United States Patent

Breunich

[15] **3,756,284**

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

[54] **THREE-WAY, SELF-CLOSING VALVE UNIT**

[75] Inventor: **Theodore R. Breunich**, Stamford, Conn.

[73] Assignee: **Universal Oil Products Company**, Des Plaines, Ill.

[22] Filed: **Aug. 28, 1970**

[21] Appl. No.: **67,728**

[52] **U.S. Cl.** **137/636**

[51] **Int. Cl.** **F16k 11/10**

[58] **Field of Search** 137/636, 636.1

[56] **References Cited**

UNITED STATES PATENTS

2,409,765	10/1946	Kehle	137/636
2,934,091	4/1960	Chapou	137/636.1 X
2,935,090	5/1960	Arnot	137/636

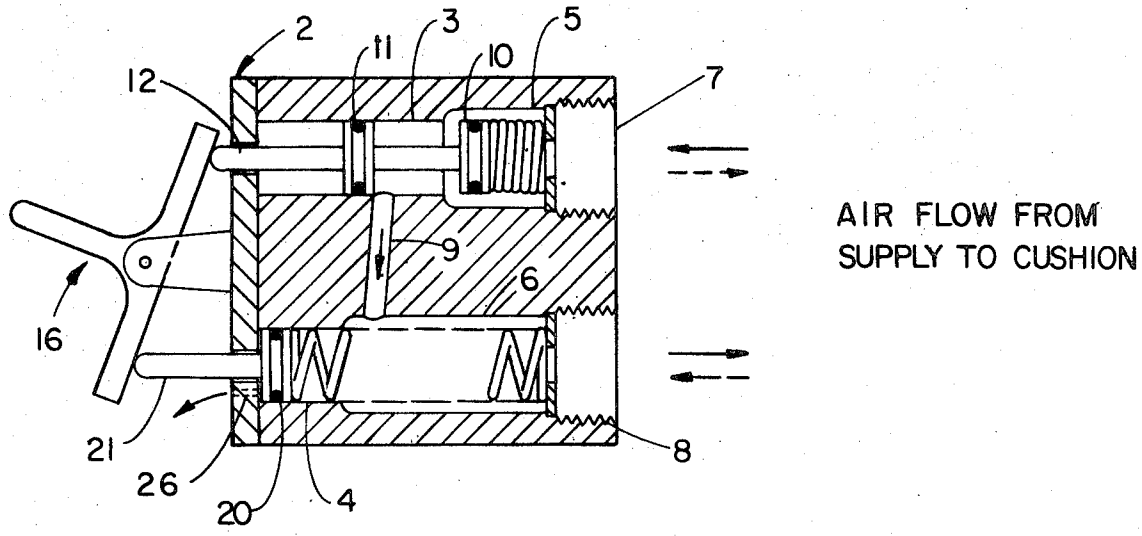
Primary Examiner—Henry T. Klinksiek

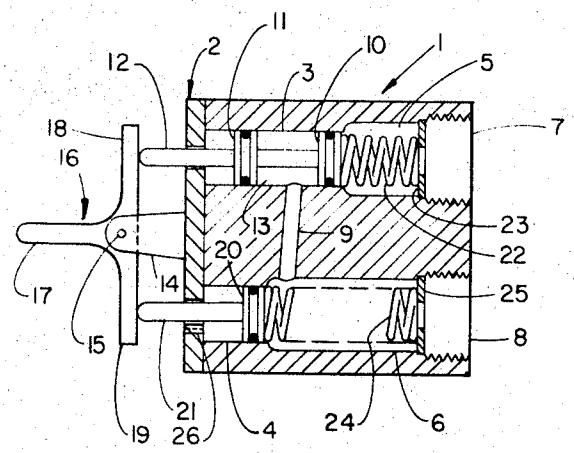
Attorney—James R. Hoatson, Jr. and Philip T. Liggett

[57] **ABSTRACT**

A lever operated, three-way valve unit provides for movable piston-like valve members in each of a pair of parallel fluid passageways which are, in turn, connected by an internal transverse passageway. A pivotally mounted valve operating member engages valve stems from the internal valve members such that air flow can be permitted into one passageway and out of the other or, alternatively, there can be an exhaust of air from one of the passageways and from the means connective with such passageway. A preferred unit provides spring biasing to have the valve members retained in normally closed mid-positions, with no air flow into or out from the valve body.

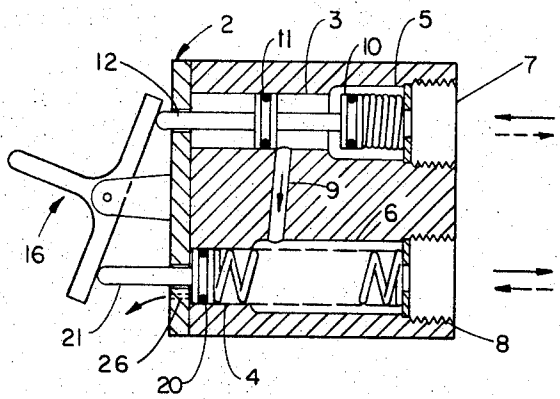
8 Claims, 4 Drawing Figures





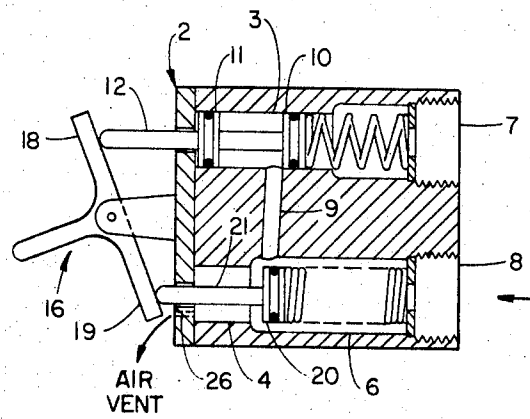
NEUTRAL POSITION
(NO AIR FLOW)

FIG. 1



AIR FLOW FROM
SUPPLY TO CUSHION

FIG. 2



AIR FLOW FROM
CUSHION TO EXHAUST

FIG. 3

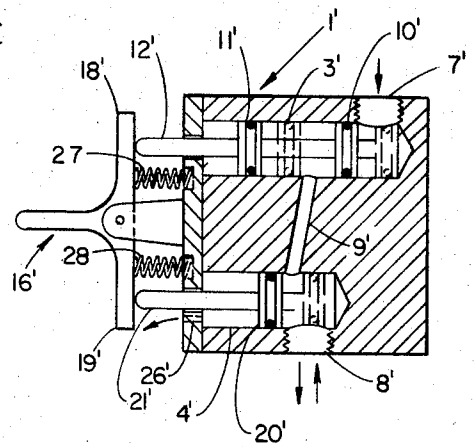


FIG. 4

INVENTOR.
Theodore R. Breunich

BY Thomas K. Hoatson, Jr.
Philip J. Bonasso

ATTORNEYS

THREE-WAY, SELF-CLOSING VALVE UNIT

The present invention relates to a special form of three-way valving unit and particularly to a design with a lever operation for moving a pair of valve members such that there is controlled fluid flow into and through the valve unit.

A preferred form of valve unit is provided with spring biasing means which holds an operating lever in a neutral or mid-position such that each valve member in its respective valve cylinder will be in a mid-way position to preclude any fluid flow into or out from the passageways to the valve body.

It is recognized that there are many types of valving units and that there are also numerous variations in design and construction with respect to each general type of valve unit; however, the present three-way valve construction is unique in its utilization of two separate piston-like valve members in combination with specially sized and specially located valve cylinder portions that interconnect with internal fluid passage ways. Also, generally, three-way valves, or other multiple position valves provide for the movement of a single rotatable or slide member into a plurality of positions, but in the present design, there is used a single pivoted or rocking lever member as a valve operating means that can simultaneously operate two spaced apart valve members such that there is the means to provide fluid flow into the valve from one port and out from another port or, alternatively, there may be the venting of a fluid flow connecting to one port means while still isolating and blocking flow connective with the other port means.

Actually, it may be considered a principal object of the present invention to provide a special three-way valve unit that makes use of special sliding piston-like valve members in two spaced apart cylinders that each connect to fluid port means and are also transversely interconnected so that there can be controlled flow through the unit responsive to regulated positioning of each valve member with regard to its respective cylinder.

It is also an object of the present invention to provide a lever operated form of valving unit, where the lever means will simultaneously push one piston-like valve member and permit the other to move outwardly in an opposing direction for regulation of fluid flow through the unit.

It is a still further object of the invention to provide for spring biasing in combination with the piston-like valve members and/or the valve operating means such that each valve member in its respective cylinder portion will normally be urged to rest in a neutral position where there is a resulting blocking of fluid flow through the unit.

In a broad embodiment, the present invention provides a three-way, self-closing valve unit, which comprises in combination, a valve body with a pair of parallel spaced apart cylinder portions each adapted to accommodate a slidably movable valve member therein, a first valve member in a first cylinder portion having a piston-like fluid sealing section, and a second valve member in the second cylinder portion having two axially spaced apart piston-like sections to provide at least a partially unobstructed zone therebetween, a fluid port and an internal passageway means connective to the interior end portion of each of said cylinder portions in said valve body, an internal transverse passageway in said valve body connecting between the passageway to said first cylinder portion and to an intermediate section of said second cylinder portion, whereby said piston-like sections of second valve member can be positioned to straddle the juncture with the latter, a valve stem from each valve member provided to extend outwardly from said valve body, a valve operating member pivotally connected to said valve body between said valve stems and having operating arm portions that are positioned to have one arm portion engage one valve stem and the other arm portion engage the other valve stem whereby each stem and valve member may be selectively pushed inward, while the other moves oppositely, and there is the movement of at least one fluid sealing section of a valve member from within its cylinder portion to provide a selective fluid flow therearound and through the valve body, and means for effecting a biased retention of said operating member in a mid-position.

Various types of piston-like valve members may be utilized in the cylinder portions of the valve unit; however, generally a slidable piston-form member with at least one O-ring, or other form of piston-ring, therearound will serve to advantage as the fluid sealing sections for the valve members. Each sealing section will also preferably have an axial rod to provide a valve stem which will in turn be guided through at least a portion of the valve body and extend exteriorly thereof so that it is available for connection to, or contact with, a valve operating member. Various types and forms of valve operating members may, of course, be utilized; however, a manually controllable form of member is preferred and may be of the nature of a pivoted lever having extended arm portions available to engage each of the valve stem portions for the spaced apart valve members. Thus, by a pivot connection of the lever from a post member between the valve stems, there can be the inward motion of one valve member while simultaneously obtaining an outward movement of the other valve stem and vice versa, whereby there is a reciprocating motion available for each valve member and at least two positions available for each of the valve members.

A preferred valve design makes use of spring biasing means in combination with the valve members, or with the operating member which will engage the stems from each of the valve members whereby each of the valve members will be normally urged into a "neutral" position, i.e., a position for each valve member where there is a resulting blocking of fluid flow in all passageways of the valve unit. As will hereinafter be set forth more fully, spring members may be utilized internally within the valve body so as to contact the valve members themselves or there may be spring means attachable to the valve operating member or to the external portions of the valve stems so that each valve member is urged into a desired intermediate or neutral position.

It is a feature of the internal design of the valve unit to have the inward travel of the innermost section of each valve member be such that it can pass into an enlarged cross-sectional area or into a zone opposing a fluid inlet passageway whereby there can be fluid flow around the innermost portion of the valve member and

reach at least a partial section of the valve cylinder portion to in turn reach a transverse passageway or be capable of reaching a venting passageway. Thus, air or other fluid can be permitted to flow into one port and passageway and reach the other passageway and port for flow through the valving unit or alternatively, by a reverse operation of valve positionings there can be a reverse flow through the valving unit such that fluid can enter the valve body from what was previously an "outlet" port and reach a venting passageway.

Reference to the accompanying drawing and the following description thereof will serve to illustrate the operation and advantages of the present special form of self-closing, three-way valving unit, as well as point out modifications in design and construction that may be provided.

FIG. 1 of the drawing is a sectional elevational view of one form of valving unit indicating the special arrangement of piston-like seal sections for the valve members and an arrangement of passageways whereby fluid flow is precluded through the unit when each valve member is in a neutral or intermediate position with respect to the range of its reciprocating travel.

FIGS. 2 and 3 indicate the optional positions for the valve members within the body of the valving unit as provided by a pivoted lever form of valve operating member, whereby fluid flow may be permitted inwardly through one port and outwardly from the other or optionally fluid flow is blocked in one passageway but permitted to be vented from the other passageway and from the valve body.

FIG. 4 of the drawing is a diagrammatic sectional elevational view indicating a modified construction for the valving unit where inlet and outlet port means to the interior of the cylinder portions of the valve body are other than in axial alignment therewith and spring biasing means are provided externally of the valve body.

Referring now particularly to FIG. 1 of the drawing, there is indicated a valve body section **1** provided with a removable end portion **2** and with internal valve cylinder portions **3** and **4**. In this embodiment, the valve cylinder portions **3** and **4** are parallel with one another and have axially extending passageway portions **5** and **6** leading respectively to end ports **7** and **8**. The latter are indicated as being internally threaded so as to provide for the connection of a pipe, conduit or a tube connecting fitting. In addition, there is provided a transverse passageway **9** which will connect between an intermediate zone of the cylinder portion **3** and the passageway **6** or port **8** whereby there can be fluid flow from one port to the other subject to valve positioning.

As indicated in the drawing, one cylinder portion, such as **3**, will be of a greater length than the other cylinder portion so as to accommodate a valve member having longitudinally spaced apart fluid sealing sections. In other words, within the cylinder portion **3**, the valving member has an inner piston-form seal section **10** and an outer piston-form section **11**. Each section is attached to a longitudinal valve stem **12** such that there is thus provided a spacing **13** between the piston sections **10** and **11** which can straddle the juncture of transverse passageway **9** with cylinder **3**. In addition, fluid can flow around the innermost piston section **10** and into the transverse passageway **9** when the valve member is operated inwardly to have such piston section **10** out of cylinder **3** and within the enlarged cross-sectional area provided by passageway **5**.

Exteriorly of the valve body **1** and end section **2**, there is provided a post or clevis means **14** with a pin or shaft means **15** supporting a valve operating member **16**. The latter may have various shapes or configurations but in a simplified form will have a lever form of projection **17** available for being thumb and finger gripped by a valve operator and laterally projecting arm portions **18** and **19**. Thus, there is an arm portion **18** available for contact or a linked engagement with valve stem member **12** that in turn connects to piston sections **10** and **11** while arm section **19** is available for linkage or engagement with the stem member **21** for piston-like valve member **20** in cylinder portion **4**.

In a preferred construction, where the valve operating member **16** is normally retained automatically in a "neutral" position (as shown in FIG. **1**) so that all valve passageways are blocked, there will be spring biasing means to hold the valve members in intermediate positions with respect to their possible sliding movements in valve body, and at the same time hold the operating member **16** in a normally "off" or neutral position. One form of spring biasing provides a compression spring member **22** in the passageway **5** from fluid port **7** in a position that is between the inner face of piston member **10** and a support ring **23**. Similarly, there is a compression spring **24** provided in passageway **6** between the inner face of piston member **20** and a support ring **25**. The compression springs **22** and **24** are sized to each supply a substantially equal compressive force against its adjacent piston member and in turn maintain the control lever **17** in a centered or "neutral" position. Thus, it will be seen that fluid flow into port **7** will be blocked from reaching transverse passageway **9** by the sealing action of inner piston member **10** within the cylinder portion **3**. Also, fluid flow or any fluid pressure entering port **8** is blocked from cylinder portion **4** and vent outlet **26** by the positioning of the piston-like valve member **20** in such cylinder portion, while, at the same time, there is blockage of flow through cylinder portion **3** from passageway **9** by virtue of fluid flow being trapped within spaced-apart zone **13** between piston sections **10** and **11**.

With reference to FIG. **2** of the drawing, there is indicated the inward movement of piston sections **10** and **11** by virtue of the operating lever **16** being depressed against stem **12**, as shown, whereby there may be a resulting inward flow of fluid around piston member **10** in channel **5** and into a section of cylinder portion **3** to in turn reach passageways **9** and **6** as well as port **8**. It should also be noted that when the valve members are in this position the outermost piston section **11** precludes fluid flow entirely through cylinder portion **3** and around valve stem **12** at the end member **2** while, at the same time, piston member **20** in cylinder portion **4** remains in a blocking position to preclude fluid flow outwardly from the cylinder portion **3** around stem portion **21**. As a result, a valve unit having its internal valve members in the positions indicated by FIG. **2** can be of advantage in permitting air or other fluid, from a source connecting with port **7**, to be channeled to an outlet port **8** and into a receiving zone. It is, however, not intended to limit the use of the present improved

valving unit to any one particular direction of fluid flow therethrough since, conversely, air or other fluid could flow into port 8 and outwardly from port 7.

With reference to FIG. 3 of the drawing, there is indicated the reverse or opposing movement of operating lever 16 as compared to FIG. 2, such that valve stem 21 is pushed inwardly along with piston-like valve member 20, such that the latter leaves the inner end of cylinder portion 4 and enters the slightly enlarged passageway zone 6 to permit fluid flow therearound and into cylinder portion 4, whereby fluid may be vented around stem member 21 or through vent means 26 in end section 2. At the same time, it will be noted that valve stem 12 is caused to move outwardly from the valve body 1 along with outward movements of piston-like sections 10 and 11 within cylinder portion 3; however, by virtue of the spaced zone 13 between the sections 10 and 11 and the straddling of the juncture of passageway 9 there is precluded any passage of fluid through or outwardly from such cylinder portion 3. As a result, and as diagrammatically indicated, there is no fluid flow into or outwardly from port 7 of the valve body which is in communication with cylinder portion 3, but there is permitted an inward flow of fluid into port means 8 and through passageway 6 to reach cylinder portion 4 and then be vented by way of exhaust port or opening 26.

In the valve positionings for FIG. 3, there is an expansion of spring member 22 and a compression of spring member 24 which is the reverse of that indicated in FIG. 2 such that upon a release of the operating lever means 16 there will be a normalizing of the spring members such that they will reach the neutral opposing positions as best shown in FIG. 1 of the drawing.

It will be obvious that the present improved form of valve construction, with its three-way operations, can provide many commercial uses such as, for example, the adjustment of an air flow into and out from an inflatable cushion or other support member. More specifically, where it is desired to inflate a cushion or other receiving member, the operating member 16 and the connecting valve means can be moved or positioned such that they are in the arrangement of FIG. 2 whereby air can flow from a supply source to the cushion. When the desired amount of air is provided in the cushion or other member to be inflated, there will be the release of the operating lever 16 and an automatic self-closing of the internal valve members by virtue of their reaching an intermediate position with respect to their possible sliding reciprocal motions and the neutral position of FIG. 1 is attained. Alternatively, by effecting the opposite adjustment of lever means 16, there will be permitted a flow from the means connecting to port 8 such that air will reverse its previous direction of flow and enter the valve body 1 to flow around the valve section 20 into the cylinder portion 4 such that there is a venting of air from valve body at vent means 26. During this latter flow, there is blockage of flow from passageway 9 at cylinder portion 3 so that air is neither taken from nor returned to the source connective with port 7.

In FIG. 4 of the drawing, there is shown a valve body 1' having an internal cylinder section 3' connective with a side port 7' such that there is no axial passageway extending longitudinally through the entire body 1' as compared to FIGS. 1, 2 and 3. Similarly, the parallel cylinder portion 4' is not provided with an axially extended passageway but there is provided a side passageway or communication to a side port 8' from its inner extremity. The valve members for each of the cylinder portions 3' and 4' may be of a construction similar to that shown in the other Figures of the drawing whereby there are piston-like fluid sealing sections 11' and 10' spaced apart in a manner capable of straddling the juncture of passageway 9' with cylinder portion 3' and a piston section 20' for cylinder 4'. In addition, it will be noted that the inner piston-like section 10' is capable of being moved within cylinder portion 3' to oppose port means 7' whereby there may be fluid flow therearound and into the intermediate section of cylinder portion 3' and thence into transverse passageway 9' to reach port means 8'. Conversely, in a reverse operation, the piston member 20' in cylinder portion 4' can be depressed or moved inwardly to oppose the port means 8' whereby fluid flow can enter the cylinder opening and pass around piston member 20' to reach the other extremity and vent means 26'. This latter operation is provided by lever means 16' being moved such that arm portion 19' is pushed downwardly.

It will also be noted in the embodiment of FIG. 4 that spring bias means is provided by spaced compression springs 27 and 28 that are external of the valve body 1' and directly in contact with the arm portion 18' and 19' of operating lever means 16'. Again, in a referred embodiment, the spring biasing means 27 and 28 will be sized and adjusted to effect leveling or equalizing with respect to the position of lever means 16' so that the valve stems and valve members engaged with the respective arms 18' and 19' will be returned to intermediate positions in their respective cylinders and there is a blockage of all fluid flow through the valving unit, and a resulting "self-closing" with respect to fluid flow in the valving unit.

As a variation to the design and arrangement of FIG. 4, there may be a positioning of the compression springs 27 and 28 around the stem members 12' and 21' in lieu of the positioning shown. In other words, it is not intended to limit the present embodiment to any one type of spring, or spring locationing, inasmuch as in still another arrangement, there may be the use of tension springs connecting with the arm portions of the lever means 16' to accomplish the same equivalent form of spring biasing as supplied by the compression spring action. Spring biased pins or detent means may also be used to advantage for holding the desired positions for the valve operating lever means and the valves themselves. It may be still further noted that various types or forms of piston members may be utilized within the cylinder portions of the valve body and it is not intended to limit the valve constructions to the simplified embodiments shown as 10', 11' and 20'. For instance, dual pistons, or dual O-rings can be used for each valve section in lieu of the single piston sections. In addition, still other modifications as to arrangement and detail will be obvious to those skilled in the art of valve construction.

I claim as my invention:

1. A three-way valve unit which comprises in combination, a valve body with a pair of parallel spaced

apart cylinder portions each adapted to accommodate a slidably movable valve member therein, a first sliding valve member in a first cylinder portion having cylinder sealing means thereon, and a second valve member in the second cylinder portion having two axially spaced apart sealing means thereon to provide at least a partially unobstructed space therebetween, a fluid port and fluid inlet passageway means into each cylinder portion, an internal transverse passageway in said valve body interconnecting said cylinder portions and said space between said cylinder sealing means of said second cylinder portion, whereby such space between the spaced apart cylinder means of said second valve member is sized to straddle the opening of said transverse passageway into said first cylinder portion, said first cylinder portion having a vent means in said valve body on the side of said valve member opposite its respective fluid port leading thereto to permit fluid flow through said body, a valve stem from each valve member extending outwardly from said valve body, a valve operating member movably connected with said valve body, one portion of said valve operating member engaging one valve stem and another portion thereof engaging the other of said valve stems whereby each stem and valve member may be selectively pushed inwardly while actuating the other oppositely, at least one of said fluid sealing means being moved responsively to said valve stem movement to permit selective fluid flow therearound from said fluid port and inlet passageway means and through at least a portion of such cylinder portion and through the valve body, and means for effecting a biased retention of said operating member in neutral position, thus to maintain said valve unit in normally closed position when non-actuated.

2. The three-way unit of claim 1 further characterized in that said means to maintain said valve unit in normally closed position comprises spring means linked to said valve members and to said operating member whereby each such valve member in its respective cylinder portion is normally urged to an intermediate position and to a resulting blocking of fluid flow in all passageways.

3. The three-way valve unit of claim 1 further characterized in that each of the cylinder portions have a limited length herein and there is an increased internal cross-sectional area for each passageway adjacent the inner end portion for each cylindrical portion, whereby the inward movement of a piston-like sealing section for a valve member will reach such area and fluid flow can pass therearound into at least a portion of a cylinder portion for flow through the valve body.

4. The three-way unit of claim 1 further characterized in that each of said spaced apart cylindrical portions within the valve body is in axial alignment with the other and the fluid inlet passageway means adjacent a cylinder portion is, in each instance, of slightly larger cross-sectional area than said cylinder portion, whereby a piston-like section of the valve member may be moved inwardly into said passageway means to permit flow therearound and into at least a part of the cylinder portion.

5. The three-way valve unit of claim 4 still further characterized in that spring biasing means are provided in each of the axially aligned passageway means to provide spring compressive forces against the inner faces of the valve members and in turn provide opposing forces that will maintain said valve members in normally neutral positions at intermediate points within the zones of their reciprocating travel.

6. The three-way valve unit of claim 4 further characterized in that said spring biasing means is provided externally from the valve body and in association with the valve operating member to effect the positioning of the latter in an intermediate position, whereby the valve stem and valve members are in turn retained in normally closed intermediate positions.

7. The three-way valve unit of claim 1 further characterized in that the inlet fluid passageway means to each of the respective cylinder portions within the valve body connects with an interior side portion thereof at a zone opposing the innermost travel of the piston-like fluid sealing section for each valve member, whereby fluid flow may pass around said piston-like sealing sections when the latter are moved inwardly to their innermost positions.

8. The three-way valve unit of claim 1 further characterized in that said valve operating member is pivotally and rockably connected to said valve body between said valve stems and has projecting and opposing arm portions to engage said stems, whereby the valve stems will be caused to move in opposite directions upon the actuation of said operating member.

* * * * *