

[54] FLUID PROPORTIONER MEANS

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[58] Field of Search.....137/88, 607, 115, 116.3, 117, 137/488, 492, 492.5, 606

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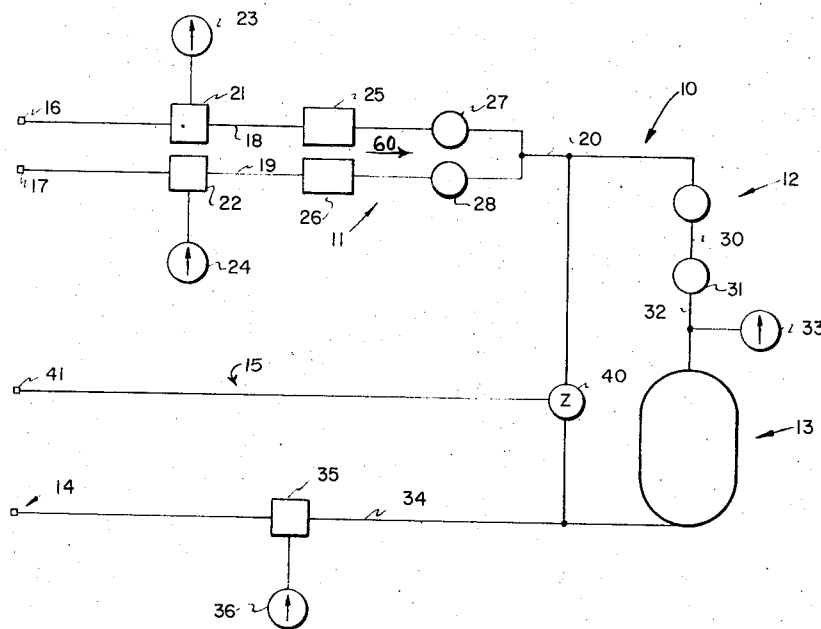
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[57]

ABSTRACT

A fluid proportioning system for obtaining desired mixtures of fluids has at least two fluid inlet conduits with each of said conduits carrying a flow meter and flow control means. A common conduit interconnects the inlet conduits and leads to an automatic fluid supply control valve means for permitting passage of fluid in the common conduit at a predetermined pressure and cutting off fluid flow at a second predetermined pressure. A surge tank is interconnected with the automatic fluid supply control valve means for receiving fluid from the common conduit and an output conduit delivers fluid from the surge tank. Preferably the automatic supply control valve means is a mechanically operated pressure valve circuit which has an inlet means for admitting fluid flow and an outlet means for delivering fluid from the inlet means. Valve means permits fluid flow from the inlet means to the outlet means in a first position of the valve means and cuts off fluid flow from the inlet to the outlet means in a second position. A fluid pressure sensitive means controls the valve means to make it automatically responsive to a buildup in pressure at the outlet means to shift from the first to second position and automatically responsive to a lowering of pressure in the outlet means to cause the valve means to shift from the second position to the first position.

1 Claim, 5 Drawing Figures



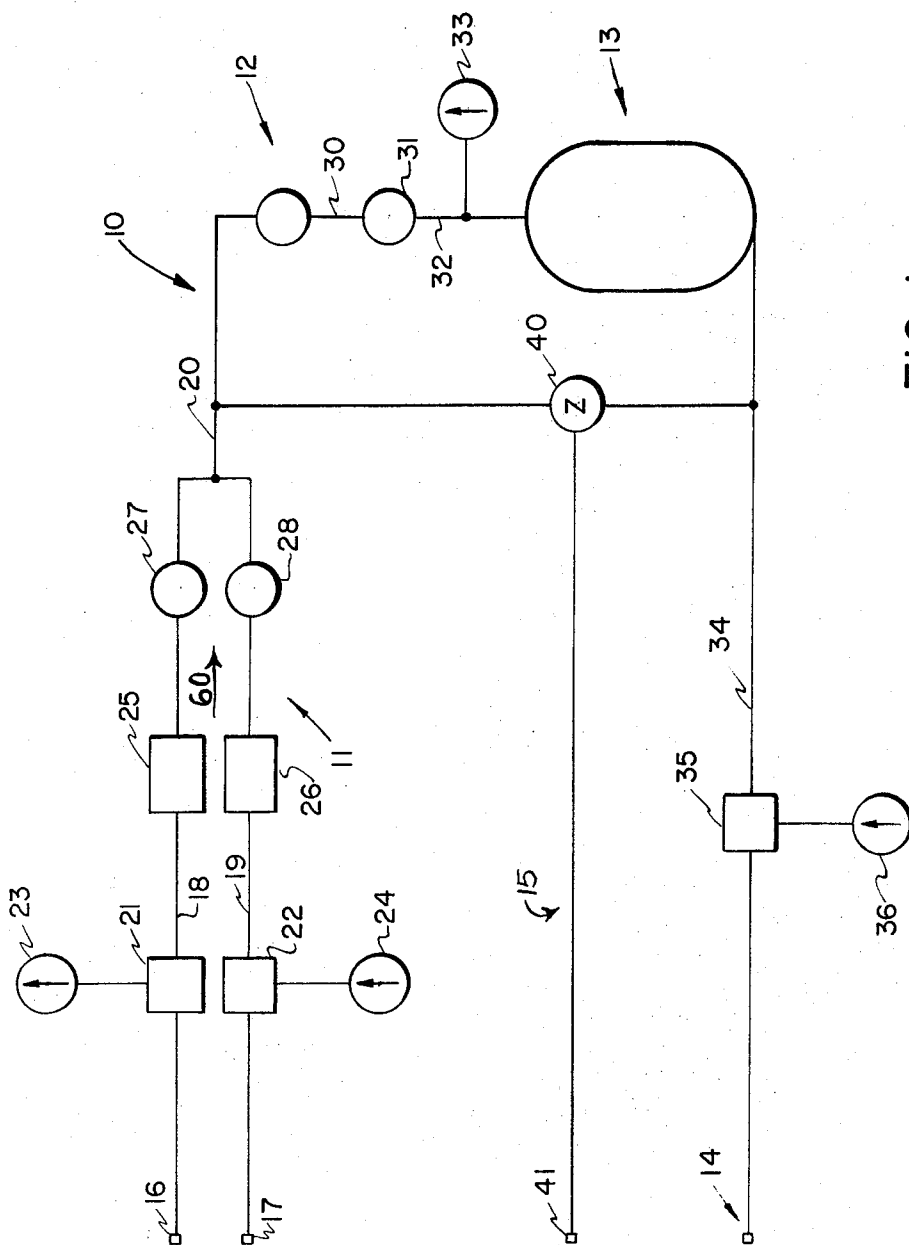


FIG. 1

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FIG. 2

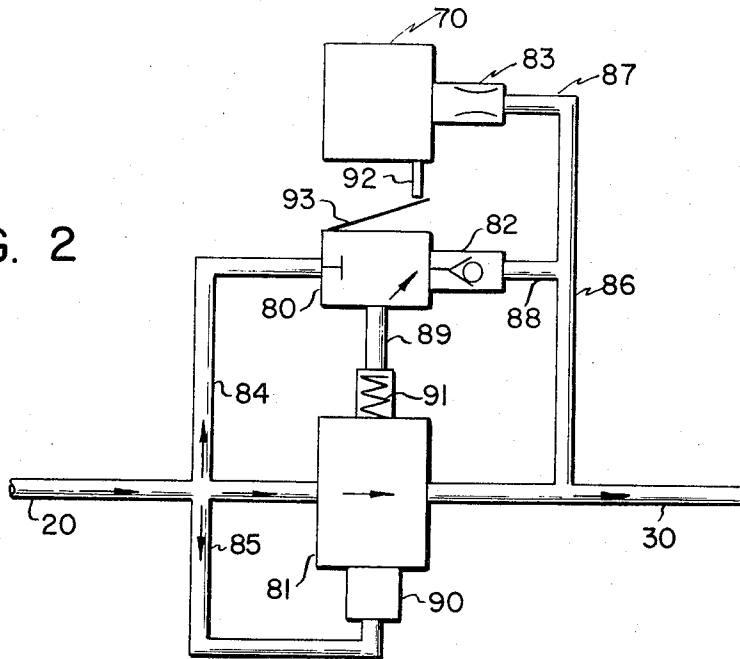
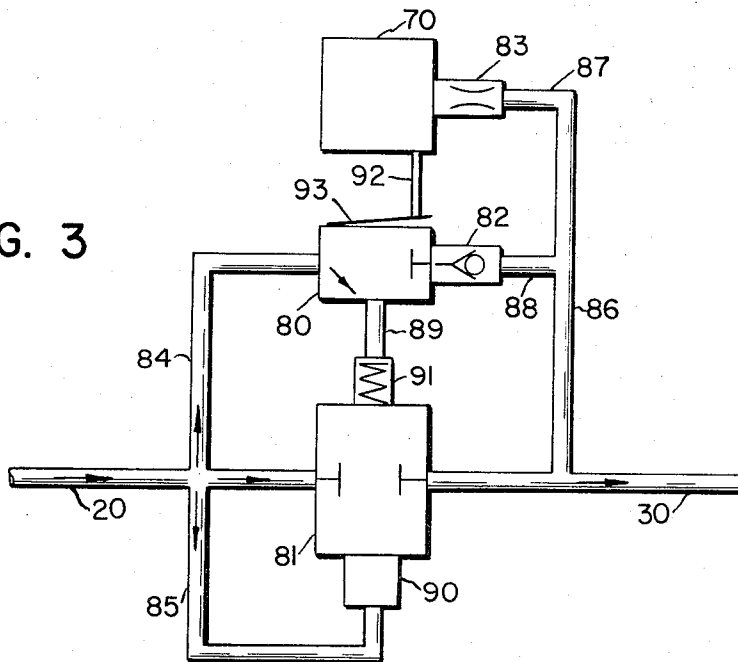


FIG. 3



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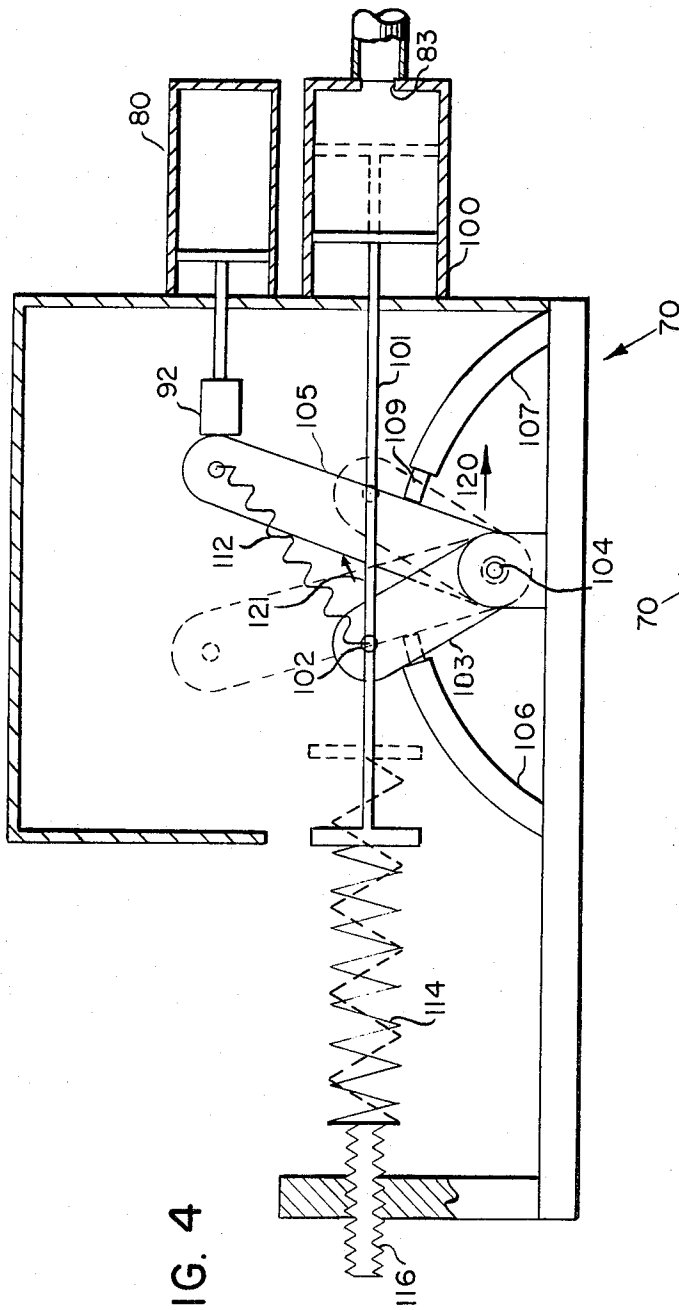


FIG. 4

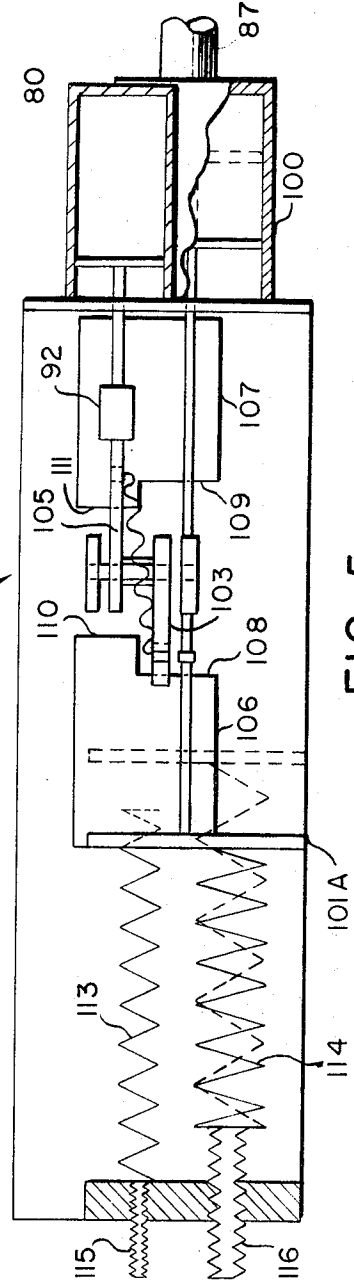


FIG. 5

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FLUID PROPORTIONER MEANS

BACKGROUND OF THE INVENTION

A large number of gas proportioning systems, i.e., systems for providing a predetermined mixture of two or more gases, are known in the art. Often such gas proportioners are electrically operated or regulated making their usage in certain field or other operations complicated because of the need for an electrical supply.

It is an object of this invention to provide a fluid proportioner for properly mixing two or more fluids in a predetermined proportion which predetermined proportion can vary as desired.

Another object of this invention is to provide a gas proportioner in accordance with the preceding object which does not require the use of electric power.

Another object of this invention is to provide a gas proportioner in accordance with the preceding objects which can be easily constructed and which requires little or no maintenance over long periods of time.

Still another object of this invention is to provide an automatic fluid supply control valve circuit sensitive to fluid pressure and automatically operable without the need for electric power.

It is a feature of this invention that the gas proportioners do not have an explosion hazard since no electric power need be used. Other features include ease of operation by unskilled personnel, the lack of any minimum gas flow requirement and automatic operation once an initial ratio of gases to be mixed is set up. Any number of gases or other fluids can be blended by the systems of this invention. Inexpensive reading, recording and adjustment instruments can be incorporated in the systems. The systems can be designed for a wide range of capacities and gas pressures. High tolerances with good precision are obtained. Bypass valves can be used to allow purging and sampling during ordinary operation. Permanent calibration can be obtained and the systems are highly versatile in that it is relatively simple to change the ratio of any gas or liquid mixture to suit different applications.

BRIEF DESCRIPTION OF THE INVENTION

A fluid proportioning system for obtaining desired mixtures of fluids comprises at least two fluid inlet conduits each having a flow meter and flow control means. A common conduit interconnects the fluid inlet conduits and leads to an automatic fluid supply control valve means for permitting passage of fluid in said common conduit at a predetermined pressure and cutting off fluid flow at a second predetermined pressure. A surge tank interconnects with the automatic fluid supply control valve means for receiving fluid from the common conduit. An output conduit delivers the fluid from the surge tank preferably at a predetermined pressure.

Preferably an automatic fluid supply control valve means comprises inlet means for admitting a fluid flow and outlet means for delivering fluid from said inlet means. Valve means permit fluid flow from the inlet means to the outlet means in a first position of the valve means and cuts off fluid flow from the inlet to the outlet means in a second position. A fluid pressure sensitive means controls the valve means to make the valve means automatically responsive to buildup in fluid pressure at the outlet means to shift from the first position to the second position and automatically responsive to a lowering of pressure in the outlet means to cause the valve means to shift from the second position back to the first position. Preferably the fluid pressure sensitive means is mechanically actuated.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will be better understood from the following specification when read in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatic showing of a preferred embodiment of a fluid proportioner of the present invention;

FIG. 2 is a diagrammatic showing of a preferred embodiment of an automatic fluid supply control valve means useful therein;

FIG. 3 is a second diagrammatic showing of the control valve system means in a second position; and

FIGS. 4 and 5 are diagrammatic showings of side and top views respectively of an element of the system of FIGS. 2 and 3.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference now to the drawings, a preferred embodiment of a fluid proportioner system is illustrated generally at 10 in FIG. 1 and comprises a supply and mixing section 11, an automatic supply control valve system 12, a surge tank storage means 13, an output section 14 and a purging section 15. The gas proportioner system 10 is set up to mix and regulate two gases such as argon and helium which may be supplied at the same or different pressures and which are blended, stored in a surge tank 13 and passed out of the system through an output at a constant pressure to a user device (not shown) requiring the uniform mixture of gases at a constant pressure.

The supply and mixing section 11 of the preferred embodiment provides for mixing of two gases although three or more gases can be mixed by duplicating the elements leading to the common conduit as desired.

The supply and mixing section 11 comprises two gas inputs 16 and 17, two inlet conduits 18 and 19, both of which meet at a T connection supplying a common duct or conduit 20. Along each of conduits 18 and 19 are positioned a fluid regulator 21 and 22 preferably having attached visual input gauges 23 and 24. Next in line in the conduits 18 and 19 are conventional flow meters 25 and 26 respectively followed by flow adjust means such as needle valves 27 and 28.

The common duct 20 leads to the automatic supply control valve system 12 as will be more fully described and from there through a conduit 30 to check valve 31 which prevents backflow of gas. In some cases, check valves can be provided in conduits 18 and 19 just before the common duct or in the common duct with the check valve 31 eliminated. Conduit 32 leads the gas to a storage surge tank 13 preferably having a conventional gas pressure gauge 33 connected in the line to determine the pressure of any gas in the surge tank when desired. A conduit 34 leads to a conventional line regulator 35 having a conventional pressure gauge 36 attached thereto and from thence to the output 14. Interconnected by conduits, with the common duct 20 and conduit 34, is a manually operated three-way bypass valve 40 having an atmospheric output 41 useful in purging the system and setting up a desired flow as will be described.

The flow meters, needle valves, gauges, line regulators, check valve and tanks are all of conventional design with many substitutes possible. Similarly, the automatic supply control valve system can be any control valve system which permits passage of gas when the gas pressure in line 30 and consequently surge tank 13 falls below a predetermined value such as 80 pounds per square inch and which shuts off gas flow to the surge tank when the pressure in tank 13 and conduit 30 reaches a predetermined value such as 120 pounds per square inch. These values can be varied greatly depending upon the particular conditions to be met.

In the preferred embodiment, the input connections 16 and 17 are connected to predetermined gas supplies to be mixed. For example, connection 16 can be connected with an argon gas supply at 200 p.s.i.g. with input 17 connected to a helium gas supply at 150 p.s.i.g. Line regulators 21 and 22 are adjusted to provide 125 p.s.i.g. in each of the conduits 18 and 19 beyond the regulators. Flow meters 25 and 26 of a conventional type provide for visual scanning of the flow rate in conduits 18 and 19 with manually operated needle valves 27 and 28 permitting adjustment of the flow rate as desired to obtain desired proportions. The gases move along lines 18 and 19 in the direction of arrow 60. The gases are mixed by flow turbu-

lence when they pass through the T connection into the common conduit 20. If the purging valve 40 is closed, the common conduit carries the mixed and blended gases to the automatic supply control valve means which automatically stops gas flow if the gas pressure in line 30 and surge tank 13 is above 120 p.s.i.g. Check valve 31 prevents backflow of gas from the surge tank 13. The surge tank 13 acts as a gas storage means and is constantly maintained at a pressure of the mixed gases within the range of from 80 to 120 pounds per square inch due to the action of the automatic supply control valve system 12. When the output connection is opened, the line regulator 35 permits flow of gas toward the output from the surge tank at pressures below 75 p.s.i.g. As the pressure in the surge tank drops, to a value below 80 p.s.i.g., the automatic supply control valve opens to refill the tank.

The purge valve 40 is used to purge the system at the end of operation, or at the beginning of operation to permit adjustment of the needle valves and purging of the system. After the proper gas ratios have been set up at the start, bypass valve 40 is closed during normal operation.

Preferably, none of the elements in the system 10 are electrically operated, therefore, the system is automatically operated by the gas pressures involved once initial start up is made.

The automatic supply control valve system 12 is best illustrated in FIGS. 2 and 3 with the system comprising a mechanical pressure actuator 70, a pilot valve 80, a main gas valve 81, a check valve 82, and a snubber 83 interconnected by suitable conduit portions 84, 85, 86, 87, 88 and 89 as shown in FIGS. 2 and 3.

In the preferred embodiment, the gas line of the common conduit 20 introduces the mixed gases to lines 84, 85 and the inlet of a conventional spring biased two-position, normally closed, spool valve 81 having an open position as shown in FIG. 2 and closed position as shown in FIG. 3 with a conventional shuttle valve spool member controlling the positions. Arrows shown in FIGS. 2 and 3 indicate gas flow in the open and closed position of valve 81.

The gas passes in the direction of arrows shown in FIG. 2 when the spool valve 81 permits flow to conduit 30 with some of the gas being directed to a pilot pressure control chamber 90 which balances the bias of a spring 91 to keep the spool in the open position. Gas from the outlet line 30 exerts a pressure in lines 87 and 88 and consequently through snubber 83 to a pressure sensitive mechanical linkage or pressure actuator 70 while the gas is stopped from flow toward the valve 80 by the check valve 82. In the open position, the pilot valve 80 which is a three-outlet, 2-position valve, permits passage of gas to exhaust gas from conduit 89 through the check valve 82 while preventing flow of gas from the line 84 into the line 89. As can be seen from the drawing, the spool valve is in an opened flow position only when sufficient gas pressure exists in the chamber 90 to overcome the bias of the spring 91 to a sufficient degree. In the preferred embodiment, the spool valve is adjusted so that a minimum gas pressure of 80 p.s.i. is required to permit flow through the valve 81.

The pressure sensitive actuator 70 of the preferred embodiment is selected so that when the gas pressure in line 87, corresponding to the gas pressure in outlet line 30, builds up beyond a value of 120 p.s.i.g., the actuator 70 will move a trip arm 92 to its extended position to trip the switching mechanical member 93 of valve 80 as shown, to the position shown in FIG. 3. Conversely, when line pressure in outlet line 30 falls below 80 p.s.i.g., the trip arm 92 moves to its withdrawn position to permit gas flow to the surge tank.

In the position shown in FIG. 3, valve 80 permits gas passage between conduits 84 and 89 so that the gas pressure in the line 20 is superimposed over the spring pressure provided by spring 91 to move the spool of valve 81 and close the valve 81. Since valve 80 in this position does not permit flow to line 88, gas flow is cut off to the outlet line 30.

A preferred mechanical pressure sensitive actuator is semidiagrammatically illustrated in FIGS. 4 and 5 where valve

80, line 87 and snubber 83 are shown. The actuator 70 has a gas pressure cylinder 100 connected to line 87 with a double ended piston 101 connected to an actuator arm 103 by a linkage 102. Arm 103 is pivotally mounted on a rod 104. A bumper arm 105 is also pivotally mounted on rod 104 for arcuate movement about the rod. Stops 106 and 107 provide a set of limit or stop surfaces 108 and 109 for the actuator arm 103 and limit or stop surfaces 110 and 111 for bumper arm 105. A compression spring 112 is interconnected with free ends of arms 103 and 105. The trip arm 92 is spring biased to its withdrawn position by a spring (not shown). High pressure cut off compression spring 113 and low pressure cut off compression spring 114 are provided and are manually adjustable through threaded bolts 115 and 116 respectively. Spring 114 is attached to one end of piston 101 at one head 101A. The low pressure position of the piston head 101A and springs is shown in dotted outline in FIG. 5. The mechanical actuator thus comprises first means 101 for reciprocally moving in response to high and low pressure conditions. The springs 115 and 116 comprise means for determining the high and low pressure conditions.

In operation, the reciprocal piston 101 is prevented from moving as pressure builds up in line 87 by high pressure spring 113 until a pressure of almost 120 p.s.i.g. is reached in line 87. When the pressure reaches 120 p.s.i.g., the piston moves to the position shown in FIGS. 4 and 5. As the pressure is reduced in line 87, spring 114 prevents movement until the pressure drops to about 80 p.s.i.g. whereupon piston 101 and arm 103 move in the direction of arrows 120 and 121. Shortly before arm 103 reaches the stop surface 109, the force of compression spring 112 snaps arm 105 to its inactive position shown in dotted outline in FIG. 4 against stop surface 110. The snap action occurs when the attachment point of spring 112 on arm 103 passes beyond a point vertically beneath the attachment point of spring 112 on arm 105. When arm 105 is thus disengaged, trip arm 92 automatically returns to its withdrawn position shown in FIG. 2. As gas pressure builds up in line 87, low pressure spring 114 prevents activation of trip arm 92 until a pressure of 80 p.s.i.g. is reached whereupon arm 102 moves to snap the bumper arm 105 into the position shown in FIG. 4 to extend trip arm 92 to its operative position.

It should be understood that other automatic supply control valve systems can be used in the gas proportioner of this invention. Similarly, other pressure sensitive actuators and mechanical linkages can be used as known in the art. The automatic supply control valve means of this invention can be used in other systems to start and stop fluid flow as desired as in liquid systems or gas systems of all types.

Many variations are possible in the present invention. For example, the main gas valve 81 can comprise a number of different types of valves including a valve which allows elimination of line 85 and the chamber 90. In this embodiment, a two-position main gas spool valve is used with the spool automatically on (allowing gas flow to conduit 30) until actuated by the mechanical linkage 92 so that pressure exerted in line 89 moves the spool to a closed position.

What is claimed is:

1. A fluid proportioner for obtaining a mixture of fluids comprising,
 - a at least two fluid inlet conduits,
 - each of said inlet conduits having a flow meter and flow control means,
 - a common conduit interconnecting said inlet conduits and connecting with an automatic fluid supply control valve means for permitting passage of fluid at fluid pressures below a first predetermined low pressure and cutting off fluid flow at a second predetermined pressure higher than said first pressure,
 - said fluid supply control valve means comprising a mechanical actuator responsive to said first fluid pressure and said second fluid pressure for permitting and cutting off fluid flow respectively,

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a surge tank interconnected with said automatic fluid supply control valve means for receiving fluid from said common conduit through said automatic fluid supply control valve means, said first and second pressures being sensed between said automatic fluid supply control valve means and said surge tank, 5
a tank outlet means for delivering fluid from said tank, a line pressure regulator in said tank outlet means for allowing fluid flow therethrough at a pressure below said second predetermined pressure, 10
said mechanical actuator comprising,
first means for moving in response to said predetermined low pressure condition between said automatic fluid supply control valve means and said tank and for moving 15

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reciprocally in response to said predetermined high pressure condition between said automatic fluid supply control valve means and said tank,
means for determining said low pressure condition and said high pressure condition,
a first arm linked to said first means for movement in response to movement of said first means,
and a second arm linked to said first arm by a spring whereby predetermined movement of said first arm causes snap movement of said second arm at a predetermined position of said first arm permitting rapid actuation of said second arm at high and low pressure values exerted on said first means.

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