

ends 14 and 15. The section 25 terminates at end 12 just inside the wall of recess 10, leaving a clearance sufficient to compensate for the wall thickness of the tubing used.

The diameter of the recess 10 is only very slightly larger than the distance 8 measured between the outer walls of the passageways 6. The width 16 of the pie-shaped portion of cam 11 is approximately equal to the chordal distance between the opposite ends 14 and 15 of the pie-shaped portion 24 of the cam element. As noted, points 12 and 13 are on the perpendicular bisector of the chord between points 14 and 15.

The specific configuration of the valve member 7 employed in this embodiment may be readily seen in FIGURE 4, where the valve member is shown in vertical cross section. Here it is seen that there is a shallow bore 19 in the bottom of housing 5, the bore terminating just before it reaches the recess 10, to form a peripheral projection 27. The valve member 7 is formed with a counter-bore 28 in the bottom thereof, and a screw 18 fits into this counterbore, the head of the screw abutting the projection 27 to retain the valve member in place, but in such a manner that rotation of the valve member is permitted. Another shallow bore or annular groove is formed in the top surface of the housing 5, forming a lip 22 of the housing around this bore. Into this bore is positioned an annular flange 17 of valve member 7, which flange is in frictional engagement with the housing 5 around the periphery of the flange. The cam portion 11 of the valve member depends from the flanged portion and fits into the recess 10, one side 29 of the cam 11 being adjacent the wall of recess 10 while the opposite side is removed from the wall, thus forming an opening 21. The cylindrical knob 23 of the valve member 7 is seen to protrude above the top surface of the housing 5 to promote ease of turning the valve member from the exterior of housing 5. As is readily seen, the entire valve member 7 is free for rotation in the corresponding recessed portions of the housing 5.

The operation of the valve can be readily understood by reference to FIGURES 2 through 7.

In FIGURE 2, both the tubes 2 and 3 are closed, so that fluid may flow through neither of these tubes. In this position, the end 12 of radial portion 25 of the cam element 11 pinches the tube 2, closing that tube; and the pie-shaped portion 24 pinches the tube 3, closing that tube.

When the cam element 11 is turned, by means of the knob 23, to the left to assume the position illustrated in FIGURE 3, the end 15 of pie-shaped portion 24 of the cam element 11 remains in engagement with the tube 3, pinching that tube closed. However, because of the circumferential relationship of the portion 25 and the portion 24 of the cam element 11, the tube 2 remains open because the end 12 of portion 25 remains free of engagement with that tube. Open tube 2, and pinched tube 3, may be readily viewed in the FIGURE 4 cross-section.

Further movement of the cam element to the left, to a position illustrated in FIGURE 5 wherein the radial portion 25 of the cam element is parallel to the tubes 2 and 3, opens both tubes 2 and 3 to permit fluid flow through both tubes.

Turning the cam element still further to the left, to the FIGURE 6 position, closes the tube 2 while leaving the tube 3 open. Still further movement of the cam to the left once again closes both tubes, as seen in FIGURE 7. As will be readily seen, the position of the cam in FIGURE 7 is 180° removed from the FIGURE 2 position, and similar results may be obtained by moving the cam through the remainder of its revolution back to the FIGURE 2 position.

Because of the frictional engagement of the flange 17 of the valve member with the housing 5, the cam element 11 will remain in the position to which it is set.

In the foregoing manner, the one-piece actuator of this

instrument is capable of operation in connection with a couple of generally parallel flexible tubes to close both tubes, leave both tubes open, or to selectively leave either tube open while closing the other tube.

The simplicity of construction and ease of operation of this invention are apparent, and the advantages of such a construction are significant.

While the invention has been explained in terms of particularly useful embodiments, it will be understood by those skilled in the art that various changes and modifications may be made in the structures disclosed herein without departing from the scope of the invention, which is defined by the following claims.

What is claimed is:

1. A four-way valve suitable for use with a pair of flexible tubes, comprising:

a housing which includes therein a recess;
a pair of passageways extending through said housing, said passageways being aligned with said recess so as to extend therethrough and be substantially parallel therein;

a flexible tube fitting in each of said passageways;
a valve member in said recess, said valve member including a knob portion which may be controlled from the exterior of said housing, and a cam element operably connected with said knob portion and having at least three spaced points on an arc of a circle, and another point 180° disposed from the midpoint of said arc,

whereby said cam element may be turned so that fluid flow may be selectively allowed through either of said tubes, neither of said tubes, or both of said tubes simultaneously.

2. A valve suitable for use with a pair of generally parallel flexible tubes, comprising:

a cam element for selectively contacting said tubes and having a major side and a minor side,

said major side including at least first and second points on the chord of a circle, one of said points being located at the intersection of one end of said chord with said circle, and one of said points being located at the intersection of the other end of said chord with said circle, and at least a third point located at the intersection of the perpendicular bisector of said chord with said circle, and

said minor side including at least one point on said circle, substantially 180° disposed from said third point,

whereby said cam element may be turned so that fluid flow may be selectively allowed through either of said tubes, neither of said tubes, or both of said tubes simultaneously.

3. A valve suitable for use with a pair of generally parallel flexible tubes, comprising:

a housing having a recess therein;
a pair of generally parallel passageways extending through said housing, each of said passageways being aligned with said recess;

a flexible tube disposed in each of said passageways;
a cam element disposed in said recess, said cam element having a major side and a minor side,

said major side including at least first and second points on the chord of a circle, one of said points being located at the intersection of one end of said chord with said circle, and one of said points being located at the intersection of the other end of said chord with said circle, and at least a third point located at the intersection of the perpendicular bisector of said chord with said circle, and

said minor side including at least one point on said circle, substantially 180° disposed from said third point; and,

a knob operably connected with said cam element, and