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3,528,087

PACKLESS VALVE CONSTRUCTION

Filed March 25, 1968

2 Sheets-Sheet 1

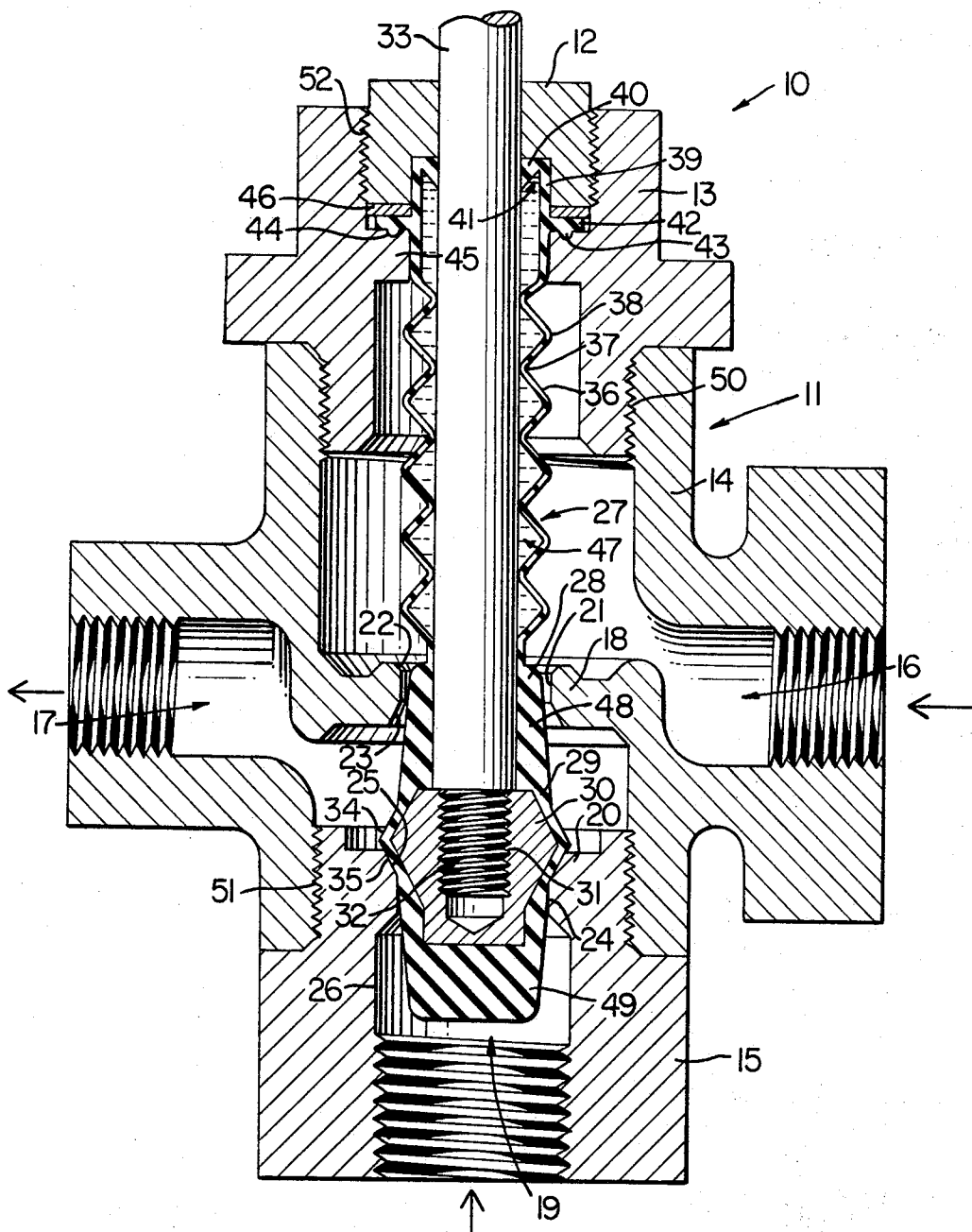


FIG. 1

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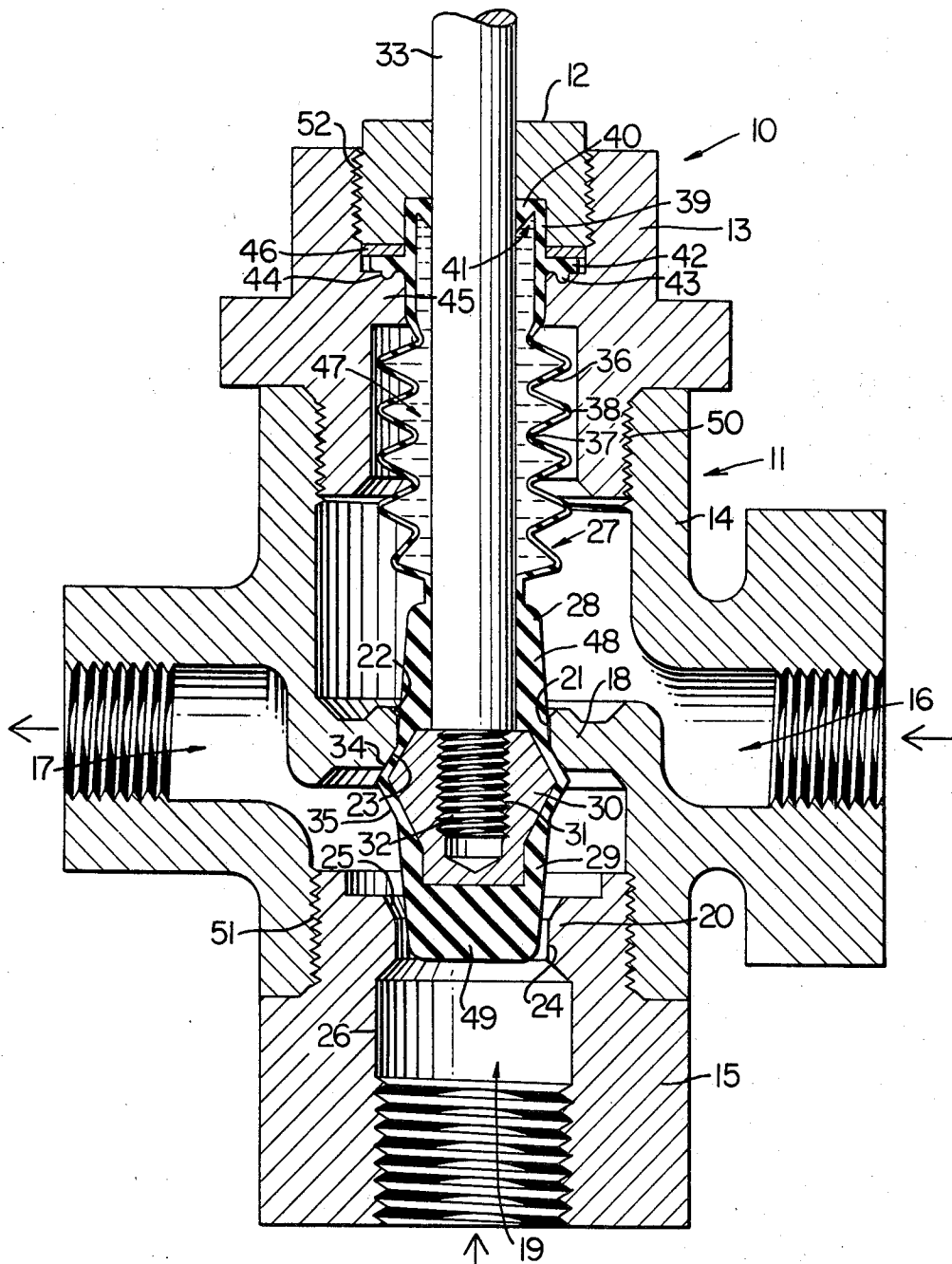


FIG. 2

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PACKLESS VALVE CONSTRUCTION

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21 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to an improved valve construction of the packless type and has a valve member for opening and closing a valve seat of the housing means that interconnects an inlet means with an outlet means thereof, the valve means including a flexible bellows type boot having a free end secured to the housing means and telescopically receiving a valve stem therethrough to be attached to the valve seating part thereof with the space between the valve stem and the boot being filled with a non-compressible fluid means so as to prevent collapse of the boot around the stem beyond a predetermined controlled degree in all operating positions of said valve means relative to the valve housing.

This invention relates to an improved valve construction as well as to an improved valve means utilized for such a valve construction or the like.

It is well known that various valve constructions have been provided in the past wherein the valve member is secured to the valve housing by a bellows construction or the like with the valve stem for moving the valve member passing through the bellow construction and being secured to the valve member to move the valve member relative to the valve seat of the housing for opening and closing the same, the bellows construction sealing the interior of the housing from the exterior thereof so that the valve stem can pass through the housing means to be operated externally of the housing means in any suitable manner.

Accordingly, one of the features of this invention is to provide an improved valve construction of the above type wherein the parts are simple to manufacture and assemble while providing a long-lasting valve construction that is relatively inexpensive and does not require auxiliary packings for sealing purposes and the like.

In particular, the valve construction of this invention includes a valve means that has a bellows type of flexible boot attached integrally at one end thereof to the valve member and at the other end thereof to the housing so that a valve stem can pass through the boot and be secured to the valve member to move the same relatively to its valve seat means, the space between the flexible boot and the valve stem being filled with a non-compressible fluid means so as to prevent collapse of the boot around the stem beyond a predetermined controlled degree in all operating positions of the valve means even though the boot is subjected to external pressures.

Accordingly, it is an object of this invention to provide an improved valve construction having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved valve means for such a valve construction or the like, the valve means of this invention having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description, which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a cross-sectional view of the improved valve construction of this invention, the valve construction being in one of its operating positions.

FIG. 2 is a view similar to FIG. 1 and illustrates the valve construction in another operating position thereof.

While the various features of this invention are herein-after described and illustrated as being particularly adaptable to control two inlets relative to one outlet, it is to be understood the various features of this invention can be utilized singly or in any combination thereof to provide any other desired valving function.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIG. 1, the improved valve construction of this invention is generally indicated by the reference numeral 10 and comprises a housing means 11 formed from a plurality of housing parts 12, 13, 14 and 15 suitably threaded together in the manner illustrated in FIG. 1 to define a first inlet passage means 16 separated from an outlet passage means 17 by a valve seat 18 and another inlet passage means 19 separated from the outlet passage means 17 by another valve seat 20.

The valve seat means 18 has an opening passing therethrough which defines a substantially cylindrical intermediate wall 21 and a pair of opposed substantially frusto-conical walls 22 and 23 respectively facing the inlet passage means 16 and the outlet passage means 17. Similarly, the valve seat means 20 has the opening passing therethrough in such a manner that the same defines a substantially cylindrical intermediate wall 24 and a pair of opposed substantially frusto-conical walls 25 and 26 respectively facing the outlet passage means 17 and inlet passage means 19 for a purpose hereinafter described.

A valve means of this invention is generally indicated by the reference numeral 27 and is utilized in the valve construction 10 of this invention for controlling or opening and closing the valve seats 18 and 20 in a manner hereinafter described.

The valve means 27 comprises a substantially flexible rubber boot 28 having one end 29 thereof molded about a metallic insert 30 that has an internally threaded bore 31 to subsequently threadedly receive a threaded end 32 of a valve stem 33. The flexible boot 28 is so molded that the same defines, in cooperation with the metallic insert 30, a pair of frusto-conical portions 34 and 35 joined together at their larger ends thereof to respectively seat against the frusto-conical surfaces 23 and 25 of the valve seat means 18 and 20 in the manner illustrated in FIGS. 1 and 2 whereby when the valve member 27 is disposed in the position illustrated in FIG. 1 the valve means 27 seals the inlet passage means 19 from the outlet passage 17 while fluidly interconnecting the inlet passage 16 to the outlet passage 17. Similarly, when the valve means 27 is disposed in the other operating position illustrated in FIG. 2, the valve means 27 seals the inlet passage 16 from the outlet passage 17 while interconnecting the inlet passage 19 to the outlet passage 17.

The boot 28 has an intermediate bellows portion 36 comprising a plurality of inner annular flutes or ridges 37 respectively interconnected to a plurality of outer annular flutes or ridges 38 in a conventional accordion manner.

The upper free end 39 of the flexible boot 28 has an annular end portion 40 disposed against the cylindrical valve stem 33 and defining an annular inverted cup-shaped chamber 41 for a purpose hereinafter described. Also, the free end 39 of the boot 28 has an outwardly directed annular flange 42 adapted to be disposed between the housing parts 12 and 13, the annular flange 42 having a downwardly directed annular rib 43 received in an an-

nular groove 44 on an inwardly directed annular shoulder 45 of the housing part 13. A flat, washer-like member 46 is disposed on top of the annular flange 42 of the boot 28 to permit tightening of the housing part 12 to the housing part 13 to fully compress the annular flange 42 of the boot 28 therebetween without causing twisting of the annular flange 42 during such assembling operation.

The space or cavity 47 that is defined between the boot 28 and the valve stem 33 is filled with a noncompressible fluid means, such as grease, other lubricant or the like, which will control the inward collapse of the bellows portion 36 of the boot 28 about the valve stem 33 in a manner hereinafter described.

The lower end 29 of the boot 28 has another pair of frusto-conical portions 48 and 49 respectively having the larger ends thereof joined to the smaller ends of the frusto-conical valve seating portions 34 and 35 and being so constructed and arranged that the same completely engage against the valve stem 33 and insert 30 so that any expansion or contraction of the bellows part 36 of the boot 28 will not effect expansion and contraction of the valve seating portions 34 and 35 as will be apparent hereinafter.

In order to assemble a pre-assembled valve means 27 to the housing means 11 to form the valve construction 10 of this invention, the valve parts 13 and 14 are first secured together at a threaded interconnection 50 thereof and the pre-assembled boot 28 and valve stem 33 are then pulled upwardly through a threaded opening 51 in the housing member 14 with the upper end 39 of the boot 28 of the valve means 27 being fully flexed through the valve seat 18 and through the opening in the annular shoulder 45 of the housing part 13 until the same is disposed in the position illustrated in FIG. 1. Thereafter, the housing part 15 can be threaded to the threaded portion 51 of the housing part 14 in the manner illustrated in FIG. 1 and the housing part 12 and washer-like member 46 can be assembled to the housing part 13 at a threaded interconnection 52 therebetween to secure the flange 42 of the flexible boot 28 to the housing part 13 and, thus, seal the inlet passage 16 from the exterior of the resulting housing means 11.

The dimensions of the valve stem 33 and flexible boot 28 can be so controlled together with the amount of non-compressible fluid means disposed in the cavity 47 between the boot 28 and valve stem 33 so that when the valve stem 33 is moved to the position illustrated in FIG. 1 to fully seat the frusto-conical valve part 35 against the frusto-conical surface 25 of the valve seat means 20 to close the inlet passage means 19 from the outlet passage 17, the non-compressible fluid means in the cavity 47 permits the fluid pressure in the inlet means 16 to only collapse the bellows part 36 of the flexible boot 28 toward the valve stem 33 in such a manner that the inner flutes 37 are just engaging the exterior cylindrical surface of the valve stem 33 as illustrated in FIG. 1 whereby the non-compressible fluid means in the cavity 47 will prevent further inward collapsing of the bellows part 36 of the boot 28 against the valve stem 33. In particular, the non-compressible fluid means is fully trapped within the chamber 47 and cannot exude or escape out of the free end 39 of the boot 28 nor downwardly along the valve stem 33 at the thickened part 48 of the boot 28 because of the unique construction of the boot 28.

In particular, as the bellows part 36 of the boot 28 is being radially inwardly compressed by fluid pressure within the passage means 16 surrounding the boot 28, such compressive force tends to force the non-compressible fluid in the cavity 47 upwardly along the valve stem 33 and out through the engaging part 41 of the upper end 39 of the boot 28. However, because of the inverted U-cup construction 41 defined by the annular portion 40 in cooperation with the free end 39 of the boot 28, such compressive force on the non-compressible fluid means in the

cavity 47 causes the engaging part 40 of the boot 28 to more tightly engage against the valve stem 33 to prevent the escape of any of the non-compressible fluid between the engaging part 40 and the stem 33.

When the valve stem 33, either automatically or manually, is moved vertically upwardly from the position illustrated in FIG. 1 to the position illustrated in FIG. 2 to open the valve seat member 20 and close the valve seat member 18 so that the inlet means 19 will be interconnected to the outlet means 17 and the inlet means 16 disconnected therefrom, it can be seen that the non-compressible material fluid means in the cavity 47 forces the bellows part 36 of the boot 28 radially outwardly from the stem 33 as illustrated because the volume of the cavity 47 is being progressively decreased as the lower end 29 of the boot 28 is being moved toward the free end 39 thereof and when in this collapsed condition of FIG. 2, the internal pressure in the inlet passage 16 cannot compress the intermediate part 16 of the boot 28 against the valve stem 33 because of the non-compressible fluid in the cavity 47 prevents such action.

If the non-compressible fluid means in the cavity 47 in the boot 28 is a lubricant, such as grease or the like, it can be seen that such lubricant aids the valve stem 33 in moving not only relative to the housing means 11, but also in lubricating the action of the valve stem 33 relative to the inward flutes 37 on the bellows part 36 of the valve means 27 whereby adverse friction will be substantially eliminated to prevent wear-out of the boot 28.

If desired, the pre-molded position of the boot 27 when assembled to the valve stem 33 to provide the valve means 27 of this invention could be such that the natural resiliency of the boot 28 would normally tend to maintain the valving part 34 and 35 thereof half-way between the valve seats 18 and 20 with the internal diameter of the inward flutes 37 of the bellows part 36 of the boot 28 being sized relative to the outside diameter of the valve stem 33 so that at the extreme down or expanded stroke position of the valve member 27 to the position illustrated in FIG. 1, the clearance between the inner flutes 37 of the boot 28 and the stem 33 approaches or is exactly zero when in the seated position of FIG. 1.

With this construction, the boot 28 thus has a substantial bag, bulge or buckle in the extreme upward stem position as illustrated in FIG. 2 and with the non-compressible fluid means disposed therein, the same will control the collapse or buckle of the bellows portion 36 in its position of FIG. 2 so as to prevent undue folding and creasing at the flutes 38 and 37 so that the boot 28 of this invention will have a relatively long life.

Therefore, it can be seen that this invention provides an improved valve construction as well as improved valve means for such a valve construction or the like.

What is claimed is:

1. A valve construction comprising a housing means having an inlet and an outlet separated from each other by a valve seat, and a movable valve means carried by said housing means for opening and closing said valve seat, said valve means having a flexible and hollow boot extending from one side thereof and having a free end secured to said housing means, said valve means having a valve stem secured thereto and passing through said boot out through said free end thereof whereby movement of said stem relative to said boot causes said valve means to move relative to said valve seat, said boot being filled with substantially non-compressible fluid means to prevent collapse of said boot around said stem beyond a predetermined controlled degree in all operating positions of said valve means, said boot having an intermediate bellows-shaped portion defining inner and outer annular flutes, said inner flutes of said intermediate portion only just engaging said stem only in the fully extended position of said valve stem.

2. A valve construction as set forth in claim 1 wherein

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said boot is disposed in said inlet of said housing so as to be subject to inward collapse about said stem by the inlet pressure.

3. A valve construction as set forth in claim 2 wherein said non-compressible fluid means comprises a lubricant that functions to lubricate said stem for movement relative to said boot.

4. A valve construction as set forth in claim 1 wherein said free end of said boot has an end portion disposed in sealed sliding relation with said valve stem to seal said fluid in said boot while permitting relative movement between said stem and said boot.

5. A valve construction as set forth in claim 4 wherein said end portion of said boot defines an annular cup at the free end of said boot that causes said end portion to collapse toward said stem as the boot is collapsed by movement of said valve stem in a particular direction.

6. A valve construction as set forth in claim 1 wherein said free end of said boot has an outwardly directed flange, said housing means having separate parts secured together and compressing said flange therebetween to secure said free end of said boot to said housing means.

7. A valve construction as set forth in claim 1 wherein said housing means has another inlet separated from said outlet by another valve seat, said valve means opening and closing said other valve seat depending upon the position of said stem relative to said housing means.

8. A valve construction as set forth in claim 7 wherein said valve means has two frusto-conical parts respectively adapted to seat against said valve seats.

9. A valve construction as set forth in claim 8 wherein said frusto-conical parts respectively have their larger ends joined to each other.

10. A valve construction as set forth in claim 1 wherein an insert is disposed in said boot adjacent the valve seating part of said valve means, said valve stem being secured to said insert.

11. A valve construction as set forth in claim 10 wherein said boot molded about said insert to secure said insert thereto.

12. A valve construction as set forth in claim 10 wherein said valve stem is threadedly interconnected to said insert to secure the same together.

13. A valve means for a housing means having an inlet and an outlet separated from each other by a valve seat, said valve means being adapted to be carried by said housing means for opening and closing said valve seat, said valve means having a flexible and hollow boot extending from one side thereof and having a free end adapted to be secured to said housing means, said valve means having a valve stem secured thereto and passing through said boot out through said free end thereof whereby movement of said stem relative to said boot causes said valve means to move relative to said free end of said boot, said boot being filled with substantially non-compressible fluid means to prevent collapse of said boot around said stem beyond a predetermined controlled

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degree in all operating positions of said valve means relative to said free end of said boot, said boot having an intermediate bellows-shaped portion defining inner and outer annular flutes, said inner flutes of said intermediate portion only just engaging said stem in the fully extended position of said stem relative to said free end of said boot.

14. A valve means as set forth in claim 13 wherein said non-compressible fluid means comprises a lubricant that functions to lubricate said stem for movement relative to said boot.

15. A valve means as set forth in claim 13 wherein said free end of said boot has an end portion disposed in sealed sliding relation with said valve stem to seal said fluid in said boot while permitting relative movement between said stem and said boot.

16. A valve means as set forth in claim 15 wherein said end portion of said boot defines an annular cup at the free end of said boot that causes said end portion to collapse toward said stem as the boot is collapsed by movement of said valve stem in a particular direction.

17. A valve means as set forth in claim 13 wherein said free end of said boot has an outwardly directed flange adapted to be secured to said housing means for securing said free end of said boot to said housing means.

18. A valve means as set forth in claim 13 wherein said valve means has two frusto-conical parts respectively adapted to seat against said first-named valve seat and another valve seat of said housing means.

19. A valve means as set forth in claim 18 wherein said frusto-conical parts respectively have their larger ends joined to each other.

20. A valve means as set forth in claim 13 wherein an insert is disposed in said boot adjacent the valve seating part of said valve means, said valve stem being secured to said insert.

21. A valve means as set forth in claim 20 wherein said boot is molded about said insert to secure said insert thereto.

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