April 22, 1952 A. J. LOEPSINGER 2,594,045

ATOMIZER

Filed May 1, 1948 2 SHEETS—SHEET 1

Fig. 1

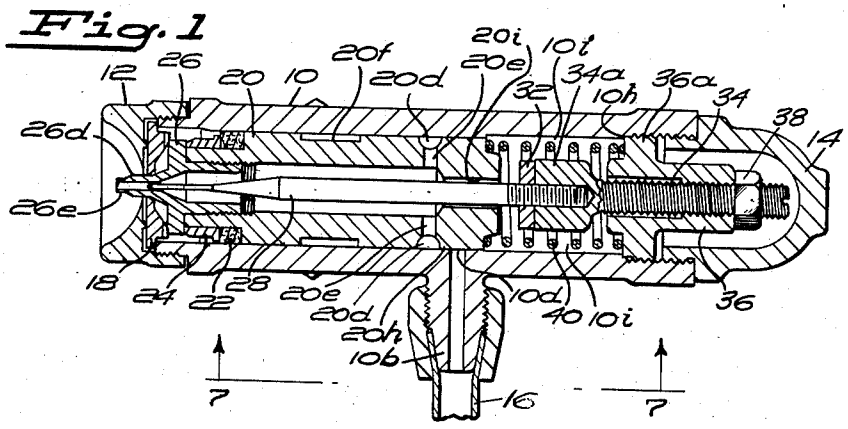


Fig. 2

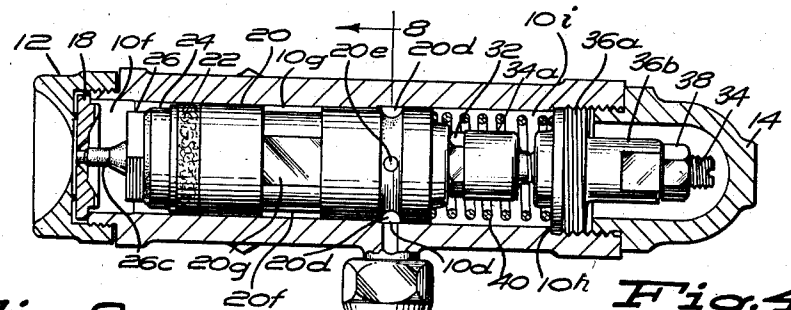


Fig. 3

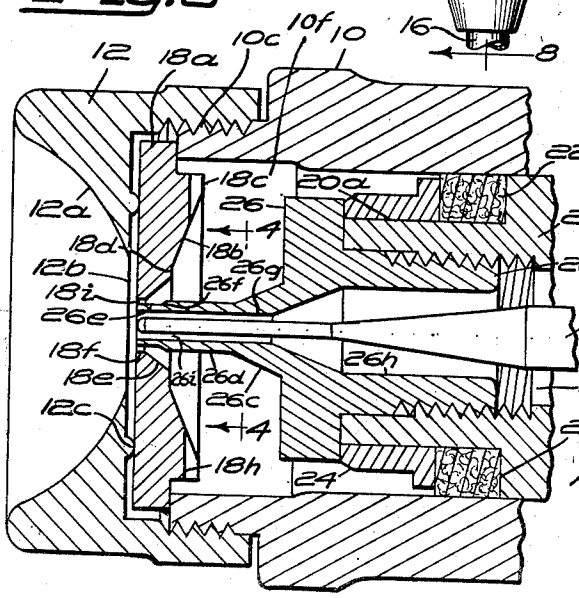
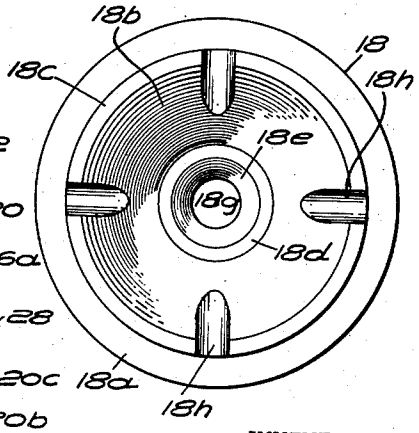


Fig. 4



INVENTOR.

Albert J. Loepsinger

BY

Harry Dexter Peck

Attorney

April 22, 1952 A. J. LOEPSINGER 2,594,045

ATOMIZER

Filed May 1, 1948

2 SHEETS—SHEET 2

Fig. 5

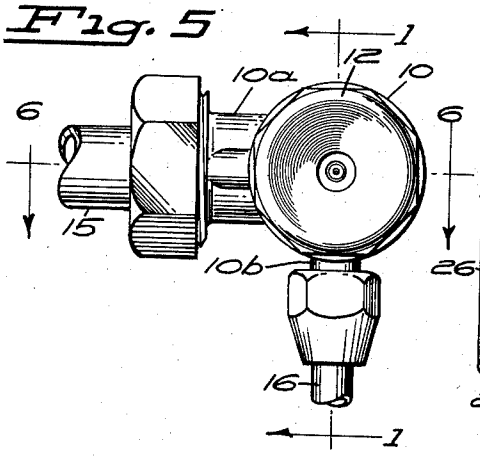


Fig. 6

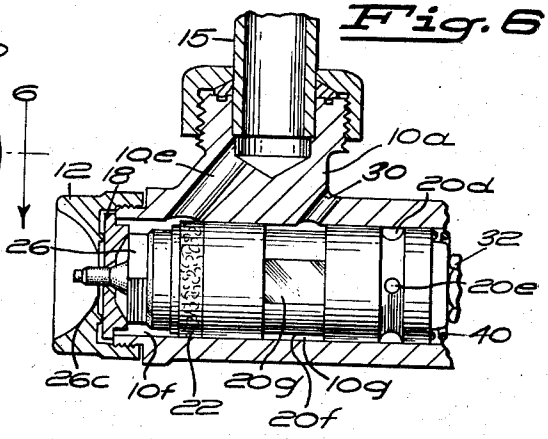


Fig. 7

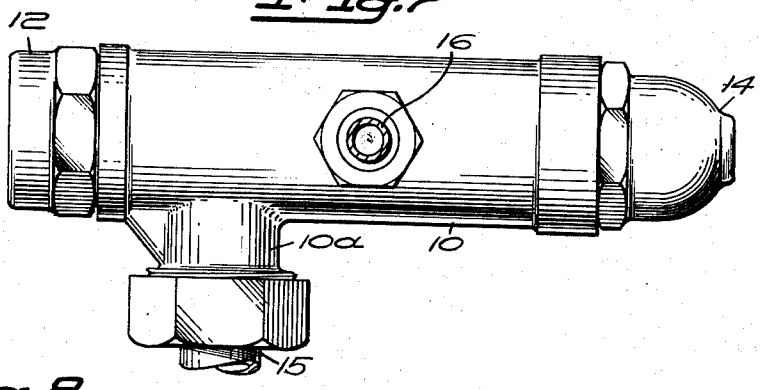
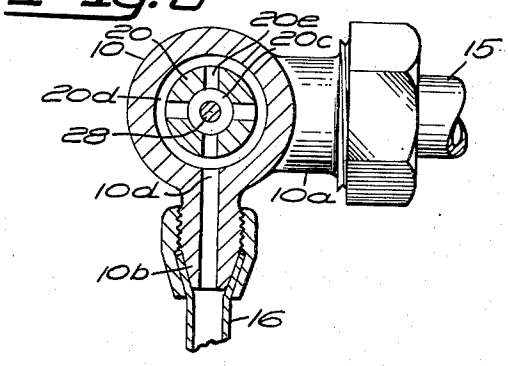


Fig. 8



INVENTOR.

Albert J. Loepsinger

BY

Harry Dexter Peck

Attorney

Patented Apr. 22, 1952

2,594,045

UNITED STATES PATENT OFFICE

2,594,045

ATOMIZER

Albert J. Loepsinger, Providence, R. I., assignor to Grinnell Corporation, Providence, R. I., a corporation of Delaware

Application May 1, 1948, Serial No. 24,489

3 Claims. (Cl. 299—149)

1

This invention relates to improvements in an atomizer. More especially it has to do with an atomizer of the type disclosed in my Letters Patent No. 2,173,072 granted on September 12, 1939.

In the atomizer of the aforesaid patent there is a pair of concentric apertures or orifices for discharge of a fluid and a liquid so as to effect atomization of the latter, and movable means actuated in one direction by the fluid pressure to open both apertures and moved in the opposite direction by resilient means to close both apertures. More specifically the liquid nozzle moves into the fluid orifice to clean and close it while a cleaning rod is simultaneously moved to clean and close the orifice of the liquid nozzle. This positive closure of both orifices, especially the liquid orifice, insures no inadvertent discharge of the liquid when the atomizer becomes inactive. Field experience has shown, however, that it is not necessary to have a movable cleaning rod of the same size as the liquid orifice and to have it withdrawn from the orifice while the atomizer is discharging. Indeed, it has been found preferable to have a cleaning rod which is somewhat smaller than the orifice and to have it remain stationary in the orifice while discharge occurs. Since this cleaning rod remains fixed in position and the liquid nozzle moves forward away from it, when discharge ceases, the liquid orifice is not closed upon the atomizer becoming inactive. This presents the problem of insuring against inadvertent discharge of liquid through the orifice after the fluid pressure has been cut off and the movable parts of the atomizer have assumed their closed positions.

It is among the objects of the present invention, while retaining in the improved atomizer many of the desired features of the prior patented device, to simplify the movable means, to improve the atomized discharge and, despite the fact that the liquid orifice is not closed when atomization stops, to insure that no inadvertent emission of the liquid will occur.

The best mode in which it has been contemplated to apply the principles of my invention is shown in the accompanying drawings but these are to be taken as merely illustrative because it is intended that the patent shall cover by suitable expression in the appended claims whatever features of patentable novelty exist in the invention disclosed.

In the accompanying drawings:

Figure 1 is a vertical longitudinal section (taken as on line 1—1 of Figure 5) of the preferred embodiment of my invention, the parts being shown in their relative positions when the atomizer is inactive;

2

Figure 2 is a view like Figure 1 but with many of the parts shown in elevation and in their relative positions when the atomizer is in operation;

Figure 3 is a partial section, on an enlarged scale, showing the details of the discharge end of the atomizer; and their possible relative positions when the atomizer is active;

Figure 4 is a view of the orifice plate, looking in the direction of the arrows 4 shown in Figure 3;

Figure 5 is a front elevation of the improved atomizer;

Figure 6 is a partial horizontal, longitudinal section taken as on line 6—6 of Figure 5; the parts being in their relative positions when the atomizer is inactive;

Figure 7 is a bottom view of the atomizer looking in the direction of the arrows 7 shown in Figure 1; and

Figure 8 is a vertical section taken as on line 8—8 of Figure 2.

Referring more particularly to the drawings, the improved atomizer comprises a casing 10, generally of cylindrical configuration, with a sleeve nut 12 at the forward or discharge end and with a cap nut 14 at the opposite end. The casing has an offset portion 10a on one side with a threaded stem to which a pipe 15 may be attached leading from a supply of fluid under pressure, and having another offset portion 10b on the bottom of the casing to which another pipe 16 may be secured leading from a source of the liquid to be atomized. When the atomizer is used for humidification purposes the liquid supplied is usually water and the fluid for atomizing the water is usually compressed air. It is to be understood, however, that the fluid under pressure may in some instances be a gas other than air, and indeed may be a liquid. Although the liquid to be atomized is generally not under other than atmospheric pressure, being drawn through the atomizer by aspirating effect, this liquid may also be supplied under pressure provided the pressure is of a lesser degree than that of the aforesaid fluid.

The forward or discharge end of the casing (see Figs. 3 and 4) has a threaded externally reduced portion 10c, on which is screwed the sleeve nut 12, having a concaved or dished surface 12a with a central opening 12b. This cap nut clamps a flange 18a of a fluid orifice plate

18 against the front edge of the body, there being a raised ring 12c around the inner face of the cap nut which engages the front or outer face of the plate. The inner face of the plate is gently tapered, as at 18b, from an outer flat annular ring surface 18c to an inner flat annular ring surface 18d from whence the surface tapers rather sharply as at 18e to a relatively thin edge 18f which constitutes a short horizontal wall around a fixed orifice 18g at the center of the plate. A series of cross-slots or grooves 18h are provided around the outer portion of the inner face of the plate for a purpose to be described later herein.

Within the casing is a movable element 20, in the form of a piston, having a nice sliding fit with the inner cylindrical wall of the casing. At its forward end, the outer surface of the piston is reduced at 20a to receive a suitable lubricating ring 22 which is held in place against a radial shoulder 20b by a retainer sleeve 24 which in turn is engaged by a liquid nozzle 26. This nozzle has a threaded stem 26a which is screwed into a central or axial bore or passageway 20c extending through the piston. At its forward end the nozzle also has a stem 26c with a portion 26d whose external diameter is substantially the same as that of the little horizontal wall 18f around the edge of the fixed orifice 18g.

This nice fit between the portion 26d of the liquid nozzle and the wall 18f of the fluid orifice is made use of in positioning the plate 18. With the nozzle forward and projecting somewhat from the casing the plate 18 is placed on the nozzle with the wall 18f around the portion 26d. The sleeve nut 12 is then applied against the plate, and pushed toward the casing until the nut can be screwed onto the portion 10c. As the nut is tightened the engagement of the wall 18f with the portion 26d maintains the plate in its proper position.

Near the front edge of this stem 26c the external diameter is reduced to provide a cylindrical portion 26e which is smaller than the fixed orifice so that when the liquid nozzle is retracted, as shown in Figure 3, there will be an annular opening 18i between this reduced cylindrical portion 26e of the stem and the edge 18f of the fixed orifice. It is through this annular opening 18i that the fluid under pressure is discharged when the atomizer is in operation. When the fluid pressure is cut off, and the liquid nozzle moves forward to the position shown in Figs. 1 and 6 the inclined shoulder 26f between the two cylindrical portions 26e and 26d of the stem wipes along the wall 18f of the fixed orifice and removes any dirt, lint or other foreign matter that may have temporarily collected on this wall.

The forward stem 26c of the liquid nozzle has a cylindrical bore 26g through it which enlarges to a somewhat larger bore 26h through the rearward stem 26a of the nozzle. Within these bores, and extending through the longitudinal passageway 20c in the piston is a solid cleaning rod 28 whose forward end is of slightly less diameter than that of the bore 26g through the forward stem 26c of the nozzle. The front end of this rod is somewhat rounded-over and its tip is located substantially in the plane of the forward edge of the liquid nozzle 26. Thus there is provided between the rod 28 and the forward portion 26c of the liquid nozzle a relatively thin annular passageway 26i from which

the liquid emerges as a hollow jet with its thin annular stream in close proximity to the thin annular stream of the fluid under pressure issuing from the annular opening 18i. As these two streams intermingle the liquid is broken up into exceedingly fine particles and projected into the atmosphere as a very fine fog-like discharge. This discharge is remarkably uniform in density and the minute liquid particles are rapidly entrained by the air.

When the fluid pressure is cut off the liquid nozzle moves forward to the position shown in Figs. 1 and 6. As seen in Fig. 1, this leaves the orifice of the liquid nozzle open. Compared to the feature of the atomizer of my aforesaid patent which resides in the positive closure of both orifices upon the atomizer becoming inactive, this open liquid orifice of the improved atomizer might seen to be a disadvantage and enable undesired discharge to occur. Indeed this would happen if the liquid supply were to enter the casing at the rear of the piston as it does in the atomizer of my prior patent. But to avoid any such inadvertent discharge, the inlet 10d from the liquid supply is located forward of the rear end of the piston 20, in a portion of the casing wall along which the piston moves in both directions of its travel. As will presently appear this not only effects closure of the liquid inlet when the atomizer becomes inactive, but enables a condition created rearward of the piston to be used with advantage.

Near the rear end of the piston or movable element 20 is an external groove 20d extending around the piston and from it a series of cross or radial passageways 20e lead to the axial bore of main passageway 20c through the piston. When the piston is retracted and the atomizer is in operation this groove 20d, constituting a part of the liquid passageway, is in register with the inlet 10d to the body from the liquid supply. This liquid is drawn from the pipe 16 through the bore of the offset 10b and the inlet 10d into the groove 20d and thence through the branch passageways 20e into the main passageway 20c of the piston. It then flows along the annular space 26i between the rod 28 and the adjacent wall 26g of the nozzle to emerge in a relatively thin annular stream as already described.

The piston is held retracted by the fluid pressure effective on its forward end. This fluid pressure flows from the pipe 15 through a passageway 10e (see Fig. 6) in the offset 10a into the casing, or more particularly into a chamber 10f between the piston and the orifice plate 18. The nice sliding fit between the piston and the wall of the casing normally prevents escape of the fluid rearward around the piston but if any should inadvertently leak rearward it enters a space 10g provided by a reduced portion 20f on the piston and escapes from the atomizer via a vent hole 30 in the casing. This reduced portion 20f of the piston has flattened faces 20g whereby the piston (when removed from the body, of course) may be gripped by a wrench while the liquid nozzle 26 is screwed into or unscrewed from the piston.

The rear end of the piston seats against a lock nut 32 that is screwed onto the cleaning rod 28 just ahead of where the rod itself is screwed into an enlarged head 34a of an adjusting screw 34. The threaded shank or stem of this screw extends through and in threaded engagement with

a sleeve nut 36. This latter has an externally threaded cylindrical portion 36*a* which screws into the internally threaded rear end of the body 10, until firmly seated against a shoulder 10*h*. A rearwardly projecting portion 36*b* of the sleeve nut is partly internally threaded for engagement with the adjusting screw 34, and its rear face provides a seat for a lock nut 38 on the extended stem of the adjusting screw. Between the forward face of the sleeve nut and a part of the rear face of the piston, within another chamber 10*i*, is a spring 40 under compression and constantly urging the movable parts forward in the casing. The force of this spring is such that it is overcome by the pressure of the fluid when the latter is admitted to the forward section 10*f* of the body chamber. At the rear of the body the cap nut 14 is removably screwed into the end of the casing back of the sleeve nut 36.

When the atomizer is inactive, the liquid nozzle 26 is forward closing the orifice 18*g* in plate 18 against the flow of any fluid and the piston 20 is likewise forward with the surface 20*h* near its rear end closing the inlet 10*d* from the liquid supply. The end of the rod 28 is then somewhat rearward of the end of the nozzle as shown in Fig. 1. Upon the fluid pressure being turned on, usually by some control apparatus remote from the atomizer, it enters the chamber 10*f* forward of the piston, passes through the cross grooves 18*h* in the back of the orifice plate and thus becomes effective on substantially the entire forward end of the piston. The force of the fluid pressure overcomes the force of the spring 40 and causes the movable parts to travel rearward until the end of the piston seats on the lock nut 32. The relative movement between the liquid nozzle and the rod 28 enables the latter to act with some cleaning effect and dislodge dirt or particles which may have gathered in the nozzle.

The rearward movement of the liquid nozzle opens the annular discharge space 18*i* of the fixed orifice permitting the fluid to flow outward in an annular stream and set up immediately an aspirating effect in the inner annular space 26*i* between the nozzle and the cleaning rod. The liquid can be promptly drawn through this space 26*i* because the rearward movement of the piston brings its external groove 20*d* in register with the inlet 10*d* for the liquid supply. The liquid accordingly enters the groove 20*d* and passes thence through the branch passageways 20*e* into the bore of the piston whence it travels forward through the annular space 26*i* around the rod to be discharged as already described.

It is to be noted that the improved atomizer, like the atomizer of my aforesaid prior patent, can be adjusted while it is discharging. With the end cap 14 removed and the lock nut 38 loosened, the adjusting screw 34 can be rotated to effect movement of the liquid orifice with respect to the fixed fluid orifice. With a suitable pressure and supply of fluid a nice adjustment of the liquid orifice can be made, the result thereof determined as it is effected, and the desired fog-like discharge attained with maximum efficiency.

Upon the shutting off of the fluid pressure, the spring 40 becomes effective to push the movable parts forward until the flat face of the liquid nozzle 26 brings up against the rear side of the orifice plate 18. During this forward movement of the part the shoulder 26*f* on the nozzle wipes the wall 18*f* of the fluid orifice thus cleaning it as the larger portion 26*d* of the front stem on the

nozzle enters and closes the fluid orifice 18*g*. The same forward movement of the piston moves the groove 20*d* out of register with the liquid inlet 10*d* and brings the outer surface 20*h* of the piston over the inlet to close it tight. If this liquid inlet 10*d* were located rearward of the piston (as in my prior patented atomizer) so that it were always open to the chamber 10*i* in the casing, then upon the piston 20 moving forward and increasing the size of this chamber, the initial effect would be to create a reduced pressure condition (a slight vacuum) which would increase the rate of flow of the liquid entering the atomizer. The sudden stopping of the forward movement of the piston, as it contacts the plate 18, would cause an abrupt stoppage of the inflowing liquid and create a liquid hammer. This would momentarily produce a positive pressure in the liquid and as a result the liquid would be forced through the now open liquid orifice as a small solid stream with most undesired precipitation on whatever may be located below the atomizer. But this sort of liquid discharge is entirely avoided in the arrangement of the improved atomizer.

As the piston 20 moves forward the space in the chamber 10*i* between the rear end of the piston and the sleeve nut 36 of course becomes larger and this increase in size momentarily reduces the pressure therein. This change in pressure is not effective on the liquid supply because the inlet 10*d* is promptly closed as the piston moves forward. But the reduced pressure in the chamber 10*i* enables the atmospheric pressure outside the atomizer to force some of the liquid in the piston rearward from the chamber 20*c* through the annular space 20*i* around the cleaning rod 28 and into the increased space of the chamber 10*i* behind the piston. Thus the discharge of any liquid from the nozzle is immediately arrested because the liquid in the forward stem 26*c* of the nozzle is likewise forced backward toward the main passageway 20*c* in the piston by the pressure of the outside atmosphere. Thus there is no precipitation or drip from the atomizer when it is rendered inactive.

Upon the fluid pressure being again turned on, there is no forward movement of the liquid until the piston is forced backward. This of course decreases the space of the chamber 10*i* behind the piston and some of the water standing therein is forced forward into the main passageway 20*c* of the piston and also forward into the discharge stem 26*c* of the nozzle. But by the time this liquid reaches the end of the nozzle the annular space 18*i* is open and the annular fluid stream is flowing and ready to effect atomization of the water. Thus there is likewise no precipitation or dripping from the atomizer when it is put in operation.

The only liquid discharge from the atomizer is in the form of finely atomized particles which are projected into the atmosphere in the form of a very fine and highly desirable fog.

I claim:

1. An atomizer comprising a casing having a chamber at one end thereof connected with a supply of fluid under pressure greater than atmospheric pressure and having a fixed discharge orifice at one end of said chamber; an element movable within the casing separating the internal space thereof into said chamber for the fluid adjacent said orifice and a second chamber for liquid remote therefrom, the second said chamber being connected with a supply of liquid;

said element having a nozzle with a continuously open outlet at the end adjacent said fixed orifice and having a longitudinal passageway through said element between said outlet and the said second chamber; an inlet in the side wall of the casing connected with the liquid supply; a cross passageway in said element intermediate of its ends and adapted to connect said longitudinal passageway with said liquid inlet; said element being moved by the pressure of said fluid to position the said continuously open outlet in atomizing relation with said fixed orifice and to position the cross passageway in flow relation with the said inlet for the liquid; the flow of the fluid under pressure greater than atmospheric pressure past the said nozzle outlet creating a pressure less than atmospheric pressure within the passageways of said movable element and within said second chamber whereby the liquid flows into said passageways and said second chamber and is also discharged from said continuously open outlet; and spring means effective upon shutting off said fluid pressure to move said element to close said fixed orifice and said liquid inlet to said casing; the last said movement of the element causing enlargement of the said second chamber with consequent further reduction of pressure therein below atmospheric pressure whereby the atmospheric pressure outside said continuously open outlet moves the liquid in said element near its outlet and in its said longitudinal passageway toward said second chamber.

2. An atomizer comprising a casing having an inlet connected with a supply of fluid under pressure, a second inlet connected with a supply of liquid, and a discharge orifice at one end; an element movable in said casing having a continuously open nozzle at one end with its outlet concentrically arranged with respect to said orifice; a main passageway extending from said nozzle through said element to the opposite end thereof with a branch passageway therefrom for register with the said liquid inlet; the said element being moved by the fluid pressure to position said nozzle outlet and said orifice in atomizing relation whereby the flow of fluid past the nozzle outlet draws the liquid through the said passageways from the said liquid supply for atomizing discharge; and means for moving said element upon reduction of said fluid pressure to close the orifice with said nozzle and move the said branch passageway out of register with the

liquid inlet whereby the latter is closed by the said element; the last said movement of the element creating a suction at its said opposite end which is transmitted through the main passageway to effect withdrawal of the liquid backward from the nozzle outlet.

3. An atomizer comprising a cylindrical casing having a chamber at one end thereof with an inlet thereto for fluid under pressure and a discharge orifice therefrom; a second chamber near the opposite end of said casing; an inlet in the side wall of said casing between said chambers for the liquid to be atomized; a piston slideable in said casing and constituting a movable wall between said chambers; a continuously open nozzle at one end of said piston with its outlet concentrically arranged with respect to said orifice; a longitudinal passageway through said piston from chamber to chamber having a side passageway therefrom for register with said liquid inlet; a cylindrical portion on said piston rearward of said side passageway cutting off connection between said liquid inlet and said second chamber; said piston being moved by the fluid under pressure to position said nozzle in atomizing relation with said orifice and said branch passageway in register with the fluid inlet for atomizing discharge of the liquid; and means for moving said piston upon reduction of said fluid pressure to close the orifice, move the branch passage out of register the liquid inlet and move the said cylindrical portion of the piston in closing relation to said liquid inlet; the last said movement of said piston effecting enlargement of the said second chamber and thereby creating suction in the passageway of the piston to effect withdrawal of the liquid away from the nozzle outlet.

ALBERT J. LOEPSINGER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,041,787	Henry	Oct. 22, 1912
2,173,072	Loepsinger	Sept. 12, 1939
2,179,184	Hodge	Nov. 7, 1939
2,186,214	Simon	Jan. 9, 1940

FOREIGN PATENTS

Number	Country	Date
86,079	Austria	Oct. 25, 1921
664,686	France	Apr. 23, 1929