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A. O. C. NIER ET AL
FLUID SELECTING APPARATUS

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2 Sheets-Sheet 1

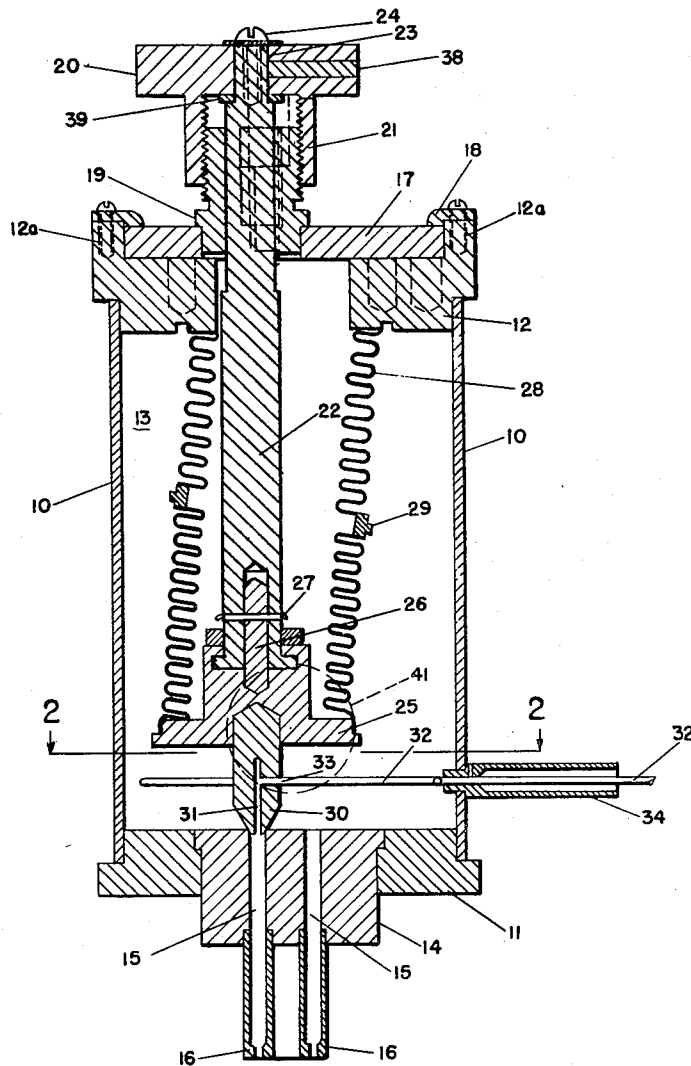


Fig. 1

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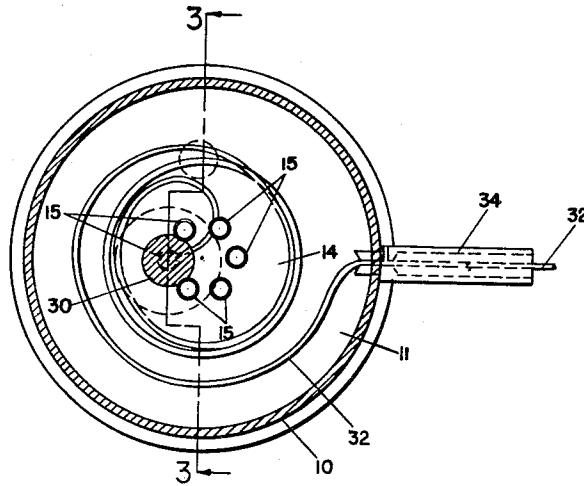


Fig. 2

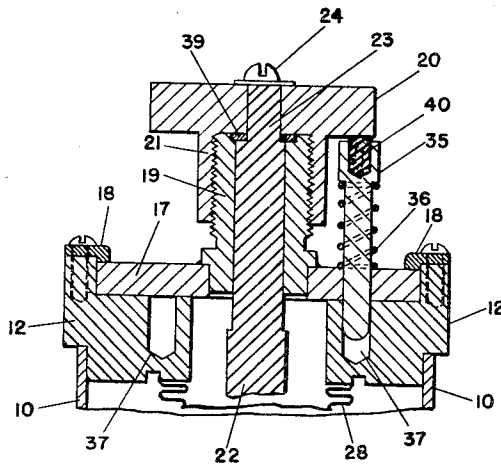


Fig. 3

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FLUID SELECTING APPARATUS

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12 Claims. (Cl. 251—22)

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The present invention relates to apparatus capable of being operated to select one of a number of passages and to place the passage thus selected in communication with another passage; and relates more particularly to an adjustable valve-like structure for securing a sample of a gas from a chosen source and supplying it to a desired place.

One of the applications of a device of the above mentioned character is in the selection of a gas or gaseous mixture to be fed into a mass spectrometer, especially a mass spectrometer comprising a part of a system for continuously analyzing a gas and for continuously indicating its composition. It is often desirable, if not imperative, that the composition of a gas stream in a manufacturing process be continuously recorded; and also that samples of it be taken in a prearranged order at widely scattered points throughout the plant and at any desired time. Formerly it was necessary to provide a separate gas conducting line running from the desired point to the mass spectrometer or other analyzing means which necessitated a multiplicity of lines with at least one valve in each line. The operation of such a system in an orderly manner required a control board, or its equivalent, by means of which a large number of valves were operated simultaneously or in some complicated sequence. Not only have these former systems been excessively difficult to set up and to operate; but they have led to errors in the results attained by the continuous analyzing and recording system.

It is therefore a principal object of the present invention to provide improved selecting means whereby any one of a number of gas lines or gas sources may be placed in communication with a previously selected passage in order to supply gas samples to a desired point such, for instance, as a mass spectrometer.

Another object of the invention is to provide a unified device of the above character which is relatively simple in design and construction, and which may be easily installed and operated as well as readily manufactured.

It is still another object of this invention to improve the operation of and results attained by analyzing devices or other apparatus requiring fluids to be supplied to them from a number of sources by simplifying and improving the means for supplying such samples.

Other objects and advantages of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this

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specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is a central longitudinal sectional view of one form of apparatus embodying the present invention.

Fig. 2 is a cross-sectional view of the form of the invention illustrated in Fig. 1 and is taken along the line 2—2 of Fig. 1 in the direction of the arrows.

Fig. 3 is a sectional view of the upper portion of the apparatus illustrated in Fig. 1 and is taken along a staggered sectional line 3—3 of Fig. 2 in the direction of the arrows. The positions of the handle 20 and pin 35 are also shown (in dotted lines in Figure 2) in order to bring out more clearly that the section line was selected in order to provide a central section of the offset handle and related parts.

Referring to the embodiment of the invention illustrated in the drawings and in particular Fig. 1, the reference numeral 10 indicates an outer casing or shell which is generally annular in shape. The casing 10 is capped at either end by an upper and lower end-piece shown at 12 and 11 respectively; these three elements 10, 11 and 12 forming a body for the device. This body possesses or is provided with an interior chamber 13. Within the lower end member 11 is an insert or seat 14 which is provided with a plurality of passages 15, 15 opening into the chamber 13. In the form of the invention illustrated, six of these openings shown at 15 are provided (see Fig. 2); and they are arranged circularly as viewed from the top. These passages not only open into the chamber; but each preferably leads to one of a plurality of connectors 16, 16. Each passage 15 forms a continuation of the internal passage in one of the connectors 16 to provide a continuous conduit or passage leading from the exterior of the device into the chamber 13. Each connector may be attached to a gas line or otherwise communicate with a different gas source for conducting a gas or gaseous mixture into the chamber 13. It will be understood that this particular construction is but a preferred one and that other suitable means of providing openings leading into chamber 13 may be employed. Also, the size, arrangement, and number of the openings will depend upon circumstances and the purpose for which the device is used.

The reference numeral 17 designates a rotatable disc or plate which overlies the top end member 12. The disc or plate 17 is held for rotation with respect to the end member 12 by a retain-

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ing ring 18. The rotatable disc or ring 17 carries an insert or projecting boss-like member 19 which is fitted into a suitable opening in the plate 17. It will be noted (see Fig. 1) that the member 19 is offset with respect to the center of the disc 17 so that as the disc 17 is rotated, the projecting member 19 will follow an eccentric path. The purpose for this particular arrangement is more fully pointed out hereinafter.

The projecting member 19 is provided with threads on its outer surface; and a knurled wheel or handle 20 which possesses a downwardly depending flange 21 is threaded onto the member 19 in the manner clearly illustrated in Figs. 1 and 3. The wheel 20 carries a rod or stem 22 which possesses a reduced end 23, and it is held at this reduced end to the wheel 20 by the bolt or screw 24. The stem 22 fits for rotation within an interior longitudinal bore in the projecting member 19, and extends inwardly throughout the major portion of the chamber 13 in the manner clearly illustrated in Fig. 1. When the handle 20 is rotated to thread it off of the fixed projecting member 19, it will rotate with respect to the reduced portion 23 of the stem 22. As a result, the handle 20 rotates and is raised at the same time; but the stem 22 is raised only. When the handle 20 is rotated to thread it onto the member 19, the stem 22 is lowered but in this case also the stem 22 does not rotate. The purpose for this arrangement will also be more fully explained hereinafter. If desired, an oil wick 38 and a washer 39 may be provided to assist in the relative movement between the wheel 20 and stem 22 when the former is rotated.

The reference numeral 25 designates the syphon bellows fitting attached to the lower end of the rod or stem 22. While any suitable means of securing the fitting to the stem may be used, the construction particularly illustrated in Fig. 1 is preferred. This construction, generally speaking, consists of a flanged lower end of the stem 22 which is fitted within a suitable recess within the upper portion of the fitting 25. Since this flange has to be slid into place as a practical matter, the pin 26 drops into a suitable opening and holds the fitting 25 and stem 22 in assembled relationship (see Fig. 1). In order that this assembled relationship may not be disturbed inadvertently, a cotter pin 27 or similar fastening element is used to hold the pin 26 in place.

To an annular undercut in the end member 12, the upper end of the syphon bellows 28 is attached by suitable means such as soldering. The lower end of this bellows is secured by similar means to the fitting 25 and the latter may be provided with a small shoulder at its lower portion for more easily securing the bellows in place. In the form of the invention illustrated, the bellows was formed in two sections, each section being secured to the ring 29 to form a unified bellows of the necessary length. However this was done for convenience in manufacturing the bellows, and a one-piece construction or other suitable bellows arrangement could be employed.

As pointed out hereinbefore, the arrangement of the handle 20 stem 22 and their associated parts is intended to prevent rotation of the stem 22 when the handle 20 is turned. The purpose of this arrangement is to prevent a twisting of the bellows 28 and to prevent, insofar as possible, the application of torque thereto. This avoids damage to the bellows and prevents, to a large extent, the development of leaks in the device which tend to occur as a result of ineffectively installed or defective bellows. In order to insure

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that the bellows 28 is protected against such twisting it may be desirable to install means for preventing any rotation of the stem 22 while permitting it to be raised or lowered. For instance, a keyway may be milled or formed in the stem 22 and positioned to receive a key affixed to the member 19. This keyway may be long enough to permit any desired raising and lowering of the stem 22 but it will prevent turning thereof. Other means for accomplishing this end may also be utilized.

To the lower portion of the fitting 25 there is inserted in a suitable recess, the inner end of an extending member or needle 30. This member is attached to the fitting 25 and moves therewith; preferably it is firmly soldered in place. The needle 30 is constructed as illustrated in Fig. 1; and in particular is provided with a tapered or somewhat pointed nose which is dimensioned and shaped to fit snugly within any one of the openings 15. This extending member or needle 30 is provided with an internal passage 31 extending generally lengthwise and which forms a continuation of the passages of the inlet 15 and connector 16 when the needle is inserted in one of the openings 15, as shown in Fig. 1.

The reference numeral 32 designates a coiled flexible pipe or conduit best illustrated in Fig. 2. This conduit is connected with the needle 30 and communicates with the internal passage 31 by means of a short cross passage 33 within the needle 30. The coiled flexible conduit 32 passes through some convolutions and is eventually fixed to the connecting member 34 which, in turn, is attached to a wall of the casing 10. The flexible conduit 32 extends outside of the casing 10 and is secured to the connector 34 which protects it. While any suitable flexible conduit may be used, the material employed in the form of the invention illustrated was small nickel tubing.

The reference numeral 35 (Fig. 3) indicates a movable pin, the upper end of which is normally pressed against the underside of the wheel 20. The pin 35 is held in this position by the spring 36, one end of which rests against the underside of the head of the pin 35, and the other end of which rests upon the top surface of the disc 17. The lower portion of the pin 35 extends through a suitable opening in the disc 17; and when the disc 17 is positioned to align this opening with an opening 37 in the upper surface of the member 12, the pin 35 will extend into the opening 37 and prevent rotation of the disc 17 with respect to the member 12. A number of these openings 37 are provided in the upper end member 12 so that the disc 17 may be moved to any one of a number of positions and may then be locked in place by operation of the pin 35 as more fully explained hereinafter. In order to assist in movement of the handle or wheel 20 relative to the pin 35, an insert 40 of fibre or similar material may be employed and suitably lubricated if necessary or desirable.

The operation of the present apparatus or device is as follows: The disc or plate 17 is rotated manually by grasping the handle 20. While the disc 17 is not fixed to an axle or shaft, it may rotate nevertheless since it fits within the outwardly extending flange or shoulder 12a of the end piece 12 and is held in place by the retaining ring 18. Sufficient clearance is provided to permit movement of the disc 17 relative to the members 12a and 18. Of course the rod 22 and needle 30 move with the disc 17 since they are carried by it. Both the handle 20 and the disc 17 are moved until the stem 22 and the needle 30

are positioned in alignment with one of the passages 15; and these members may be aligned with any passage 15 desired to be selected. The handle 20 is then rotated to lower the rod or stem 22 and therefore to lower the needle 30 until the needle 30 is snugly fitted within the opening of the selected passage 15 in the manner shown in Fig. 1.

As the handle 20 is rotated to lower the needle 30, the pin 35 (Fig. 3) is moved downwardly, that is, it is also lowered and will enter one of the openings 37. These openings 37 are so arranged in the top surface of the member 12 that an opening 37 is aligned with the pin 35 when the needle 30 is aligned with a passage 15. However, it is not until the needle 30 and stem 22 are lowered 15 that the pin 35 enters the opening 37.

When the device is adjusted in the manner described above, a gas entering the selected passage 15 will flow into the interior passage 31 of the needle 30 and will thereafter flow through the cross passage 33 and through the pipe or conduit 32. Accordingly, this gas may be led to any point to which the outer end of the conduit 32 is connected.

It will be noted that the structure illustrated does not permit rotation of the disc 17 relative to the upper end member 12 when the stem 22 and needle 30 are in their lowered positions. On the other hand, the pin 35 is automatically raised as the wheel 20 is rotated to raise the stem 22. Accordingly, when it is desired to position the needle 30 in another opening 15, the wheel 20 is rotated to raise the rod 22 which removes the needle 30 from the opening 15. At the same time the spring 36 will raise the pin 35. After a predetermined amount of rotation of the wheel 20, the pin 35 will clear the top surface of the end member 12 and permit rotation of the disc 17. The parts are so arranged that the pin 35 will be in the opening 37 to lock the disc 17 if the needle 30 is in an opening 15; and conversely the pin 35 will release the disc 17 for rotation only when the needle 30 is clear of an opening 15. This arrangement prevents inadvertent rotation of the disc 17, rod 22 and needle 30 when the needle is seated in an opening 15, which would damage the device. The disc 17 may then be rotated to position the needle 30 over any desired opening 15 and the handle 20 may then be rotated 45 to lower the rod 22 to lock the disc and by continued rotation may seat the needle 30 in the selected opening 15 in the manner above described.

It is convenient to provide a generally circular arrangement of the openings 15, 15 in the manner best illustrated in Fig. 2. However, it is not utterly necessary that these openings be so arranged provided that suitable means of moving the needle 30 or its equivalent to any of the openings, as desired, is provided. In the particular form of the invention illustrated the openings 15 are arranged generally circularly; so it is necessary to arrange the openings 37 also generally circularly, in order that an opening 37 may be properly positioned to receive the pin 35 when the needle 30 is aligned with an opening 15. However, the position of the openings 37 will depend upon the position of the pin 35 and the structure of the top end member 12. Various arrangements of these parts may be devised provided that the pin 35 may enter an opening 37 when the disc 17 is positioned to align the needle 30 with an opening 15. Only two of these openings 37, 37 are illustrated in the drawings (Fig. 3); but it will be understood that more openings could nor-

mally be provided and that their position would be arranged in accordance with the foregoing description.

It will be noted that the device especially illustrated in the drawings permits but one of the passages 15 to be placed in communication with the conduit 32. The gas flowing through the remaining passages 15 entered the chamber 13 and was removed by a suitable connection to a vacuum line. For instance, the vacuum line may be connected at the opening in the casing 10 shown in dotted lines at 41 (Fig. 1). However, it will be understood that the flow of gas may be cut off from one or more of the passages 15 which are not selected, if desired. Also, according to the modification of the invention illustrated in the drawings, it is always necessary to place one of the passages 15 in communication with the conduit 32 if the conduit 32 is to be connected to 20 any of these passages. However, by a simple change in its construction, one of the passages 15 could be altered to provide a blind recess or other suitable arrangement whereby the needle 30 could be cut off from any communication with gas passing through the passages 15 or into the chamber 13.

The apparatus or device above described, especially the particular modification illustrated in the drawings, was intended for use with low vacuum systems having a relatively small quantity of gas flowing in all of the passages or conduits 15. It is accordingly best suited for these conditions but could be adapted or employed for use under other circumstances as desired or needed.

It will be noted that the present device is especially useful if the gases flowing are very valuable or are of a corrosive or noxious nature; for the bellows 28 very effectively prevents any leakage of the gas past the stem 22, which leakage is an undesirable feature of ordinary valves, or the like, having packing or sealing glands.

Having illustrated and described our invention and having explained the principles thereof, it will be understood nevertheless that, within the scope of the appended claims, the invention may be practiced otherwise than specifically illustrated and described. Furthermore, the phraseology or terminology employed herein is for purposes of description and not of limitation; for it is not intended to limit the invention beyond the requirements of the prior art.

We claim:

1. Apparatus for directing a flow of fluid which comprises a member having an interior chamber, a plurality of conduits opening into said chamber, a bodily movable element situated in said chamber and possessing an internal passage, said element being shaped for insertion within each of said conduits, adjustable means associated with said member and carrying said element for inserting and removing the element from said conduits and thereby connecting the interior passage in the element with one of the conduits, and fluid conducting means connected to said element and communicating with said passage.

2. Apparatus for selecting one of a number of fluid sources which comprises a body having an internal chamber, a plurality of fluid conducting passages opening into said chamber, a bodily movable member having a portion constructed to fit within each of said passages and having an internal passage, a flexible conduit communicating with said internal passage, and means for moving said member to place said internal passage in

alignment with one of said fluid conducting passages.

3. Apparatus for selecting one of a number of fluid sources which comprises a body having an internal chamber, a plurality of ports opening into said chamber, a movable member having a portion constructed to fit within each of said ports and having an internal passage, fluid conducting means communicating with said passage, and means for moving said member to a selected port and also toward and away from the same to fit said portion within the selected port, whereby a passage leading to said port may be placed in communication with said fluid conducting means.

4. Apparatus for the selection of one of a number of fluid sources which comprises a chamber, a plurality of ports in said chamber, passages leading to said ports, a movable member extending into said chamber, a closure carried by said member, a passage in said closure, and flexible fluid conducting means communicating with said passage, said member being movable for alignment with as well as being movable toward and away from said ports, whereby said closure may cooperate with a selected port for conducting fluid flowing in the passage leading to said port.

5. Apparatus for selecting one of a number of fluid sources which comprises a body having an internal chamber, a plurality of passages opening into said chamber, a movable member having a portion constructed to cooperate with each of said passages and adapted to conduct fluid received therefrom, fluid conducting means connected with said member, means for aligning said member with a selected passage, and means for preventing misalignment of said member and said selected passage.

6. Apparatus for establishing communication between a conduit and one of a plurality of other conduits, which comprises a body member having a chamber, a plurality of openings in said chamber, a member extending into said chamber, a part carried by said member and constructed to fit within each of said openings, an internal passage in said part, a flexible conduit leading to said passage, adjustable means supporting said member for aligning said passage with one of said openings and for inserting said part into and removing the same from such an opening, and locking means operably associated with said adjustable means for maintaining the aforesaid alignment when said portion is inserted in a selected opening, whereby said selected opening may be placed in communication with said flexible conduit.

7. Apparatus for establishing communication between a conduit and one of a plurality of other conduits, which comprises a body having an internal chamber, a plurality of passages opening into said chamber, a raisable and lowerable stem having a portion constructed to fit within any one of said openings and having an internal passage, a flexible conduit connected with said stem and communicating with said passage, means for moving said stem to place said passage in alignment with any one of said openings, and means operably associated with said stem for locking when the stem reaches a predetermined lowered position and releasing when the stem reaches a predetermined raised position, whereby one of said openings may be selected and placed in communication with said flexible conduit.

8. Apparatus for the selection of one of a number of fluid sources which comprises a chamber, a plurality of ports in said chamber, a passage

leading to each of said ports, a rotatable member, a rod carried by said rotatable member and extending into said chamber, means carried by said rotatable member for extending and retracting said rod, a closure carried by said rod and having an interior passage, and fluid conducting means communicating with said passage, whereby rotation of said rotatable member is adapted to align said closure with any one of said ports and whereby said extending and retracting means is adapted to seat the closure in the selected port.

9. Apparatus for the selection of one of a number of fluid sources which comprises a chamber, a plurality of ports in said chamber, a passage leading to each of said ports, a rotatable member, a rod carried by said member and extending into said chamber, means carried by said rotatable member for extending and retracting said rod, a closure carried by said rod and possessing an interior passage, a flexible fluid conducting conduit communicating with said passage, a locking element associated with and operated by said extending and retracting means, and openings adapted to receive said locking element, whereby rotation of said rotatable member is adapted to align said closure with any one of said ports and whereby said extending and retracting means is adapted to seat the closure in said port while moving said locking element into one of the openings adapted to receive it to prevent rotation of said rotatable member when said closure is seated.

10. Apparatus for the selection of one of a number of fluid sources which comprises a body having a chamber, a plurality of circularly arranged ports in said chamber, a passage leading to each of said ports, a rotatable member, an offset axially movable member extending into said chamber and carried by said rotatable member a closure carried by said offset member and having an interior passage, a flexible fluid conducting conduit in communication with said passage, means carried by said rotatable member for axially moving said offset member, a pin carried by said rotatable member and operably associated with said axially moving means, and openings in said body positioned to receive said pin when said closure is in alignment with one of said ports, whereby operation of said rotatable member and of said axially moving means is adapted to seat said closure in a selected port and also prevent rotation of said rotatable member when the closure is so seated.

11. Apparatus for establishing communication between a conduit and one of a plurality of other conduits, which comprises a body having an internal chamber, a plurality of passages opening into said chamber, a raisable and lowerable stem having a portion constructed to fit within any one of said openings and having an internal passage, a flexible conduit connected with said stem and communicating with said passage, means for moving said stem to place said passage in alignment with any one of said openings, and means operably associated with said stem for automatically locking the same in place when said stem is lowered into one of said openings and for automatically releasing when said stem is removed from said opening.

12. Apparatus for establishing communication between an outlet and one of a plurality of inlets which comprises a body having an internal chamber, a plurality of inlets leading to said chamber, a raisable and lowerable stem constructed to fit within each of said inlets and having an internal passage, a flexible conduit

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connecting said passage with said outlet, means for moving said stem to place said passage in alignment with any one of said inlets, means operably associated with said stem for locking the same in place when it reaches a predetermined lowered position and for releasing when the stem reaches a predetermined raised position, and sealing means in said chamber for preventing leakage past said stem, whereby one of said inlets may be selected and placed in communication with said outlet.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
47,546	Hurd	May 2, 1865
1,718,530	Cook	June 25, 1929
2,333,934	Jacobson	Nov. 9, 1943