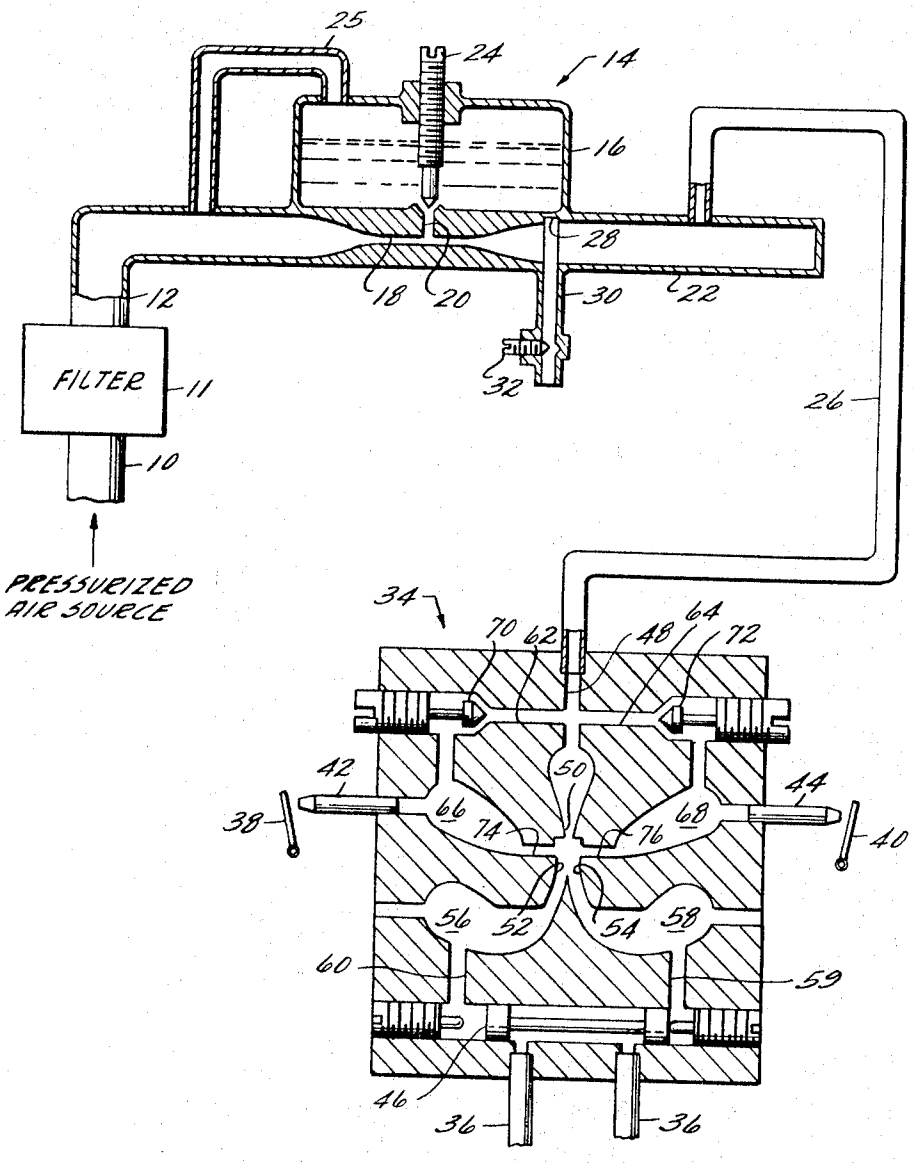
June 24, 1969 J. A. ROCHE 3,451,409

FLUIDIC SYSTEMS

Filed June 3, 1966



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United States Patent Office 3,451,409
Patented June 24, 1969

3,451,409

FLUIDIC SYSTEMS

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Filed June 3, 1966, Ser. No. 555,051
Int. Cl. F15c 1/10
U.S. Cl. 137—81.5 5 Claims

ABSTRACT OF THE DISCLOSURE

A fluidic system is disclosed wherein the motive fluid supply section includes a container containing a solvent for contaminants known to be in the motive gas and means for injecting the solvent into suspension in the motive fluid.

The present invention relates to improvements in fluidic devices and more particularly to supply systems therefor.

In recent years there has been an accelerated effort to develop fluidic devices most of which are commonly referred to fluid amplifiers. In such devices a fluid power stream is controlled by one or more control jets having a substantially lower pressure than the power stream. The power stream may be deflected towards and away from a receiver port to provide pressure changes therein substantially greater than the control jet pressure, hence the term fluid amplifier.

By employing air or other gases, extremely rapid pressure variations can be obtained, enabling control functions to be performed by inexpensive components with little or no use of electrical or electronic elements. Among other advantages is the capability of operating in temperature environments which cannot be tolerated by electronic components.

Another potential of fluidic controls is a high level of reliability over a long life attributable, to a large measure, to the lack of mechanical, moving parts. This potential has been difficult to fully realize in many instances, particularly where air has been employed as the motive fluid. Over a period of time it has been found that the fluid amplifier characteristics tend to change so that, for example, a fluidic control circuit having a counting function will fail to count all of the input pulses thereto.

Such malfunctioning is obviously unacceptable for many, if not all, types of controls and accordingly, it is the object of the invention to improve the reliability of fluidic devices, particularly those in which air or other gases are employed as the motive fluid.

It has been discovered that air, even after having passed through a high grade filtration system, contains oil vapors or oil mist droplets which will condense or collect on the walls of the flow paths through a fluidic device. As this occurs over a period of time, there will be a sufficient accumulation of condensate to change the flow characteristics of the air and eventually the fluidic device can be rendered wholly inoperative.

In accordance with this invention it has been discovered that the addition of small amounts of an atomized, low viscosity, oil solvent to the air supplied to fluid devices will prevent heavier oils from forming a coating adversely affecting flow passages in the device. The low viscosity solvent wets at least all critical surfaces of the device so that both the solvent and oil contaminant will be flushed through the device during its operation.

In a broader sense the invention comprises providing means for adding small amounts of solvent to the motive fluid supply of fluidic devices and thereby preventing condensate buildup on the flow walls which would affect operation of the device.

The above and other related objects and features of the invention will be apparent from a reading of the following description of the disclosure found in the accompanying drawing and the novelty thereof pointed out in the appended claims.

The single figure in the drawing diagrammatically illustrates the present invention supplying motive fluid to an illustrative fluidic device.

A conduit **10** extends from an appropriate source of pressurized air to a filter **11** which removes solid contaminants and some vapor contaminant from the air. The air then passes through conduit **12** to an atomizer **14**.

The atomizer **14** comprises a solvent container **16**, a venturi throat **18** and a passageway **20** from the bottom of the container to the throat **18**. As air passes from the inlet **12** to discharge passage **22**, a controlled amount of solvent is atomized in the air stream. The amount of solvent may be varied by adjusting a screw **24** which controls the inlet area of the passageway **20**. A conduit **25** connects the upper end of the container **16** to the conduit **12** in order to insure a substantially uniform addition of solvent as its level in container **16** varies.

A groove **28** and depending trap **30** are provided downstream of the throat **18** to collect solvent that is not atomized. The trap may be periodically drained by opening valve **32**.

The solvent bearing air is then directed to a fluidic device **34** by a conduit **36** which preferably is connected tto the upper side of the discharge passage **22**. The fluidic device **34** is essentially the same as that disclosed in U.S. Patent No. 3,220,428, issued in the name of Robert B. Wilkerson and assigned to the same assigne as the present application. Reference is made thereto for further details beyond those given in the following brief description.

The fluidic device **34** controls flow of fluid through a conduit **36** in response to displacement of flappers **38** and **40**. When either or both of the flappers **38**, **40** are displaced towards tubes **42**, **44** respectively, they will cause shifting of a valve piston **46** to either permit or shut off the flow of fluid through the conduit **36**.

The solvent bearing air enters a passageway **48** of the fluidic device **34** and is discharged from a nozzle **50** as a power stream or jet. The device **34** may be referred to as a bistable fluid amplifier by reason of the fact that the power stream will attach itself to either of the wall surfaces **52** or **54** to maintain a constant elevated pressure level in either of vented chamber **56** or **58**. As illustrated, the power stream is attached to the surface **52** and the pressure within the chamber **56** is transmitted by passageway **60** to the lefthand end of the valve **46**, maintaining it in an open position so that there is flow of fluid through the conduit **36**.

The solvent bearing air from conduit **26** also passes through lateral passageways **62**, **64** to chambers **66**, **68** respectively. Needle valves **74**, **76** may be employed to provide equal pressures in the chambers **66**, **68** which are vented through the tubes **42**, **44**. Fluid from the chambers **66**, **68** is directed from control nozzles **74**, **76** laterally against the power stream discharged from the nozzle **50**. The power stream, once attached to either of surfaces **52**, **54** will remain so attached so long as the control jets are of equal pressure or the jet from nozzle **76** is greater. Under the illustrated conditions, if the flapper **38** is moved to restrict venting of air through the tube **42**, there will be an increased pressure in the chamber **66** and the control jet discharged from nozzle **74**. This will displace the power stream toward the right causing it to become attached to the surface **54** and increase the pressure in the chamber **58**. This in turn will cause an increase in pressure on the right-hand end

of the piston **46** which is connected to chamber **58** by passageway **59**. The piston **46** will then be displaced to a position in which the flow of fluid through conduit **36** is shut off. The power stream will remain attached to the wall surface **54** when the flapper **38** is moved outwardly to allow the tube **42** to vent air from the chamber **66** in the normal fashion and will remain so attached until flow of air from the tube **44** is restricted by the flapper **40**.

For economical operation it is desirable that the source of pressurized air to which the conduit **10** is connected is a "factory" air supply. It is known that such a supply is contaminated to a relatively high level with oil vapors and mists as well as vapors and mists of other relatively heavy petroleum products. For practical and economical reasons, the filter **11** is not intended, nor does it function, to remove such vapors and mists or droplets from the air as it passes to conduit **12**.

The solvent in container **16** is selected as a petroleum solvent having a relatively low viscosity, gasoline, petroleum ether, and kerosene being illustrative. For the most part, such solvents remain "in suspension" in the motive air as it passes through the fluidic device **34**. This solvent bearing air wets the passageways of the device **34** to prevent the vapors and mist droplets of the heavier oils from condensing or depositing on any of the functional wall surfaces of the device. The contaminant vapors and mist droplets thus pass through the fluidic device and have no effect on its operation, even over long periods of time.

It has been found that very small amounts of solvent are required for the purpose of the present invention. For example, a kerosene solvent added in the range of 1% to $\frac{1}{1000}$ of 1% on a weight basis to air has been found successful in preventing contamination of fluidic devices using factory air supply as the motive fluid source.

Where it is known that other non-filterable (in a practical sense) contaminants are in the supply air for a fluidic device, then an appropriate solvent may be selected in accordance with the principles discussed in connection with a heavy oil contaminant. As a further example, salt spray might become ingested in the supply air source. In this case distilled water could be selected as the solvent. Similarly, a liquid device employing "hard" water as its motive fluid could employ dilute acids as the solvent to prevent calcium deposits. It will further be recognized that temperature can have an effect on what would constitute a proper solvent. In colder temperatures gasoline would be a more effective oil solvent, whereas at higher temperatures kerosene would be preferred.

It will thus be apparent that variations from the preferred embodiment deescribed will occur to those skilled in the art and that the scope of the invention is thus to be derived from the following claims.

Having thus described the invention, what is claimed as novel and desired to be secured by Letters Patent of the United States is:

1. A fluidic system comprising,

a fluidic device, having a plurality of relatively small passageways,

conduit means connected to a source of pressurized fluid and supplying motive fluid to said device, said pressurized fluid having a known contaminant therein, which has a propensity for collecting on the walls of the relatively small passageways,

means for removing the contaminant from the walls of said relatively small passageways of said fluidic device comprising, a solvent for said known contaminant, and

means for introducing a relatively small amount of said solvent into said conduit means whereby said contaminant will be maintained in suspension in said motive fluid and pass through the fluidic device in operation thereof.

2. A fluidic system as in claim **1** wherein,

the conduit means are connected to a source of pressurized gas and

the introducing means take the form of atomizing means which introduce solvent as a function of the rate of gas flow through the conduit means.

3. A fluidic system as in claim **1** wherein,

said pressurized fluid comprises air contaminated with heavy oil vapors, and

said solvent comprises a petroleum product having a relatively high vapor pressure.

4. A fluidic system as in claim **3** wherein,

the introducing means take the form of atomizing means.

5. A fluidic system as in claim **4** wherein,

the atomizing means are adjustable to add between $\frac{1}{1000}$ of 1% and 1% of solvent to air on a weight basis.

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