

May 23, 1961

A. S. TAYLOR ET AL

2,985,192

DOUBLE PINCH VALVE

Filed July 24, 1959

3 Sheets-Sheet 1

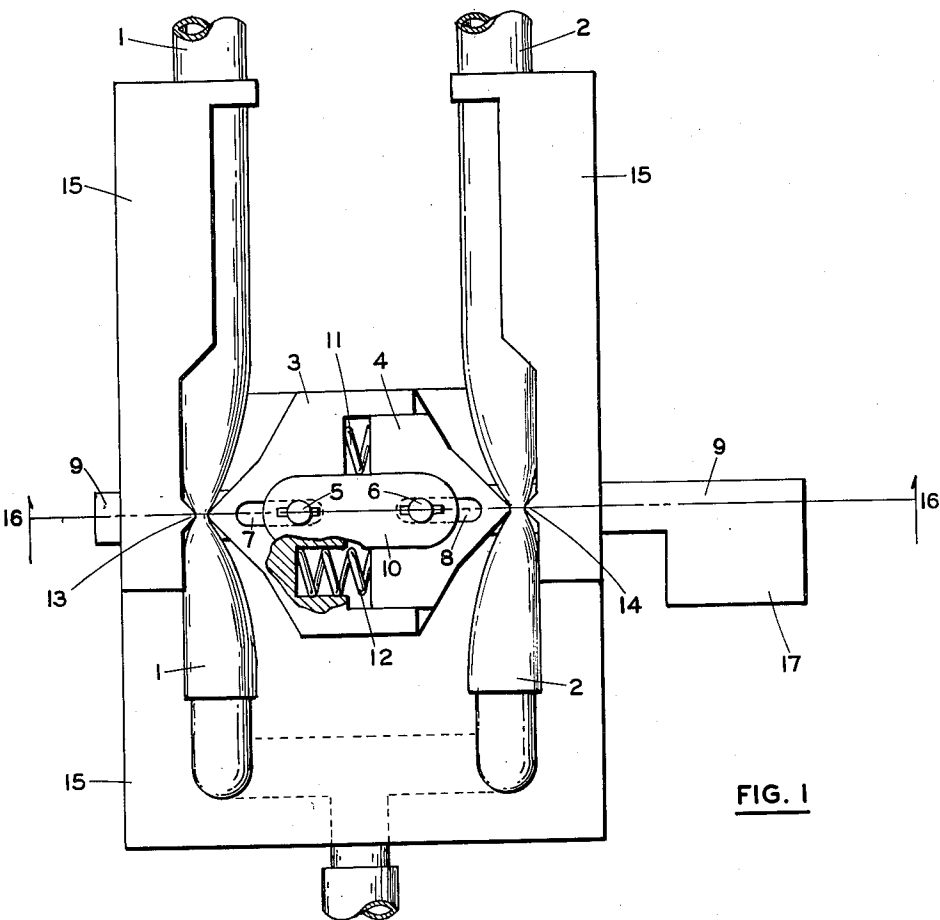


FIG. 1

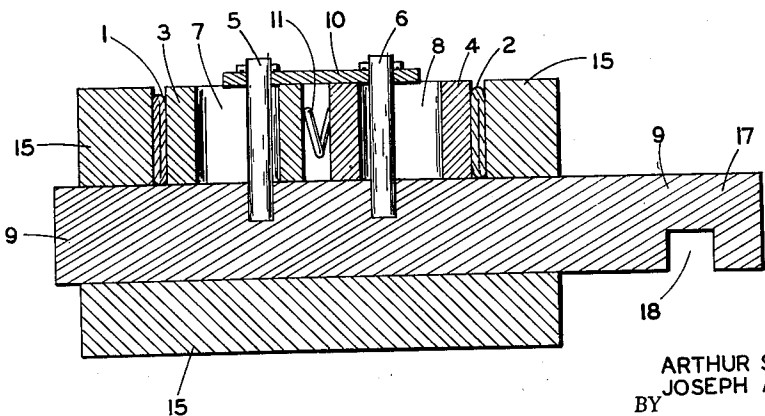


FIG. 2

INVENTORS.
ARTHUR SINCLAIR TAYLOR
JOSEPH AMES CORLEY
BY
Edward C. Corroy, Jr.

May 23, 1961

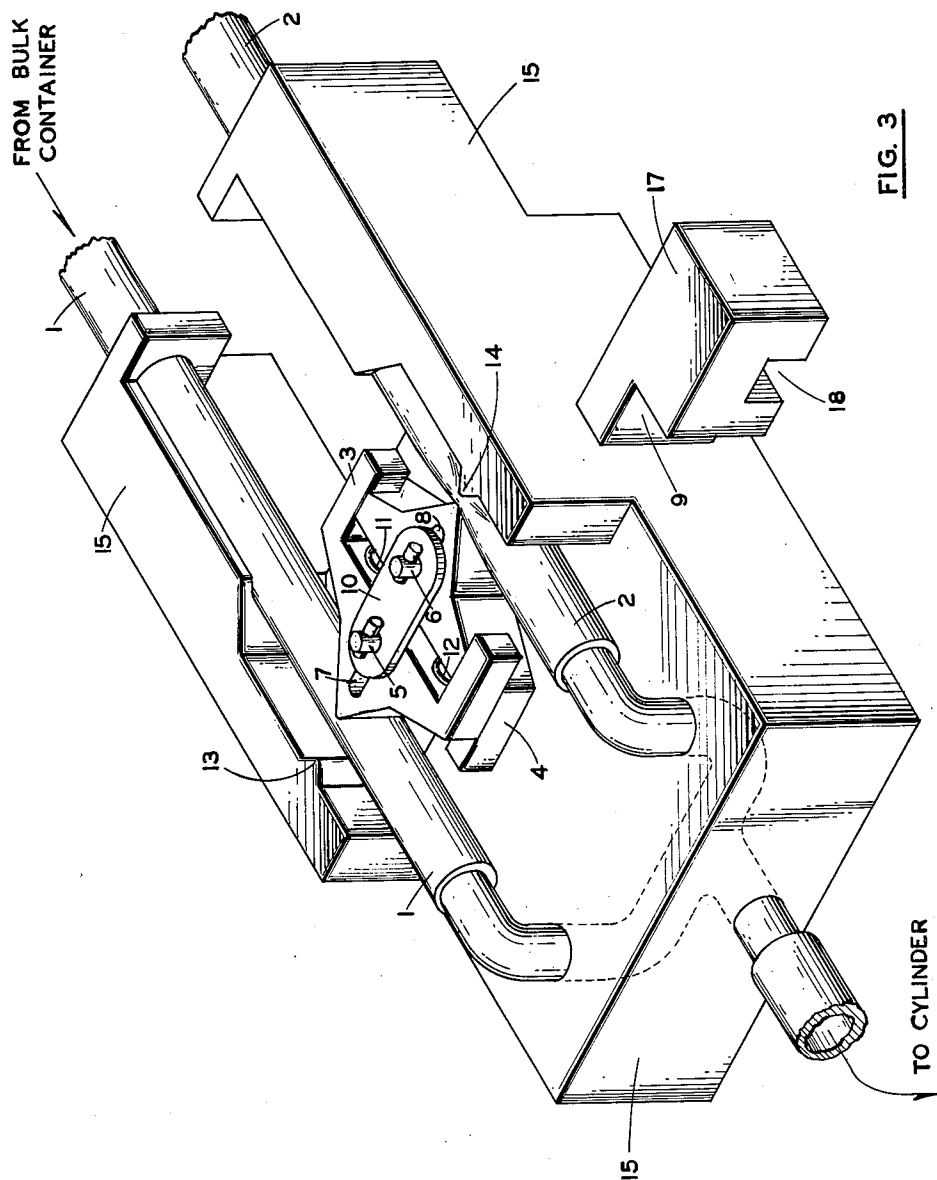
A. S. TAYLOR ET AL

2,985,192

DOUBLE PINCH VALVE

Filed July 24, 1959

3 Sheets-Sheet 2



INVENTORS.
ARTHUR SINCLAIR TAYLOR
JOSEPH AMES CORLEY

BY

Edward A. Conway, Jr.

May 23, 1961

A. S. TAYLOR ET AL
DOUBLE PINCH VALVE

2,985,192

Filed July 24, 1959

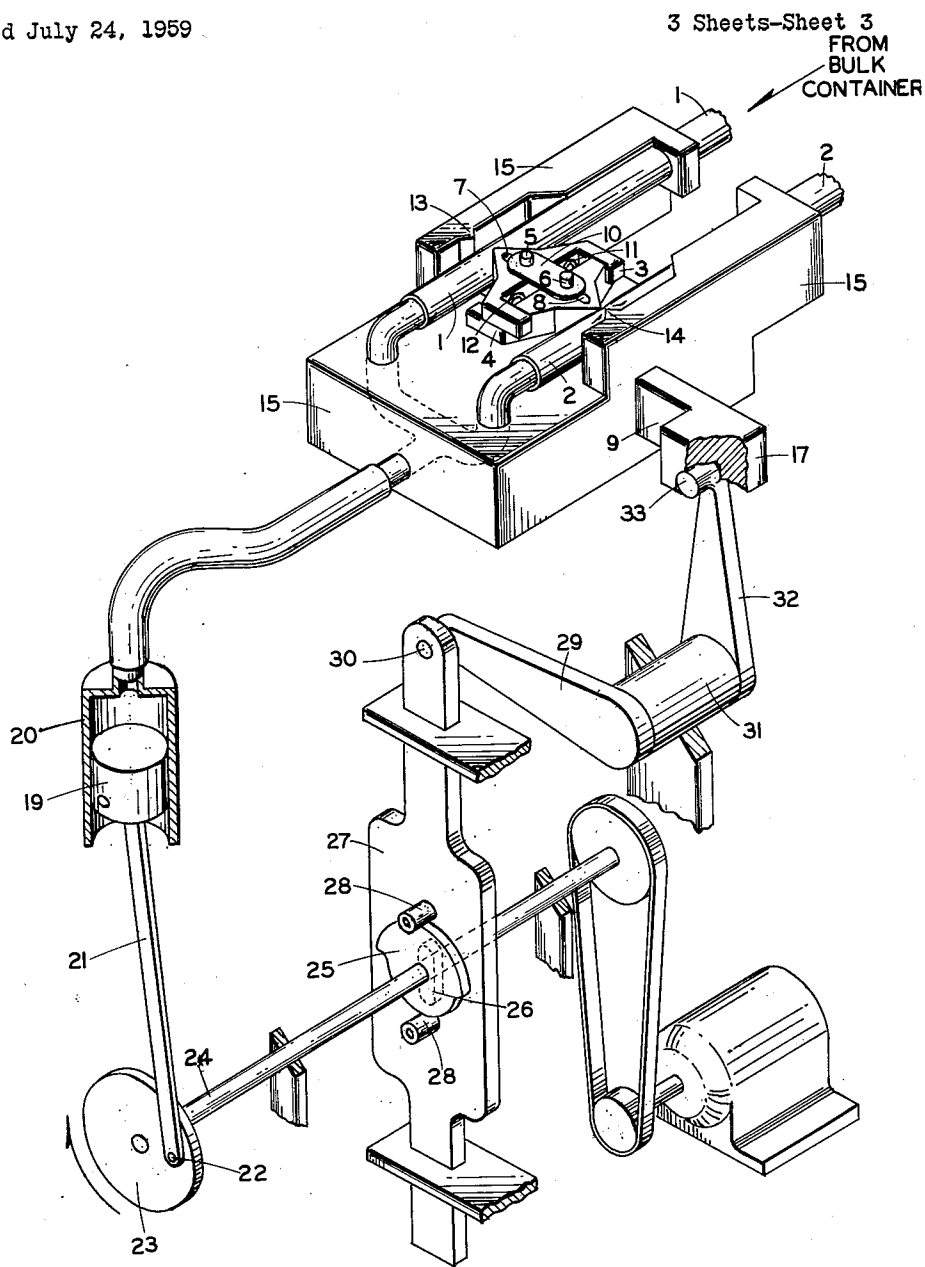


FIG. 4

INVENTORS
ARTHUR SINCLAIR TAYLOR
JOSEPH AMES CORLEY

BY

Edward A. Conway, Jr.

1

2,985,192

DOUBLE PINCH VALVE

Arthur Sinclair Taylor, Spring Valley, and Joseph Ames Corley, Sloatsburg, N.Y., assignors to American Cyanamid Company, New York, N.Y., a corporation of Maine

Filed July 24, 1959, Ser. No. 829,374

3 Claims. (Cl. 137—627.5)

This invention relates to a novel valve mechanism, and more particularly to a novel double pinch valve mechanism for use with liquid filling machines which supply repeated, measured volumes of a liquid by means of the action of a reciprocating piston.

The measuring and dispensing of liquid material, especially viscous material, under sterile conditions has presented numerous difficulties to the pharmaceutical industry. Over a period of many years, various attempts have been made to obtain a device which would have relatively trouble-free, easily sterilizable working parts and which would be capable of withdrawing, from bulk containers, various liquids of a wide range of viscosities and delivering repeatedly accurate reproducible volumes.

The type of liquid filling machine employed in combination both with the double pinch valve mechanism of the prior art and with the novel double pinch valve mechanism of this invention is usually constructed as follows. A vertical cylinder, closed at its upper end save for a T-connection, is fitted with a piston having a connecting rod passing through the lower open end of the cylinder to a crankpin on a drive wheel in the usual manner. One horizontal arm of the T-connection constitutes an inlet tube for filling the cylinder with liquid on the down-stroke of the piston, whereas the other horizontal arm of the T-connection constitutes an outlet tube whereby the liquid is discharged from the cylinder on the up-stroke of the piston. The inlet arm of the T-connection is fitted with a flexible tube which terminates in the bulk container, whereas the outlet arm of the T-connection is fitted with a flexible tube which terminates in the injection nozzle for filling the containers. At some convenient point, both flexible tubes are arranged parallel to, but spaced from, each other on a retaining block. This retaining block is so constructed that a force exerted from between and against the flexible tubes by a pressure-exerting member collapses and closes the flexible tubes against properly located retaining plates.

The pressure-exerting member of the prior art consists of a single reciprocating block which is beveled at each of the two points of contact with the two flexible tubes so as to insure positive closure of the flexible tubes. The pressure-exerting member of the prior art is mounted on the retaining block, between the flexible tubes, and is so dimensioned that when it completely collapses and closes one of the flexible tubes at one extreme of its reciprocating path, the other flexible tube is completely open. It is readily apparent that when the single reciprocating block of the prior art is at a point intermediate of the extremes of its reciprocating path that both of the flexible tubes are partly open.

The single reciprocating block of the prior art is actuated by conventional means from the drive wheel in such manner that the reciprocating block snaps from one extreme to the other of its reciprocating path at the same time that the crankpin passes through top dead center or bottom dead center. As the crankpin passes through top dead center, the reciprocating block snaps to that

2

extreme of its reciprocating path which effects complete closure of the outlet tube. As the crankpin passes through bottom dead center, the reciprocating block snaps to that extreme of its reciprocating path which effects complete closure of the inlet tube. Between passes of the crankpin through dead centers, the piston is either on down-stroke while the reciprocating block stays at that extreme of its reciprocating path whereby the inlet tube is completely open and the outlet tube is completely collapsed, or the piston is on up-stroke while the reciprocating block stays at that extreme of its reciprocating path whereby the outlet tube is completely open and the inlet tube is completely collapsed.

As has been previously described, when the crankpin passes through dead centers, the single reciprocating block of the prior art snaps from one extreme to the other of its reciprocating path, at which time both of the flexible tubes are partly open. This incident in the operating cycle gives rise to siphoning or surging of the liquid in the system, with the over-all effect of volume variations in the amount of liquid delivered to the containers. The problem posed by the double pinch valve mechanism of the prior art may be succinctly stated by pointing out that, ideally, one flexible tube should be completely closed before the other flexible tube is allowed to open. The double pinch valve mechanism of the prior art fails dismally in this regard because its fundamental approach to the problem is to provide tube closure only when required in the operating cycle.

The novel double pinch valve mechanism of the present invention solves this problem of the prior art because its fundamental approach is to provide tube opening only when required in the operating cycle. That is to say, continuous closure pressure which is exerted upon both flexible tubes is removed alternately in the operating cycle, first from the inlet tube during movement of liquid from the bulk container to the cylinder, and then from the outlet tube during delivery of the liquid to the containers to be filled. This most desirable result is obtained by means of the present invention whereby there is provided a pressure-exerting member consisting essentially of two reciprocating blocks, each of which acts upon but one of the flexible tubes.

The novel double pinch valve mechanism of the present invention is illustrated in the accompanying drawings, wherein like reference numerals indicate corresponding parts in the several views, and in which:

Figure 1 is a top plan view, partly broken away, of the double pinch valve mechanism of the present invention at that point in the operating cycle where both flexible tubes are completely closed;

Figure 2 is a vertical cross-sectional view of the double pinch valve mechanism of the present invention taken on the line 16—16 of Figure 1;

Figure 3 is a perspective view of the double pinch valve mechanism of the present invention at that point in the operating cycle where the inlet tube is completely open and the outlet tube is completely closed;

Figure 4 is a perspective view, partly broken away, of a liquid filling machine incorporating the double pinch valve mechanism of the present invention at that point in the operating cycle where the inlet tube is completely open and the outlet tube is completely closed.

Referring now to Figure 1 and Figure 2, the slide bar 9, which is slidably recessed in a groove in retaining block 15, is fitted with pins 5 and 6 which pass through slots 7 and 8 in the reciprocating blocks 3 and 4. The pins 5 and 6 also pass through appropriate holes in retaining plate 10 which is slidably mounted on the reciprocating blocks 3 and 4 and serves to hold said blocks upon the retaining block 15. When the slide bar 9 is in its neutral position, as shown in Figure 1 and Figure 2, the pins 5

3

and 6 do not make contact with the adjacent ends of the slots 7 and 8. In such case, blocks 3 and 4 are both free to exert a compressing force upon the flexible tubes 1 and 2 by reason of the springs 11 and 12 mounted between blocks 3 and 4. The compressing force exerted by blocks 3 and 4 upon the flexible tubes 1 and 2 serves to collapse said tubes against the ridges 13 and 14, causing positive closure of both tubes and thus preventing movement of the liquid being dispensed. The slide bar 9 is actuated by way of the slot 18 in the actuating head 17 of slide bar 9 by means shown in Figure 4.

Referring now to Figure 3 and Figure 4, the double pinch valve mechanism of the present invention is shown at that point in the operating cycle where a liquid is being withdrawn from a bulk container and transferred to the cylinder 20 via flexible inlet tube 1 by reason of the partial vacuum created by the down-stroke of the piston 19 in the cylinder 20 of the liquid filling machine.

Figure 4 shows the means whereby the slide bar 9 is actuated synchronously with the movement of piston 19 in cylinder 20 as follows. Piston 19 has the connecting rod 21 passing through the lower open end of cylinder 20 to the crankpin 22 on the drive wheel 23. The drive wheel 23 is mounted on the crankshaft 24, upon which is also mounted the cam 25. The crankshaft 24 passes through the slot 26 in the reciprocating plate 27 which carries the cam followers 28 which bear upon the cam 25. The reciprocating plate 27 is connected to the arm 29 by means of the linkage pin 30. The arm 29, the shaft 31, the arm 32, and the actuating knuckle 33 are constructed integrally. The actuating knuckle 33 fits loosely, but with a minimum of play, in the slot 18 in the actuating head 17 of slide bar 9.

In Figure 4, the piston 19 is halfway through its down-stroke and the high side of cam 25 is bearing upon the upper cam follower 28 with the result that the slide bar 9 is at that extreme of its reciprocating path where flexible tube 1 is completely open and flexible tube 2 is completely closed. When piston 19 reaches the end of its down-stroke, crankpin 22 passes through bottom dead center and the high side of cam 25 comes to bear upon lower cam follower 28 with the result that reciprocating plate 27 is moved downward and slide bar 9 is moved to that extreme of its reciprocating path where flexible tube 1 is completely closed and flexible tube 2 is completely open. When piston 19 reaches the end of its up-stroke, crankpin 22 passes through top dead center and the high side of cam 25 again comes to bear upon upper cam follower 28 with the result that reciprocating plate 27 is moved upward and slide bar 9 is moved back to that extreme of its reciprocating path where flexible tube 1 is completely open and flexible tube 2 is completely closed. In short, as crankpin 22 passes through dead centers, the slide bar 9 is moved through its neutral position, as shown in Figure 1 and Figure 2, and both flexible tubes are momentarily closed before either flexible tube is opened.

Referring again to Figure 3 and Figure 4, the inlet tube 1 is completely open by reason of the fact that the actuating means moved the slide bar 9 so that the pin 5 moved in its slot 7 towards flexible outlet tube 2 until it engaged the end of slot 7 and withdrew block 3 from the flexible inlet tube 1. Meanwhile, block 4 continues to exert compressing force upon flexible outlet tube 2 only by reason of the springs 11 and 12, since the movement of pin 6 in its slot 8 towards flexible outlet tube 2 does not bring pin 6 into engagement with the end of slot 8. When the piston 19 reaches the end of its down-stroke, slide bar 9 is momentarily returned to its neutral position, as shown in Figure 1 and Figure 2. Then, upon the up-stroke of the piston 19, an accurate amount of liquid, measured by the volume of the cylinder 20 between extreme down-stroke and extreme up-stroke of the piston 19, will be sent to the container to be filled via flexible outlet tube 2 by reason of slide bar 9 being moved in the opposite direction.

4

Referring now to all the figures, upon initiation of the down-stroke of the piston 19, a synchronous movement to the right of the slide bar 9 removes the pressure of block 3 on flexible inlet tube 1 by reason of the pin 5 sliding in its slot 7 until it engages the end of slot 7 and withdraws block 3 from the flexible inlet tube 1. Meanwhile, block 4 continues to exert compressing force upon flexible outlet tube 2 by reason of springs 11 and 12. Thus, liquid flows from the bulk container via flexible inlet tube 1 to the cylinder 20. Upon initiation of the up-stroke of the piston 19, a synchronous movement to the left of the slide bar 9 removes the pressure of block 4 on flexible outlet tube 2 by reason of the pin 6 sliding in its slot 8 until it engages the end of slot 8 and withdraws block 4 from the flexible outlet tube 2. Meanwhile, block 3 continues to exert compressing force upon flexible inlet tube 1 by reason of springs 11 and 12. Thus, a measured volume of liquid in the cylinder 20 passes via flexible outlet tube 2 to the container to be filled.

To sum up, the complete operating cycle of the novel double pinch valve mechanism of the present invention consists of four stages as follows. In stage one, slide bar 9 is in its neutral position as the crankpin 22 passes through top dead center. In stage two, block 3 is withdrawn from tube 1 as slide bar 9 is moved to the right during the down-stroke of the piston 19 while block 4 keeps tube 2 closed. In stage three, slide bar 9 is in its neutral position as the crankpin 22 passes through bottom dead center. In stage four, block 4 is withdrawn from tube 2 as slide bar 9 is moved to the left during the up-stroke of the piston 19 while block 3 keeps tube 1 closed.

As shown in the drawings, the preferred embodiment of the present invention contemplates the use of coil springs 11 and 12. However, coil springs 11 and 12 may be replaced by leaf springs, and the leaf springs used may be fashioned of any suitable material. The retaining block 15, the reciprocating blocks 3 and 4, and the slide bar 9 are preferably fashioned of brass, but other suitable metals, or even plastic materials, may be used. The flexible tubes may be fabricated of any material which will withstand sterilizing operations and, in some cases, corrosive liquids and which has sufficient structural strength to withstand repeated collapsing of the tubes.

Another advantage of the present invention lies in the fact that no matter in what stage the liquid filling machine is stopped, no siphoning from the bulk container is possible since at no time during the four stage cycle of operation are both flexible tubes open simultaneously.

What is claimed is:

1. A double pinch valve for controlling two separate pinched tubes, the flow through each of which is shut off before flow through the other is initiated, comprising; a retaining block, two opposed fixed ridges thereon, two flexible tubes spaced apart and adjacent said ridges, two reciprocating blocks slidably mounted between said tubes with one of said tubes between each ridge and its coacting reciprocating block, at least one spring mounted between said blocks adapted to press said blocks towards their respective coacting ridges thereby pinching said tubes to shut off flow therethrough, and means adapted to alternately override said spring and move one of said blocks away from its coacting ridge so as to permit flow through one of said tubes.

2. The device of claim 1 wherein the means adapted to alternately override said spring consists of a reciprocating slide bar slidably mounted on said retaining block parallel to the axis of reciprocation of said reciprocating blocks, said slide bar being fitted with two pins each of which passes through a slot in one of said reciprocating blocks, the long axis of said slots being parallel to said slide bar and of a length at least as great as half the length of reciprocation of said slide bar, the adjacent ends of said slots being spaced so as to just permit said reciprocating blocks to pinch and close both of said tubes.

3. A double pinch valve for controlling a pair of sepa-

5

rate pinched tubes, the flow through each of which is shut off before flow through the other is initiated, comprising; a retaining block, a pair of parallel opposed fixed ridges thereon, a pair of parallel flexible tubes spaced apart and mounted between and adjacent said ridges at right angles thereto, a pair of reciprocating blocks having a common axis of reciprocation slidably mounted between said tubes with one of said tubes between each ridge and its coating reciprocating block, at least one spring mounted between said blocks adapted to press said blocks towards their respective coating ridges thereby pinching said tubes to shut off flow therethrough, and a reciprocating slide bar slidably mounted on said retaining block parallel to the axis of reciprocation of said reciprocating blocks, said slide bar being fitted with two pins each of which

5

10

15

6

passes through a slot in one of said reciprocating blocks, the long axis of said slots being parallel to said slide bar and of a length at least as great as half the length of reciprocation of said slide bar, the adjacent ends of said slots being spaced so as to just permit said reciprocating blocks to pinch and close both of said tubes.

References Cited in the file of this patent

UNITED STATES PATENTS

583,632	Roesch	June 1, 1897
962,516	Mueller	June 28, 1910

FOREIGN PATENTS

845,292	Germany	of 1952
---------	---------	---------