Oct. 18, 1966 W. J. KUDLATY 3,279,680

DE-AIR DEVICE

Filed July 20, 1964

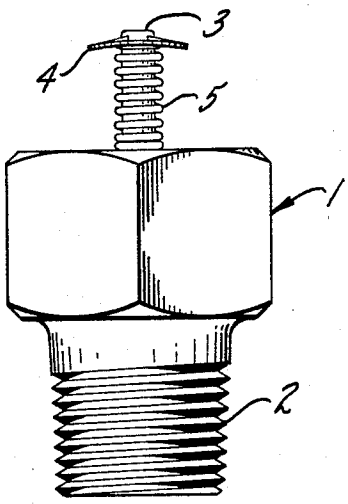


Fig. 1.

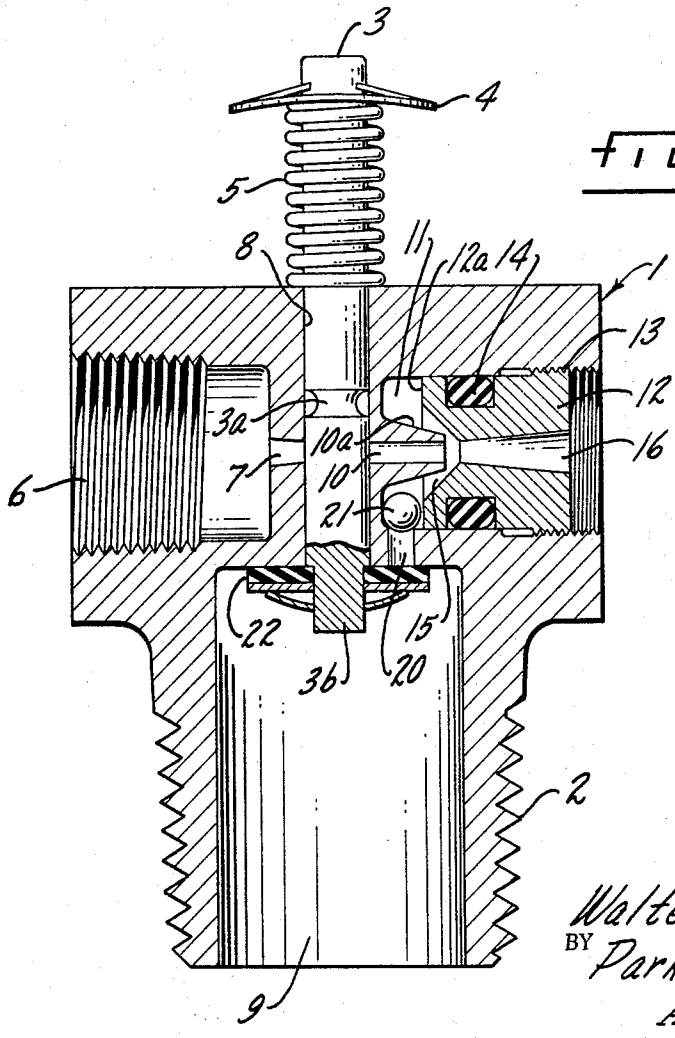


Fig. 2.

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United States Patent Office

3,279,680

Patented Oct. 18, 1966

3,279,680

DE-AIR DEVICE

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Filed July 20, 1964, Ser. No. 383,682
17 Claims. (Cl. 230—111)

This invention relates to de-air devices and has particular relation to a device effective to remove air from the area within a chamber, such as that within a filter housing for example.

One purpose of the invention is to provide a device effective to withdraw air from a filter housing and simultaneously to draw liquid thereinto.

Another purpose is to provide a device effective to replace the air within a filter housing with the fluid to be filtered.

Another purpose is to provide a de-air device of maximum simplicity and minimum cost in manufacture.

Another purpose is to provide a de-air device of assured repetitive operation.

Another purpose is to provide a de-air device effective to draw fluid into a housing and to hold said fluid at the point to which it is drawn when the device is deactivated.

Another purpose is to provide a de-air device of maximum compactness.

Another purpose is to provide a de-air device capable of effective intermittent operation.

Another purpose is to provide a device effective to bleed air from a chamber with which the device is associated.

Factories and similar installations frequently employ liquids requiring filtering and frequently have a source of air pressure or compressed air constantly available. Accordingly, it is another purpose to provide a de-air device adapted for continuous communication with such air pressure source and for intermittent operation to draw such liquid into a suitable filter housing.

Other purposes will appear from time to time during the course of the specification and claims.

The invention is illustrated more or less diagrammatically in the accompany drawings wherein:

FIGURE 1 is a side elevation; and

FIGURE 2 is a side view in cross section on an enlarged scale.

Like parts are indicated by like numerals throughout the specification and drawings.

Referring now to the drawings, and particularly to FIGURE 1 thereof, the numeral 1 generally designates a body or housing. The body 1 has an externally threaded extension or fitting portion 2 extending in one direction therefrom. Extending in the opposite direction from and slidably mounted in body 1 is a shaft or valve rod 3. A retainer 4 is carried by and adjacent the outer end of shaft 3 and a spring 5 has its opposite ends in engagement with body 1 and an opposed surface of retainer 4, the spring 5 conveniently surrounding the shaft 3 externally of body 1. While the externally threaded fitting portion 2 is shown as extending in a straight line from housing 1 in a direction opposite that of shaft 3, it will be realized that the fitting portion 2 could be curved, bent, or otherwise directed without departing from the nature and scope of the invention.

Referring now to FIGURE 2, it will be observed that the body 1 has an internally threaded inlet opening 6 in a side wall thereof, the opening 6 communicating with an axially aligned passage 7, the largest diameter of which is substantially less than that of opening 6. The opening 6 and passage 7 extend in body 1 laterally of the axis of shaft 3 and on one side thereof. Passage 7 has its wall surface inwardly directed or converging conically downstream of opening 6.

The shaft 3 extends slidably in and through a passage 8 which itself extends through body 1 in perpendicular relationship with the axis of passage 7 with which it communicates, the passage 8 communicating also at one of its ends with the passage 9 within fitting 2. Intermediate its ends the shaft or valve rod 3 has a reduced portion 3*a*.

In axial alignment with passage 7, the body 1 has formed therein an internal passage 10 communicating at one of its ends, as does passage 7, with the passage 8 in body 1. The opposite end of passage 10 communicates with a nozzle chamber 11 formed in the body 1. A nozzle member 12 is threadably, and thus adjustably, positioned in chamber 11, as indicated at 13. The member 12 carries a seal 14 in sealing engagement with the inner wall surface of chamber 11. The inner end face 12*a* of nozzle member 12 has a central, frusto-conical well 15 formed centrally therein, the conical wall surface of well 15 being conically inclined inwardly and in a downstream direction from passage 10. A similarly formed outer surface 10*a* surrounds the body extension in which passage 10 extends. An outwardly flared or conical passage 16 is formed centrally in the member 12 and communicates with the bottom of well 15 in spaced relationship and in axial alignment with the adjacent outlet end of passage 10, the passage 16 communicating with atmosphere externally of body 1.

A fourth passage 20 is formed in body 1 and communicates at one of its ends with the area or passage 9 in fitting 2 and and at its opposite end with the chamber 11. A ball 21 has a diameter greater than that of the mouth of passage 20 communicating with chamber 11 and is positioned in chamber 11 to seat upon and seal the passage 20 in the absence of pressure flowing therethrough toward chamber 11.

The inner end 3*b* of shaft 3 extends into area of passage 9 within fitting 2 and carries a closure valve element 22 for sealing engagement with passage 20 and to seal passages 20 and 9 against communication therebetween.

Whereas there has been shown and described an operative form of the invention, it should be understood that this showing and description are to be taken in an illustrative or diagrammatic sense only. There are many modifications in and to the invention which will be apparent to those skilled in the art and which will fall within the scope and spirit of the invention.

The use and operation of the invention are as follows:

It will be understood that a suitable source of fluid pressure, such as air pressure, is connected to pressure inlet opening 6 of body 1 for delivery of fluid pressure to passage 7. Industrial installations conventionally employ a source of fluid pressure having plural outlets, one of which could conveniently be connected continuously

to inlet **6**. A pressure regulator may be conveniently connected to a conduit communicating with inlet **6**. It has been found effective, for example, to provide such pressure regulator and to set the same at approximately 10 p.s.i. maximum pressure when the device of the invention is employed in removing air from the area within a particular filter and housing of a particular size and configuration, such as that shown in the drawings. It will be understood that the pressures involved may be different, with changes in a number of variables in size and detail of construction of the filter and housing, without departing from the nature and scope of the invention.

With the parts as shown in FIGURE 2, fluid pressure delivered to inlet **6** and passage **7** is rendered ineffective by the blocking action of valve rod **3** across passages **7**, **10** under the influence of spring **5** and valve **22** is held on its seat closing passage **20** by the action of spring **5**.

It will be understood that fitting **2** is suitably connected to the device to be evacuated of air, such as a filter housing for example. The passage or area **9** within fitting **2** is thus in communication with the area within such housing. When the operator desires to bleed or evacuate said housing area or to replace air within said housing with the fluid to be filtered, the operator merely presses on the outer exposed end of rod **3**, moving the same against the resistance of spring **5** to align reduced shaft area **3***a* with passages **7**, **10**. In so doing the operator also unseats valve **22** from passage **20** and thus opens communication between the area within the housing to be evacuated of air and the chamber **11**, through passages **9** and **20**.

It will be observed that passage portion **7** is substantially smaller than inlet **6** and converges in downstream direction. Passage portions **3***a* and **10** have a continuous diameter and passage portion **16** flares outwardly. Chamber **11** communicates with the venturi passage **7**, **3***a*, **10**, **16** at the junction of spaced portions **10** and **16** in the form of a cone formed by the outer surface **10***a* of a boss **10***b* surrounding passage **10** and by surface **15**. The increased speed of air through venturi **7**, **3***a*, **10** and **16** produces a lowered pressure thus communicated to chamber **11** and to unseat valve **21** and to evacuate the housing connected to area **9**.

When reduced area **3***a* is aligned with passages **7**, **10** fluid pressure from passage **7** flows through passage **10**, across the space within chamber **11** toward and into the outwardly flaring passage **16** for delivery to atmosphere. The reduced pressure thus created by relatively rapid air flow and created within chamber **11** causes ball check valve **21** to be unseated from passage **20** and to produce a vacuumlike or suction action in passage **9** and **20**, and thus in the housing communicating with passage **9**, the said suction or pressure differential being effective to draw air from the area within said housing into chamber **11** and to dispel said air to atmosphere through passage **16**. When said housing is, for example, a filter housing, it will be understood that such housing is suitably connected to a source of the fluid to be filtered and that an evacuation or reduced pressure within said filter housing will cause such fluid to be drawn thereinto to replace the air withdrawn by the device of the invention.

If at any time during the de-airing action of the device of the invention the reduced area **3***a* of shaft **3** be out of alignment with passages **7**, **10** and valve **22** be off its seat closing passage **20**, the resultant balance of lowered pressure within the housing being bled of air and the atmosphere communicating with chamber **11** could cause a return of air into said housing. The presence of ball check valve **21**, however, is, effective to prevent such result, any balance of pressures tending to cause a retrograde flow of air through passage **20** into area **9** being effective to seat the ball **21** on the passage **20** and thus to preclude such flow.

Fluid moving into the housing being de-aired by the device of the invention will be held, by such pressure balances, at whatever level the same had reached when the area **3***a* moved out of alignment with passages **7**, **10**. It will be further noted that the ball check valve **21** is effective to accomplish this result even if the reduced pressure communicating with passage **9** were sufficient, in a particular case, to hold valve **22** off its seat.

Thus is provided a simplified, compact device effective to employ a first flow of air in creating a second flow of air outwardly from a housing to be evacuated of air and to provide for a replacement of such evacuated air with fluid in such housing. Included in the device is an adjustable nozzle element and means for preventing backflow therethrough into the housing being evacuated. A single movable member is provided and is effective normally, yieldingly to render the device inoperative, the said movable element being movable in one direction simultaneously to open communication between the area to be evacuated and the venturi structure of the device and to provide an immediate flow of pressure air through said venturi to withdraw air from said housing.

It will be understood that nozzle member **12** may be factory-set at the desired position within chamber **11** for maximum efficiency. When the structure of the housing to be evacuated is known, the nozzle **12** may be set or otherwise suitably locked in the optimum position. Similarly, when desired, the nozzle structure **12** may be otherwise formed in the housing **1** without departing from the nature and scope of the invention.

What is claimed is:

1. A de-air device including a body, a first passage through said body, a second passage laterally through said body, and communicating with opposite sides of said first passage, a shaft movably positioned in said first passage, a reduced area on said shaft selectively alignable with said lateral passage and yieldingly urged out of said alignment, a venturi nozzle structure communicating with said lateral passage on one side of said shaft, and means carried by said shaft and positioned to open and close communication of said nozzle structure with a chamber to be evacuated.

2. A de-air device comprising a body, a venturi passage through said body, a member movable transversely of said venturi passage to open and close the same, a passage in said body and means communicating said venturi passage with said body passage when said member is in venturi-open position, and a valve element carried by said member and positioned to close communication of said venturi passage with said valve passage when said member is in venturi-closed position.

3. A de-air device comprising a body, a venturi passage through said body, a member movable transversely of said venturi passage to open and close the same, a passage in said body and means communicating said venturi passage with said body passage when said member is in venturi-open position, and an adjustable nozzle element carrying a portion of said venturi passage.

4. An evacuating device including a body, a venturi passage laterally through said body, a member slidable in said body transversely of said venturi passage to open and close the same, a chamber, means carried by said member and positioned to open and close communication of said chamber with an intermediate portion of said venturi passage.

5. An evacuating device including a body, a venturi passage laterally through said body, a member slidable in said body transversely of said venturi passage to open and close the same, a chamber, means communicating said chamber with an intermediate portion of said venturi passage, a check valve in said chamber and openable in response to the action of said venturi, a second passage in said body communicating with said chamber when said check valve is open.

6. An evacuating device including a body, a venturi passage laterally through said body, a member slidable

in said body transversely of said venturi passage to open and close the same, a chamber, means communicating said chamber with an intermediate portion of said venturi passage, a check valve in said chamber and openable in response to the action of said venturi, a second passage in said body communicating with said chamber when said check valve is open, and a fitting portion on said body, the area within said fitting portion communicating with said second passage when said member is in venturi open position.

7. An evacuating device including a body, a venturi passage laterally through said body, a member slidable in said body transversely of said venturi passage to open and close the same, a chamber, means communicating said chamber with an intermediate portion of said venturi passage, a check valve in said chamber and openable in response to the action of said venturi, a second passage in said body communicating with said chamber when said check valve is open, a fitting portion on said body, the area within said fitting portion communicating with said second passage when said member is in venturi-open position, and a valve element carried by said member and positioned to close said second passage when said member is in venturi-closing position.

8. An evacuating device including a body, a venturi passage laterally through said body, a member slidable in said body transversely of said venturi passage to open and close the same, a chamber, means communicating said chamber with an intermediate portion of said venturi passage, a check valve in said chamber and openable in response to the action of said venturi, a second passage in said body communicating with said chamber when said check valve is open, a fitting portion on said body, the area within said fitting portion communicating with said second passage when said member is in venturi-open position, a valve element carried by said member and positioned to close said second passage when said member is in venturi-closing position, and yielding means engaging said body and member and urging said member toward venturi-closing position.

9. An evacuating device including a body, a venturi passage laterally through said body, a member slidable in said body transversely of said venturi passage to open and close the same, a chamber, means communicating said chamber with an intermediate portion of said venturi passage, a check valve in said chamber and openable in response to the action of said venturi, a second passage in said body communicating with said chamber when said check valve is open, a fitting portion on said body, the area within said fitting portion communicating with said second passage when said member is in venturi-open position, a valve element carried by said member and positioned to close said second passage when said member is in venturi-closing position, and yielding means engaging said body and member and urging said member toward venturi-closing position, said member having a manually engageable portion extending outwardly from said housing.

10. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said body and extending transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged toward venturi-closing position and having a manually operable portion extending outwardly from said body, a chamber in said body, a passage in said body communicating said chamber with said venturi passage, and means carried by said valve rod for opening and closing said last-named passage.

11. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said body and extending transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged toward venturi-closing position and having a manually operable portion extending outwardly from said body, a chamber in said body and communicating with said venturi passage, and a nozzle element adjustably positioned in said chamber and carrying a portion of said venturi passage.

12. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said body and extending transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged toward venturi-closing position and having a manually operable portion extending outwardly from said body, a chamber in said body and communicating with said venturi passage, a nozzle element adjustably positioned in said chamber and carrying a portion of said venturi passage, a body passage in said body communicating with said chamber, and a ball member positioned in said chamber for normally closing said body passage, said ball member being movable into body-passage opening position in response to the action of said venturi passage.

13. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said body and extending transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged toward venturi-closing position and having a manually operable portion extending outwardly from said body, a chamber in said body and communicating with said venturi passage, a nozzle element adjustably positioned in said chamber and carrying a portion of said venturi passage, a body passage communicating with said chamber, and a valve element carried by said valve rod and closing said body passage when said valve rod is in venturi-closing position.

14. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said housing transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged into venturi-closing position, a chamber communicating with said venturi passage, a nozzle member adjustably positioned in said body and having a conical surface for communication with said venturi passage, said nozzle member forming with said body said chamber, a portion of said venturi passage extending through said nozzle member and communicating with atmosphere.

15. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said housing transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged into venturi-closing position, a chamber communicating with said venturi passage, a nozzle member adjustably positioned in said body and having a conical surface for communication with said venturi passage, said nozzle member forming with said body said chamber, a portion of said venturi passage extending through said nozzle member and communicating with atmosphere, and a body passage communicating with said chamber and a valve element carried by said valve rod and positioned to close said body passage when said valve rod is in venturi-closing position.

16. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said housing transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged into venturi-closing position, a chamber communicating with said venturi passage, a nozzle member adjustably positioned in said body and having a conical surface for communication with said venturi passage, said nozzle member forming with said body said chamber, a portion of said venturi passage extending through said nozzle member and communicating with atmosphere, a second passage in said body and a check valve positioned in said body to control communication between said second passage and said chamber.

17. A de-air device including a body, a venturi passage extending through said body, a valve rod slidable in said housing transversely of said venturi passage to open and close the same, said valve rod being yieldingly urged into venturi-closing position, a chamber communicating

with said venturi passage, a nozzle member adjustably positioned in said body and having a conical surface for communication with said venturi passage, said nozzle member forming with said body said chamber, a portion of said venturi passage extending through said nozzle member and communicating with atmosphere, a second passage in said body and a check valve positioned in said body to control communication between said second passage and said chamber, said check valve being openable automatically in response to passage of air through said venturi passage.

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