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Barb

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[54] **CONTROL VALVE STRUCTURE HAVING DOUBLE PORTS**

[75] Inventor: **Gayle E. Barb,** Houston, Tex.

[73] Assignee: **ACF Industries Incorporated,** New York, N.Y.

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[52] **U.S. Cl.** **137/625.3,** 251/210

[51] **Int. Cl.** **F16k 11/06**

[58] **Field of Search**..... 137/625.3, 625.37, 625.38, 137/625.39; 251/205, 210

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Primary Examiner—Henry T. Klinksiek

Attorney, Agent, or Firm—Eugene N. Riddle

[57] **ABSTRACT**

A control valve structure in which the flow of fluid from the inlet is divided into two separate streams and then recombined at the outlet. The control valve is of the globe-valve type having two opposed parts through which the fluid flows from the inlet, and the control valve includes two cylindrical valve portions thereon to control the flow of fluid through the two ports. The cylindrical valve portions are mounted on a common valve post in spaced relation to each other and are perforated to provide a restriction to the fluid flow, thereby converting some of the energy of the fluid stream to heat.

4 Claims, 5 Drawing Figures

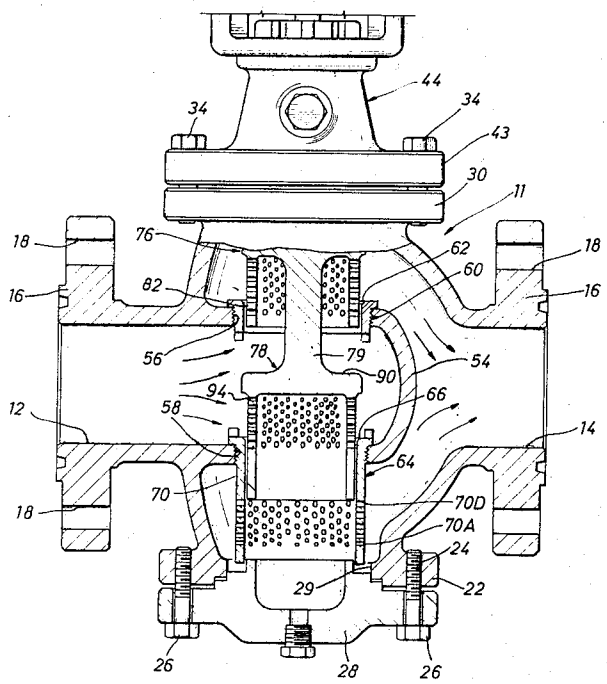


FIG.1

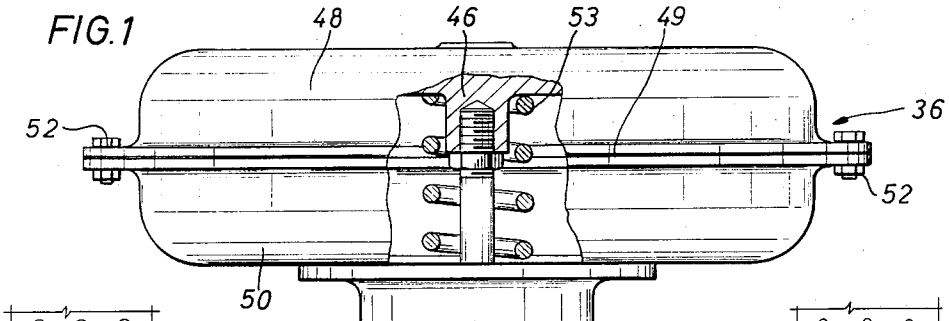


FIG.4

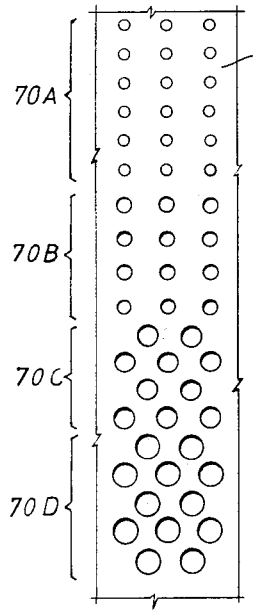
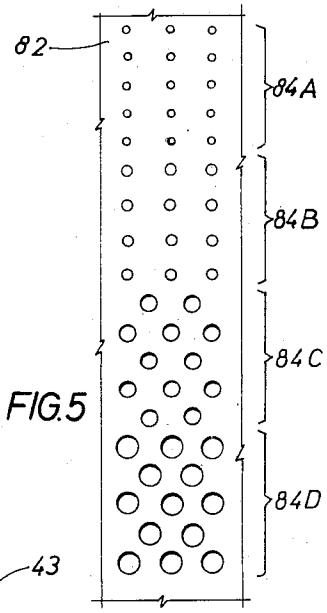


FIG.5



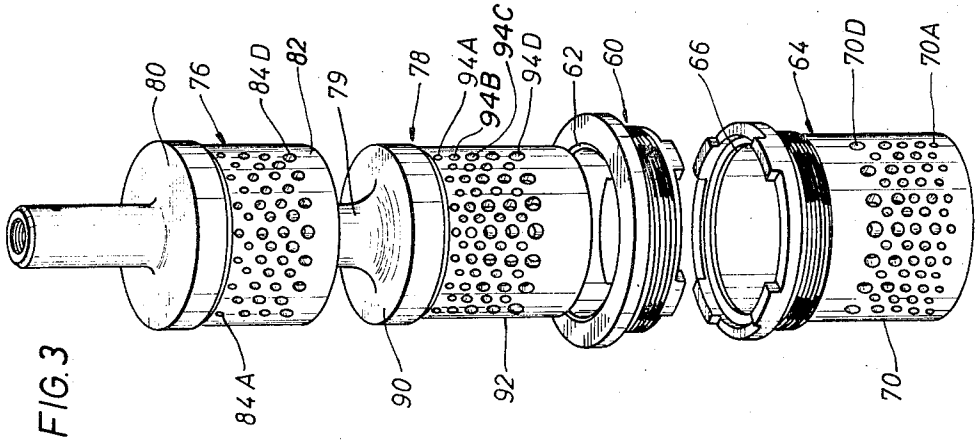

80
76
84D
82
79
78
94A
94B
94C
94D
62
60
66
64
70D
70A
84A
90
92
70

FIG. 3

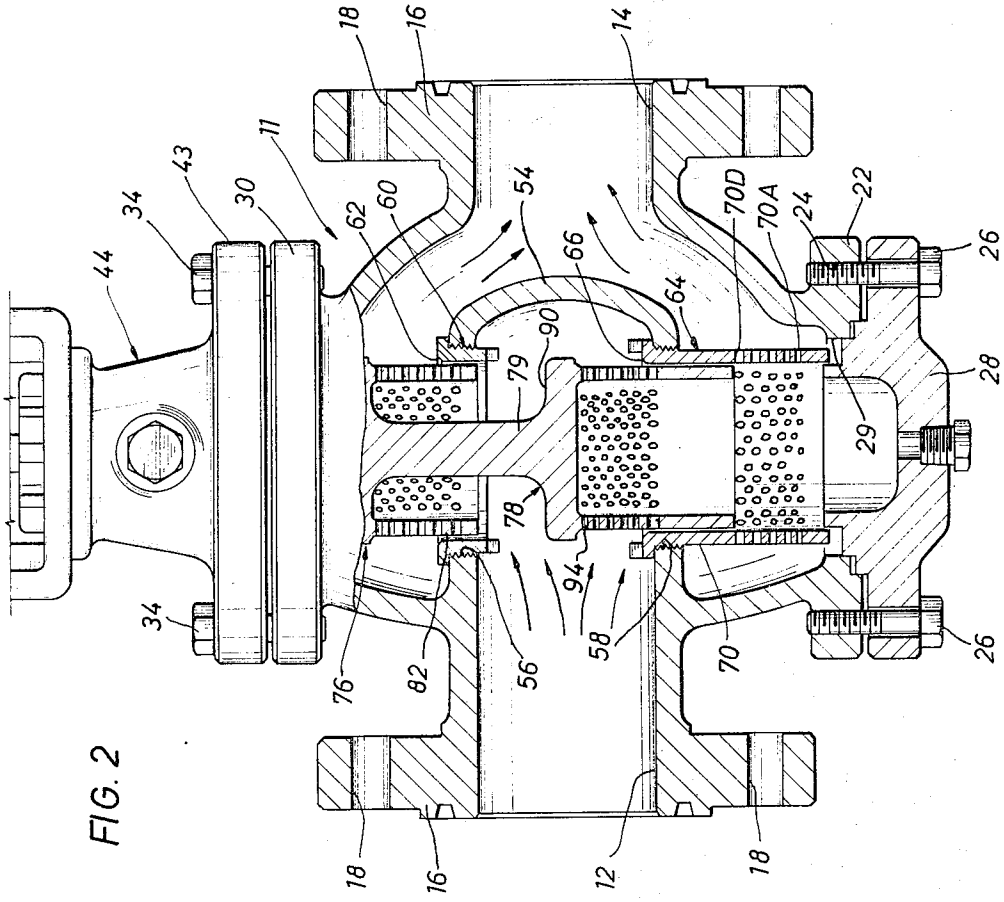

18
16
14
11
43
34
30
62
60
54
66
64
70D
70A
24
22
26
44
90
79
28
29
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94
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76
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34
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16
12
18

FIG. 2

CONTROL VALVE STRUCTURE HAVING DOUBLE PORTS

BACKGROUND OF THE INVENTION

A low noise level must be obtained in order to meet governmental and industry standards. Several methods have been advised for a reduction in noise levels, such as directing the flow of fluid through tortuous fluid passages with the direction of flow being changed. This technique also converts some of the energy of the fluid stream to heat. A plurality of perforated discs has also been provided heretofore for the flow of fluid therethrough. Perforated or slotted cages through which the fluid is directed have likewise been utilized heretofore. Multiple-orifice plates or discs placed downstream of a valve will reduce the pressure drop across the valve and reduce the discharge velocity. Flow passages of the multiple plates may be staggered or spaced so that flow does not jet straight through the plates. All such means have converted some of the energy of the fluid stream and reduce the tendency toward cavitation. Thus, excessive valve noise has been reduced or minimized by such previous arrangements.

DESCRIPTION OF THE PRESENT INVENTION

The present invention introduces a large ratio of wetted area to flow area thus converting energy of the fluid stream to heat. This large ratio, i.e. wetted area to flow area, is provided by having an inlet leading to a pair of opposed ports. To control the flow of fluid through the opposed ports to the outlet, two cylindrical valve plug portions are mounted on a common post. The cylindrical valve plug portions have open lower ends and imperforate upper ends which seat about the opposed ports in closed position. The cylindrical valve plug portions are perforated so that in the open position of the valve the fluid flows through the perforated portions to the discharge outlet. The change in direction of the fluid as it flows through the perforated valve plug portions also converts energy of the fluid stream. This energy conversion tends to reduce cavitation and the resultant noise.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

FIG. **1** is a sectional view of a control valve constructed in accordance with the invention, certain parts thereof shown in elevation, with the valve being in a closed position;

FIG. **2** is a sectional view generally similar to FIG. **1** but showing the valve plug member in an open position thereof with the fluid flow from the inlet through the upper and lower cylindrical portions and thence through the outlet;

FIG. **3** is an exploded view of the double port type valve plug forming the present invention and including the lower fixed cage structure;

FIG. **4** is a diagrammatic view showing the pattern or arrangement of the multiple openings in the fixed lower cage structure;

FIG. **5** is a diagrammatic view similar to FIG. **4** but showing the multiple openings in the identical upper and lower sections of the valve plug.

Referring now to the drawings for a better understanding of the invention, a control valve structure generally indicated **10** and embodying the present invention includes a valve body generally indicated **11** having an inlet **12** and an outlet **14.** Flanges **16** are provided adjacent inlet **12** and outlet **14** having suitable openings **18** adapted to receive bolts or the like for connecting an adjacent pipe section thereto. Valve body **11** has a lower flange **22** thereon. Suitable openings **24** in lower flange **22** receive bolts **26** for securing a bottom closure **28** fitting over an opening **29** in the lower end of valve body **11** to provide easy access to the interior of valve body **11.** An upper flange **30** of valve body **11** has suitable bolt openings **32** therein which receive bolts **34** for securing a bonnet generally indicated **43.** A valve actuator generally indicated **36** may be suitably secured to bonnet **43.**

A lower stem **38** has a valve plug generally indicated **40** connected thereto. An upper valve stem **42** is connected to lower valve stem **38.** A suitable stuffing box is generally indicated **44.** Upper stem **42** is secured to a diaphragm plate **46.** A diaphragm **49** is clamped between an upper casing **48** and a lower casing **50** by bolts **52.** A spring **53** contacts diaphragm plate **46.**

Inlet **12** has a closed end **54** and a pair of opposed openings **56** and **58.** An upper generally cylindrical valve seat member indicated **60** is threaded within opening **56** and has a seat **62** thereon. A lower generally cylindrical valve seat member or cage **64** is threaded within opening **58** and has a lower seat **66** thereon. Lower valve seat member **64** has a lower skirt or wall **70.** Perforations or openings **70A**, **70B**, **70C**, and **70D** are formed in rings about skirt **70** and increase in size from the lower end of skirt **70** toward the upper end thereof. As a non-limiting example of openings **70A**, **70B**, **70C**, **70D**, openings **70A** may comprise six rings of 96 openings each having a diameter of 3/32 inch and spaced 3.75° apart in each ring. Openings **70B** comprise four rings of 96 openings each of one-eighth inch diameter 3.75° apart in each ring. Openings **70C** comprise four rings of 96 openings each of five thirty-seconds inch diameter 3.75° apart in each ring. Openings **70D** comprise five rings of 96 openings each of three-sixteenths inch diameter and 3.75° apart in each ring. Each ring is spaced approximately 0.20 inch from the adjacent ring. It is noted that openings **70A**, **70B**, **70C**, and **70D** are arranged in FIG. **4** in an inverted relation with respect to FIGS. **1–3.**

Valve plug **40** includes an upper plug portion generally indicated **76** and a lower plug portion generally indicated **78** connected by a post **79.** Upper plug portion **76** includes an upper body **80** and a lower skirt or wall **82** extending therefrom and having an open lower end. Perforations or openings **84A**, **84B**, **84C**, and **84D** are formed in rings about skirt **82** and increase in size from the upper ring thereof to the lower ring thereof. As a non-limiting example of **84A**, **84B**, **84C**, and **84D**, openings **84A** may comprise five rings of 96 openings each of five sixty-fourths inch diameter which are 3.75° apart. Openings **84B** comprise four rings of 96 openings each of seven sixty-fourths inch diameter which are 3.75° apart. Openings **84C** comprise five staggered rings of 96 openings each of nine sixty-fourths inch diameter which are 3.75° apart. Openings **84D** comprise five staggered rings of 96 openings each of five thirty-seconds inch diameter which are 3.75° apart. Each ring from openings **84A** to **84D** is spaced approximately 0.20 inch from the adjacent ring.

Lower valve plug portion **78** includes an upper main body **90** having a wall or skirt **92** extending therefrom

and having an open lower end. Perforations or openings 94A–94D are formed in valve plug skirt 92 identical to those of 84A, 84B, 84C, and 84D.

In operation, as shown in FIG. 1 with valve plug member 40 in seated position, main body 80 is seated on seat 62 and main body 90 is seated on seat 66 to prevent the flow of fluid through valve 10. Upon the opening of valve plug 40 by diaphragm plate 46, diaphragm 49, and spring 53 exerting an upward movement on stem 42, valve plug portions 76 and 78 are moved to an open position as shown in FIG. 2 and fluid flows from inlet 12 simultaneously through openings 84A, 84B, 84C, 84D, and 94A, 94B, 94C, and 94D. Openings 70A, 70B, 70C, and 70D are introduced in series with openings 94A, 94B, 94C, and 94D.

Valve 10 may be suitably employed with either gaseous or liquid fluids, such as steam or water, for example. Further, the present invention may be suitably employed with a so-called reverse acting valve plug as contrasted with the present design which is a direct acting valve plug. A direct acting valve plug moves downwardly toward a closed position while a reverse acting valve plug moves downwardly toward an open position. The valve plug of the present invention may be easily designed to move downwardly toward an open position, if desired.

What is claimed is:

1. A valve structure comprising, a body having an inlet and an outlet, said inlet having an end portion extending within said body and having aligned upper and lower annular valve ports communicating with said outlet, aligned upper and lower valve seats defining said valve ports, a valve plug structure mounted within said valve body having axially aligned integral upper and lower valve plug portions connected to a common post and adapted to seat on the respective upper and lower valve seats, said lower valve plug portion having a perforated cylindrical wall and an open lower end, the upper end of said lower valve plug portion being closed and adapted to seat on the lower valve seat in a closed position to prevent the flow of fluid therethrough, a fixed cage having an upper circumference forming the lower valve seat and a lower cylindrical perforated wall communicating with the outlet, said lower valve plug portion being received within the cage and covering at least a substantial portion of the perforated area of the fixed cage in a closed position, the perforated area of the lower plug portion and the perforated area of the cage which are exposed to fluid flow both increasing simultaneously in size upon movement of the lower plug portion toward an open position and said fluid first flowing through the perforations in said lower valve plug portion and then through the perforations in said cage to said outlet, and means to move said valve plug portions between open and closed positions relative to the valve ports.

2. A valve structure as set forth in claim 1 wherein the openings in each of said generally cylindrical walls are arranged in a plurality of spaced rings about the walls with the openings being of an increasing size from closed position toward full open position.

3. A valve structure as set forth in claim 1 wherein the openings in the perforated wall of said cage are of a decreasing size from a position adjacent the associated seat to a position remote from the associated seat.

4. A valve structure comprising, a body having an inlet and an outlet, said inlet having an end portion extending within said body and having a pair of aligned annular valve ports communicating with said outlet, a pair of aligned valve seats defining said valve ports, a valve plug structure mounted within said valve body having a pair of axially aligned valve plug portions connected to a common post and adapted to seat on said valve seats, one of said valve plug portions having a perforated cylindrical wall and one open end, the other end of said valve plug portion being closed and adapted to seat on its associated valve seat in a closed position to prevent the flow of fluid therethrough, a fixed cage forming one of the valve seats and having a cylindrical perforated wall communicating with the outlet, said one valve plug portion being received within the cage and covering at least a substantial portion of the perforated area of the fixed cage in a closed position, the perforated area of said one plug portion and the perforated area of the cage which are exposed to fluid flow both increasing simultaneously in size upon movement of said one plug portion toward an open position and said fluid first flowing through the perforations in said one valve plug portion and then through the perforations in said cage to said outlet, and means to move said valve plug portions between open and closed positions relative to the valve ports.

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