water shut-off and regulator valve 21, Fig. 4, comprises a valve casing formed in two parts, a base 28 and a cover 29. The base contains a chamber 30 to which water may be admitted from the water supply pipe 20 through a valve opening 31 smaller than the opening in the spray nozzle 16 to guard

against creating back pressure in the chamber sufficient to interfere with the working of the valve. The cover part 29 of the valve casing and the spring adjusting threaded bushing 32 carried by it together form a housing for the moving parts of the water supply valve 21. The valve 21 has a hollow stem 33 which carries an adjustable valve plunger 34 which is screw threaded to and extended through the hollow stem 33 and which thus constitutes the lower end of the valve stem and may be locked in adjusted position with reference to the stem 33 by means of a nut 35 on the plunger. The adjusting bushing 32, screw threaded plunger 34 and lock nut 35 are exposed outside of the casing where they may be easily reached for adjustment.

A flexible diaphragm 36, Fig. 4, of rubber or other suitable material is attached by any convenient means as a nut 36ª to the stem 33 of the valve 21, and is secured at its edges between the two abutting edges of the base 28 and cover 29 of the valve 21, thereby closing the top of the chamber 30 in the base and permitting the diaphragm to respond to the pressure therein to open the valve against the pressure of the valve closing spring 37. The tension of the valve spring may be adjusted by turning the bushing 32 which is screw threaded into the valve cover 29 and which also serves as a guide for the outer end of the valve stem. The diaphragm 36 and the valve parts may be removed from the base 28 by unscrewing the cover 29 without affecting the adjustment of the valve spring and plunger. The pressure chamber 30 is in open communication with the mixing and churning chamber 22 through the pipe 38, whereby the pressure in the latter will be transmitted to the former.

The operation of the device is as follows:

Air or steam pressure is admitted to the branch pressure pipe 12 through the main control valve 14 and thence flows to all of the vaporizers upon the branch 17. Some of the air flows through the pipe 38 from the mixing and churning chamber to the control valve 21, and pressing against the flexible diaphragm lifts the stem 33 of the water control valve 21 off its seat, the tension of the spring upon the stem being sufficient to close the valve opening 31 against the water pressure in the water supply pipe 20 acting against the inner end of the valve plunger 34, but not sufficiently great to prevent the valve being lifted from its seat by the water and air pressure in the chamber 30 acting upon the inner side of the diaphragm. Thus, water is admitted to the chamber 30, and the water pressure being greater than the air pressure in the chamber, the water continues to flow through the opening 31 and pipe 38 to the mixing and churning chamber 22 and mingles with the air flowing through the discharge nozzle 27 to the spray nozzle 16.

The discharge of water through the spray nozzle may be regulated by increasing or diminishing the fluid pressure in the pressure pipe as desired. By increasing the pressure in the pressure pipes 12 and 17 until it is sufficiently greater than the pressure in the water pipes 11 and 20 the flow of water from the valve chamber 30 to the mixing and churning chamber 22 will be stopped, and dry air will be delivered from the spray nozzle. This is sometimes advantageous in dissipating smoke and noxious gases which through accident may have found their way into the premises.

Upon cutting off the pressure in the pressure pipes 12 and 17 the spring 37 will close the water supply valve opening 31 and cut off the flow of water to the mixing and churning chamber and spray nozzle, although the water will continue to flow, after it has once started to operate, at a fluid pressure somewhat less than the water pressure. The tension of the spring 37 may be adjusted to suit the water pressure and the location of the vaporizer in the system, and the valve plunger 34 may be adjusted to permit the desired amount of water to be vaporized. Hence either a graduated or a uniform discharge of spray may be obtained from all of the vaporizers in the system. The fluid pressure shut-off valve 18 in the pipe 17 leading to the vaporizer from the pressure supply pipe 12 is provided in case it is desired to cut out any particular vaporizer from the system.

I claim the following as my invention:

1. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, and pressure responsive means associated with said pressure chamber for opening said water regulating valve upon admission of fluid pressure to said pressure chamber from said mixing chamber.

2. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, a spring for closing said valve against the water pressure, means for adjusting the pressure of said spring, and pressure responsive means associated

with said pressure chamber for opening said water regulating valve upon admission of fluid pressure to said pressure chamber from said mixing chamber.

3. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a spring-closed water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, and a diaphragm closing an opening from said pressure chamber, and connections between said diaphragm and valve for opening said water regulating valve upon admission of fluid pressure to said pressure chamber from said mixing chamber.

4. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, said valve having an adjustable plunger for regulating the amount of opening thereof, and pressure responsive means associated with said pressure chamber for opening said water regulating valve upon admission of fluid pressure to said pressure chamber from said mixing chamber.

5. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, said valve having an adjustable plunger for regulating the amount of opening thereof, a spring for closing said valve against the water pressure, means for adjusting the pressure of said spring, and pressure responsive means associated with said pressure chamber for opening said water regulating valve upon admission of fluid pressure to said pressure chamber from said mixing chamber.

6. A fluid pressure control means for humidifying systems comprising vaporizers connected to a fluid pressure pipe and a water supply pipe, said control means comprising a common fluid and liquid pressure chamber and operating upon a change in pressure in the fluid pressure pipe to shut off the water supply at each vaporizer.

7. A fluid pressure control means for humidifying systems comprising vaporizers connected to a fluid pressure pipe and a water supply pipe, said control means comprising a combined fluid pressure inlet and outlet pipe and operating upon a reduction in pressure in the fluid pressure pipe to shut off the water supply at each vaporizer, upon increase in fluid pressure to open the water supply, and upon further increase in pressure to prevent the flow of the water and blow dry air through each vaporizer.

8. Humidifying apparatus comprising in combination with a fluid pressure pipe and a water supply pipe and a spray nozzle, a vaporizer having a mixing chamber communicating with said spray nozzle and with the fluid pressure pipe, a water regulating valve in the water supply pipe having a pressure chamber in communication with said mixing chamber, and pressure responsive means associated with said pressure chamber for opening said water regulating valve upon an increase of fluid pressure in said fluid pressure pipe.

9. Humidifying apparatus comprising in combination a water pipe, a fluid pressure pipe, a vaporizer establishing communication between said pipes, a spraying nozzle communicating with the vaporizer, and a water regulating valve in the water line normally closed against the water pressure but responsive to open under combined water and air pressure.

10. Humidifying apparatus comprising in combination a water pipe, a fluid pressure pipe, a vaporizer communicating with said pipes, a spraying nozzle communicating with the vaporizer, and a water regulating valve in the water line having a pressure chamber and connections thereto for admitting both air and water, and a valve therein normally closed against either water or air pressure but responsive to open under the combined water and air pressure.

11. Humidifying apparatus comprising in combination a water pipe, a fluid pressure pipe in which the pressure is less than the pressure in the water pipe, a vaporizer communicating with said pipes, a spraying nozzle communicating with the vaporizer, a water regulating valve in the water line and a connection from the fluid pressure line thereto, said water regulating valve normally closed against either water or fluid pressure but responsive to the combined water and fluid pressure to open and permit continued flow of water therethrough.

12. In humidifying apparatus, the combination with a spray nozzle of a water regulating valve connected thereto and comprising a chambered body, a diaphragm cover therefor, a water supply pipe leading into said chamber, a fluid pressure pipe leading to the chamber, a valve stem on the cover normally closing the water pipe, but adapted to be raised to open said pipe by combined water pressure on the valve stem and fluid pressure on the diaphragm.

13. In humidifying apparatus, the combination with a spray nozzle of a water regulating valve connected thereto and comprising a chambered body, a diaphragm therefor, a water supply pipe leading into the chamber, a fluid pressure pipe leading to the chamber, a valve stem connected to the diaphragm normally closing the water pipe, but adapted to be raised by combined fluid and liquid pressure on the diaphragm and valve stem and also thereafter to remain raised by liquid pressure alone.

14. In humidifying apparatus, the combination with a spray nozzle of a water regulating valve connected thereto and comprising a chambered body having a liquid inlet, a liquid supply pipe leading thereto, a fluid pressure pipe leading also thereto, a liquid inlet closing member, the liquid and fluid pressures, when in operation, both acting in the same direction, but one from within and the other from without the liquid inlet to move the closing member therefrom.

15. Humidifying apparatus comprising in combination a water pipe, a fluid pressure pipe, a vaporizer establishing communication between said pipes and comprising a mixing chamber, a restricted fluid pressure inlet thereto, a combined fluid and water outlet therefrom, said inlet and outlet providing a path through the mixing chamber, in angular relation to the water inlet, a spray nozzle communicating with the vaporizer and a water regulating valve in the water line constructed and arranged to be yieldingly held closed against the water pressure, but responsive to open under combined water and air pressure.

16. Humidifying apparatus comprising in combination, the water pipe 20 having the outlet 31 therein and fluid pressure pipe 17, a vaporizer 15 communicating with the pipes 20 and 17, the spray nozzle 16 communicating with the vaporizer 15, the water regulating valve 21 communicating with the water pipe and vaporizer 15, the valve 21 comprising the chamber 30, the cover 29 therefor, the valve stem 34 carrying the diaphragm 36 in said chamber 30, the valve stem 34 closing the water inlet valve 31 in the pipe 20, the sleeve 32 adjustable in said top 29 with the spring 37 in said sleeve constructed and arranged to provide resilient support for the valve stem 34 and diaphragm 36, and to seat the stem 34 to close the water opening 31 and to be raised to open said opening 31 by pressure in the chamber 30.

In testimony whereof, I have signed my name to this specification.

GEORGE W. D'ARCY.