United States Patent

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[72] Inventor Gordon N. Baustian
Sioux City, Iowa

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[73] Assignee American Air Filter Company, Inc.
Louisville, Kentucky
a corporation of Delaware

[54] **BALANCING VALVE**
4 Claims, 4 Drawing Figs.

[52] U.S. Cl. 137/614.11, 137/614.16, 251/121
Int. Cl. F16k 5/10
[50] Field of Search 137/614.16, 614.17; 251/121, 122, 315; 137/637.4, 614.11

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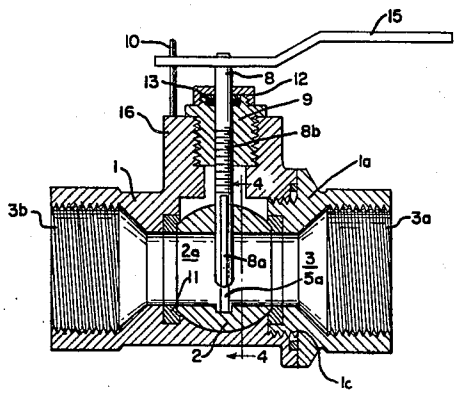
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Primary Examiner—William F. O'Dea
Assistant Examiner—Howard M. Cohn
Attorney—Ralph B. Brick

ABSTRACT: A quick opening plug type valve which includes a selectively adjustable vane to close a portion of the opening through the plug member to control the maximum flow through the valve when the valve is in open position.



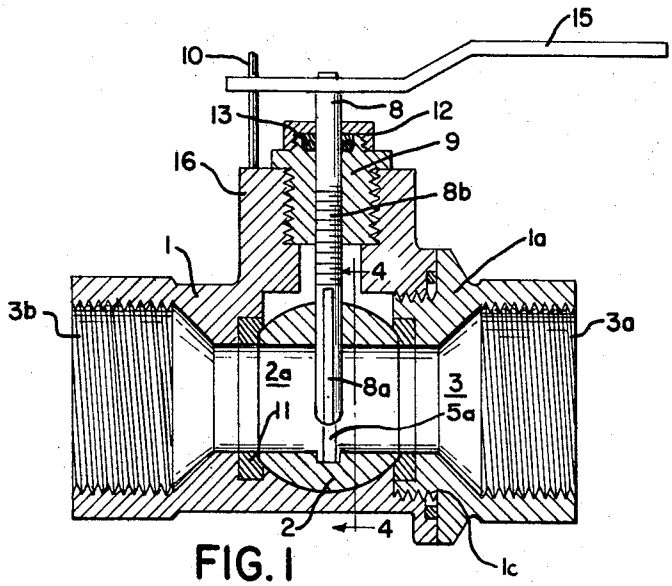


FIG. 1

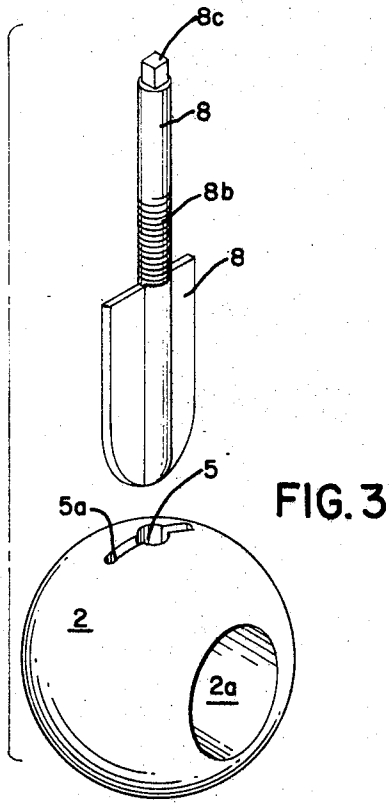


FIG. 3

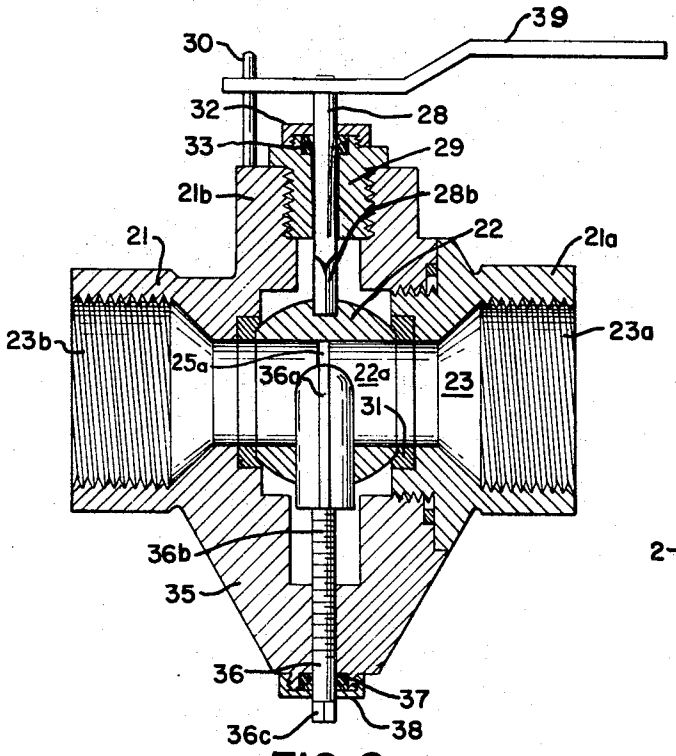


FIG. 2

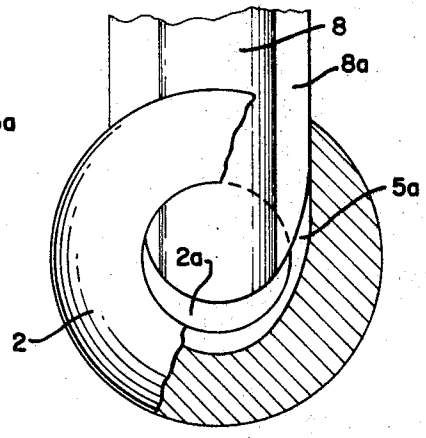


FIG. 4

INVENTOR.
GORDON N. BAUSTIAN
BY Edward M. Steinmann
ATTORNEY

BALANCING VALVE

BACKGROUND OF THE INVENTION

In certain fluid flow applications, for example heating systems where a tempered fluid is supplied to air conditioning units located in different rooms within a building, it is desirable to provide a valve which includes means to selectively regulate the maximum rate of fluid flow through the valve. In such air conditioning applications a valve is usually provided in the tempering fluid supply system before each air conditioning unit and is usually not used to modulate the flow of fluid to the unit but is either fully opened or fully closed. There are usually a number of units spaced throughout a building and it is important that the fluid system be balanced to assure adequate flow of tempering medium to every unit and to make certain that there is not an oversupply to some units and an undersupply to others as a result of differences in distance from the source of fluid to the unit, difference in elevation of the location of the units, etc. The maximum fluid flow to the different units in such systems can be balanced by adjusting the opening through each valve so there will be an adequate supply of fluid to every unit when all the units are to receive tempering medium and such valves should be selectively adjustable so the maximum flow through the valves can be changed in accordance with changing conditions but should also provide means for the valve to be closed and then easily opened to provide the same maximum flow.

Previous valves have included various means to selectively regulate the maximum flow of liquid through the valve and have generally been of the gate or globe type with a stop provided to restrict movement of the stem or valve head beyond the selected opening. Several turns are required to open such valves and the valves are complicated and expensive to manufacture.

SUMMARY OF THE INVENTION

The present invention provides a ball valve with straightforward means to regulate the maximum flow through the valve. The valve is inexpensive to fabricate and requires only a minimum number of moving parts. Furthermore, the present invention provides a quick opening valve which can be selectively adjusted to provide a given maximum flow when the valve is in fully opened position and which can be moved from fully opened to fully closed position, and vice versa, with a quarter turn or less of the valve stem without disturbing the maximum flow setting.

Various other features of the present invention will become obvious to those skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides a valve comprising: a valve housing defining a first fluid flow passageway therethrough and having cooperative end connections at each end of the passageway; a rotatable valve member having a second passageway therethrough and a slot extending from the periphery of the valve member into the second passageway; means to dispose the valve member in rotatable relation within the first passageway of the valve housing in engaging sealing relation with the housing so the second passageway through the valve member can be rotated to aligned relation with the first passageway through the housing to permit flow of fluid therethrough and can be rotated out of alignment with the first passageway to stop flow through the valve housing; vane means to be inserted in the slot means of the valve member to be advanced into the second passageway to restrict fluid flow through the second passageway; stem means to selectively adjust the position of the vane means within valve member and selectively rotate the valve member so the second passageway is in aligned relation with the first passageway defined by the valve housing.

It is to be understood that the example of the present invention given hereinafter is not by way of limitation and that various changes can be made in the arrangement, form, or configuration of the apparatus disclosed hereinafter without departing from the scope or spirit of the present invention.

Referring now to the drawings:

FIG. 1 is an elevational view, in section, of one example of a valve in accordance with the present invention;

FIG. 2 is an elevational view, in section, of another example of a valve means in accordance with the present invention;

FIG. 3 shows an exploded, enlarged, view of a valve member and vane member which can be used in the apparatus of FIG. 1; and

FIG. 4 shows a vane member disposed in position to close off a portion of the passageway through a valve member as in the example of FIG. 1.

The example of FIG. 1 shows a valve including a housing **1**, **1***a* adapted to receive a rotatable ball valve member **2**. In accordance with one feature of the present invention valve member **2** is provided with a cooperative slot **5***a* to receive a stem member **8**, which includes vanes **8***a*, to control the maximum flow through the valve and rotate the valve member **2** from open to closed position within the valve body, as hereinafter described.

In the example of the FIGS., the valve housing includes two cooperative elements **1***a* and **1**, adapted to be assembled, through the male and female thread arrangement at **1***c*, where ball valve member **2** is positioned within element **1** before the valve housing is assembled. Valve member **2** is disposed within the valve housing so passage **2***a* can be disposed in aligned relation with passage **3** through the valve housing to provide flow through the valve and the valve member can be rotated to nonaligned relation to block fluid flow through passage **3**. Inlet **3***a* of portion **1***a* and outlet **3***b* of portion **1** of the valve housing can be adapted, for example by thread means as shown, so the valve can be joined to piping connections in a fluid flow system.

Element **1** of the valve housing includes an internally threaded bonnet sleeve **16** adapted to receive a bonnet nut **9** and it will be noted that bonnet nut **9** has internal threads to receive threaded section **8***b* of valve stem **8**. A packing gland **13**, adapted to receive packing as shown, is provided by bonnet nut **9** to seal valve stem **8** to prevent fluid leakage from the valve. A packing nut **12** is provided to engage cooperative threads on bonnet nut **9** to compress the packing to form the seal.

As shown in FIG. 3, valve member **2** includes an aperture **5** adapted to receive valve stem **8** and lateral slots **5***a* to receive cooperative vanes **8***a*. Aperture **5** and slot **5***a* extend into valve member **2** in a direction generally transverse the passageway **2***a* through valve member **2** and valve stem **8** and vanes **8***b* are free to move laterally through opening **5**—**5***a* to block a selected portion of passageway **2***a* as shown in FIG. **4**. Valve member **2** can be made of resilient material, for example nylon, and stem **8**—**8***a* can, advantageously, be adapted for a force fit in aperture **5** and slots **5***a* to restrict leakage of fluid into bonnet sleeve **16**. Also, valve housing elements **1**, **1***a*, are adapted to receive sealing rings **11** to form a fluid seal between the valve body and valve member **2** to prevent fluid leakage through the valve. It will be noted that the advantageous two piece valve housing disclosed in the example of FIG. **1** provides means for easy replacement of the valve member and the seal between the valve housing and the valve member **2**. Also, the seal between sealing rings **11** and ball member **2** can be adjusted by tightening element **1***a* in element **1**.

A stop member **10** is provided to be removably attached to the valve housing and a handle **15** is provided to be mounted on section **8***c* of valve stem **8** to facilitate turning the valve stem. When stop **10** is attached to the valve housing, the rotation of handle **15** is restricted so valve member **2** can only be rotated from open to closed position and vice versa.

FIG. **3** is an example of another valve in accordance with the present invention which is similar to the valve in FIG. **1** except separate stems **28**, **36** are provided for adjusting the position of the vanes within valve member **22** and for rotating the valve member from open to closed position. The valve in FIG. **3** includes a valve housing comprising two cooperative ele-

ments 21 and 21*a* which define a passageway 23 and are adapted to receive valve member 22, for example a ball valve having an aperture therethrough, in rotatable relation within the valve housing so that the passage through valve member 22 can be turned to aligned relation with passage 23. Like the valve of FIG. 1, valve element 21 of the valve of FIG. 2 is provided with a fluid flow passage 23*b* and element 21*a* is provided with a fluid passage 23*a*. Valve housing element 21 includes a bonnet sleeve 21*b* adapted to receive a cooperative bonnet nut 29 where bonnet nut 29 provides an aperture adapted to receive the valve stem 28. A packing gland 33 is provided to hold packing material in compressed condition to prevent leakage of fluid from around valve stem 28 and a packing nut 32, adapted to be received by cooperative threads of bonnet nut 29, is provided to retain the packing within the gland in compressed, sealing, relation. The end 28*b* of stem 28 can be shaped to be received by valve member 22, as shown.

A vane bonnet sleeve 35 is also provided by valve housing 21 and is adapted to receive a vane stem 36 which carries vane members 36*a* adapted to be received by cooperative slots 25*a* (shown in side view of FIG. 2) of valve member 22. Bonnet sleeve 35 includes a packing gland 37 adapted to receive packing material to prevent leakage of fluid from the valve body through the opening between bonnet 35 and stem 36. A packing nut 38 is received by the threaded portion of vane bonnet 35 to retain the packing in sealing, compressed, relation with the stem. Stem 36 includes a threaded portion 36*b* to match internal threads provided by vane bonnet 35 so stem 36 moves longitudinally with respect to bonnet 35 as stem 36 is rotated. Stem 36 carries vane members 36*a* which can be selectively advanced into valve member 22 by rotating stem 36 to restrict the actual flow area of passage 22*a*.

Valve member 22 of the valve of FIG. 2 can be of a resilient material, for example nylon, and as in the case of stem 8 and valve member 2 of the valve of FIG. 1, stem 36 and vanes 36*a* can be sized to provide a forced fit when inserted in the cooperative aperture of valve member 22 to restrict fluid leakage into the vane bonnet sleeve. Valve elements 21 and 21*a* are adapted to receive sealing rings 31 to form a seal between valve member 22 and the valve body to prevent fluid leakage through the valve when valve member 22 is in closed position.

End 36*c* of valve member 36 can be shaped to receive a handle or wrench to facilitate rotation of the valve stem to position stem 36 and vanes 36*a* within passage 22*a* and a valve stop 30 can be provided adjacent the handle 35 to limit the rotation of valve stem 28.

A valve handle 39 can be fixed to stem 28 for opening and closing valve member 22 and a stop 30 can be removably attached to valve housing 21 to limit the rotation of handle 39.

To adjust the opening in the valve of FIG. 1 stop member 10 is removed from the valve and handle 15 is rotated in a direction to advance valve stem 8 and vanes 8*a* into, or withdraw valve stem 8 and vanes 8*a* from, valve member 2 to selectively restrict opening 2*a* through valve member 2 as shown in FIG. 4. The direction of rotation is determined by whether it is desired to increase or decrease the rate of flow of fluid through the valve. When the proper opening has been determined, stop 10 is replaced so the valve can be rotated from closed position where there is no fluid flow to fully open position where the maximum flow rate is controlled by the position of stem 8 and vanes 8*a* within passage 2*a* through valve member 2.

To change the setting of the valve shown in FIG. 2, stop member 30 is removed from the valve body, or handle 39 is removed from valve stem 28, and stem 36 is rotated so vanes 26*a* are moved to a position within channel 22*a* of valve member 22 to provide a selected flow through the valve. When the valve stem 36 has been positioned in aperture 22*a* of valve member 22 stop 30, or handle 39, is replaced and the valve is then opened and closed by rotating valve stem 28.

I claim:

1. A quick opening valve comprising: a valve housing including bonnet means having cooperative aperture means, fluid inlet means, fluid outlet means, and defining a first fluid flow passageway therethrough; a rotatable spherical valve member having a second passageway extending diametrically therethrough and a slot means extending transversely relative to the axis of said second passageway of said valve member, from the periphery of said valve member to intersect said second passageway; means to dispose said valve member in rotatable relation within said first passageway of said valve housing in engaging, sealing relation with said housing so said valve member can be rotated so said second passageway through said valve member can be rotated to aligned relation with said first passageway through said valve housing to permit flow of fluid therethrough and can be rotated out of alignment with said first passageway to terminate flow through said valve housing; cooperative flat vane means having the same cross-sectional configuration as the slot received by said slot means of said valve member to be advanced into said second passageway of said valve member to effectively restrict fluid flow through said second passageway of said valve member; and a stem extending through said bonnet means and connected to said vane means to selectively adjust the longitudinal position of said vane means within said slot means of said valve member and to rotate said valve member from first position where said second passageway of said valve member is in aligned relation with said first passageway defined by said valve housing to permit fluid flow through said valve housing to second position where said second passageway of said valve member is out of alignment with said first passageway of said housing to terminate flow of fluid through said valve housing.

2. The valve of claim 1 wherein said valve housing includes two cooperative portions, a first portion to receive said rotatable valve member and a second portion to be joined to said first portion to retain said valve member in rotatable relation in said first portion.

3. The valve of claim 1 including: threaded stem receiving bonnet means; cooperative thread means on said stem to engage said thread means of said bonnet; and means to dispose said stem within said valve in aligned relation with said slot in said valve member so said stem and said vane means are advanced through said slot in said valve member as said stem is turned in one direction and are retracted from said valve member as said stem is rotated in an opposite direction and wherein said stem can be rotated to move said second passageway to aligned relation with said first passage defined by said valve housing to provide flow through said valve.

4. The valve of claim 3 including stop means removably fixed to said valve housing to engage said stem to limit rotation of said valve between a position wherein said second passageway is in aligned relation with said first passageway to a position where said second passageway is out of alignment with said first passageway.