Aug. 23, 1949. A. H. BAHNSON, JR 2,479,895

ATOMIZER

Filed Oct. 19, 1945

Fig. 1.

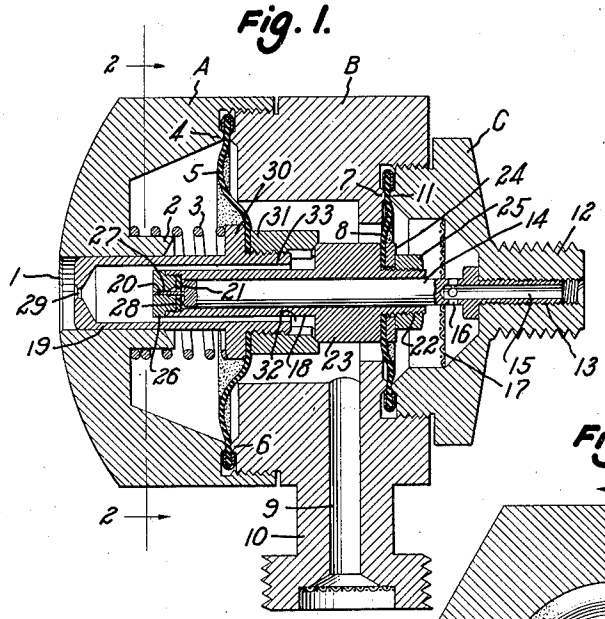


Fig. 2.

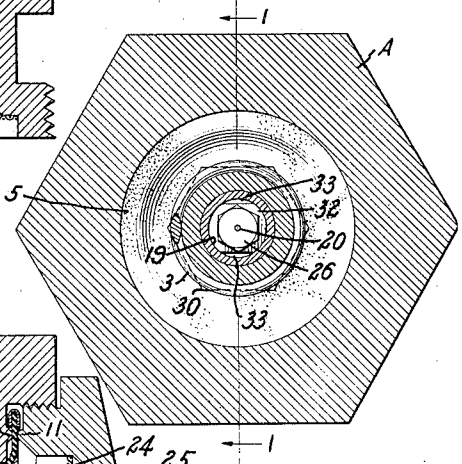
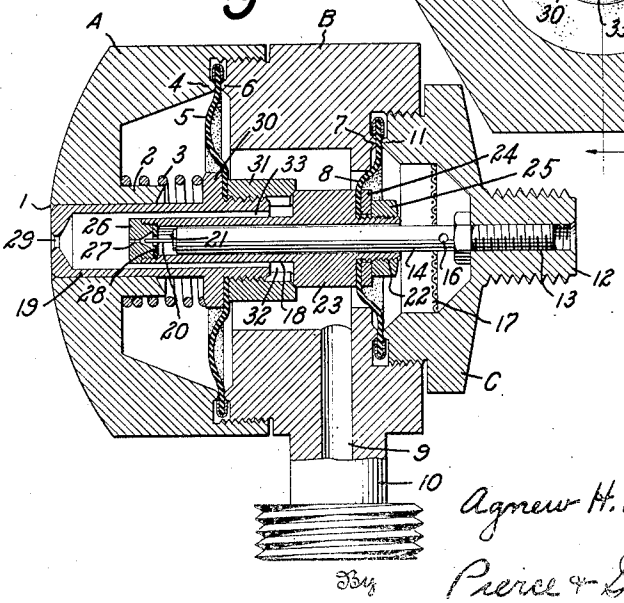


Fig. 3.



Inventor:

Agnew H. Bahnson Jr.

By Pierce & Scheffler

his Attorneys.

Patented Aug. 23, 1949 2,479,895

UNITED STATES PATENT OFFICE

2,479,895

ATOMIZER

Agnew H. Bahnson, Jr., Winston-Salem, N. C., assignor to Katharine King Bahnson, Winston-Salem, N. C.

Application October 19, 1945, Serial No. 623,227

7 Claims. (Cl. 299—59)

1

This invention relates to atomizers of the type commonly employed for adding moisture in air conditioning systems.

An object of the invention is to provide an atomizer of simple and relatively inexpensive construction which is reliable in operation and requires a minimum of service to maintain it in operation. Another object of the invention is to provide an atomizer in which the flow of water is automatically controlled, i. e., which may be connected at all times to a supply of water at a predetermined pressure but which will not function to atomize the water unless and until air at a pressure within a range corresponding to the water pressure is supplied.

The atomizer of the present invention is so designed that the air orifice through which air alone or the mixture of air and atomized water passes is open at all times and the water valve leading to the water orifice normally is held closed or seated by a spring of sufficient strength to resist the water pressure which tends to open the valve. The spring may be made strong enough to hold all water pressures which are likely to be applied to the atomizer. The strength of the spring may vary within a wide range but must, as stated, be strong enough to close the water valve in the absence of sufficient air pressure to atomize the water and must not be so strong that it cannot be overcome by the air pressure applied to the atomizer. The relationships of the strength of the spring, the air pressure, the water pressure and the sizes of the air and water diaphragms will be understood from the following detailed description of the atomizer and its operation.

Referring to the accompanying drawings which illustrate an embodiment of the invention:

Figure 1 is a longitudinal section through the atomizer on the line 1—1 of Figure 2 showing the parts of the atomizer in rest position with the water valve closed.

Figure 2 is a transverse section through the atomizer on line 2—2 of Figure 1.

Figure 3 is a section similar to that of Figure 1 but showing the parts of the atomizer in operating position with the water valve open.

Referring to the drawings the atomizer consists of a housing formed of the three parts A, B and C threaded together. The front part A has the central opening 1 surrounded internally by the sleeve 2 which serves to position the spring 3. Part A also has the shoulder or ridge 4 which provides a seat for the outer edge of the air diaphragm 5. Between the sleeve 2 and the shoulder 4 is an open space permitting free movement of the spring 3 and the diaphragm 5. The front side of the middle part B of the housing has the ridge 6 of the same diameter as ridge 4, which also provides a seat for the diaphragm 5,

2

that is to say, the outer edge of the diaphragm 5 is held between the ridges 4 and 6 when parts A and B are screwed tightly together. The rear side of the middle part B of the housing is provided with a ridge 7 for engaging the outer edge of the water diaphragm 8. Part B has a central opening through which the valve mechanism extends and which forms an air chamber defined by the wall of the opening, the valve mechanism and the two diaphragms. A passageway 9 extends through the wall of part B from the air chamber therein to the pipe connection 10 adapted to be connected to a source of air under pressure (not shown).

The rear part C of the housing has a ridge 11 on its front face of the same diameter as the ridge 7 and adapted to cooperate therewith when parts B and C are screwed tightly together to grip and hold the outer edge of the water diaphragm 8. Rear part C has the rearwardly projecting screw threaded projection 12 adapted to be connected to a source of water under pressure (not shown). Projection 12 has an axial screw threaded bore 13. The valve rod 14 is screw threaded into this bore. The valve rod 14 has a central bore 15 extending through that portion thereof within the bore 13 and laterally extending connecting bores 16 through which water may pass into the chamber formed by the inner wall of the part C and the diaphragm 8. Within the part C and in front of the bores 16 is a fine screen or filter 17 for preventing dirt from passing with the water into the valve mechanism.

The valve mechanism comprises the stem 14 referred to above, the sleeve 18 and the sleeve 19. The valve stem is provided at its front end with the cleaning pin 20 around which is the shoulder 21 constituting the valve disc or seat. The sleeve 18 slidably fits over the valve stem 14 with sufficient clearance between them for the passage of sufficient water to supply the valve orifice. The rear end of the sleeve 18 has screw threaded projection 22 which extends through a central opening in the diaphragm 8. In front of the screw threaded end 22 is the shoulder 23. Diaphragm 8 is secured to the sleeve 18 between the shoulder 23 and a washer 24 by the nut 25. The front end of the sleeve 18 is closed by the screw plug 26 having the central opening or water jet orifice 27 which receives the cleaning pin 20 when the valve is closed as shown in Figure 1. Washer means 28 provides a water tight joint between the rear face of the plug 26 and the shoulder 21 when the valve is closed.

As will be seen from the foregoing description the valve stem 14 is stationary and the sleeve 18 may move with the diaphragm 8 longitudinally with respect to the stem 14 to open or close the water valve.

Sleeve 19 is slidable within the opening 1 in the front part A and is also slidable over the sleeve 18, there being sufficient clearance between the sleeves 18 and 19 for the passage of the quantity of air required for the atomization of the stream of water passing through the jet orifice 27. Sleeve 19 is closed at its front end excepting the orifice 29 through which air or the mixture of air and atomized water passes. Sleeve 19 is screw threaded at its rear end and extends through the diaphragm 5 to which it is secured between the shoulder 30 and the nut 31. Nut 31 extends rearwardly to engage the shoulder 23 on the sleeve 18 and determines the spacing between the diaphragms 5 and 8. Diaphragms 5 and 8 and sleeves 18 and 19 move together as will appear in the description of the operation of the atomizer. It is to be noted, however, that the nut 31 does not seat fluid tight on the shoulder 23 but is apertured as shown at 32 to permit the passage of air from the chamber within the middle part B to the clearance or passageway 33 between the sleeves 18 and 19 (see Figure 2). The spring 3 is mounted between the inner wall of the front part A and the shoulder 30 and is supported in position concentric to the sleeve 19 by the sleeve 2. Spring 3 is compressed and tends to force the diaphragm 5, sleeve 19, sleeve 18 and diaphragm 8 rearwardly and to hold the plug 26 on the seat 21 to close the water valve.

The operation of the atomizer is as follows: Assuming that a water pressure of say 25 pounds per square inch is maintained from the source thereof through the bores 15 and 16, the screen 17 and the passage between the stem 14 and the sleeve 18 to the water valve 21, 26, 28, this pressure will be applied to the rear face of the diaphragm 8 and will tend to force it and its associated parts, i. e., sleeves 18 and 19, forwardly against the pressure of the spring 3. Spring 3 must therefore be strong enough to hold the water valve closed against the water pressure employed. Now when air under a pressure of, say 20 pounds per square inch, is admitted through passageway 9 it will press on the rear surface of the diaphragm 5 and on the front surface of the diaphragm 8 and will move the diaphragm 5 and its associated parts, i. e., sleeve 19 forwardly against the pressure of the spring 3. The pressure of the air tends to hold diaphragm 8 and its sleeve 18 in their rearward position but since sleeve 18 has now been freed of the pressure of spring 3 and since the water pressure on the rear surface of the diaphragm 8 is greater than the air pressure on its front surface, it and the sleeve 18 will move forwardly opening the water valve 21, 26, 28. Actually sleeve 18 will follow sleeve 19 in its forward movement maintaining the nut 31 and the shoulder 23 in contact. If the water pressure falls, the diaphragm 8 will be moved rearwardly by the air pressure and the water valve will close and air will escape through the orifice 29 harmlessly. If the air pressure is reduced or cut off the spring 3 will force sleeves 19 and 18 rearwardly and close the water valve. Thus failure of either the air pressure or the water pressure or such variation thereof which would give inferior operation of the atomizer will stop its operation. As stated above an air pressure greater than the water pressure, although it may force sleeve 19 forwardly against the spring 3, will also force sleeve 18 rearwardly against the water pressure and prevent the opening of the water valve. On the other hand an air pressure which is insufficient to force sleeve 19 forwardly against the spring 3 will not cause the water valve to open. The air pressure must therefore be within limits, which may be determined by correlation of the relative effective areas of the diaphragms 5 and 8 and the strength of the spring 3, best suited for operation of the atomizer. The spring 3 must, as stated, be strong enough in the absence of air pressure to hold the water valve closed against the water pressure. The large size of the diaphragm 5 relative to the diaphragm 8 makes it possible for an air pressure which is less than the water pressure and which therefore will permit the water pressure to open the water valve to overcome the pressure of the spring 3.

The above description of the operation of the atomizer only takes into account a complete opening or a complete closing of the water valve. It is noted however that the water valve does not necessarily move to completely open or completely closed position. With a water pressure of 25 pounds and no air pressure the valve will be completely closed and with a water pressure of 25 pounds and an air pressure of 20 pounds it will be completely open, assuming that the effective area of the diaphragm 5 is materially greater than the effective area of the diaphragm 8, say a ratio of 2 to 1, and that the spring 3 is of the proper strength to hold the water pressure and to yield freely to the air pressure. I have noted that at intermediate water and air pressures which are insufficient to completely open the water valve, for instance at a water pressure of 25 pounds and an air pressure of about 15 pounds, the water valve opens only partially and permits only a limited flow of water corresponding to the reduced air pressure. This is a very desirable action since a full supply of water with a diminished air pressure would tend to overload the stream of air and give an effect known as "wetting down" which is due to incomplete atomization and vaporization of the water. The pin 20 also serves, due to its close proximity to the opening 27 to cause turbulence in the stream of water passing through the opening 27 and thus to break up the stream and improve the atomization thereof. This effect increases as the pin 20 approaches the opening 27 i. e. as the valve approaches closed position, due to a fall in water pressure or air pressure and when there is greater need for this effect. The pin 20 also serves to clean the opening 27.

I claim:

1. An atomizer comprising a hollow shell enclosing a chamber, a front and a rear flexible diaphragm dividing said chamber into a front compartment, a middle compartment, and a rear compartment; a water inlet to said rear compartment and at the rear of said rear diaphragm, an air inlet to said middle compartment and an outlet for atomized mixture of air and water in that portion of the shell enclosing said front compartment, a stationary valve stem supported by that portion of the shell enclosing said rear compartment, a valve sleeve secured to and extending through said rear diaphragm and surrounding said valve stem, means including said sleeve and stem constituting a valve controlling the passage of water from said rear compartment through said sleeve, a second sleeve secured to and extending through said front diaphragm and surrounding said valve sleeve; cooperating stop means on said sleeves to limit the minimum separation thereof when displaced by fluid pressures exerted upon their respective supporting diaphragms and

a spring within said front compartment positioned to urge said sleeves rearwardly to close said valve, the force exerted by said spring being greater than the pressure of the water in said rear compartment on said rear diaphragm, and said front diaphragm presenting a substantially greater area than said rear diaphragm to the interior of said middle compartment.

2. An atomizer comprising a shell enclosing a chamber, said shell having an inlet for water, an inlet for air and an outlet for mixture of air and atomized water, a valve including relatively movable elements controlling the flow of water from said water inlet to said outlet, a first diaphragm within said chamber and carrying a movable element of said valve, said first diaphragm being positioned to be subjected on one side to the pressure of the water supplied through said water inlet and on the other side to the pressure of the air supplied through said air inlet, a second diaphragm within said chamber positioned to be subjected on one side to the pressure of the air supplied through said air inlet, and a valve-closing spring within said chamber positioned to urge said second diaphragm in opposition to said air pressure and to act with said air pressure to urge said first diaphragm in opposition to said water pressure to close said valve, said second diaphragm presenting a greater area than the first diaphragm to the air pressure.

3. An atomizer comprising a shell enclosing a chamber, two parallel spaced apart flexible diaphragms extending across said chamber and dividing the same into a front compartment, a middle compartment and a rear compartment, said diaphragm forming parts of the front and rear walls of said middle compartment, an air conduit open to and extending forwardly from said middle compartment through one of said diaphragms into said front compartment and having an orifice in its front end, a water conduit open to said rear compartment and extending forwardly therefrom through the other of said diaphragms into said air conduit and having an orifice in its front end, a stationary valve member supported by said shell and extending forwardly through said water conduit, valve means carried by said water conduit and cooperating with said stationary valve member to prevent flow of water through the orifice when said diaphragms are in rearward position, a water inlet to said rear compartment, an air inlet to said middle compartment, an opening in said front compartment for the discharge of atomized water and air, and resilient means in said front compartment tensioned to urge said air conduit and water conduit rearwardly to close said water orifice.

4. An atomizer as defined in claim 3 in which the orifice in said water conduit has rearwardly outwardly sloping side walls and said stationary valve member has a forwardly projecting pin adapted to extend through said orifice when said diaphragms are in rearward position.

5. An atomizer comprising a hollow shell, a front and a rear flexible diaphragm dividing the interior of said shell into a front compartment and a rear compartment separated by an intermediate compartment, an inlet to the intermediate compartment for connection to a source of gas under pressure, an inlet to the rear compartment for connection to a source of liquid under a higher pressure than that of said gas source, said front compartment having an outlet for an atomized mixture of gas and liquid, a stationary valve stem supported by that portion of the shell enclosing the rear compartment, a valve sleeve secured to and extending through said rear diaphragm, said valve sleeve being radially spaced from said valve stem to provide a passage for liquid and having a liquid orifice at its forward end, valve means carried by said valve sleeve and cooperating with said stationary valve stem to prevent flow through said liquid orifice when said valve sleeve is in rearward position, a second sleeve secured to and extending through said front diaphragm, said second sleeve being radially spaced from said first sleeve to provide a gas passage and having at its front end an orifice for the discharge of a mixture of gas and liquid, spring means in the front compartment tending to retain said second sleeve in rearward position, and cooperating stop means on said sleeves to force said valve sleeve rearwardly into valve-closing position when said second sleeve is moved into rearward position by said spring means, the areas of the diaphragms forming walls of the intermediate chamber being so related to the gas and liquid pressures that gas pressure within the intermediate chamber overcomes said spring means to move said second sleeve forwardly and is insufficient to prevent forward movement of said valve sleeve by liquid pressure exerted upon the rear surface of the rear diaphragm.

6. An atomizer as recited in claim 5, in combination with a pin mounted on said valve stem for cleaning the orifice of said valve sleeve when the latter is in valve-closed position.

7. An atomizer for operation from a pressure source of liquid and a gas source under a lower pressure, said atomizer comprising an elongated hollow shell and axially spaced pressure-responsive means dividing the interior space of said shell into a front compartment and a rear compartment separated by an intermediate compartment, a liquid inlet to the rear compartment and at the rear of the pressure-responsive means forming a wall of said rear compartment, a gas inlet to the intermediate compartment, valve means for controlling the flow of liquid through said atomizer and comprising a stationary valve stem cooperating with a valve sleeve supported by and movable with the rear pressure-responsive means, and spring means preventing opening movement of said valve means by liquid pressure exerted on said rear pressure-responsive means, the dimensions of said front pressure-responsive means being such that gas pressure within said intermediate chamber relieves said rear pressure-responsive means from the force of said spring means, whereby said valve means may be opened by liquid pressure in the rear compartment.

AGNEW H. BAHNSON, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
724,685	Evans	Apr. 7, 1903
1,363,470	Knudson	Dec. 28, 1920
1,879,363	Loepsinger	Sept. 27, 1932
2,097,696	MacDonald	Nov. 2, 1937
2,186,214	Simon	Jan. 9, 1940
2 311,018	Bahnson	Feb. 16, 1943
2 348 248	Elliott	May 9, 1944
2,362,102	Simon	Nov. 7, 1944
2,384,679	Holtzclaw	Sept. 11, 1945