United States Patent [19]

Okui

[11] **3,756,558**

[45] **Sept. 4, 1973**

[54] **FLUID CONTROL VALVE**

[76] Inventor: **Seiichi Okui,** 543 Talsumyagara-cho, Ikuno-ku, Osaka, Japan

[22] Filed: **Nov. 11, 1971**

[21] Appl. No.: **197,648**

[52] **U.S. Cl.** **251/282,** 137/505.18

[51] **Int. Cl.** **F16k 1/12**

[58] **Field of Search** 137/505.18; 251/282

[56] **References Cited**

UNITED STATES PATENTS

1,294,151	2/1919	Page	137/505.18 X
3,179,123	4/1965	Kowalski	137/505.18 X
3,075,545	1/1963	Eichelman	137/505.18
3,064,670	11/1962	Peras	137/505.18 X
219,114	9/1879	Ross	137/505.18 X

Primary Examiner—Harold W. Weakley

Attorney—Dawson, Tilton, Fallon & Lungmus

[57] **ABSTRACT**

This valve control valve comprises a valve body having a central bore therein provided with an intermediate enlarged part and an annular seat, said enlarged part being substantially a first chamber communicated with an inlet in the valve, a valve plug slidably inserted in the bore and having upper and lower cylindrical sliding members, an intermediate brim and a neck portion between the upper sliding member and the brim to define a second chamber there around which is communicated with an out-let of the valve, said brim being positioned in the first chamber and adapted to cooperate with the valve seat to regulate the valve orifice therebetween, and the construction being so arranged that upward and downward fluid pressures within the first chamber to the brim of the plug are balanced and upward and downward fluid pressures in the second chamber to the plug being also balanced thereby moving the plug lightly and easily.

1 Claim, 5 Drawing Figures

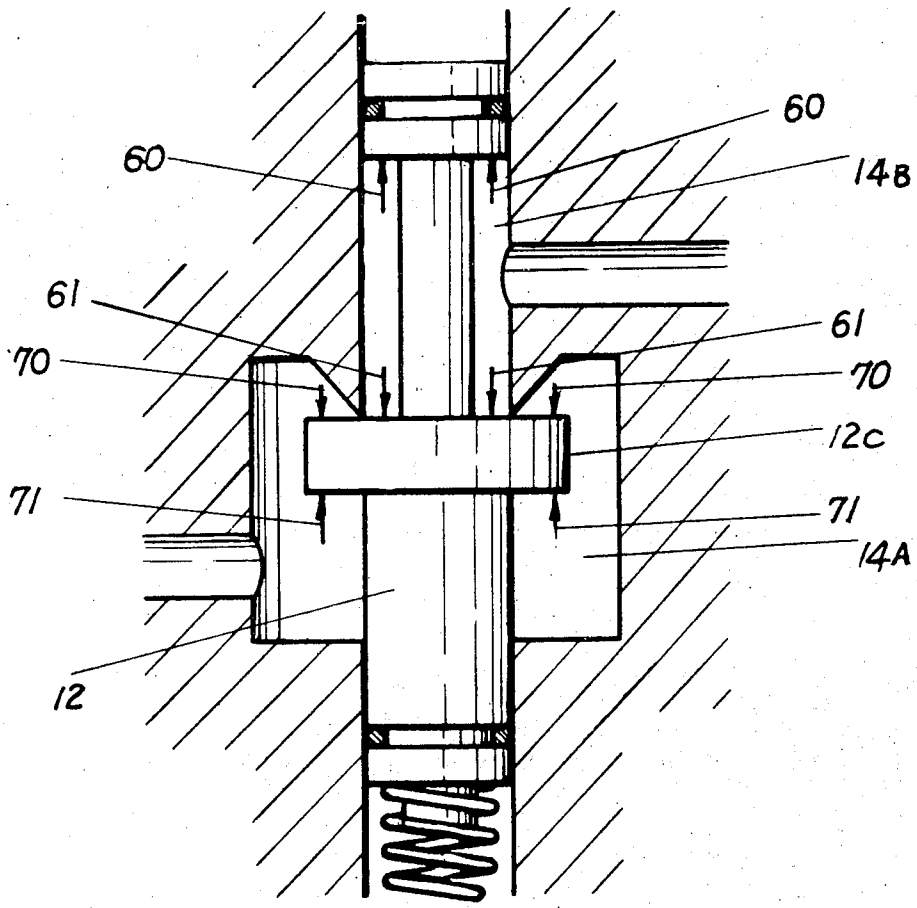


Fig. 1

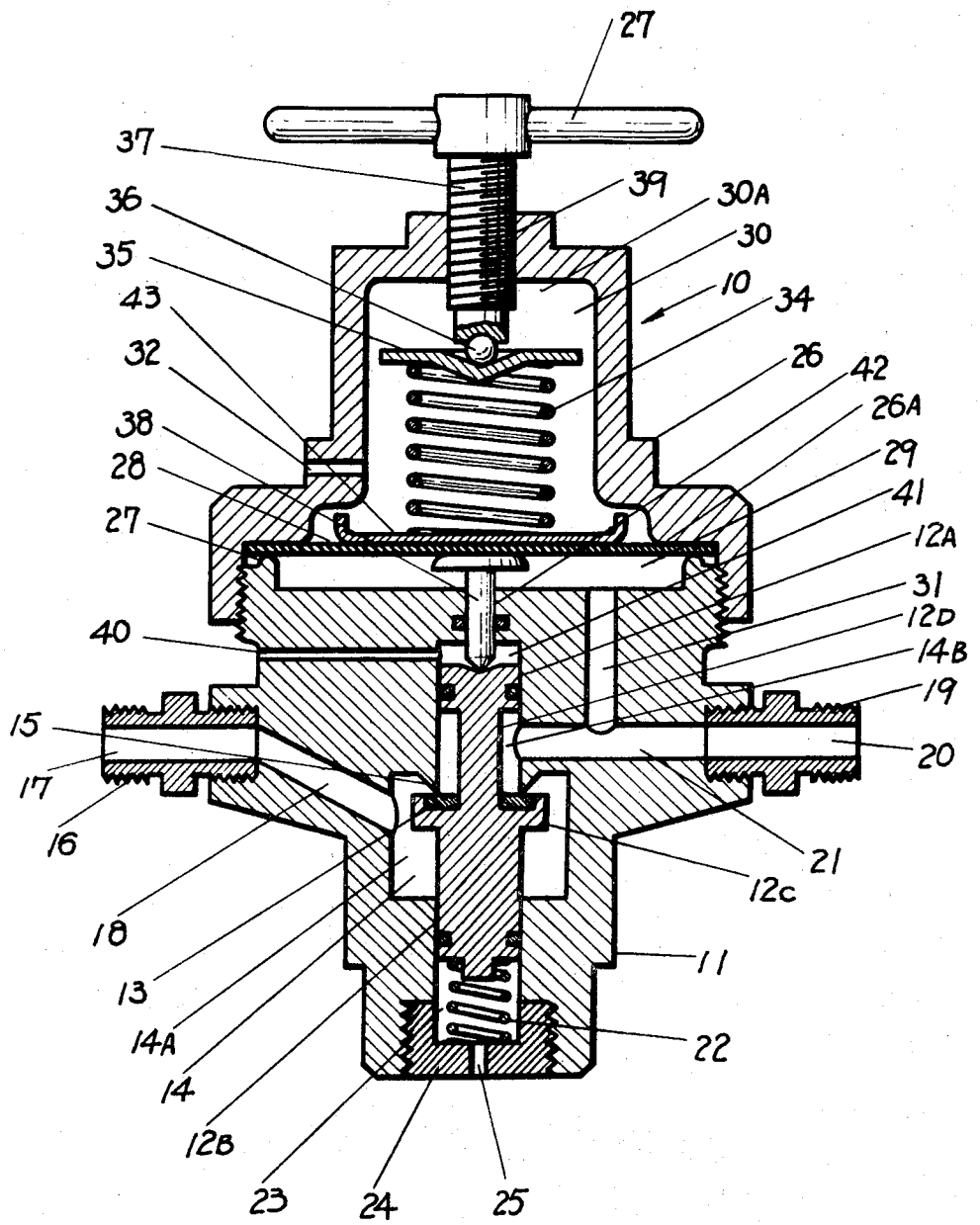

27
37
39
30A
36
30
35
10
34
43
32
26
42
26A
38
29
28
41
27
12A
31
40
12D
14B
19
15
20
17
16
21
12C
18
11
13
14A
22
14
12B
23
24
25

Fig. 2

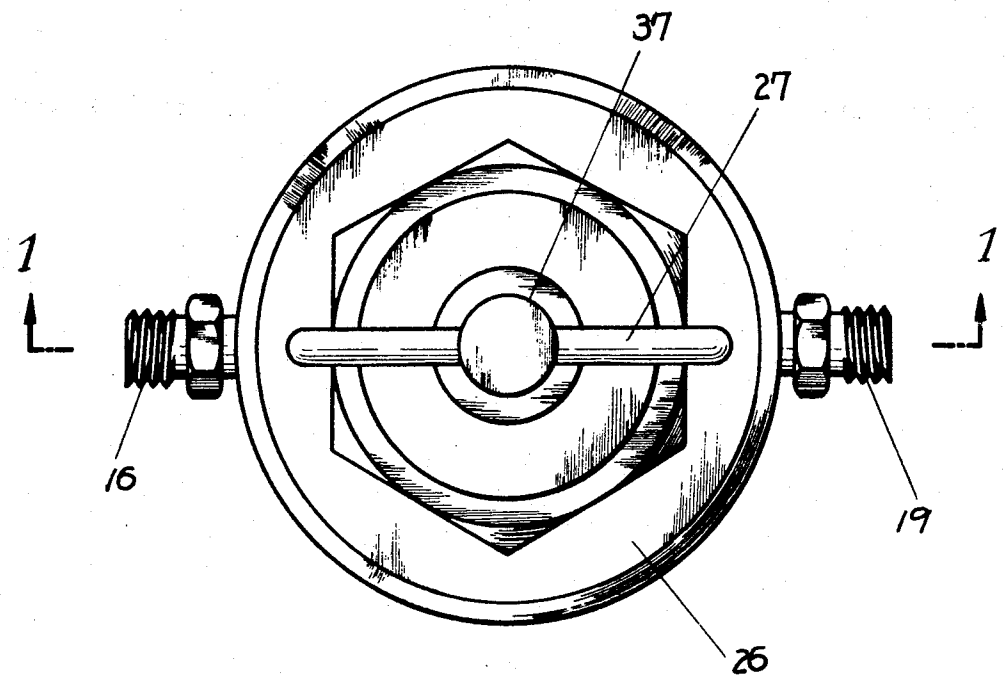


Fig. 3

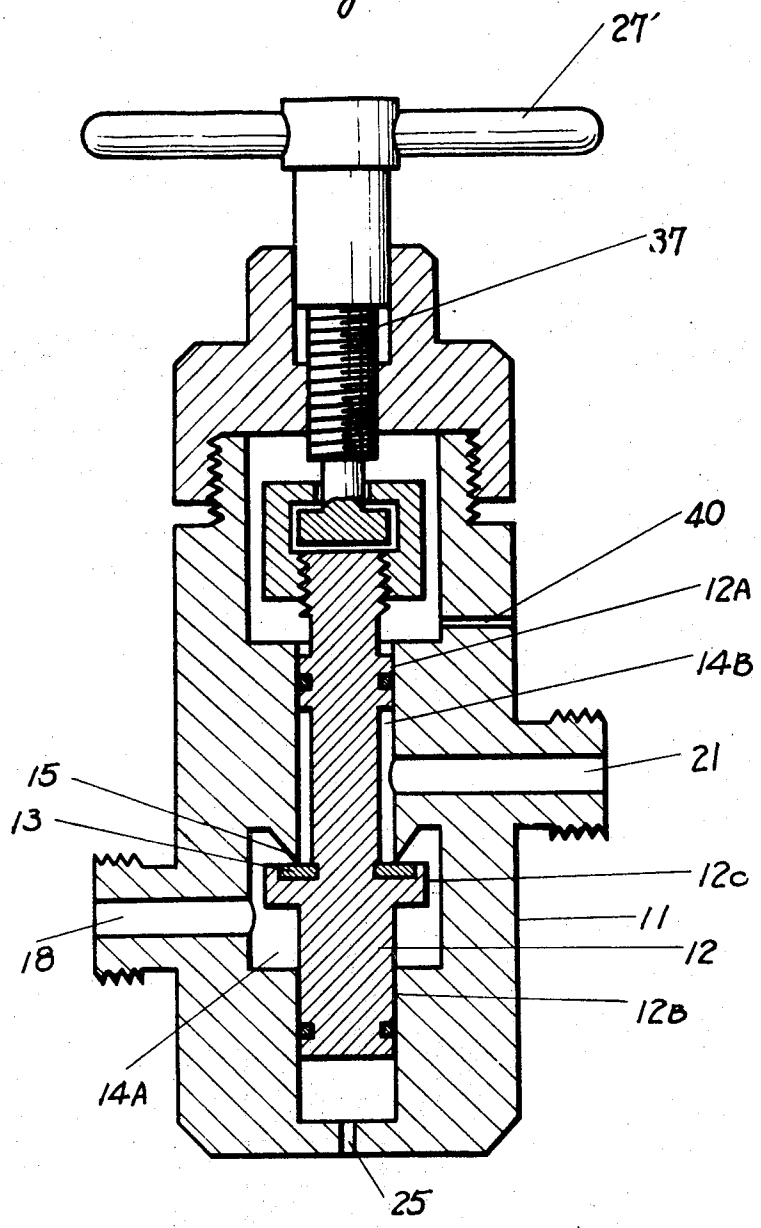


Fig. 4

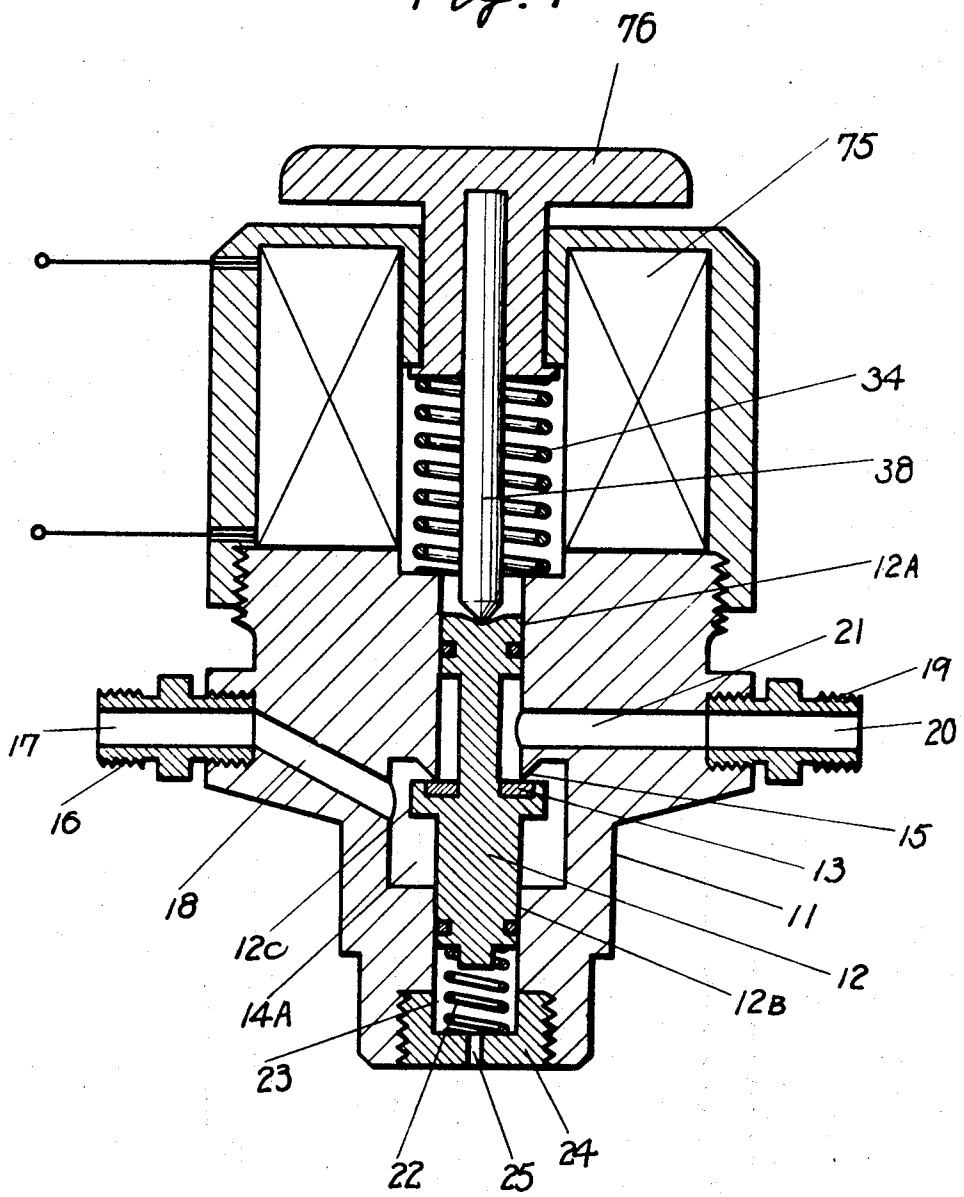
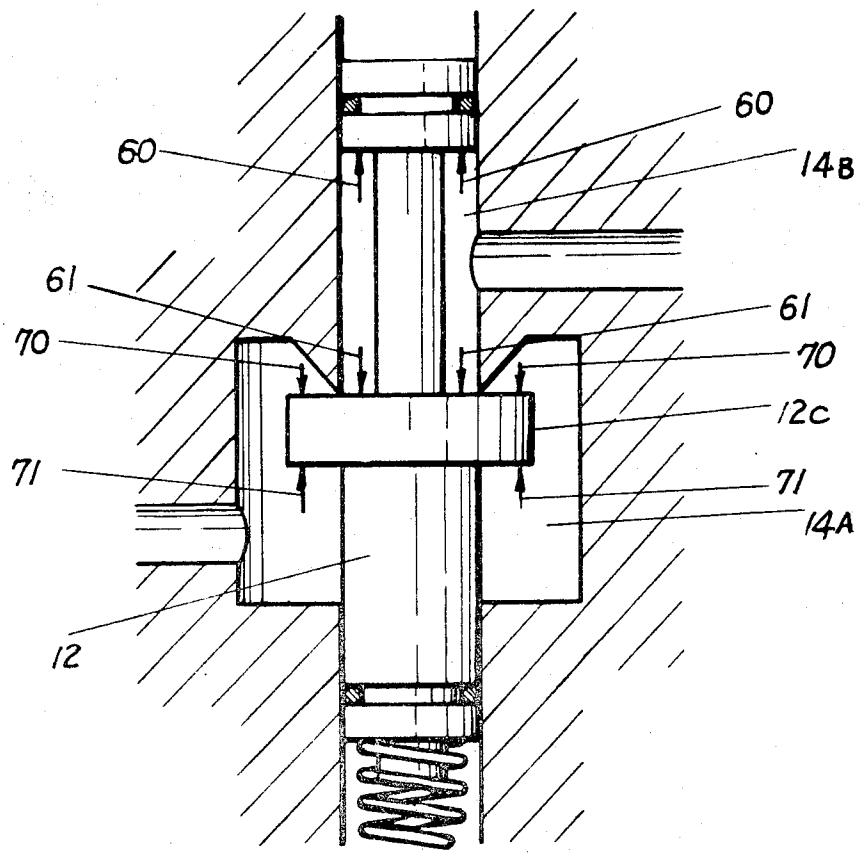


Fig. 5



FLUID CONTROL VALVE

The present invention relates to a fluid control valve and this invention is directed more particularly to the provision of such a valve for use with cylinders containing gas, such s oxygen, acetylen gas or the like.

A main object of the present invention is to provide an improved fluid control valve in which the valve plug can be lightly moved without receiving any fluid pressure and fluid resistance thereby correctly controlling the flow or pressure of fluid.

And another object of the present invention is to provide a fluid control valve which is responsive to fluid pressures and changes the rate of opening of the valve orifice to control the fluid pressure on the outlet side in a predeterminate condition.

In carrying out the invention in one aspect thereof, a fluid control valve is provided in which the combination comprises a valve body having a bore therein provided with an intermediate enlarged part and an annular seat, said enlarged part being substantially a first chamber communicated with an inlet in the valve, a valve plug slidably inserted in the bore and having upper and lowe cylindrical sliding members, an intermediate brim and a neck portion between the upper sliding member and the brim to define a second chamber there around which is communicated with an outlet of the valve, said brim being positioned in the first chamber and adapted to cooperate with the valve seat to regulate the valve orifice therebetween, and the construction being so arranged that upward and downward fluid pressures within the first chamber to the brim of the plug are balanced eand upward and downward fluid pressures in the second chamber to the plug being also balanced thereby moving the plug lightly and easily.

Other objects and advantages of the subject invention will become apparent from reading the following detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a longitudinal sectional view taken along the line in 1—1 in FIG. 2, of the fluid control valve according to the present invention;

FIG. 2 is a plan view of the fluid control valve;

FIG. 3 and 4 are longitudinal sectional view of other embodiments of the valve according to the present invention; and

FIG. 5 is an enlarged sectional view showing essential parts of the fluid control valve according to the present invention.

The fluid control valve of this invention is genrally designated at **10** and it includes a valve body **11** formed of brass or the like. The valve body **11** has a longitudinal central bore **14** in which a valve plug **12** is slidably mounted. The central bore **14** has at intermediate portion thereof an enlarged part to form a first chamber **14A** which is communicated through a passage **18** with an opening **17** of an externally threaded coupling member **16**, the latter being communicated through a suitable duct (not shown) with a cylinder containing a gas, such as an oxygen, acetylene gas and the like. The valve plug **12** comprises an upper sliding portion **12A**, a lower sliding portion **12B**, an enlarged brim **12C** formed at intermediate part of the plug **12** and having an upwardly facing valve element **13**, and a neck portion **12D** formed between the upper sliding portion **12A** and the brim **12C** to form a second chamber **14B** there-around, said valve element **13** being preferably

formed from nylon or the like. The brim **12C** of the plug is positioned in the first chamber **14A**, and the valve element **13** on the brim **12C**, upon movement of the valve plug **12** engages and disengages a seat **15** for closing and opening the fluid passage through the valve. The valve body **11** also provided with a lateral bore **21** which communicates the second chamber **14B** with an opening **20** of an externally threaded coupling member **19** which is connected with means, for example, as a cutting tip or nozzle of the welding and cutting device by means of a duct. The lower end of the central bore **14** is closed by cup **24** having small opening **25**, and a spring **22** is positioned in a lower space **23** defined between the end of the central bore **14** and the top surface of the cup **24** to upwardly urge the plug. An upper space defined between the top surface of the plug **12** and the downwardly facing end surface of the centrol bore **14** is communicated with the outer air by a small opening **40**.

Designated at **26** is a housing which has a diaphragm chamber **30** therein. The housing **26** is provided with a threaded opening **39** at the top thereof to which a screw shaft **37** of a handle **27** is threaded. The bottom of the housing is open and provided with an internal thread. The valve body **11** has a top shallow recess or pilot chamber **29** and a top external thread which is engaged with the internal thread of the housing. There is a diaphragm **28** which is extended over the end **27** of the valve body **11** and which is gripped between that end **27** and an internal flange **26a** in the housing **26**. The diaphragm **28** is carried by a push rod **38** at intermediate portion of the back surface thereof, and a lower part of the push rod **38** is extended into the upper space **41** through a perforation **42**, the extended lower end of the push rod **38** being adjoined to the uppen surface of the valve plug **12**. On the lower end of the screw shaft **39**, a receiving plate **35** is positioned with a ball **36** which allows relative rotation between the screw shaft and the receiving plate **35**, the latter being adapted to receive one end of a spring **34**. The spring **34** is arranged between the upper receiving plate **35** and a lower receiving plate **43** mounted on the diaphragm **28**. The upper chamber **30A** defined by the diaphragm **28** is also communicated with the outer air by an aperture **32**, and the pilot chamber **29** is communicated with the second chamber **14B** through a passage **31** and the opening **21**.

As illustrated in FIG. **5**, the areas of upper and back surfaces of the brim **12C** within the first chamber **14A** are equal to each other, so that downward pressure **70** in the first chamber **14A** to the upper surface and the upward pressure **71** to the back surface are balanced. Furthermore, downward pressure **61** in the second chamber **14B** to the plug **12** and upward pressure **60** to the plug are so intended as to balance. Therefore, there is no resistance of the fluid in the first and the second chambers to the plug **12** during its movement.

In FIG. **1**, valve closed condition is shown in which the valve element **13** of the plug **12** is normally seated on the valve seat **15** and no fluid pressure may pass from the inlet or opening **17** to the outlet or opening **20**. When the handle **37** is manually roteted clockwise in FIG. **2**, the diaphragm **28** deforms downwardly by the depressed spring **34**, and the push rod **38** is pressed down with the plug **12**, thereby opening the valve passage and permitting the possage of fluid from the inlet **17** and out of the outlet **20**. The rate of opening of the

valve passage is small and fluid pressure passing through the valve passage is reduced. When the pressure in the second chamber increases by reason of, for example, flow resistance, this increased pressure is introduced into the pilot chamber **29** through the passage **31**, raising the diaphragm **28** against pressure of the spring **34**, whereby the plug **12** is upwardly moved by action of spring to reduce valve gap between the valve seat **15** and the valve element **13** untill the fluid pressure in the second chamber is reduced by predetermined pressure. Thus, the fluid pressure in the second chamber is automatically controlled.

It is to be noted that as the plug **12** is moved up and down without meeting with any resistance from the fluid in the first and second chambers by reason of beforementioned construction, the plug **12** responds sensitively to variation of pressure in the second chamber **14B** and its communicated parts for varrying the valve gap or orifice. Furthermore, the spring **22** for carrying the plug may be made from small spring steel sufficient to maintain the plug in the position, whereby manipulation of the handle **27** will be performed lightly and easily.

In FIG. **3**, other embodiment of the fluid control valve according to the present invention is shown wherein there is no above mentioned diaphragm means and, instead of such means the valve orifice or the rate of valve opening is manually operated by rotating of a handle **27'**. Furthermore, another embodiment of the fluid control valve illustrated in FIG. **4** is electrically controled, that is, the valve orifice in this fluid control valve is varried by an electric magnet **75** having a moving core **76.** Other components in this fluid control valve are similar to beforementioned first embodiment illustrated in FIG. **1.**

While the present invention has been illustrated and described herein with respected to preferred embodiments, it is not desired to limit the invention only to the embodiments, but the invention should be considered to include all the substilutes, modifications and equivalents which are encompassed within the essential part of the invention to be set forth in the scope of the underwritten claim and within the scope of the spirit exhibited in the intention of the invention.

What is claimed:

1. A fluid control valve comprising a valve body having an elongated central bore providing first and second chambers and terminating in a bottom portion, the first chamber having a transverse dimension greater than the transverse dimension of the second chamber, the transverse cross sectional area of the second chamber and the transverse cross sectional area of the bottom portion of the bore being equal, the valve body being provided with a valve seat surrounding the second chamber and separating the second chamber from the first chamber, an elongated valve plug slidably received in the central bore for longitudinal sliding movement therein, the valve plug including a first sliding portion slidably received in and sealingly engaging the bottom portion of the bore, a brim portion extending transversely outwardly from the first sliding portion, the brim portion having an upper surface engageable with the valve seat to seal the first chamber from the second chamber and a lower surface extending outwardly from the first sliding portion, a second sliding portion slidably received in and sealingly engaging the second chamber, and a neck portion extending between the second sliding portion and the brim portion and having a transverse dimension less than the transverse dimension of the second sliding portion, spring means within the bore acting on the valve plug for resiliently biasing the brim portion of the valve plug against the valve seat, and means on the valve body for moving the valve plug against the bias of the spring means whereby the brim portion is moved away from the valve seat, the portion of the upper surface of the brim portion which extends outwardly of the valve seat when the upper surface engages the valve seat having an area substantially the same as the area of the lower surface of the brim portion, the portion of the upper surface of the brim which is located inwardly of the valve seat having an area substantially the same as the area of the portion of the second sliding portion of the valve plug which extends outwardly of the neck portion whereby neither the pressure within the first chamber nor the pressure within the second chamber exerts a sliding force on the valve plug.

* * * * *