NASA Case No. ERC-10208

NASA/Electronics Research Center
Patent Application Abstract
~~NASA Case No. ERC-10208~~

FULL FLOW WITH SHUT OFF AND SELECTIVE DRAINAGE CONTROL VALVE

This invention relates to a fluid flow control valve and, more particularly, to a multiple-position three orifice valve. Simple manipulation of the valve permits any possible combination of fluid flow between its three orifices.

FIGURES 2 and 4 show the device with a valve stem 9 in a primary axial position wherein the transverse bore 31 is disposed in a horizontal plane defined by passages 19 and 20 in a valve body 11. In that axial position the stem 9 can be rotated between a closed position (shown in FIGURE 4) and an open position in which fluid communication is provided between orifices 23 and 24 by the passages 19 and 20 and the transverse bore 31. FIGURES 3 and 5 show the stem 9 raised by a lever 16 into an auxiliary axial position wherein a T-shaped transverse bore including a head portion 32 and a leg portion 33 is located in the horizontal plane defined by the passages 19 and 20. In that axial position rotation the stem 9 can be rotated between a first position (shown in FIGURE 5) that provides fluid communication only between orifice 23 and an orifice 33 that terminates an axial bore 34 communicating with the T-shaped bore 32, 33; a second position providing fluid communication only between orifice 24 and orifice 35; and a composite position providing fluid communication between all three orifices 23, 24 and 35.

The novelty of the invention resides in the rotatable and axially adjustable stem 9 having longitudinally spaced transverse bores 31 and 32, 33 that permit selective fluid flow between any of the orifices 23, 24 and 35. The invention would appear to have utility in any system wherein various patterns of fluid flow are desired between a plurality of system branches.

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CONTRACT NO.: N/A

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FIG. 1.

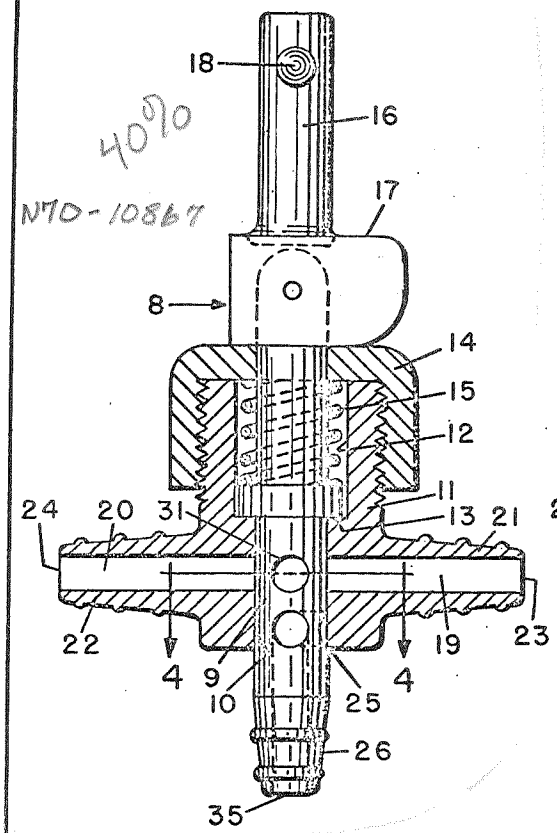


FIG. 3.

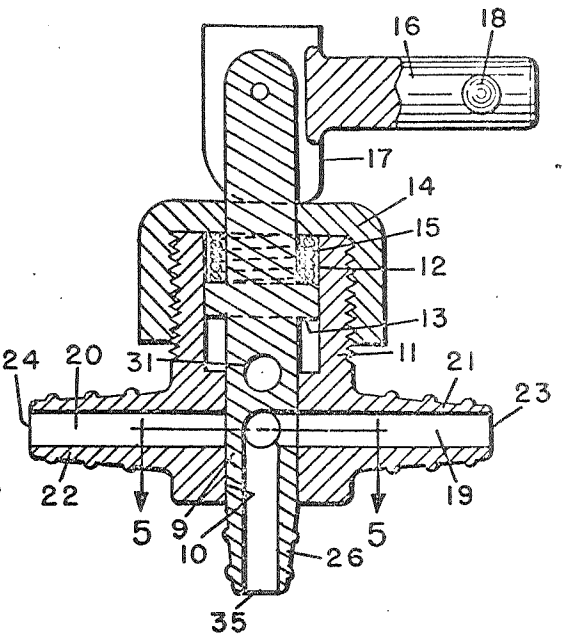


FIG. 2.

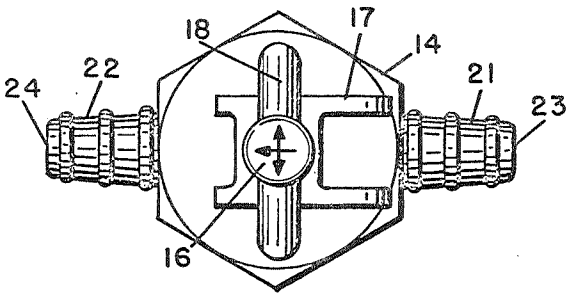


FIG. 4.

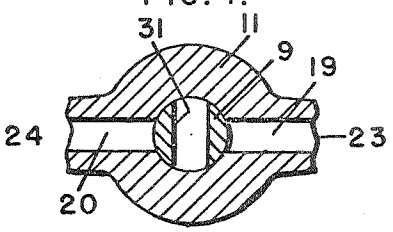
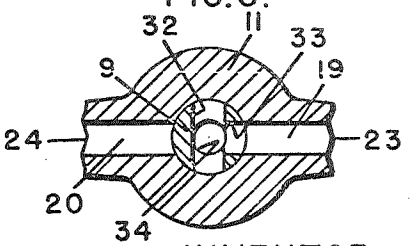


FIG. 5.



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NASA CASE NO. ERC-10208
SHEET 1 OF 1

A17

NASA Case No. ERC-10208

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NASA Case No. ERC-10208 ~~Herbert E. Farmer/Kr-JET~~

APPLICATION FOR LETTERS PATENT

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT Joseph J. Paolini

a citizen of the United States of America, an employee of the United States Government

and resident of Newton, Massachusetts

has invented certain new and useful improvements in FULL FLOW WITH SHUT OFF AND SELECTIVE DRAINAGE CONTROL VALVE

of which the following is a specification:

NASA FORM 1028 NOV 63

SUMMARY OF THE INVENTION

The invention is characterized by the provision of a valve having a valve body and a valve stem defining first, second and third fluid flow orifices. The valve stem is axially movable within the valve body between a primary position that seals the third orifice and an auxiliary position. While in the primary position the valve stem can be rotated between an open position permitting full fluid flow between the first and second orifices and a closed position completely obstructing fluid flow therebetween. Rotational movement of the valve stem into a composite position while in said auxiliary axial position permits fluid flow between all of the first, second and third orifices. Conversely, rotation of the stem into a selective position permits fluid flow only between the first and third orifices while rotation into an alternate selective position permits fluid flow only between the second and third orifices. By selecting an appropriate valve position any desired pattern of fluid flow can be produced between system branches connected to the three valve orifices.

According to a featured embodiment of the invention, the valve body possesses a cylindrical cavity communicating with the first, second and third orifices and the valve stem comprises an elongated cylindrical member slidably fitted into the cylindrical cavity and having axially spaced transverse bores that permit fluid flow between the orifices. The transverse bores include a linear bore adapted for alignment between the first and second orifices with the valve stem in the primary axial and open rotational positions and for non-alignment

therewith with the valve stem in either the auxiliary axial or closed rotational positions. A T-shaped transverse bore is longitudinally spaced from the linear bore and communicates with the third orifice via a longitudinal bore. A head portion of the T-shaped bore is adapted for alignment between the first and second orifices with the valve stem in the auxiliary axial and composite rotational positions. The T-shaped bore includes also a leg portion adapted for alignment with the first orifice with the valve stem in the auxiliary axial and selective rotational positions and for alignment with the second orifice with the valve stem in the auxiliary axial and alternate selective positions. This embodiment provides in an extremely simple and inexpensive unit the various fluid flow possibilities described above.

Another feature of the invention entails a lever and cam mechanism pivotally connected to the cylindrical stem member and a compression spring that opposes axial movement of the valve stem in one direction. The lever and cam mechanism facilitates axial movement of the stem between its primary and auxiliary positions and the compression spring insures proper alignment of the stem's transverse bores with appropriate valve body orifices.

According to still another feature of the invention the first and second orifices are formed by diametrically opposed hollow nipple portions extending from the valve body and adapted to accommodate suitable tubing and the third orifice is formed by a hollow extension of the valve stem also adapted for connection with suitable tubing.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and objects of the present invention will become more apparent upon a perusal of the following specification taken in conjunction with the accompanying drawings wherein:

Figure 1 is an elevation view partially in section illustrating the functional relationship between the various components of the invention;

Figure 2 is a plan view of the valve shown in Figure 1;

Figure 3 is a sectional view illustrating another position of the valve stem shown in Figure 1;

Figure 4 is a cross-sectional view taken along lines 4-4 shown in Figure 1; and

Figure 5 is a cross-sectional view taken along lines 5-5 of Figure 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to Figures 1-3 there is shown a valve stem 8 including an elongated cylindrical member 9 that is slidably fitted into a cylindrical cavity 10 of a valve body 11. A counter bore 12 in the valve body 11 accommodates a shoulder 13 on the stem member 9. Restrained between the shoulder 13 and a retaining nut 14 is a compression spring 15. A lever arm 16 terminates with a cam portion 17 that is pivotally attached to the cylindrical valve stem member 9. Extending through an aperture in the opposite end of the lever arm 16 is an actuating handle 18.

Extending out of diametrically opposed positions on the valve body 11 are a pair of identical nipples 21 and 22 having

hollow passages 19 and 20 that form, respectively, a first orifice 23 and a second orifice 24. The nipples 21 and 22 are externally ribbed to accommodate flexible tubing and the orifice passages 19 and 20 provide communication between the orifices 23 and 24 and the central cavity 10. An opening 25 in the valve body 11 accommodates a projection 26 of the cylindrical valve stem member 9. The projection 26 is also externally ribbed to accommodate flexible tubing.

As shown in Figures 4 and 5, the cylindrical stem member 9 possesses a linear transverse bore 31 and a longitudinally spaced T-shaped transverse bore including a head portion 32 and a leg portion 33. A longitudinal bore 34 extends between the T-shaped bore and the termination of projection 26 providing a third orifice 35.

Figure 1 shows the valve with the valve stem 8 in a primary position with the linear bore 31 positioned in a horizontal plane defined by the orifice passages 19 and 20. In this position, T-shaped bore 32 and 33 as indicated in Figure 5 is axially spaced from passages 19 and 20 thereby sealing the third orifice 35. Also illustrated in Figure 1 is a closed rotational position of the valve stem 8 wherein the linear bore 31 is perpendicular to or non-aligned with the orifice passages 19 and 20. As shown, the first and second orifices 23 and 24 are closed in this position by solid portions of the cylindrical stem member 9 that seat against the passages 19 and 20. Thus, in the primary axial and closed rotational positions of the valve stem 8 fluid flow is completely obstructed between all three orifices 23, 24 and 35. After turning the handle 18

such that the cylindrical stem member 9 rotates 90°, the closed position illustrated in Figure 1, the linear 31 is aligned with the passages 19 and 20. This open rotational position of the valve stem 8 permits full and unobstructed fluid flow between first orifice 23 and the second orifice 24.

Figure 3 shows the valve with the valve stem 8 in an auxiliary axial position created by downward pivotal movement of the lever arm 16. During this pivotal movement, the surface of the cam 17 engages the nut 14 producing upward axial movement of the stem member 9 against the biasing force exerted against the shoulder 13 by the compression spring 15. The compression spring 15 facilitates desired horizontal alignment of the T-shaped bore 32 and 33 with the orifice passages 19 and 20. In the selective rotational position illustrated in Figure 3, the leg portion 33 of the T-shaped bore is directly aligned with the orifice passage 19 while a solid portion of the stem member 9 seals the orifice passage 20. Thus, in this selective rotational position, the passage 19 and the longitudinal bore 34 provide communication between the first orifice 23 and the third orifice 35 permitting fluid flow therebetween.

Either clockwise or counter-clockwise rotation of the lever arm 16 ninety degrees from the position shown in Figure 3 moves the stem member 9 into a composite rotational position wherein the head portion 32 of the T-shaped bore is aligned with the orifice passages 19 and 20. In this position, the orifice passages 19 and 20 and the longitudinal bore 34 provide communication between all three orifices 23, 24 and 35 thereby

permitting fluid flow therebetween. Further rotation of the lever arm 16 one hundred and eighty degrees from the position shown in Figure 3 moves the stem member 9 into an alternate selective position wherein the leg portion 33 of the T-shaped bore is aligned with the orifice passage 20 and the orifice passage 19 is sealed by a solid portion of the stem member 9. In this position, communication is provided only between the second orifice 24 and the third orifice 35 by the orifice passage 20 and the longitudinal bore 34.

During typical use of the valve, full fluid flow is provided between system branches connected to the first and second orifices 23 and 24 with the valve stem 8 in the open position described above. Conversely, rotation of the stem into the closed position produces a positive shut-off between all parts of the system. After pivoting the lever arm 16 into the auxiliary axial position shown in Figure 3, full fluid flow is provided between all system branches by rotating the stem member 9 into the composite position described above. In that position, for example, the system portions connected to the first and second orifices 23 and 24 can be simultaneously filled, drained or purged through the orifice 35. Rotation of the stem member 9 into the selective position permits independent draining, filling or purging of only that system branch connected to the first orifice 23. Similarly, rotation of the stem member 9 into the alternate selective position permits independent draining, filling or purging of only that system branch directly connected to the second orifice 24. Thus, the valve of the present invention can be selectively operated

to produce any desired pattern of fluid flow between system branches connected to its three orifices.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. For example, the ribbed nipples 21, 22 and 26 can be replaced by other conventional types of hose connections. Also, seals may be placed on stem member 9 or valve body 11 to obtain high pressure capabilities.