

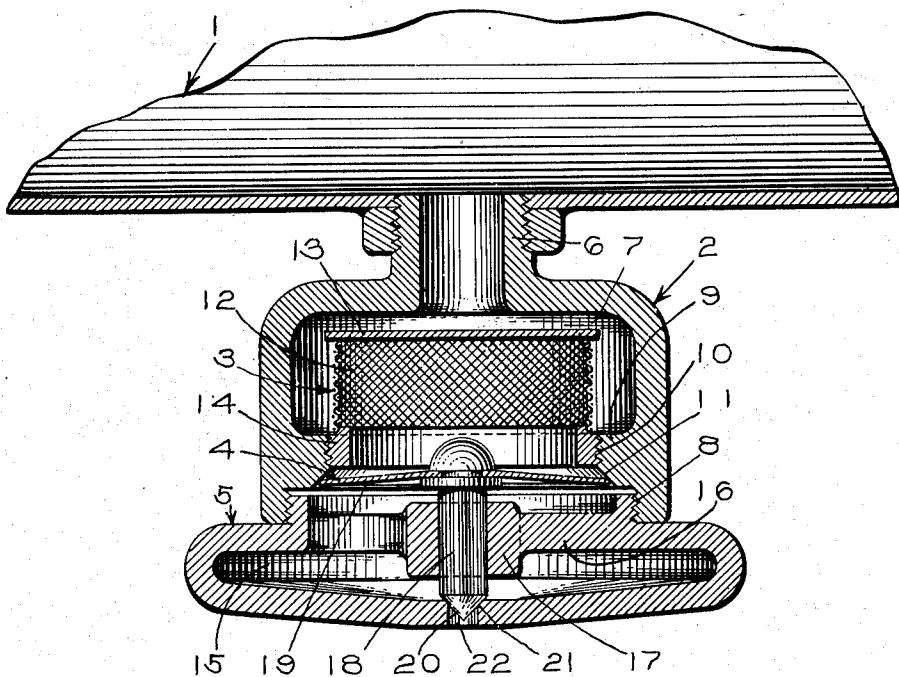
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AUTOMATIC DRAIN VALVE DEVICE

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AUTOMATIC DRAIN VALVE DEVICE

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5 Claims. (Cl. 303—88)

This invention relates to an automatic drain valve for use on a reservoir or receiver for fluid under pressure and which operates to release moisture from this receiver or reservoir.

5 In the operation of fluid pressure systems, such as fluid pressure brake systems, air from the atmosphere is compressed and is stored in a reservoir or receiver from which fluid is with-
10 drawn during operation of the brake equipment. As a result of the supply of fluid under pressure to and the release of fluid under pressure from the reservoir, water is deposited in the reservoir and unless it is periodically drained away it ac-
15 cumulates in the reservoir and reduces its volume, and also may freeze and cause injury to the equipment.

It is an object of this invention to provide valve means adapted to be employed to release liquid which accumulates in the reservoir of a
20 fluid pressure system.

Another object of the invention is to provide a valve device automatically operable in response to variations in the pressure of the fluid in a reservoir or receiver for controlling a communica-
25 tion through which liquid may be released from the reservoir or receiver.

A further object of the invention is to provide a valve device of the type described which re-
30 leases fluid from the receiver in limited volumes so that the supply of fluid in the receiver will not be unduly depleted by operation of the valve device.

A still further object of the invention is to provide a valve device of the type referred to
35 which is of rugged construction, and in which the elements are of such design as not to be damaged, if water present in the device freezes.

It is still a further object of the invention to provide an improved automatic drain valve de-
40 vice.

Other objects of the invention and features of novelty will be apparent from the following description taken in connection with the accom-
45 panying drawing, the single figure of which is a sectional view showing a drain valve device embodying my invention.

Referring to the drawing, there is illustrated therein a portion of a receiver or reservoir 1 for a fluid pressure system which is supplied with
50 fluid under pressure by a suitable compressor, not shown, and from which fluid is withdrawn through a suitable pipe, not shown.

The drain valve device provided by my invention is mounted in a threaded opening in the
55 lowermost portion of the reservoir or receiver 1,

and, as shown, comprises a body casing 2, a strainer portion 3, a valve portion 4 and a cover portion 5.

The body casing 2 has a tubular threaded por-
tion 6 adapted to be received by the threaded
opening in the reservoir 1.

The body has an annular chamber 7 formed therein which is in constant communication with the reservoir 1 through said tubular portion 6.
10 The opposite end of the chamber is provided with a screw-threaded opening 8. At an inter-
mediate point in the chamber 7, an annular flange 9 is provided. A portion of this flange is adapted to form a valve seat 11 and a portion
15 above the valve seat is provided with screw-threads.

The strainer portion 3 may comprise a cylindrical tubular wall member 12 made of perforated metal, such as, close mesh wire, which is closed at one end by a metal plate 13. The tubular
20 member is supported at the opposite end by a metal ring 14 which is provided with screw-threads on its outer circumference. Both of said parts 13 and 14 may be secured to the wall member 12 in any suitable manner. This strainer
25 portion is screw-threaded into the threaded portion of flange 9 with the closed end projecting into the chamber 7, as shown in the accompanying drawing.

The chamber 7 is closed by the cover portion
30 5 which is screw-threaded into the open end of the chamber 7 at 8.

The cover portion is provided with a chamber
15 into which one or more ribs 16 extend from the inside wall thereof and form a central boss
35 17. At the bottom of the cover there is provided a release passage 22 which extends there-
through.

The valve portion 4 comprises a thin flexible diaphragm valve 19 interposed between the cham-
40 bers 7 and 15 and which is adapted to seat at its perimeter on the valve seat 11 provided on the annular flange 9 in chamber 7. A valve stem 18 is secured at one end to the center of the diaphragm valve 19 and extends through an
45 opening in the boss 17. The opposite end of the stem 18 has a substantially conical face thereon indicated at 20, which is adapted to seat upon a seat 21 formed on the cover 5 surrounding the
50 release passage 22.

The length of the stem 18 is such that when the valve portion 4 is assembled in operative position, that is, with the conical valve face 20
of the stem 18 engaging the seat 21 and the outer periphery of the diaphragm 19 engaging 55

the seat 11, the central portion of the diaphragm 19 will be flexed upwardly slightly into chamber 7, as shown in the drawing.

In initially charging the equipment, fluid under pressure is supplied to the reservoir 1 and it flows through the tubular portion 6 to the chamber 7 of the drain valve device. From this chamber fluid under pressure flows through the strainer member 12, which functions to remove foreign particles from the fluid passed therethrough, and thus prevents particles of dirt and dust from accumulating on the valve seat 11. Thereby insuring that the diaphragm 19 will seat properly on said seat when it is so intended. After passing through the strainer the fluid under pressure exerts force on the upper face of the diaphragm 19 to flex it downwardly, away from the seat 11. On downward flexing of the diaphragm 19, fluid under pressure flows past the valve seat 11 to the chamber 15 in the cover portion 5. This flow continues until the pressure in chamber 15 is substantially equal to the pressure of fluid in chamber 7 and in the reservoir 1. During this charging period the face 20 on the end of the stem 18 is pressed more firmly into engagement with the seat on the cover surrounding the release passage 22, so that there is no escape of fluid to the atmosphere.

On an increase in the pressure of fluid in the chamber 15 to a pressure substantially equal to the pressure in the chamber 7 and the reservoir 1, the force exerted by the fluid under pressure in the chamber 15, together with the force exerted by the diaphragm 19 overcomes the opposing force of the fluid under pressure in the chamber 7 and reservoir 1 on the opposite side of the diaphragm. When this occurs the diaphragm 19 is thereupon flexed upwardly until it seats on the seat 11 and cuts off the further supply of fluid under pressure from the chamber 7 and reservoir 1 to the chamber 15.

Any liquid which accumulates in the reservoir 1 flows by gravity to the lower portion thereof and through the passage in the tubular portion 6 to the chamber 7 of the drain valve. From thence it flows through the strainer member 12 to the upper face of the diaphragm 19.

On a subsequent reduction in the pressure of the fluid in the reservoir 1 as a result of the withdrawal of fluid therefrom, there is a reduction in the force exerted by this fluid on the upper side of the diaphragm 19 in opposition to the opposing force of the fluid in the chamber 15 acting on the lower side of the diaphragm 19. When this occurs the diaphragm 19 is thereupon flexed upwardly by the fluid under pressure in the chamber 15.

On this movement of the diaphragm 19, the face 20 on the end of the stem 18 is lifted away from the seat 21 surrounding the release passage 22 so as to release fluid from the chamber 15 and thereby reduce the pressure of fluid in this chamber.

On a reduction in pressure of the fluid in the chamber 15 to a value slightly below the pressure of the fluid in the reservoir 1, the fluid under pressure in the reservoir 1 flexes the diaphragm downwardly. This causes the valve face 20 on the end of stem 18 to move into engagement with the seat 21 on the cover, so as to cut off the release of fluid from the chamber 15.

The volume of fluid released from the chamber 15 before the pressure of the fluid in this chamber is reduced to a value slightly below the pressure of the fluid in the reservoir is relatively

small because of the relatively small volume of the chamber 15.

On a subsequent increase in the pressure of the fluid in the reservoir 1 as a result of the supply of fluid thereto by operation of the compressor, the pressure of the fluid in the reservoir 1 and in the chamber 7 will exceed the pressure of the fluid in the chamber 15 on the opposite face of the diaphragm 19. When the pressure of the fluid in the reservoir 1 and consequently in chamber 7 has increased to a value slightly above the pressure of the fluid in the chamber 15, the force exerted on the upper face of the diaphragm by this fluid will exceed the opposing force exerted on the diaphragm by the fluid in chamber 15. Then the diaphragm 19 will flex downwardly against the opposing force of the pressure in chamber 15, while the valve face 20 on the end of the stem 18 is pressed more firmly into engagement with the seat surrounding the release passage 22.

On this flexing of the diaphragm 19 it is moved away from the seat 11 so as to permit liquid accumulated in the chamber above the diaphragm 19 to flow past the valve seat 11 to the chamber 15 at the opposite sides of the diaphragm. This liquid will flow past the seat into the chamber 15 until the pressure of the fluid trapped in the chamber 15 is increased substantially to the pressure of the fluid in the chamber 7 and reservoir 1.

On an increase in the pressure of the fluid in chamber 15 substantially to the pressure of the fluid in the chamber 7, the diaphragm 19 will be flexed upwardly by this fluid under pressure, until it engages the seat 11, to cut off the flow of fluid from the chamber 7 and reservoir 1 to the chamber 15.

On flexing of the diaphragm 19 upwardly into engagement with the seat 11, the face 20 on the end of the stem 18 is held in engagement with the seat 21 surrounding the release passage 22 so as to cut off the release of fluid from the chamber 15.

On a subsequent reduction in the pressure of the fluid in the reservoir 1 and chamber 7 to a predetermined value below the pressure of the fluid in the chamber 15, the force exerted by the fluid under pressure in the chamber 7 on the upper side of the diaphragm is insufficient to hold this diaphragm against the opposing force of the fluid under pressure in the chamber 15. When this occurs the diaphragm is flexed upwardly and the stem 18 is lifted so that the valve face 20 on the stem 18 is out of engagement with the seat surrounding the release passage 22 and the liquid in the chamber 15 is forced out through the release passage 22 by the fluid under pressure trapped in said chamber.

After a predetermined amount of liquid is released from the chamber 15, the pressure of the fluid remaining in this chamber is insufficient to maintain the diaphragm 19 flexed upwardly against the opposing force of the fluid under pressure in the chamber 7 and reservoir 1. At this time the diaphragm 19 is thereupon moved downwardly by the fluid under pressure in the chamber 7 until the valve face 20 on the end of the stem 18 engages the seat surrounding the passage 22 so as to cut off the further release of fluid from the chamber 15.

On a subsequent increase in the pressure of the fluid in the reservoir 1 and connected chamber 7, the diaphragm is flexed downwardly against the opposing force of the fluid under pressure in chamber 15. This permits the liquid which has accumulated in the chamber 7 on the upper face of the diaphragm 19 to flow

therefrom past the valve seat 11 to the chamber 15 to increase the pressure of the fluid in this chamber. When this pressure is increased substantially to the pressure of the fluid in chamber 7 and reservoir 1, the diaphragm is thereafter again flexed upwardly until it engages the seat 11.

On the next reduction in the pressure of the fluid in the reservoir 1 and connected chamber 7, the drain valve device operates as described in detail above to again release liquid from the chamber 15, and this cycle of operation is repeated on subsequent fluctuation in the pressure of the fluid in the reservoir 1.

It will be seen that the volume of fluid, either liquid or gaseous, released by the drain valve device on each fluctuation of the pressure of the fluid in the reservoir is relatively small. Therefore, the fluid under pressure in the reservoir 1 will not be unduly depleted by operation of the drain valve device. The amount discharged by the drain valve device on each operation thereof is, however, proportioned so that the drain valve device is enabled to maintain the reservoir 1 substantially free from moisture.

It will be seen also that this drain valve device operates automatically in response to variations in the pressure of the fluid in reservoir 1, and that it requires no attention on the part of the operator of the fluid pressure system with which it is associated.

While one embodiment of the improved automatic drain valve device provided by my invention has been illustrated and described in detail, it should be understood that the invention is not limited to these details of construction, and that numerous changes and modifications may be made without departing from the scope of the following claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a drain valve device for a reservoir, in combination, a body having a first chamber and a second chamber therein and having a release passage surrounded by a seat and communicating with said second chamber, another seat associated with said body, a valve member having a face thereon adapted to engage the seat surrounding the release passage, a diaphragm subject to the opposing pressures of the fluid in said first chamber and of the fluid in said second chamber adapted to engage said other seat to control communication from said first chamber to said second chamber and to urge said valve member into engagement with the seat surrounding said passage.

2. In a drain valve device for a reservoir, in combination, a body having a chamber therein and having a release passage surrounded by a seat and communicating with said chamber, another seat associated with said body, a valve member having a face thereon adapted to engage the seat surrounding said passage, a dia-

phragm subject to the opposing pressures of the fluid in the reservoir and in said chamber, said diaphragm being adapted to engage said other seat and control the flow of fluid from said reservoir to said chamber and to urge said valve member into engagement with the seat surrounding said release passage.

3. In a drain valve device for a reservoir, in combination, a body having a chamber therein and having a release passage surrounded by a seat communicating with said chamber, a diaphragm subject to the opposing pressures of the fluid in the reservoir and in said chamber, a second seat on the body, said diaphragm controlling a passage surrounded by said second seat, a valve member carried by said diaphragm and having a face thereon adapted to engage the seat surrounding said release passage, and a strainer interposed between the reservoir and said second seat and adapted to remove foreign particles from the fluid under pressure flowing from said reservoir through the passage surrounded by said second seat.

4. In a drain valve device for a reservoir, in combination, a body having a first chamber and a second chamber therein, a valve seat formed on the body between said chambers, a thin flexible valve adapted to cooperate with said seat, said thin flexible valve being subject on one side to the pressure of the fluid in the first chamber and subject on the other side to the fluid under pressure in the second chamber and operative upon an increase in pressure in said first chamber to a value exceeding the pressure of the fluid in the second chamber for opening a communication through which liquid accumulated in said reservoir may drain to said second chamber and through which fluid under pressure may be supplied to said second chamber, and operative upon a reduction in the pressure of the fluid in said first chamber to a value below the pressure of the fluid in said second chamber to close said communication and open another communication through which liquid may drain from said second chamber.

5. In a drain valve device for a reservoir or the like, in combination, a body provided with two chambers and having an annular valve seat located between said chambers and also provided with a passage leading to the atmosphere, a valve normally closing said passage, and a thin flexible valve cooperating with said seat and subject to the opposing pressures in said chambers, and operative in response to an increase in the pressure in one of said chambers to establish a communication from said one chamber to the other chamber and operative upon substantially equalization of the pressures in the two chambers to close said communication, said thin flexible valve being further operative upon a decrease in the pressure of fluid in said one chamber to actuate said valve to open the passage leading to the atmosphere.

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