Sept. 20, 1960 C. W. BONDURANT 2,953,305

PLURAL FLUID DISCHARGE ASSEMBLY

Filed Sept. 25, 1957 2 Sheets-Sheet 1

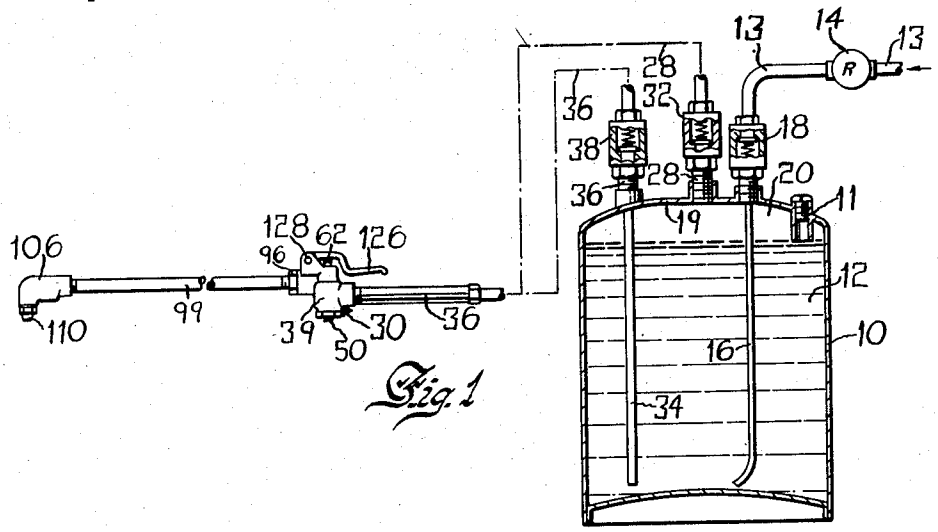

Fig. 1

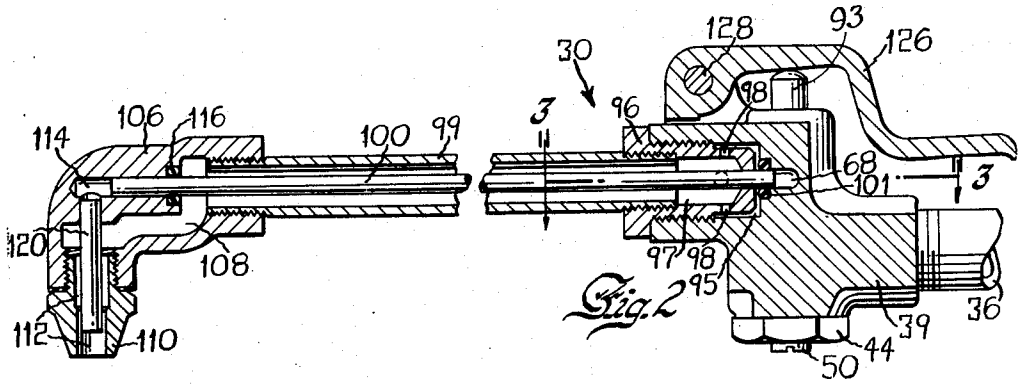

Fig. 2

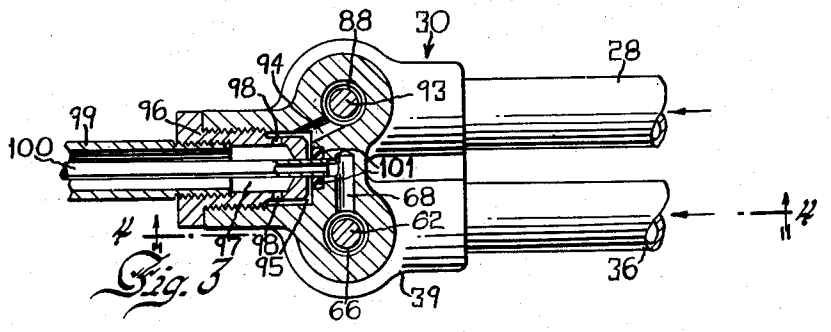

Fig. 3

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Sept. 20, 1960 C. W. BONDURANT 2,953,305

PLURAL FLUID DISCHARGE ASSEMBLY

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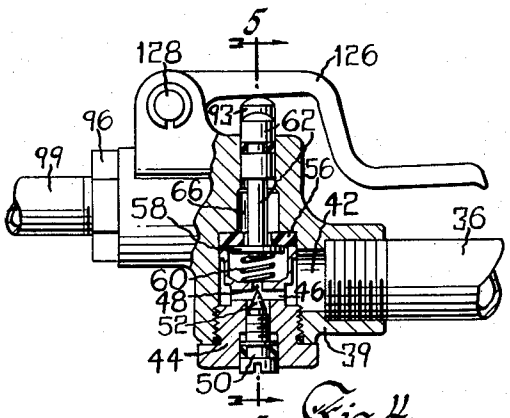

Fig. 4

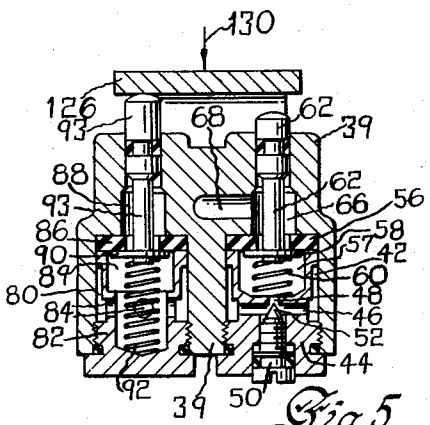

Fig 5

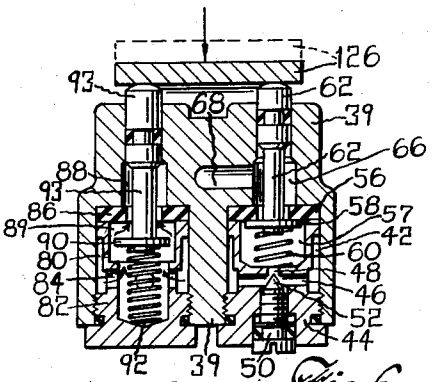

Fig. 6

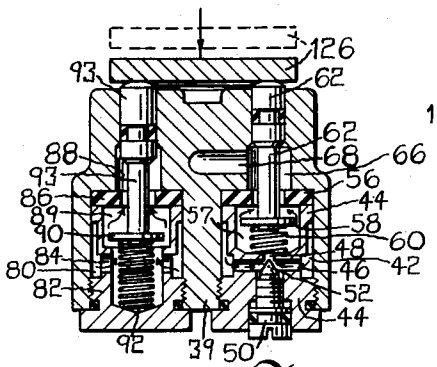

Fig. 7

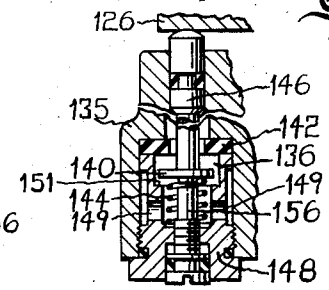

Fig. 8

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2,953,305

PLURAL FLUID DISCHARGE ASSEMBLY

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Filed Sept. 25, 1957, Ser. No. 686,143

5 Claims. (Cl. 239—353)

This invention relates to a fluid discharge assembly. The invention relates more particularly to a fluid discharge assembly for discharging or dispensing a plurality of fluid materials. This invention also relates to a valve apparatus or a fluid gun assembly for discharging one or more fluids under pressure either separately or in a mixture.

This application is a continuation-in-part of my co-pending application for Fluid Dispenser Assembly, Serial No. 641,915, filed February 25, 1957.

It is an object of this invention to provide a fluid discharge assembly having means by which a plurality of fluid materials may be discharged, under pressure, separately or as a mixture through a single outlet.

Another object of this invention is to provide means by which a gas and a liquid are discharged under pressure either separately or in combination from a single outlet and in which the liquid is thoroughly atomized at the outlet.

Another object of this invention is to provide a nozzle assembly for separate transmission of a plurality of fluids in which the direction of flow of each fluid into the nozzle is at an angle with respect to the direction of flow of the fluid from the nozzle.

Another object of this invention is to provide such a nozzle, the elements of which may be easily and readily assembled.

Another object of this invention is to provide such a nozzle assembly which may be easily and readily attached to a fluid gun.

Another object of this invention is to provide means for discharging either a gas and/or a liquid in which the two fluids are discharged under pressure and in which the gas assists in the flow and atomization of the liquid.

Another object of this invention is the provision of a fluid gun which discharges either a gas and/or a liquid and in which one of these fluids is always discharged first and separately without any portion of the other fluid. Thus, there is no portion of one fluid remaining in the gun which can be discharged inadvertently when the other fluid is desired.

Another object of this invention is to provide apparatus for conducting separately a plurality of fluids to a device which discharges the fluids either separately or in combination.

Another object of this invention is to provide a gas and/or liquid gun which is provided with means for adjusting the rates of flow and the ratio between the rates of gas and liquid flow from the gun.

Another object of this invention is to provide means by which two fluids may be discharged separately or in combination from a single container and in which one of the fluids is constantly agitated during discharge of either fluid.

Another object of this invention is to provide a fluid discharge assembly including a fluid gun which is long lived and sturdily built and the parts of which can be constructed and assembled at low costs.

Other objects and advantages reside in the construction of parts, the combination thereof, the method of manufacture, and the mode of operation, as will become more apparent from the following description.

In the drawings:

Figure 1 is a schematic view with parts shown in section of a fluid discharge assembly of this invention.

Figure 2 is an elevational sectional view of a fluid gun of this invention.

Figure 3 is a sectional view taken substantially on line 3—3 of Figure 2.

Figure 4 is a sectional view taken substantially on line 4—4 of Figure 3.

Figure 5 is a sectional view taken substantially on line 5—5 of Figure 4. Figure 5 shows the valve elements of the fluid gun in closed position.

Figure 6 is a sectional view similar to that of Figure 5 showing one of the valve members of the fluid gun in an open position.

Figures 7 is a sectional view similar to that of Figures 5 and 6 showing a plurality of valve members of the fluid gun in open position.

Figure 8 is a fragmentary sectional view showing a preferred modification of a valve mechanism of this invention.

Referring to the drawings in detail, a fluid discharge assembly of this invention comprises a closed tank or container **10**, shown in Figure 1. Within the container **10** is a quantity of liquid **12**, which may be a single liquid or a mixture of liquids. The liquid **12** may also consist of a liquid having finely divided solid particles therein.

The tank **10** is provided with a high level tube **11** through which liquid **12** may flow into the tank **10**. Liquid is prevented from rising above the bottom of the tube **11** if there are no other vents in the tank **10** during filling thereof.

A conduit **13** connects to a supply of fluid, preferably a gas, or other material considerably lighter in weight than the liquid **12**. A pressure regulator **14** may be used in the conduit **13** if desired. The conduit **13** connects to a pipe **16** within the tank **10** by means of a unidirectional valve member **18** which may be of any suitable type or style. The pipe **16** extends through an upper enclosing wall **19** of the container **10**. The pipe **16** extends downwardly within the container **10** to a position adjacent the bottom thereof.

Due to the fact that the gas entering the tank **10** through the pipe **16** is under pressure, the gas bubbles upwardly through the liquid **12**, agitating the liquid **12**, causing all portions of the liquid **12** to be thoroughly mixed.

The gas is referred to herein by reference numeral **20**. The gas **20** after leaving the lower end of the pipe **16** and after bubbling upwardly through the liquid **12** collects above the surface of the liquid **12** and below the upper enclosing wall **19** of the tank **10**.

Also connected to the upper enclosing wall **19** of the tank **10** and extending therethrough is a fluid conduit **28** which is adapted to conduct only the gas **20** outwardly from the tank **10** to a fluid gun **30** to which the conduit **28** is attached. Within the conduit **28** intermediate the ends thereof is a unidirectional valve member **32** which may be of any suitable type or style.

Also extending through the upper enclosing wall **19** of the container **10** and having a lower end disposed adjacent the bottom of the tank **10** is a fluid pipe **34**. The pipe **34** connects to a conduit **36** through a suitable unidirectional valve **38** exterior of the tank **10**. The conduit **36** also connects to the fluid gun **30** for conducting liquid **12** from the tank **10** to the gun **30**.

The conduits **28** and **36** extending from the tank **10** to the fluid gun **30** may be flexible throughout a portion

of the length thereof and rigid throughout a portion of the length thereof. Preferably, the fluid conduits 28 and 36 have rigid portions adjacent the fluid gun 30.

The fluid gun 30 is provided with an internal cavity 42 which connects to the conduit 36, as shown in Figure 4. A plug member 44 is threadedly attached to the body 39 and is disposed within the cavity 42. The plug 44 is provided with a plurality of passages 46 leading to a central orifice 48. An adjustment screw member 50 is threadedly movable within the plug 44 and has a conical end 52 movable toward and away from the orifice 48 for governing the rate of flow of fluid through the orifice 48. The plug 44 extends into the cavity 42 substantially the length thereof and engages a resilient valve seat member 56 which is provided with a fluid port therethrough. The plug 44 thus forms a chamber 57 adjacent the valve seat 56. It is thus understood that all of the fluid flowing to the fluid port in the valve seat 56 must flow through the orifice 48 and through the chamber 57.

A movable closure member 58 is resiliently held in engagement with the valve seat 56 by means of a spring 60 which engages a portion of the plug 44 and encircles the orifice 48. The movable valve closure member 58 is provided with a valve stem 62 which extends upwardly through the body 39 and has a portion thereof exterior of the body 39. The valve stem 62 extends through an intermediate passage 66 which connects to the chamber 57 by means of the fluid port through the valve seat 56. The intermediate passage 66 connects to an outlet passage 68 which extends horizontally from the intermediate passage 66, as shown in Figures 5, 6, and 7.

Also within the body 39 adjacent the cavity 42 is a cavity 80 which joins the conduit 28 in a manner similar to the connection of the cavity 42 to the conduit 36, shown in Figure 4. Extending within the cavity 80, as shown in Figures 5, 6, and 7, is a hollow plug 82 which is threadedly attached to the body 39.

The plug 82 is provided with a plurality of radially extending inlet passages 84 which permit fluid to flow therein. The plug 82 engages a resilient valve seat member 86 which is provided with a fluid port therethrough leading to an intermediate passage 88. The plug 82 forms a chamber 89 adjacent the valve seat 86. Thus, all fluid flowing through the fluid port of the valve seat 86 must flow through the passages 84 and through the chamber 89. The fluid port through the valve seat 86 is normally closed by means of a movable valve closure member 90 which is resiliently urged toward engagement with the valve seat 86 by means of a helical spring 92 which is disposed within the plug 82.

The valve stem 93 is attached to the valve closure member 90 and extends through the intermediate passage 88 and outwardly from the body 39.

The intermediate passage 88 connects to an angularly extending horizontal outlet passage 94 which joins an outlet cavity 95, as shown in Figure 3. Disposed within the outlet cavity 95 and threadedly attached to the body 39 is an adapter 96 which is provided with a cylindrical recess 97 therein. A plurality of orifices 98 extend through the wall of the adapter 96 adjacent the inner end thereof and permit flow of fluid from the outlet passage 94 into the internal recess 97 of the adapter 96. Threadedly attached to the adapter 96 and extending within the recess 97 thereof is an outer tubular member 99 which extends from the body 39. An inner tubular member 100 extends through the end of the adapter 96 and extends into the outlet passage 68, as shown in Figures 2 and 3.

A sealing member 101 within the body 39 surrounding the passage 68 resiliently seals against the peripheral surface of the inner tubular member 100 so that fluid in the outlet passage 68 must flow into the inner tubular member 100 rather than into outlet cavity 95.

The inner tubular member 100 extends through the outer tubular member 99 as shown in Figures 2 and 3, the inner tubular member 100 being shown as substantially concentric with the outer tubular member 99. At the end of the outer tubular member 99 is threadedly attached a nozzle body 106, as shown in Figures 1 and 2. The outer tubular member 99 thus connects to a cavity 108 within the nozzle body 106, as shown in Figure 2. The cavity 108 opens into a nozzle tip 110 which is threadedly inserted into the nozzle body 106. The nozzle tip 110 is provided with a passage 112 extending therethrough.

Also within the nozzle body 106 is a passage 114 into which the inner tubular member 100 extends. A sealing member 116 encircles the inner tubular member 100 in engagement therewith. A short tube 120 is disposed within the passage 112 of the nozzle tip 110 and extends into the passage 114. The tube 120 is preferably disposed substantially concentric with the passage 112 of the nozzle tip 110, as shown in Figure 2.

The valve stem members 62 and 93, extending upwardly from the body 39, are actuated by means of a manually operable lever 126 which is pivotally attached to the body 39 by means of a pin 128.

As clearly shown in Figures 4 and 5, the stem 93 is longer than the stem 62. Therefore, when the lever 126 is manually pressed downwardly as shown by an arrow 130 in Figure 5, the stem 93 is first moved, causing the valve closure member 90 to move from engagement with its valve seat 86. Thus, gas 20 is permitted to flow from the chamber 89 through the fluid port formed by the valve seat 86. As stated above, the cavity 80 communicates with chamber 89 and with the fluid conduit 28. The fluid conduit 28 is open to the gaseous fluid 20 at the upper portion of the container 10. Thus, gas 20 is permitted to flow under pressure from the container 10 through the fluid gun 30 when the lever 126 is moved downwardly as shown in Figure 6. Gaseous fluid 20 thus moves through the intermediate passage 88 and through the outlet passage 94, as shown in Figure 3. Thence the gas 20 flows into the outlet cavity 95 and into the recess 97 through the orifices 98 of the adapter 96. Thus, the gas 20 flows into the outer tubular member 99. The gaseous fluid 20 then flows into the cavity 108 of the nozzle body 106 and thence flows outwardly from the nozzle tip 110 through the passage 112 thereof.

Thus, it is understood that if only the gaseous fluid is desired from the fluid gun 30, the lever 126 is moved downwardly, axially moving the stem 93. The maximum position of the stem 93 and the valve 90 for obtaining gaseous fluid 20 only is shown in Figure 6. At this position the lever 126 engages the upper surface of the stem 62 as shown in Figure 6, indicating that further downward movement will also actuate the stem 62. The operator of the lever 126 can manually feel the increased pressure when the lever 126 engages the stem 62, as shown in Figure 6. The lever 126 is thus retained in the position shown in Figure 6 during the period that it is desired to discharge gaseous fluid only from the gun 30.

It is to be understood that as the gaseous fluid 20 is flowing outwardly from the upper portion of the tank or container 10, additional fluid 20 is flowing into the tank 10 through the conduit 13 and through the pipe 16, thus maintaining a substantially constant pressure within the container 10. As additional gaseous fluid 20 flows into the container 10 through the pipe 16, the gaseous fluid 20 bubbles upwardly through the liquid 12 agitating the liquid 12 so that the liquid 12 is constantly maintained in a thoroughly mixed condition.

When it is desired to obtain liquid 12 mixed with the gaseous fluid 20 from the fluid gun 30, the lever 126 is forced downwardly to the position thereof shown in Figure 7. Thus, the valve stem 62, in addition to the valve stem 93 is forced downwardly, as shown in Figure 7 so that the valve closure members 58 and 90 are both in an open position, disengaged from their respective valve

seat members **56** and **86**. Thus, liquid flows from the container **10** through the conduit **36** and into the cavity **42** and then through the orifice **48**, as shown in Figure 7. The rate of flow through the orifice **48** is adjusted by means of threadedly moving the adjustment screw **50**, as discussed above.

The liquid **12** thus flows through the chamber **57** and through the port formed by the valve seat **56**. The liquid **12** then flows outwardly through the outlet passage **68** and into the inner tubular member **100**, as shown in Figures 2 and 3. The liquid **12** thus flows through the inner tubular member **100** and into the passage **114** of the nozzle body **106** and outwardly through the tube **120** and through the nozzle tip **110**, shown in Figure 2.

When the gaseous fluid **20** is flowing from the nozzle tip **110** the velocity of flow of the gas **20** and the expansion thereof causes a pressure differential at the end of the tube **120** within the nozzle tip **110**. This pressure differential at the end of the tube **120** causes a high degree of atomization of the liquid **12**. This is due to the fact that the gas **20** is expanding at the end of the nozzle tip, and the liquid **12** is forced as well as drawn into the gas **20** at the nozzle tip. Furthermore, the pressure differential at the end of the tube **120** caused by expanding gas adds to the pressure of the liquid **12** flowing from the tank **10** in causing increased rate of flow of the liquid **12** from the tube **120** for engagement with the expanding gas **20**.

It is to be understood that the fluid discharge assembly of this invention is particularly useful in the art of cleaning and lubricating mold cavities during molding operations. The fluid gun **30** may be provided with tubular members, such as members **99** and **100**, of any desired length or shape so that the nozzle tip **110** may be inserted into mold cavities of any particular size or shape.

When it is desired to clean the mold cavity the lever **126** is moved to the position thereof shown in Figure 6 so that only gaseous fluid **20** flows from the fluid gun. After the cleaning operation by means of the gaseous fluid, the lever **126** is forced downwardly to the position thereof shown in Figure 7 so that a liquid is atomized and forced into the cleaned mold cavity. The liquid may consist of a lubricant so that the mold cavity is lubricated by means of the fluid gun **30** after the mold cavity is cleaned by means of the same fluid gun. Thus, it is understood that by means of a single fluid gun member of this invention fluid may be discharged either singly or in combination with another fluid.

In a molding operation it is highly desirable to clean a mold cavity with air or other gas before the liquid, such as an oil, is sprayed into the mold cavity. It is objectionable to have the liquid material sprayed into the mold cavity when a cleaning operation is needed and gas alone is desired. The structure of this invention in which liquid flows to the nozzle tip in one tube and gas flows to the nozzle tip in another tube, eliminates the possibility of inadvertently spraying portions of a liquid which may remain in the gun when gas alone is desired. Thus, the fluid gun of this invention makes possible the discharge of gas only whenever such is desired. The fluid gun also permits the discharge of two fluids when such is desired.

Even though the gun **30** is disposed at a considerable height or distance from the container **10**, the fluids are discharged from the gun with considerable force and at a considerable rate due to the fact that all fluids flow to and from the gun under pressure. Furthermore, as described above the flow of each fluid through the gun may be readily adjusted.

Figure 8 shows a preferred modification of a valve mechanism of a fluid gun of this invention.

In the use of the fluid discharge assembly of this invention in connection with molding operations, it is desirable to obtain a high volume of flow of the gas **20**

when the gas **20** only is flowing for cleaning action. However, it is often desirable to have a lesser quantity of gas **20** flowing when the liquid **12** flows for atomization. This is due to the fact that frequently a better application of atomized liquid upon the walls of the mold cavity is possible when the force of the atomized liquid is reduced to a lower value than the force of gas **20** required for cleaning. Such forces are reduced by reducing the volume of the gas **20** atomizing the liquid **12**.

Thus, in the modification shown in Figure 8, a housing **135** is provided with a cavity **136**. The cavity **136** communicates with a conduit (not shown), similar to the conduit **28**, for flow of gaseous fluid **20** to the cavity **136**. The housing **135** also has a cavity (not shown) similar to the cavity **42**, through which a liquid flows to a tubular member such as the tubular member **100**.

A movable valve member **140**, within the cavity **136**, is urged toward a valve seat member **142** by means of a spring **144**. The movable valve member **140** is attached to a valve stem **146**.

The spring **144** is compressed between the movable valve member **140** and a plug **148** which is threadedly attached to the body **135** and which extends into the cavity **136**. The plug **148** engages the valve seat **142** and is provided with a plurality of fluid ports **149** therethrough. Thus, gas **20** flows from the cavity **136** to a tubular member such as the tubular member **99**, when permitted to do so by the movable valve member **140**.

The plug **148** is also provided with a valve seat **151** immediately above the fluid ports **149**. An abutment screw **156** is threadedly attached to the plug **148** and extends into the cavity **136** for engagement by the lower end of the valve stem **146** for limiting the downward movement of the movable valve member **140**.

The stem **146** is of sufficient length so that upon downward movement of the stem **146**, the movable valve member **140** can engage the valve seat member **151** if the lower end of the stem **146** does not engage the abutment screw **156**. However, as shown in Figure 8, the abutment screw **156** is so adjusted that the maximum downward position of the movable valve member **140** is limited by engagement of the lower end of the stem **146** with the abutment screw **156**. The abutment screw **156** is so adjusted that the stem **146** is limited thereby. Thus, in its maximum downward position, governed by the screw **156**, the movable valve member **140** is slightly spaced from the valve seat **151** so that the flow of gaseous fluid through the gun is limited. The flow of liquid through the gun which controls spray density is always governed by an orifice such as the orifice **48** and the adjustment screw **50** movable with respect thereto, as shown in Figure 7.

Thus, the adjustment screw **156** provides means by which the volume of flow of gaseous fluid **20** is limited when the liquid **12** is flowing. Thus, the flow of gas **20** for atomization of the liquid **12** may be adjusted without changing the full flow of the gas **20** alone.

The adjustment screw **156** may be adjusted so that the valve **140** contacts the valve seat **151** in the lowermost position of the valve **140**. In such position no gas **20** flows even though liquid **12** is flowing. The adjustment screw **156** may also be adjusted so that the downward limit of the valve **140** is at the maximum flow position thereof.

Although the preferred embodiment of the device has been described, it will be understood that within the purview of this invention various changes may be made in the form, details, proportion and arrangement of parts, the combination thereof and mode of operation, which generally stated consist in a device capable of carrying out the objects set forth, as disclosed and defined in the appended claims.

Having thus described my invention, I claim:

1. In a fluid discharge assembly, a housing provided with a pair of inlet passages and a pair of outlet pas-

sages, each inlet passage connecting to one of the outlet passages, movable closure means for closing the connection between each inlet and outlet passage, the housing having an outlet cavity therein joining the outlet passages, an adapter threadedly attached to the housing and extending into the outlet cavity, the adapter having a recess therein, a first tubular member, the first tubular member extending through the recess of the adapter and extending from the adapter at opposite ends thereof, the first tubular member slidably disposed within one of the outlet passages, means within the housing encompassing the first tubular member and sealing the first tubular member from the cavity, the adapter having openings therethrough joining the recess thereof to the cavity of the housing, a second tubular member threadedly attached to the adapter and extending within the recess thereof, the second tubular member encircling the first tubular member, a nozzle body threadedly attached to the second tubular member at the end thereof opposite the adapter, the nozzle body having two passages therein, the second tubular member extending into the nozzle body, the first tubular member extending through a portion of one of the passages of the nozzle body and having an end slidably disposed within the other passage thereof, means within the nozzle body encompassing said end of the first tubular member and sealing the first tubular member from the passage through which it extends, each of said passages of the nozzle body having an open end at a portion thereof opposite the tubular members, a short tube within the nozzle body connecting the passage into which the first tubular member extends to the open end of the other passage and substantially concentric therewith.

2. A fluid gun comprising a housing having a pair of separate chambers therein with a separate conduit joining each chamber, a pair of valve seat members, there being a valve seat member in each chamber forming a fluid port therethrough, a pair of valve stem members, there being a valve stem member extending through each fluid port and into each chamber, a pair of movable valve members, there being a movable valve member within each chamber and attached to the valve stem member therewithin, a second valve seat member within one of the chambers forming a fluid port therethrough, the second valve seat member being in spaced relation from the other valve seat member of the chamber, the movable valve member of the last said chamber being movable to engage either valve seat member thereof for closing the fluid port therethrough, the movable valve member of the other chamber being adapted to engage the valve seat member thereof for closing the fluid port therethrough, an adjustable abutment member movable with respect to the said second valve seat member, the abutment member being engageable by the movable valve member within the chamber thereof for preventing engagement of the second valve seat member by the movable valve member, the volume of flow of fluid through said second valve seat member thus being controlled by adjusting the position of the abutment member with respect to the second valve seat member.

3. A fluid gun of the type provided with a housing having a pair of separate flow passages therethrough, one of the passages being a first flow passage, the first flow passage having a pair of spaced-apart valve seat members each of which has a fluid port therethrough, one of the flow passages being a second flow passage, the second flow passage having a valve seat member provided with a fluid port therethrough, a pair of valve stem members, there being a valve stem member extending into each flow passage, means for simultaneous movement of the valve stem members, a pair of closure members, there being one closure member within each passage attached to the valve stem member thereof for movement therewith, the improvement comprising adjustable abutment means within the first flow passage engageable by the closure member limiting movement of the closure member, the abutment means thus limiting closing movement of the closure member with respect to at least one of the valve seat members.

4. In a fluid gun of the type provided with a housing having a pair of separate flow passages therethrough, one of the passages being a first flow passage, the first flow passage having a pair of spaced-apart valve seat members each of which has a fluid port therethrough, one of the flow passages being a second flow passage, the second flow passage having a valve seat member provided with a fluid port therethrough, a pair of valve stem members, there being a valve stem member extending into each flow passage, means for simultaneous movement of the valve stem members, a pair of closure members, there being one closure member within each passage attached to the valve stem member thereof for movement therewith, the improvement comprising adjustable abutment means within the first flow passage limiting movement of the closure member of the first flow passage with respect to one of the valve seat members thereof.

5. In a valve assembly, a housing provided with a pair of inlet passages and a pair of outlet passages, each inlet passage connecting to one of the outlet passages, movable closure means within the housing for closing the connection between each inlet and outlet passage, the housing having an outlet cavity therein joining the outlet passages, an adapter attached to the housing and extending into the outlet cavity, the adapter having a recess therein, a first tubular member, the first tubular member extending through the recess of the adapter and extending from the adapter at opposite ends thereof, the first tubular member connecting to one of the outlet passages, means sealing the first tubular member from the cavity, the adapter having openings therethrough connecting the recess thereof to the outlet cavity of the housing, a second tubular member attached to the adapter and extending within the recess thereof, the second tubular member encircling the first tubular member, a nozzle body attached to the tubular members at the end thereof opposite the adapter.

References Cited in the file of this patent

UNITED STATES PATENTS

1,114,592	De Witt	Oct. 20, 1914
1,728,756	Hansen	Sept. 17, 1929
2,049,194	Chapin	July 28, 1936
2,197,979	Jones	Apr. 23, 1940
2,717,806	Dale	Sept. 13, 1955